PRESIDENCY UNIVERSITY

PROGRAMME REGULATIONS & CURRICULUM

2022-26

PRESIDENCY SCHOOL OF COMPUTER SCIENCE & ENGINEERING

BACHELOR OF TECHNOLOGY (B.TECH.)

COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS-CIT)

www.presidencyuniversity.in   #proudpresidencian

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum

2022-2026

BACHELOR OF TECHNOLOGY (B.Tech.) in

COMPUTER SCIENCE AND ENGINEERING(Internet of Things)

based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

(As amended up to the 24thMeeting of the Academic Council held on 3rd August 2024. This document supersedes all previous guidelines)

Regulations No.: PU/AC-24.05/SOCSE03/CCS/2022-26

Resolution No.05 of the 24th Meeting of the Academic Council held on 03rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 05th August, 2024.

AUGUST-2024

Table of Contents

20.		27
21.		31
22.		32
23.		36

PART A – PROGRAM REGULATIONS

1. Vision & Mission of the University and the School / Department

1.1 Vision of the University

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

1.2 Mission of the University

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

1.3 Vision of Presidency School of Computer Science and Engineering

- To be a value based, practice-driven School of Computer Science and Engineering, committed to developing globally-competent Engineers, dedicated to developing cutting-edge technology, towards enhancing Quality of Life.

1.4 Mission of Presidency School of Computer Science and Engineering

- Cultivate a practice-driven environment, with computing-based pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the realm of Computing Sciences.
- Establish state-of-the-art computing facilities, for effective Teaching and Learning experiences.
- Promote Interdisciplinary Studies to nurture talent for global impact.
- Instill Entrepreneurial and Leadership Skills to address Social, Environmental and Community-needs.

2. Preamble to the Program Regulations and Curriculum

This is the subset of Academic Regulations and it is to be followed as a requirement for the award of B.Tech degree.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Social Project Based Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations, 2025 of the University, the Academic Council hereby makes the following Regulations.

3. Short Title and Applicability

a. These Regulations shall be called the Bachelor of Technology Degree Program Regulations and Curriculum 2022-2026.
b. These Regulations are subject to, and pursuant to the Academic Regulations 2025.
c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2022-2026 batch, and to all other Bachelor of Technology Degree Programs which may be introduced in future.
d. These Regulations shall supersede all the earlier Bachelor of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2022-2026.

4. Definitions

In these Regulations, unless the context otherwise requires:

a. *"Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;*
b. *"Academic Council" means the Academic Council of the University;*
c. *"Academic Regulations" means the Academic Regulations, of the University;*
d. *"Academic Term" means a Semester or Summer Term;*
e. *"Act" means the Presidency University Act, 2013;*
f. *"AICTE" means All India Council for Technical Education;*
g. *"Basket" means a group of courses bundled together based on the nature/type of the course;*
h. *"BOE" means the Board of Examinations of the University;*
i. *"BOG" means the Board of Governors of the University;*
j. *"BOM" means the Board of Management of the University;*
k. *"BOS" means the Board of Studies of a particular Department/Program of Study of the University;*
l. *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*
m. *"Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*
n. *"COE" means the Controller of Examinations of the University;*
o. *"Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;*
p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*
q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific*

Academic Term;

r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*

s. *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*

t. *"DAC" means, the Departmental Academic Committee;*

u. *"Dean" means the Dean / Director of the concerned School;*

v. *"Dean" means the Dean of the concerned School;*

w. *"Degree Program" includes all Degree Programs;*

x. *"Degree Program" includes all Degree Programs;*

y. *"Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;*

z. *"Discipline" means specialization or branch of B.Tech. Degree Program;*

aa. *"HOD" means the Head of the concerned Department;*

bb. *"L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;*

cc. *"MOOC" means Massive Open Online Courses;*

dd. *"MOU" means the Memorandum of Understanding;*

ee. *"NPTEL" means National Program on Technology Enhanced Learning;*

ff. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

gg. *"Program Head" means the administrative head of a particular Degree Program/s;*

hh. *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2022-2026;*

ii. *"Program" means the Bachelor of Technology (B.Tech.) Degree Program;*

jj. *"PSCS" means the Presidency School of Computer Science and Engineering;*

kk. *"Registrar" means the Registrar of the University;*

ll. *"School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

mm. *"Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;*

nn. *"SGPA" means the Semester Grade Point Average as defined in the Academic Regulations, 2021;*

oo. *"Statutes" means the Statutes of Presidency University;*

pp. *"Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

qq. *"Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;*

rr. *"SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.*

ss. *"UGC" means University Grant Commission;*

tt. *"University" means Presidency University, Bengaluru; and*

uu. *"Vice Chancellor" means the Vice Chancellor of the University.*

5. Program Description

The Bachelor of Technology Degree Program Regulations and Curriculum 2022-2026 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2022-2026 offered by the Presidency School of Computer Science and Engineering (PSCS):

1. Bachelor of Technology in Computer Science and Engineering, abbreviated as B.Tech. Computer Science and Engineering;
2. Bachelor of Technology in Computer Science and Technology (Big Data), abbreviated as B.Tech. Computer Science and Technology (Big Data);
3. Bachelor of Technology in Computer Science and Engineering (Block Chain), abbreviated as B.Tech. Computer Science and Engineering (Block Chain);
4. Bachelor of Technology in Computer Science and Technology (Dev Ops), abbreviated as B.Tech. Computer Science and Technology (Dev Ops);
5. Bachelor of Technology in Computer Science and Engineering (Cyber Security), abbreviated as B.Tech. Computer Science and Engineering (Cyber Security);
6. Bachelor of Technology in Computer Science and Engineering (Internet of Things), abbreviated as B.Tech. Computer Science and Engineering (Internet of Things);
7. Bachelor of Technology in Computer Science and Engineering (Data Science), abbreviated as B.Tech. Computer Science and Engineering (Data Science);
8. Bachelor of Technology in Computer Science and Technology (Artificial Intelligence and Machine Learning), abbreviated as B.Tech. Computer Science and Technology (Artificial Intelligence and Machine Learning);
9. Bachelor of Technology in Information Science and Technology, abbreviated as B.Tech. Information Science and Technology;
10. Bachelor of Technology in Computer Science and Information Technology, abbreviated as B.Tech. Computer Science and Information Technology;
11. Bachelor of Technology in Computer Science and Engineering (Networks), abbreviated as B.Tech. Computer Science and Engineering (Networks);
12. Bachelor of Technology in Computer Engineering (Artificial Intelligence and Machine Learning), abbreviated as B.Tech. Computer Engineering (Artificial Intelligence and Machine Learning);
13. Bachelor of Technology in Information Science and Engineering (Artificial Intelligence and Robotics), abbreviated as B.Tech. Information Science and Engineering (Artificial Intelligence and Robotics); and

14. Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) abbreviated as B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning);

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations

6. Minimum and Maximum Duration

6.1 Bachelor of Technology Degree Program is a Four-Year, Full-Time Semester based program. The minimum duration of the B.Tech. Program is four (04) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the B.Tech. program is eight (08) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (Refer to Clause **Error! Reference source not found.** of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.**Error! Reference source not found.** of Academic Regulations) in the prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Programme Educational Objectives (PEO)

After four years of successful completion of the program, the graduates shall be:

PEO1. Demonstrate as a Computer Engineering Professional.

PEO2. Engage in lifelong learning through research and professional development,

PEO3. Serve as a leader in the profession through consultancy, extension activities or entrepreneurship.

8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

8.1 Programme Outcomes (PO)

On successful completion of the Program, the students shall be able to:

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

8.2 Program Specific Outcomes (PSOs):

On successful completion of the Program, the students shall be able to:

PSO 01: [Problem Analysis]: Identify, formulate, research literature, and analyze complex engineering problems related to Cyber Security principles and practices, Programming and Computing technologies reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PSO 02: [Design/development of Solutions]: Design solutions for complex engineering problems related to Cyber Security principles and practices, Programming and Computing technologies and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.

PSO 03: [Modern Tool usage]: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities related to Cyber Security principles and practices, Programming in Internet of Things Computing & analytics with an understanding of the limitations.

9 Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time**.** The admission criteria to the B.Tech. Program is listed in the following Sub-Clauses:

9.1   An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.

9.2 Provided further, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics / Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.

9.3 The applicant must have appeared for Joint Entrance Examinations (JEE) Main / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level Engineering Entrance Examinations.

9.4 Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.

9.5 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.

9.6 Candidates must fulfil the medical standards required for admission as prescribed by the University.

9.7 If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

9.8 The decision of the BOM regarding the admissions is final and binding.

10 Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.Tech. Degree program as per the provisions and/or regulations of the Government of Karnataka pertaining to the "Lateral Entry" scheme announced by the Government from time to time. Further, the general conditions and rules governing the provision of Lateral Entry to the B.Tech. Program of the University are listed in the following Sub-Clauses:

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentage (45%) marks in the final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case of SC / ST and OBC candidates from Karnataka the minimum marks for eligibility shall be forty percent (40%).

10.1.2 Provided further that, candidates seeking Lateral Entry may be required to complete specified bridge Courses as prescribed by the University. Such bridge Courses, if any, shall not be included in the CGPA computations.

10.1.3 All the existing Regulations and Policies of the University shall be binding on all the students admitted to the Program through the provision of Lateral Entry.

10.1.4 The Course requirements prescribed for the 1st Year of the B.Tech. Program shall be waived for the student(s) admitted through Lateral Entry and the duration of the B.Tech. Program for such students is three (03) years, commencing from the 3rd Semester (commencement of the 2nd Year) of the B.Tech. Program and culminating with the 8th Semester (end of the 4th Year) of the B.Tech. Program.

10.1.5 Provided that, if a Lateral Entry student misses any mandatory program specific courses that are typically offered in the 1st year (1st or 2nd semesters), then those courses must be cleared by the students as soon as possible, preferably during the Summer Term.

10.1.6 The existing Program Regulations of the concerned Program to which the student is admitted through the provision of Lateral Entry shall be binding on the student with effect from the 3rd Semester of the Program. i.e., the Program Structure and Curriculum from the 3rd to 8th Semesters of the Program concerned shall be binding on the student admitted through Lateral Entry. Further, any revisions / amendments made to the Program Regulations thereafter, shall be binding on all the students of the concerned Program.

10.1.7 All the Courses (and the corresponding number of Credits) prescribed for the 1st Year of the concerned B.Tech. Program shall be waived for the student(s) admitted to the concerned B.Tech Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Tech. Degree in the concerned Program shall be prescribed / calculated as follows:

The **Minimum Credit Requirements** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. (Internet of Things Engineering) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Internet of Things Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.8 Further, no other waiver except the Courses prescribed for the 1st year of the B.Tech. Program of the University shall be permissible for students joining the B.Tech. Program through the provision of Lateral Entry.

10.2 Transfer of student(s) from another recognized University to the 2nd year (3rd Semester) of the B.Tech. Program of the University

A student who has completed the 1st Year (i.e., passed in all the Courses / Subjects prescribed for the 1st Year) of the B.Tech. / B.E. / B.S., Four-Year Degree Program from another recognized University, may be permitted to transfer to the 2nd Year (3rd Semester) of the B.Tech. Program of the University as per the rules and guidelines prescribed in the following Sub-Clauses:

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 2.3.1, 2.3.2 and 2.3.3.

10.2.2 The student shall submit the Application for Transfer along with a non-refundable Application Fee (as prescribed by the University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) B.Tech. Program commencing on August 1 on the year concerned.

10.2.3 The student shall submit copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

10.2.4 The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Tech. / B.E. / B.S. Four Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the B.Tech. Program of the University.

10.2.5 The Branch / Discipline allotted to the student concerned shall be the decision of the University and binding on the student.

11 Change of Branch / Discipline / Specialization

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a

change of Branch, at the end of 1st Year of the B.Tech. Program to eligible students in accordance with the following rules and guidelines: framed by the University from time to time.

11.1 Normally, only those students, who have passed all the Courses prescribed for the 1st Year of the B.Tech. Program and obtained a CGPA of not less than 6.50 at the end of the 2nd Semester, shall be eligible for consideration for a change of Branch.

11.2 Change of Branch, if provided, shall be made effective from the commencement of the 3rd Semester of the B.Tech. Program. There shall be no provision for change of Branch thereafter under any circumstances whatsoever.

11.3 The student provided with the change of Branch shall fully adhere to and comply with the Program Regulations of the concerned Branch of the B.Tech. Program, the Fee Policy pertaining to that Branch of the B.Tech. Program, and, all other rules pertaining to the changed Branch existing at the time.

11.4 Change of Branch once made shall be final and binding on the student. No student shall be permitted, under any circumstances, to refuse the change of Branch offered.

11.5 The eligible student may be allowed a change in Branch, strictly in order of *inter se* merit, subject to the conditions given below:

11.5.1 The actual number of students in the 3rd Semester in any particular Branch to which the transfer is to be made, should not exceed the intake fixed by the University for the concerned Branch;

11.5.2 The actual number of students in any Branch from which transfer is being sought does not fall below 75% of the total intake fixed by the University for the concerned Branch.

The process of change of Branch shall be completed within the first five days of Registration for the 3rd Semester of the B.Tech. Program.

12 Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)

12.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

12.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 12.5) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

12.3 Format of the End-Term examination shall be specified in the Course Plan.

12.4 Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)

- Courses with a class strength less than 30

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause **Error! Reference source not found.**) shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

12.5 Assessment Components and Weightage

S.No	Credit Structure [L-T-P-C]	Percentage/ Marks	CA		Mid-Term		End-term		Project	Total	Exam Conducted by
			Theory	Practical	Theory	Practical	Theory	Practical			
1	3-0-0-3	Percentage	25%	-	25%	-	50%	-	-	100%	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	
2	2-0-2-3	Percentage	12.50%	12.50%	12.50%	12.50%	25%	25%	-	100%	Mid-Term & End Term by CoE * Except for full stack courses
		Marks	25	25	25	25	50	50	-	200	

Table 1:Assesment Components and Weightage

#	L-T-P-C										Remarks
3	1-0-4-3	Percentage	-	25%	10%	40%	5%	20%	-	100%	Mid-Term & End Term by School
		Marks	-	25	10	40	5	20	-	100	
4	2-0-4-4	Percentage	12.50%	12.50%	10%	15%	20%	30%	-	100%	*Mid-Term & End Term by CoE
		Marks	25	25	20	30	40	60	-	200	
5	0-0-4-2	Percentage	-	50%	-	-	-	-	50%	100%	Project evaluated by IC at School level
		Marks	-	50	-	-	-	-	50	100	
6	0-0-2-1	Percentage	-	100%	-	-	-	-	-	100%	Only CA at School Level
		Marks	-	100	-	-	-	-	-	100	
7	3-0-2-4	Percentage	12.50%	12.50%	15%	10%	30%	20%	-	100%	Mid-Term & End Term by CoE
		Marks	25	25	30	20	60	40	-	200	
8	2-0-0-2	Percentage	25%	-	25%		50%	-	-	100%	Mid-Term & End Term by CoE
		Marks	50	-	50		100	-	-	200	

*CSE3150-Front End Full stack development

CSE3151-Java Full Stack Development

CSE3152-.Net Full Stack development

The exact weightages of Evaluation Components shall be clearly specified in the concerned PRC and respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in Clause **Error! Reference source not found.** of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

12.6 Minimum Performance Criteria:

12.6.1 Theory only Course and Lab/Practice Embedded Theory Course

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

12.6.2 Lab/Practice only Course and Project Based Courses

The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

12.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per Clause 12.6.1, 12.6.2) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

13 Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc. – Note: These are covered in Academic Regulations

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

13.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer **Error! Reference source not found.**) and approved by the Dean - Academics.

13.2 Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

13.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits

of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 13.3 and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

13.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 13.3 shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

13.3.3 Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

13.3.4 Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

13.3.5 A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 13.3.2 above.

13.3.6 SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

13.3.7 A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.

13.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL

approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table **Error! Reference source not found.**.

Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses		
Sl. No.	Course Duration	Credit Equivalence
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

13.3.9 The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

13.3.10 The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

13.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (17.**Error! Reference source not found.**), shall not be included in the calculation of the CGPA.

PART B – PROGRAM STRUCTURE

14. Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements

The B.Tech. (Internet of Things) Program Structure (2022-2026) totalling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: B.Tech. (Internet of Things) 2022-2026: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets	
Baskets	Credit Contribution
SCHOOL CORE	61
PROGRAM CORE	60
DISCIPLINE ELECTIVE	30

OPEN ELECTIVE	9
TOTAL CREDITS	**Min. 160**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 57% out of the total credits of 160 for B.Tech. (Internet of Things) program of four years' duration.

15. Minimum Total Credit Requirements of Award of Degree

As per the AICTE guidelines, a minimum of 160 credits is required for the award of a B.Tech. degree.

16. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,

16.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University**.**

16.2 A student shall be declared to be eligible for the award of the concerned Degree if she/he:

a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b. Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause a of Academic Regulations**;**

c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and

d. No disciplinary action is pending against her/him.

PART C – CURRICULUM STRUCTURE

17. Curriculum Structure – Basket Wise Course List (not Semester Wise)
List of Courses Tabled – aligned to the Program Structure
(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

**Table 3.1 : List of School Core**
S.No	Course Name	L	T	P	C
1	Foundation of English/ Technical English	1	0	2	2
2	Introduction to soft skills	0	0	2	1
3	Technical English/ Advanced English	1	0	2	2
4	Soft Skills for Engineers	0	0	2	1
5	Introduction to Aptitude	0	0	2	1
6	Kali Kannada / Thili Kannada	1	0	0	1
7	Being Corporate Ready	0	0	2	1
8	Logical and Critical Thinking	0	0	2	1
9	Aptitude for Employability	0	0	2	1
10	Preparedness for Interview	0	0	2	1
11	Calculus and Linear Algebra	3	0	2	4
12	Applied Statistics	1	0	2	2
13	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3
14	Numerical Methods for Engineers	1	0	2	2
15	Environmental Science	1	0	2	0
16	Optoelectronics and Device Physics	2	0	2	3
17	Elements of Electronics Engineering	3	0	2	4
18	Innovative Projects - Arduino using Embedded 'C'	0	0	4	2
19	Basic Engineering Sciences	2	0	0	2
20	Engineering Graphics	2	0	0	2
21	Problem Solving using JAVA	1	0	4	3
22	Programming in Python	1	0	4	3
23	Data Structures and Algorithms	3	0	2	4
24	Innovative Projects Using Raspberry Pi	-	0	-	1
25	Mastering Object-Oriented Concepts in Python	0	0	2	1
26	Data Structure and Web Development with Python	0	0	2	1
27	Capstone Project	0	0	0	4
28	Internship	0	0	0	8
		\multicolumn{3}{r}{**Total No. of Credits**}		**61**

**Table 3.2 : List of Program Core**
S. No	Course Name	L	T	P	C
1	Web Technologies	2	0	2	3
2	Design and Analysis of Algorithms	3	0	0	3

21

3	Computer Organization and Architecture	3	0	0	3
4	Operating Systems	3	0	0	3
5	Data Communications and Computer Networks	3	0	0	3
6	Database Management Systems	2	0	2	3
7	Cloud Computing	2	0	2	3
8	Software Engineering	3	0	0	3
9	Digital Design	2	0	2	3
10	Discrete Mathematical Structures	3	0	0	3
11	Theory of Computation	3	0	0	3
12	Artificial Intelligence and Machine Learning	2	0	2	3
13	Cryptography and Network Security	3	0	0	3
14	Data Handling and Visualization	2	0	2	3
15	Fundamentals of Data Analytics	3	0	0	3
16	Wireless Communication in IoT	3	0	0	3
17	Mobile Application for IoT	3	0	0	3
18	Privacy and Security in IoT	3	0	0	3
19	Big Data Analytics for IoT	1	0	4	3
20	Introduction to FoG Computing	3	0	0	3
	Total No. of Credits				**60**

18. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, 2021, are simply assigned the number of Credits based on the quantum of work / effort required to fulfill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip B.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations, 2021). The same shall be prescribed in the Course Handout.

18.1 Internship

A student may undergo an Internship for a period of 10-12 weeks in an industry / company or academic / research institution during 8th Semester, subject to the following conditions:

18.1.1 The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

18.1.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

18.1.3 The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 18.1.2 above.

18.1.4 A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

> **18.1.4.1** A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

18.2 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7th Semester as applicable, subject to the following conditions:

> **18.2.1** The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

> **18.2.2** The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

18.2.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 18.2.2 above.

18.2.4 A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the I Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

18.2.5 A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

18.3   Research Project / Dissertation

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

18.3.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.3.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

19. List of Elective Courses under various Specialisations / Stream Basket

Table 3.3 : List of Discipline Electives Courses

	Track 01-Artificial Intelligence and Machine Learning Basket				
1	Artificial Intelligence in Practice	2	0	2	3
2	Applied Machine Learning	2	0	2	3
3	Deep Learning	2	0	2	3
4	Reinforcement Lea rning	2	0	2	3
5	Time Series Analysis	2	0	2	3
6	Natural Language Processing	2	0	2	3
7	Advanced Natural Language Processing	2	0	2	3
8	Autonomous Navigation and Vehicles	3	0	0	3
9	Digital Health and Imaging	3	0	0	3
10	Stochastic Decision Making	3	0	0	3
11	Business Intelligence and Analytics	3	0	0	3
12	Cognitive Science & Analytics	3	0	0	3
13	Expert Systems	3	0	0	3
	Track 02-Big Data Basket				
1	Data Mining	3	0	0	**3**
2	Domain Specific Predictive Analytics	3	0	0	**3**
3	Data Warehousing and its Applications	3	0	0	**3**
4	No SQL Databases	2	0	2	**3**
5	Big Data Technologies	2	0	2	**3**
6	Mining Massive Datasets	2	0	2	**3**
7	Web Intelligence and Analytics.	2	0	2	**3**
8	Streaming Data Analytics	2	0	2	**3**
9	Information Visualization	2	0	2	**3**
10	Big Data Security and Privacy.	3	0	0	**3**
	Track03- Block Chain Basket				
1	Blockchain for Public Sector	3	0	0	**3**
2	Crypto Currency Technology	3	0	0	**3**
3	Emerging Areas in Blockchain	3	0	0	**3**
4	Industry Use Cases using Blockchain	3	0	0	**3**
5	Foundations of Blockchain Technology	3	0	0	**3**
6	Blockchain Technology and Applications	3	0	0	**3**
7	Smart Contract and Solidity	2	0	2	**3**
8	Distributed Ledger Technology	2	0	2	**3**
9	Blockchain Security and Performance	2	0	2	**3**
	Track04-Data Science Basket				
1	Statistical Foundations of Data Science	2	0	2	**3**
2	Web Data Analytics	2	0	2	**3**
3	R programming for Data Science	1	0	4	**3**
4	Applied Data Science	2	0	2	**3**
5	Social Media Analytics	2	0	2	**3**
6	E-Business and Marketing Analytics	3	0	0	**3**
7	Text Mining and Analytics	3	0	0	**3**

	Track 05-DevOps Basket				
1	Agile Structures and Frameworks	3	0	0	**3**
2	Applied DevOps	2	0	2	**3**
3	Automated Test Management	2	0	2	**3**
4	Build and Release Management	3	0	0	**3**
5	Development Automation	2	0	2	**3**
6	DevOps Tools Internals	2	0	2	**3**
7	Software Project Management	3	0	0	**3**
8	System Monitoring	3	0	0	**3**
	Track 06-IoT Basket				
1	Introduction to Fog Computing	3	0	0	**3**
2	Big Data Analytics for IoT	1	0	4	**3**
3	Wireless Communication in IoT	3	0	0	**3**
4	Privacy and Security in IoT	3	0	0	**3**
5	Mobile Application for IoT	3	0	0	**3**
6	IoT: Architecture and Protocols	3	0	0	3
7	IoT Platforms and Application Development	2	0	2	3
8	Industrial Internet of Things (IIoT)	3	0	0	3
9	Internet of Medical Things (IoMT)	3	0	0	3
	Track 07-General Basket				
1	Go Programming	3	0	0	**3**
2	Computer Graphics	3	0	0	**3**
3	Advanced Java Programming	1	0	4	**3**
4	Programming in C++	1	0	4	**3**
5	Advanced Database Management Systems	2	0	2	**3**
6	Introduction to Bioinformatics	3	0	0	**3**
7	Advanced Computer Networks	3	0	0	**3**
8	Computer Vision	2	0	2	**3**
9	Wireless Sensor Networks	3	0	0	**3**
10	Game Design and Development	3	0	0	**3**
11	Microprocessors and Microcontrollers	3	0	0	**3**
12	Mobile Application Development	1	0	4	**3**
13	Compiler Design	2	0	2	**3**
14	Parallel Computing	3	0	0	**3**
15	Quantum Computing	3	0	0	**3**
16	Digital Image Processing	2	0	2	**3**
17	Object Oriented Analysis and Design	3	0	0	**3**
18	Advanced Computer Architecture	3	0	0	**3**
19	Software Quality Assurance	2	0	2	**3**
20	Real Time Operating System	3	0	0	**3**
21	Information Theory and Coding	3	0	0	**3**
22	Software Architecture	3	0	0	**3**
23	5G Networking	3	0	0	**3**

24	Programming in C# and .NET	1	0	4	**3**
25	Distributed Systems	3	0	0	**3**
Track 08-Information Science & Engineering Basket					
1	System Software	3	0	0	**3**
2	Information Retrieval	3	0	0	**3**
3	Enterprise Network Design	3	0	0	**3**
4	Operating System with Linux Internals	2	0	2	**3**
5	Pattern Recognition	2	0	2	**3**
6	Search Engine Optimization	3	0	0	**3**
7	Service Oriented Architecture	3	0	0	**3**
8	E-Commerce	3	0	0	**3**
Track 09-Information Science & Technology Basket					
1	Storage Area Networks	3	0	0	**3**
2	Information Systems Audit	3	0	0	**3**
3	Web 2.0	2	0	2	**3**
4	Cloud Computing and Virtualization	3	0	0	**3**
5	Firewall and Internet Security	2	0	2	**3**
6	Mobile Networking	2	0	2	**3**
7	Information Security and Management	3	0	0	**3**
8	Human Computer Interaction	3	0	0	**3**
9	Infrastructure Management	3	0	0	**3**
10	Network Management Systems	3	0	0	**3**
Track 10: Cyber Security Basket					
1	Cyber Security	3	0	0	3
2	Ethical Hacking	2	0	2	3
3	Digital and Mobile Forensics	2	0	2	3
4	Web Security	2	0	2	3
5	Intrusion Detection and Prevention System	3	0	0	3
6	Vulnerability Assessment and Penetration Testing	3	0	0	3
7	Malware Analysis	3	0	0	3
8	Cyber Threats for IoT and Cloud	3	0	0	3
9	Cyber Forensics	2	0	2	3
10	Privacy and Security in Online Social Media	3	0	0	3
11	Cyber Digital Twin	3	0	0	3
12	Security Assessment and Testing	2	0	2	3
13	Digital Watermarking and Steganography	3	0	0	3
Track 11:Special Courses					
1	Practical Deep Learning with TensorFlow	2	0	2	3
2	Deep Learning for Computer Vision	2	0	2	3
3	Language Models for Text Mining	2	0	0	2

20. List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.

Table 3.4 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 9

Sl. No.	Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Prerequisites/ Corequisites	Antirequisites	Future Courses that need this as a Prerequisite
Chemistry Basket											
1	CHE1003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-
2	CHE1004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-
3	CHE1005	Computational Chemistry	2	0	0	2	S	ES	-	-	-
4	CHE1006	Introduction to Nano technology	3	0	0	3	S	ES	-	-	-
5	CHE1007	Biodegradable electronics	2	0	0	2	S	ES	-	-	-
6	CHE1008	Energy and Sustainability	2	0	0	2	S	ES	-	-	-
7	CHE1009	3D printing with Polymers	2	0	0	2	S	ES	-	-	-
8	CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	S	ES	-	-	-
9	CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	S	ES	-	-	-
10	CHE1012	Introduction to Composite materials	2	0	0	2	S	ES	-	-	-
11	CHE1013	Chemistry for Engineers	3	0	0	3	S	ES	-	-	-
12	CHE1014	Surface and Coatings technology	3	0	0	3	S	ES	-	-	-
13	CHE1015	Waste to Fuels	2	0	0	2	S	ES	-	-	-
14	CHE1016	Forensic Science	3	0	0	3	S	ES	-	-	-
Civil Engineering Basket											
1	CIV1001	Disaster mitigation and management	3	0	0	3	S	-	-	-	-
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
3	CIV2001	Sustainability Concepts in Engineering	3	0	0	3	S	-	-	-	-
4	CIV2002	Occupational Health and Safety	3	0	0	3	S	-	-	-	-

5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-
6	CIV2004	Integrated Project Management	3	0	0	3	EN	-	-	-	-
7	CIV2005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-
9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
10	CIV2045	Environmental Meteorology	3	0	0	3	S	-	-	-	-
11	CIV3046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-
Commerce Basket											
1	COM2001	Introduction to Human Resource Management	2	0	0	2	F	HP/GS	-	-	-
2	COM2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
3	COM2003	Contemporary Management	2	0	0	2	F	-	-	-	-
4	COM2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
5	COM2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
6	COM2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
7	COM2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Computer Science Basket (not to be offered for CSE Department students)											
1	CSE2002	Programming in Java	2	0	2	3	S/EM	-	-	-	-
2	CSE2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
3	CSE2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
4	CSE2005	Web design fundamentals	2	0	2	3	S/ EM/EN	-	-	-	-
5	CSE3111	Artificial Intelligence : Search Methods For Problem Solving	3	0	0	3	S/ EM/EN	-	-	-	-

6	CSE31 12	Privacy And Security In Online Social Media	3	0	0	3	S/ EM/EN	-	-	-	-
7	CSE31 13	Computational Complexity	3	0	0	3	S/ EM/EN	-	-	-	-
8	CSE31 14	Deep Learning for Computer Vision	3	0	0	3	S/ EM/EN	-	-	-	-
9	CSE31 15	Learning Analytics Tools	3	0	0	3	S/ EM/EN	-	-	-	-
Design Basket											
1	DES10 01	Sketching and Painting	0	0	2	1	S	-	-	-	-
2	DES10 02	Innovation and Creativity	2	0	0	2	F	-	-	-	-
3	DES11 21	Introduction to UX design	1	0	2	2	S	-	-	-	-
4	DES11 22	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
5	DES11 24	Spatial Stories	1	0	2	2	S	-	-	-	-
6	DES11 25	Polymer Clay	1	0	2	2	S	-	-	-	-
7	DES20 01	Design Thinking	3	0	0	3	S	-	-	-	-
8	DES10 03	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
9	DES10 04	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
10	DES10 05	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
11	DES10 06	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
12	DES20 80	Art of Design Language	3	0	0	3	S	-	-	-	-
13	DES20 81	Brand Building in Design	3	0	0	3	S	-	-	-	-
14	DES20 85	Web Design Techniques	3	0	0	3	S	-	-	-	-
15	DES20 89	3D Modeling for Professionals	1	0	4	3	S	-	-	-	-
16	DES20 90	Creative Thinking for Professionals	3	0	0	3	S	-	-	-	-
17	DES20 91	Idea Formulation	3	0	0	3	S	-	-	-	-
Electrical and Electronics Basket											
1	EEE10 02	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-
2	EEE10 03	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-

#	Code	Course	L	T	P	C					
3	EEE1004	Fundamentals of Industrial Automation	3	0	0	3	S	-	-	-	-
4	EEE1005	Electric Vehicles & Battery Technology	3	0	0	3	S	-	-	-	-
5	EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	S	-	-	-	-
Electronics and Communication Basket											
1	ECE1003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-
2	ECE1004	Microprocessor based systems	3	0	0	3	F	-	-	-	-
3	ECE3089	Artificial Neural Networks	3	0	0	3	S	-	-	-	-
4	ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM	-	-	-	-
5	ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM	-	-	-	-
6	ECE3102	Consumer Electronics	3	0	0	3	F/EM	-	-	-	-
7	ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-
8	ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM	-	-	-	-
9	ECE3107	Machine Vision for Robotics	3	0	0	3	F/EM	-	-	-	-
English Basket											
1	ENG1008	Indian Literature	2	0	0	2	-	GS/ HP	-	-	-
2	ENG1009	Reading Advertisement	3	0	0	3	S	-	-	-	-
3	ENG1010	Verbal Aptitude for Placement	2	0	2	3	S	-	-	-	-
4	ENG1011	English for Career Development	3	0	0	3	S	-	-	-	-
5	ENG1012	Gender and Society in India	2	0	0	2	-	GS/ HP	-	-	-
6	ENG1013	Indian English Drama	3	0	0	3	-	-	-	-	-
7	ENG1014	Logic and Art of Negotiation	2	0	2	3	-	-	-	-	-
8	ENG1015	Professional Communication Skills for Engineers	1	0	0	1	-	-	-	-	-
DSA Basket											
1	DSA2001	Spirituality for Health	2	0	0	2	F	HP	-	-	-
2	DSA2002	Yoga for Health	2	0	0	2	S	HP	-	-	-

No	Code	Title	L	T	P	S	C					
3	DSA2003	Stress Management and Well Being	2	0	0		2	F	-	-	-	-
Kannada Basket												
1	KAN1001	Kali Kannada	1	0	0		1	S	-	-	-	-
2	KAN1003	Kannada Kaipidi	3	0	0		3	S	-	-	-	-
3	KAN2001	Thili Kannada	1	0	0		1	S	-	-	-	-
4	KAN2003	Pradharshana Kale	1	0	2		2	S	-	-	-	-
5	KAN2004	Sahithya Vimarshe	2	0	0		2	S	-	-	-	-
6	KAN2005	Anuvadha Kala Sahithya	3	0	0		3	S	-	-	-	-
7	KAN2006	Vichara Manthana	3	0	0		3	S	-	-	-	-
8	KAN2007	Katha Sahithya Sampada	3	0	0		3	S	-	-	-	-
9	KAN2008	Ranga Pradarshana Kala	3	0	0		3	S	-	-	-	-
Foreign Language Basket												
1	FRL1004	Introduction of French Language	2	0	0		2	S	S	-	-	-
2	FRL1005	Fundamentals of French	2	0	0		2	S	S	-	-	-
3	FRL1009	Mandarin Chinese for Beginners	3	0	0		3	S	S	-	-	-
Law Basket												
1	LAW1001	Introduction to Sociology	2	0	0	0	2	F	HP	-	-	
2	LAW2001	Indian Heritage and Culture	2	0	0	0	2	F	HP/GS	-	-	
3	LAW2002	Introdcution to Law of Succession	2	0	0	0	2	F	HP/GS	-	-	
4	LAW2003	Introduction to Company Law	2	0	0	0	2	F	HP	-	-	
5	LAW2004	Introduction to Contracts	2	0	0		2	F	HP	-	-	-
6	LAW2005	Introduction to Copy Rights Law	2	0	0		2	F	HP	-	-	-
7	LAW2006	Introduction to Criminal Law	2	0	0		2	F	HP	-	-	-
8	LAW2007	Introduction to Insurance Law	2	0	0		2	F	HP	-	-	-
9	LAW2008	Introduction to Labour Law	2	0	0		2	F	HP	-	-	-
10	LAW2009	Introduction to Law of Marriages	2	0	0		2	F	HP/GS	-	-	-
11	LAW2010	Introduction to Patent Law	2	0	0		2	F	HP	-	-	-

#	Code	Course Name	L	T	P	C					
12	LAW2011	Introduction to Personal Income Tax	2	0	0	2	F	HP	-	-	-
13	LAW2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
14	LAW2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
15	LAW2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
16	LAW2015	Cyber Law	3	0	0	3	F	HP	-	-	-
17	LAW2016	Law on Sexual Harrassment	2	0	0	2	F	HP/GS	-	-	-
18	LAW2017	Media Laws and Ethics	2	0	0	2	F	HP/GS	-	-	-
Mathematics Basket											
1	MAT2008	Mathematical Reasoning	3	0	0	3	S	-	-	-	-
2	MAT2014	Advanced Business Mathematics	3	0	0	3	S	-	-	-	-
3	MAT2041	Functions of Complex Variables	3	0	0	3	S	-	-	-	-
4	MAT2042	Probability and Random Processes	3	0	0	3	S	-	-	-	-
5	MAT2043	Elements of Number Theory	3	0	0	3	S	-	-	-	-
6	MAT2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-
Mechanical Basket											
1	MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-
2	MEC1002	Introduction to Matlab and Simulink	3	0	0	3	S/EM	-	-	-	-
3	MEC1003	Engineering Drawing	1	0	4	3	S	-	-	-	-
4	MEC2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-
5	MEC2002	Operations Research & Management	3	0	0	3	F	-	-	-	-
6	MEC2003	Supply Chain Management	3	0	0	3	S/ EM/ EN	-	-	-	-
7	MEC2004	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	MEC2008	-
8	MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
9	MEC2006	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-

	Code	Course	L	T	P	C					
10	MEC2007	Additive Manufacturing	3	0	0	3	F/EM	-	-	-	-
11	MEC3069	Engineering Optimisation	3	0	0	3	S/EM	-	-	-	-
12	MEC3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-
13	MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	S/EM	ES	-	-	-
14	MEC3072	Thermal Management of Electronic Appliances	3	0	0	3	S/EM				
15	MEC3200	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
16	MEC3201	Industry 4.0	3	0	0	3	S/EM	-	-	-	-
Petroleum Basket											
1	PET1011	Energy Industry Dynamics	3	0	0	3	FC	ES	-	NIL	-
2	PET1012	Energy Sustainability Practices	3	0	0	3	FC	ES	-	NIL	-
Physics Basket											
1	PHY1003	Mechanics and Physics of Materials	3	0	0	3	FC / SD				
2	PHY1004	Astronomy	3	0	0	3	FC				
3	PHY1005	Game Physics	2	0	2	3	FC / SD				
4	PHY1006	Statistical Mechanics	2	0	0	2	FC				
5	PHY1007	Physics of Nanomaterials	3	0	0	3	FC				
6	PHY1008	Adventures in nanoworld	2	0	0	2	FC				
7	PHY2001	Medical Physics	2	0	0	2	FC	ES			
8	PHY2002	Sensor Physics	1	0	2	2	FC / SD				
9	PHY2003	Computational Physics	1	0	2	2	FC				
10	PHY2004	Laser Physics	3	0	0	3	FC	ES			
11	PHY2005	Science and Technology of Energy	3	0	0	3	FC	ES			
12	PHY2009	Essentials of Physics	2	0	0	2	FC				
Management Basket- I											
1	MGT2007	Digital Entrepreneurship	3	0	0	3	S/EM/EN	-	-	-	-

2	MGT2015	Engineering Economics	3	0	0	3	S	-	-	-	-
3	MGT2023	People Management	3	0	0	3	S/EM/EN	HP	-	-	-
Management Basket- II											
1	MGT1001	Introduction to Psychology	3	0	0	3	F	HP	-	-	-
2	MGT1002	Business Intelligence	3	0	0	3	EN	-	-	-	-
3	MGT1003	NGO Management	3	0	0	3	S	-	-	-	-
4	MGT1004	Essentials of Leadership	3	0	0	3	EM/ EN	GS/HP	-	-	-
5	MGT1005	Cross Cultural Communication	3	0	0	3	S/EM/EN	HP	-	-	-
6	MGT2001	Business Analytics	3	0	0	3	S/EM/EN	-	-	-	-
7	MGT2002	Organizational Behaviour	3	0	0	3	F	HP	-	-	-
8	MGT2003	Competitive Intelligence	3	0	0	3	S	-	-	-	-
9	MGT2004	Development of Enterprises	3	0	0	3	S/EM/EN	-	-	-	-
10	MGT2005	Economics and Cost Estimation	3	0	0	3	S/EM	-	-	-	-
11	MGT2006	Decision Making Under Uncertainty	3	0	0	3	S	-	-	-	-
12	MGT2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-
13	MGT2009	Management Consulting	3	0	0	3	S/EM/EN	-	-	-	-
14	MGT2010	Managing People and Performance	3	0	0	3	S/EM/EN	HP/GS	-	-	-
15	MGT2011	Personal Finance	3	0	0	3	F	-	-	-	-
16	MGT2012	E Business for Management	3	0	0	3	S/EM	-	-	-	-
17	MGT2013	Project Management	3	0	0	3	EN / EM	GS/HP/ES	-	-	-
18	MGT2014	Project Finance	3	0	0	3	EN / EM	HP	-	-	-
19	MGT2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
20	MGT2017	Principles of Management	3	0	0	3	S/EM/EN	-	-	-	-
21	MGT2018	Professional and Business Ethics	3	0	0	3	S/EM/EN	HP	-	-	-
22	MGT2019	Sales Techniques	3	0	0	3	S/EM/EN	HP	-	-	-
23	MGT2020	Marketing for Engineers	3	0	0	3	S/EM/EN	HP	-	-	-

24	MGT20 21	Finance for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
25	MGT20 22	Customer Relationship Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Media Studies Basket											
1	BAJ30 50	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-
2	BAJ30 51	Digital Photography	2	0	2	3	EM	HP	-	-	-
3	BAJ30 55	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-
Research URE Basket											
1	URE20 01	University Research Experience	-	0	-	3					
2	URE20 02	University Research Experience	-	0	-	0					

21.List of MOOC (NPTEL) Courses

Sl. No	Course Code	Course Name	Total Credits	L-T-P-C
1	CSE3111	Artificial Intelligence : Search Methods For Problem Solving	3	3-0-0-3
2	CSE3112	Privacy And Security In Online Social Media	3	3-0-0-3
3	CSE3113	Computational Complexity	3	3-0-0-3
4	CSE3114	Deep Learning for Computer Vision	3	3-0-0-3
5	CSE3115	Learning Analytics Tools	3	3-0-0-3
6	CSE502	Technical Skills in JAVA	3	0-0-6-3
7	CSE503	Technical Skills in Python	3	0-0-6-3
8	CSE504	Comprehensive Technical Skills	5	0-0-10-5
9	CSE505	The Joy Of Computing Using Python	3	3-0-0-3
10	CSE3119	Coding Skills in Python	3	3-0-0-3
11	CSE3121	Parallel Computer Architecture	3	3-0-0-3
12	CSE3124	Games and Information	3	3-0-0-3
13	CSE3140	Introduction To Industry 4.0 And Industrial Internet Of Things	3	3-0-0-3
14	CSE3142	Affective Computing	3	3-0-0-3
15	CSE3112	Privacy and Security in Online Social Media	3	3-0-0-3
16	CSE3196	Foundations of Cyber Physical Systems	3	3-0-0-3
17	CSE3197	Getting Started with Competitive Programming	3	3-0-0-3
18	CSE3198	GPU Architectures And Programming	3	3-0-0-3
19	CSE3199	Artificial Intelligence: Knowledge Representation And Reasoning	3	3-0-0-3
20	CSE3200	Programming in Modern C++	3	3-0-0-3
21	CSE3201	Circuit Complexity Theory	3	3-0-0-3
22	CSE3202	Basics of Computational Complexity	3	3-0-0-3
23	CSE3212	ion to Computer and Network Performance Analysis Using Queuing	1	1-0-0-1
24	CSE3213	C Programming And Assembly Language	1	1-0-0-1
25	CSE3214	Python For Data Science	1	1-0-0-1
26	CSE3215	Software Conceptual Design	1	1-0-0-1
27	CSE3117	Industrial Digital Transformation	3	3-0-0-3
28	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
29	CSE3349	Technology for Lawyers	3	3-0-0-3
30	CSEXXXX	Deep Learning for Natural Language Processing	3	3-0-0-3
31	CSEXXXX	Machine Learning for Engineering and science applications	3	3-0-0-3
32	CSEXXXX	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
33	CSEXXXX	Introduction to Large Language Models (LLMs)	3	3-0-0-3
34	CSEXXXX	Quantum Algorithms and Cryptography	3	3-0-0-3

22.Recommended Semester Wise Course Structure / Flow including the Programme / Discipline Elective Paths / Options

SEMESTER-1									
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	SCHOOL CORE		
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4	SCHOOL CORE		

3	ECE1001	Elements of Electronics Engineering	3	0	2	4	5	SCHOOL CORE		
4	ENG1001/ ENG1002	Foundation of English/ Technical English	1	0	2	2	3	SCHOOL CORE		
5	PPS1001	Introduction to soft skills	0	0	2	1	2	SCHOOL CORE		
6	CSE1002	Innovative Projects - Arduino using Embedded 'C'	0	0	4	2	4	SCHOOL CORE		
7	CHE1018	Environmental Science	1	0	2	0	3	SCHOOL CORE		
		TOTAL	10	0	16	**16**	26			

SEMESTER-2

S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT1003	Applied Statistics	1	0	2	2	3	SCHOOL CORE		
2	ECE2007	Digital Design	2	0	2	3	4	PROGRAM CORE		
3	CIV1008	Basic Engineering Sciences	2	0	0	2	2	SCHOOL CORE		
4	MEC1006	Engineering Graphics	2	0	0	2	2	SCHOOL CORE		
5	CSE1006	Problem Solving using JAVA	1	0	4	3	5	SCHOOL CORE		
6	ENG1002/ ENG2001	Technical English/ Advanced English	1	0	2	2	3	SCHOOL CORE		
7	CSE2014	Software Engineering	3	0	0	3	3	PROGRAM CORE		
8	PPS1002	Soft Skills for Engineers	0	0	2	1	2	SCHOOL CORE		
9	KAN1001/	Kali Kannada / Thili Kannada	1	0	0	1	1	SCHOOL CORE		
		TOTAL	13	0	12	**19**	25			

SEMESTER-3

S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	3	SCHOOL CORE		
2	CSE1005	Programming in Python	1	0	4	3	5	SCHOOL CORE		
3	CSE2001	Data Structures and Algorithms	3	0	2	4	5	SCHOOL CORE		
4	CSE2011	Data Communications and Computer Networks	3	0	0	3	3	PROGRAM CORE		
5	CSE2009	Computer Organization and Architecture	3	0	0	3	3	PROGRAM CORE		
6	CSE2018	Theory of Computation	3	0	0	3	3	PROGRAM CORE		
7	CSE3190	Fundamentals of Data Analytics	2	0	2	3	4	PROGRAM CORE		
8	CSEXXXX	Discipline Elective – I	3	0	0	3	3	DISCIPLINE ELECTIVE		
9	PPS4002	Introduction to Aptitude	0	0	2	1	2	SCHOOL CORE		
		TOTAL	21	0	10	**26**	31			
SEMESTER-4										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT2003	Numerical Methods for Engineers	1	0	2	2	3	SCHOOLCORE		

S.NO.	COURSE CODE	COURSE NAME	L	T	P	C	CONTACT HOURS	BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
2	CSE2007	Design and Analysis of Algorithms	3	0	0	3	3	PROGRAM CORE		
3	CSE2074	Database Management Systems	2	0	2	3	4	PROGRAM CORE		
4	CSE2010	Operating Systems	3	0	0	3	4	PROGRAM CORE		
5	CSE3078	Cryptography and Network Security	3	0	0	3	3	PROGRAM CORE		
6	CSE2026	Data Handling and Visualization	2	0	2	3	3	PROGRAM CORE		
7	CSEXXXX	Discipline Elective – II	3	0	0	3	3	DISCIPLINE ELECTIVE		
8	XXXXXXX	Open Elective – I(Management Basket)	3	0	0	3	3	OPEN ELECTIVE		
9	PPS2002	Being Corporate Ready	0	0	2	1	2	SCHOOL CORE		
10	ECE2011	Innovative Projects Using Raspberry Pi	-	0	-	1	0	SCHOOL CORE		
		TOTAL	19	0	10	25	29			

SEMESTER-5

S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	CSE3001	Artificial Intelligence and Machine Learning	2	0	2	3	4	PROGRAM CORE		
2	CSE2032	Introduction to FOG Computing	3	0	0	3	3	PROGRAM CORE		
3	CSE3055	Wireless Communication in IoT	3	0	0	3	3	PROGRAM CORE		
4	CSE2018	Theory of Computation	3	0	0	3	3	PROGRAM CORE		
5	CSE2067	Web Technologies	2	0	2	3	4	PROGRAM CORE		
6	CSEXXXX	Discipline Elective – III	3	0	0	3	3	DISCIPLINE ELECTIVE		

7	CSEXXX X	Discipline Elective – IV	3	0	0	3	3	DISCIPLINE ELECTIVE		
8	PPS4006	Logical and Critical Thinking	0	0	2	1	2	SCHOOL CORE		
9	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1	2	SCHOOL CORE		
		TOTAL	1 8	0	0 8	**2 3**	27			

<table>
<tr><td colspan="11" align="center">SEMESTER-6</td></tr>
</table>

S. NO .	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKIL L	COURSE ADDRESS ES TO
			L	T	P	C	CONTAC T HOURS			
1	CSE3066	Mobile Application for IoT	3	0	0	3	3	PROGRAM CORE		
2	CSE3063	Privacy and Security in IoT	3	0	0	3	3	PROGRAM CORE		
3	CSE3343	Cloud Computing	2	0	2	3	3	PROGRAM CORE		
4	CSE3053	Big Data Analytics for IoT	1	0	4	3	5	PROGRAM CORE		
5	CSEXXX X	Discipline Elective - V	3	0	0	3	3	DISCIPLINE ELECTIVE		
6	CSEXXX X	Discipline Elective - VI	3	0	0	3	3	DISCIPLINE ELECTIVE		
7	XXXXXX X	Open Elective – II	3	0	0	3	3	OPEN ELECTIVE		
8	PPS3002	Programming skills for employment	0	0	2	1	2	SCHOOL CORE		
9	PPS4005	Aptitude for Employability	0	0	2	1	2	SCHOOL CORE		
10	CSE3217	Data Structure and Web Development with Python	0	0	2	1	2	SCHOOL CORE		
		TOTAL	1 9	0	1 0	**2 4**	30			

<table>
<tr><td colspan="11" align="center">SEMESTER-7</td></tr>
</table>

S. NO .	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKIL L	COURSE ADDRESS ES TO

S.No	COURSE CODE	COURSE NAME	L	T	P	C	CONTACT HOURS	BASKET		
1	XXXXXXX	Open Elective – III (Management Basket)	3	0	0	3	3	OPEN ELECTIVE		
2	CSEXXXX	Discipline Elective –VII	3	0	0	3	3	DISCIPLINE ELECTIVE		
3	CSEXXXX	Discipline Elective – VIII	3	0	0	3	3	DISCIPLINE ELECTIVE		
4	CSEXXXX	Discipline Elective – IX	3	0	0	3	3	DISCIPLINE ELECTIVE		
5	CSEXXXX	Discipline Elective – X	3	0	0	3	3	DISCIPLINE ELECTIVE		
6	PIP2001	Capstone Project	-	0	-	4	0	SCHOOL CORE		
7	PPS3018	Preparedness for Interview	0	0	2	1	2	SCHOOL CORE		
		TOTAL	15	0	2	**20**	17			

SEMESTER-8

S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	PIP4002	Internship	-	0	-	8	0	SCHOOL CORE		
		TOTAL	0	0	0	**8**				

23.Course Catalogue

Course Catalogue of all Courses Listed including the Courses Offered by other School / Department and Discipline / Programme Electives – Course Code, Course Name, Prerequisite, Anti-requisite, Course Description, Course Outcome, Course Content (with Blooms Level, CO, No. of Contact Hours), Reference Resources.

The Course Catalogues for the Courses offered in each basket are attached below:

SEMESTER I

Course Code: MAT1001	Course Title: Calculus and Linear Algebra Type of Course: School Core Lab Integrated	L-T- P-C	2	1	2	4
Version No.		3.0				
Course Pre-requisites		Basic Concepts of Limits, Differentiation, Integration				
Anti-requisites		**NIL**				
Course Description		The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature. The lab sessions associated with the course are concerned with acquiring an ability to use the MATLAB software.				
Course Objective		The objective of the course is **Skill Development** of student by using **Problem Solving Techniques.**				
Course Out Comes		On successful completion of the course the students shall be able to: 1) Comprehend the knowledge of applications of matrix principles.				

		2) Understand the concept of partial derivatives and their applications. 3) Apply the principles of integral calculus to evaluate integrals. 4) Adopt the various analytical methods to solve differential equations. 5) Demonstrate the use of MATLAB software to deal with a variety of mathematical problems.			
Course Content:					
Module 1	**Linear Algebra**				**10 Classes**
		Review: Types of matrices, elementary transformations, rank of a matrix, normal form, Solution of systems of linear equations: (Homogenous and non-homogenous system) AX = O and AX = B using rank method. **Linear Algebra:** Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms. Engineering Applications of Linear Algebra.			
Module 2	**Partial Derivatives**				**10 CLASSES**
		Review: Differential calculus with single variable. **Partial Derivatives:** Homogeneous functions and Euler's theorem, Total derivative, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor's series for functions of two variables, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers. Engineering Applications of partial derivatives.			
Module 3	**Advanced Integral calculus**				**12 Classes**
		Review: Integral calculus for single integrals. **Advanced Integral calculus:** Beta and Gamma functions–interrelation-evaluation of integrals using gamma and beta functions; error function-properties. Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area			

	enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates. Engineering applications of partial derivatives.				
Module 4	**Ordinary Differential Equations**	**Assignment**	**Programming**		**12 Classes**
	Review: First order and first-degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non- Homogeneous Equations reducible to Homogeneous form. Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non-Exact Differential Equations, Higher order Differential Equation with constant coefficients and with right hand side of the form e^{ax}, sinax, cosax, $e^{ax}f(x)$, $x^n f(x)$ etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, D-operators and Inverse D- operators, Method of Variation of Parameters. Engineering applications of differential equations.				
	List of Laboratory Tasks: Introductory Task: Introduction to usage of the software and simple programming tasks. [3 Sessions] Experiment N0 1: Solution of Simple differentiation with single variable and use of chain Rule. Experiment No. 2: Solution based on application of Tailors' Series using software Experiment No. 3: Application of Maxima and Minima condition using software. Experiment No. 4 Computation of different functions for a specific problem Experiment No. 5 Computation of Area under a curve. Experiment No. 6 Solution of a set of simultaneous equations in matrix method Experiment No. 7 Computation of Eigen Values and Eigen Vectors. Experiment No. 8 Solution of Partial Differential equation Experiment No. 9 solution using Cauchy Equation and Lagrange's Equation				
	Targeted Application & Tools that can be used: The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design. Tools Used: MatLab, Zylink.				
	Assignment:				
	1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB.				

<table>
<tr>
<td></td>
<td colspan="3">2. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.</td>
</tr>
<tr>
<td></td>
<td colspan="3">**Text Book**
1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.</td>
</tr>
<tr>
<td></td>
<td colspan="3">**References:**
1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
2. Walter Ledermann, Multiple integrals, Springer, 1st edition
3. Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India.
4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
5. MatLab usage manual

E-resources/ Web links:

1. https://nptel.ac.in/courses/109104124
2. https://nptel.ac.in/courses/111106051
3. https://nptel.ac.in/courses/111102137
4. https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/
5. https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus
6. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/
7. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
8. https://www.scu.edu.au/study-at-scu/units/math1005/2022/</td>
</tr>
<tr>
<td></td>
<td colspan="3">**Topics relevant to the development of Foundation Skills:** **All solution methods**

Topics relevant to development of Employability skills: **Use of Matlab software.**</td>
</tr>
</table>

<table>
<tr>
<td>**Course Code:** **PHY1002**</td>
<td>**Course Title: Optoelectronics and Device Physics**

Type of Course: 1] School Core & Laboratory integrated</td>
<td>L-T-P-C</td>
<td>2-0-2-3</td>
</tr>
</table>

Version No.	1.0
Course Pre-requisites	**NIL**
Anti-requisites	**NIL**
Course Description	The purpose of this course is to enable the students to understand the fundamentals, working and applications of optoelectronic devices and to develop the basic abilities to appreciate the applications of advanced microscopy and quantum computers. The course develops the critical thinking, experimental and analytical skills. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to use the concepts for technological applications. The laboratory tasks aim to develop following skills: **An attitude of enquiry, confidence and ability to tackle new problems, ability to interpret events and results, observe and measure physical phenomena, select suitable equipment, instrument and materials, locate faults in systems.**
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the concepts of semiconductors, magnetic materials and superconductors. CO2: Apply the concept of materials in the working of optoelectronic and magnetic devices. CO3: Discuss the quantum concepts used in advanced microscopy and quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields. CO5: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. **[Lab oriented].**
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Optoelectronics and device physics "and attain **Skill Development** through **Experiential Learning** techniques
Course Content:	

Module 1	**Fundamentals of Materials.**	Assignment	Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and ferromagnetic materials using excel/ origin software.	**No. of Classes: 07**

	Topics: Concept of energy bands, charge carriers, carrier concentration, concept of Fermi level, Hall effect, Magnetic materials, Superconductors:			
Module 2	**Advanced Devices and applications**	Assignment	Data collection on efficiency of solar cells.	**No. of Classes: 8**
	Topics: p-n junctions, Zener diode, transistor characteristics, Optoelectronic devices:, Solar cells, I-V characteristics, and LEDs			
Module 3	**Quantum concepts and Applications**	Term paper	Seminar on quantum computers.	**No. of classes: 8**
	Topics: Planck's quantum theory, applications of Quantum theory: de-Broglie hypothesis, matter waves, properties. de-Broglie wavelength associated with an electron. Heisenberg's uncertainty principle. Schrodinger time independent wave equation. Particle in a box			
Module 4	**Lasers and Optical fibers**	Term paper	Case study on medical applications of Lasers.	**No. of classes :07**
	Topics: Interactions of radiations with matter, Characteristics of laser, conditions and requisites of laser, Modern day applications of laser: LIDAR, LASIK, Cutting, Welding and Drilling. Principle of optical fibers, Numerical aperture and acceptance angle (Qualitative), Attenuation, Applications: Point to point communication with block diagram, application of optical fibers in endoscopy.			
	List of Laboratory Tasks: Experiment No. 1: Experimental errors and uncertainty using excel Level 1: Calculation of accuracy and precision of a given data Level 2: propagation of errors in addition, subtraction, multiplication and division. Experiment N0 2: To determine the wavelength of semiconductor diode Laser and to estimate the particle size of lycopodium powder using diffraction. Level 1: Determination of Wavelength of Laser Level 2: Finding the particle size of lycopodium powder. Experiment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier. Level 1: To determine the proportionality of Hall Voltage and magnetic flux density Level 2: To determine the polarity of Charge carrier. Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions.			

Level 1:   To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage.

Level 2:   To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance.

Experiment No. 5: To study input and output characteristics of a given Transistor.

Level 1: To determine the input resistance of a given transistor.
Level 2: To determine current transfer characteristics and transistor parameters of a given transistor.

Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire.

Level 1: Determination of Fermi energy and Fermi temperature of given metal wire.

Level 2:   Determination of Fermi energy and Fermi temperature of given bimetallic wire.

Experiment No. 7:   To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance and To measure the photo-current as a function of the irradiance at constant voltage.

Level 1 To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance.
Level 2: To measure the photo-current as a function of the irradiance at constant voltage.
 Experiment No. 8: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance.
Level 1: To study the I-V characteristics
Level 2:   I-R characteristics of a solar cell as a function of the irradiance.
Experiment No. 9:   Calculate the numerical aperture and study the losses that occur in optical fiber cable. .
Level 1:   Calculate the numerical aperture.
Level 2:   study the losses that occur in optical fiber cable.
Experiment No. 10: To determine the magnetic susceptibility of a given diamagnetic and paramagnetic substances using Quincke's method.
Level 1: To determine the magnetic susceptibility of a given diamagnetic substance.
Level 2: To determine the magnetic susceptibility of a given paramagnetic substance.
Experiment No. 11:   Plotting I-V characteristics in forward and reverse bias for LEDs
and Determination of knee voltage.
Level 1:   Plotting I-V characteristics in forward and reverse bias for LEDs
Level 2: Determination of knee voltage.
Experiment No. 12: Determination of Stefan's constant and verification of Stefan-Boltzmann Law.
Level 1:   Determination of Stefan's constant
Level 2:   Verification of Stefan-Boltzmann Law.

	Targeted Application & Tools that can be used: 1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM. **2.** Origin, excel and Mat lab soft wares for programming and data analysis.
	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
	Assessment Type • Midterm exam • Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.) • Quiz • End Term Exam • Self-Learning 1. Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons. 2. Write a report on importance of quantum entanglement in supercomputers.
	Text Book 1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2018.

	References: 1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002.
	   2. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011.
	   3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017.
	   4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012.
	   5. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019

	E-Resourses: 1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live 2. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live 3. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live 4. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live

	5. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live
	Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers. for Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout.

Course Code: ENG1002	Course Title: Technical English Type of Course:1] School Core 2] Laboratory integrated	**L-T-P-C**	1-0-2-2
Version No.	1.0 V. 3		
Course Pre-requisites	Intermediate Level English		
Course Anti-requisites	NIL		
Course Description	Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.		
Course Objectives	The objective of this course is to develop the learners' **EMPLOYABILITY SKILLS** by using **EXPERIENTIAL LEARNING** and **PARTICIPATIVE LEARNING TECHNIQUES.**		
Course Outcomes	**On successful completion of the course, the students shall be able to:** 1. Develop proficiency in using technical vocabulary and terminology. 2. Apply language skills for better speaking skills in technical fields. 3. Write technical descriptions 4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.		
Course Content:			

Module 1	Fundamentals of Technical Communication	Worksheets& Quiz	Vocabulary building	9 Classes
Introduction to Technical English				
Differences between Technical English and General English				
Technical Writing Basics				
Technical Vocabulary				
Module 2	**Technical Presentation**	**Presentations**	**Speaking Skills**	**12 Classes**
Introduction				
Planning the Presentation				
Creating the Presentation				
Giving the Presentation				
Module 3	**Technical Description**	**Assignment**	**Group Presentation**	**12 Classes**
Product Description				
Process Description				
User Manuals				
Transcoding: Diagrams, charts and images				
Module 4	**Technical Writing**	**Assignment**	**Writing Skills**	**12 Classes**
Email Writing				
Persuasive and Descriptive Language				
Professional Email Etiquette				
Writing clear and concise technical emails				
Communicating technical information effectively				
Technical Report Writing				
Types of technical reports (Lab reports, research reports, etc.)				
Components of technical reports				
Writing an abstract and executive summary				
Structure and content organization				
Transcoding: diagrams, charts and images				
List of Laboratory Tasks: 1. Module-1 Level 1: Worksheets				

Level 2: Worksheets
    2.   Module 2
Level 1: Preparing Presentation
Level 2: Giving Presentation (Individual)
    3.   Module-3
Level 1: Product Description & User Manual
Level 2: Process Description & Transcoding
    4.   Module 4
Level 1: Email Writing
Level 2: Report Writing

Targeted Applications & Tools that can be used:
1. Flipgrid
2. Quizzes
3. Youtube Videos
4. Podcast

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

1. **Bring out the essence of technical communication with reference to the conventions of technical communication, with examples**
2. **Prepare a technical presentation on the importance of Technical Communication and its relevance in a technical field, with real-life examples.**

The following individual, as well as group Assignments, will be given to the students.
1. **Presentation**
2. **Describing a product/process**
3. **Individual Reports**

Text Books
1. Kumar, Sanjay; Pushpalatha. *English Language and Communication Skills for Engineers.* Oxford University Press. 2018.
2. Brieger, Nick and Alison Paul. *Technical English Vocabulary and Grammar*.
https://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf

Reference Book:
1. Chauhan, Gajendra Singh, and Kashmiramka, Smita, ***Technical Communication.*** Cengage Publication. 2018.

2. Sunder Jain. *Technical Report Writing*. Centrum Press, 2013.

3. John Bowden. "Writing a Report: How to Prepare, Write & Present Really Effective Reports?". 9th Edition 2011

Comfort, Jeremy et. al. 1984. *Business Reports in English*. Cambridge University Press.

4. Sharma, R.C. and K. Mohan. 2011. Business Correspondence and Report Writing, Fourth Edition. Tata McGraw Hill.

Topics Relevant to the Development of Employability Skills:
Speaking Skills, Writing Skills, Critical Thinking and Critical Analysis, and Group Communication.

Course Code: CSE1004	Course Title: Problem Solving Using C Type of Course: School Core Lab Integrated.	L-T-P-C		1	0	4	3
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.						
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.						
Course Outcomes	On successful completion of this course the students shall be able to: Write algorithms and to draw flowcharts for solving problems Demonstrate knowledge and develop simple applications in C programming constructs Develop and implement applications using arrays and strings Decompose a problem into functions and develop modular reusable code Solve applications in C using structures and Union Design applications using Sequential and Random Access File Processing.						
Course Content:							
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.			

Topics:
Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.

Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.

Topics:
Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. Strings: Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.

Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.

Topics:
Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.

Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.

Topics:
Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.

Module 5	File handling	Case Study	Problem Solving	9 Hrs.

Topics:
Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files

List of Practical Tasks Lab Sheet 1 (Module I)
Programs using IO Statements, Conditional Statements and Looping Statements
Lab Sheet 2 (Module II)
Programs using Arrays and Strings
Lab Sheet 3 (Module III)
Programs using Functions and Pointers
Lab Sheet 4 (Module IV)
Programs using Structures and Unions
Lab Sheet 5 (Module V)
Programs using Files

Text Book(s):
1.   E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.

Reference Book(s):
Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015 Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.

Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

Web Links and Video Lectures:
1.   https://nptel.ac.in/courses/106/105/106105171/
2.   https://archive.nptel.ac.in/courses/106/104/106104128/

Topics:
Overview of natural resources: Definition of resource; Classification of natural resources-biotic and abiotic, renewable and non-renewable. **Water resources**: Types of water resources- fresh water and marine resources;

Soil and mineral resources: Important minerals; Mineral exploitation Soil as a resource and its degradation.

Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Advantages and disadvantages.

Self- learning topics: Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges.; Environmental problems due to extraction of minerals and use; Sustainable Development Goals (SDGs)- targets, indicators, and challenges for SDGs.

Module 3	Environmental Issues: Local, Regional and Global	Case study		02 Classes

Topics:
Environmental Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans- boundary air pollution; Acid rain; Smog.
Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Global change: Ozone layer depletion; Climate change
Self -learning topics: Environmental issues and scales

Module 4	Conservation of Biodiversity and Ecosystems	Assignment		02 Classes

Topics:
Biodiversity-Introduction, types, Species interactions, Extinct, endemic, endangered and rare species, Threats to biodiversity: Natural and anthropogenic activities.

Self-learning topics: Mega-biodiversity, Hot-spots, Major conservation policies. Biodiversity loss: past and current trends, impact.

Module 5	Environmental Pollution and Health	Case study		03 Classes

Topics:
Pollution, Definition, point and nonpoint sources of pollution, **Air pollution**- sources, major air pollutants, health impacts of air pollution.

Water pollution– Pollution sources, adverse health impacts on human and aquatic life and mitigation, Water quality parameters and standards.

Soil pollution and solid waste- Soil pollutants and their sources, solid and hazardous waste, Impact on human health.

Self-learning topics: Noise pollution, Thermal and radioactive pollution.

Module 6	**Climate Change: Impacts, Adaptation and Mitigation**	Assignment/case		**02 Classes**

Topics:
Understanding climate change: Natural variations in climate; Projections of global climate change with special reference to temperature, rainfall and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts

Vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Indigenous knowledge for adaptation to climate change.
Self-learning topics: Mitigation of climate change: Synergies between adaptation and mitigation measures; National and international policy instruments for mitigation**.**

Module 7	**Environmental Management**	Case study	Data analysis	**02 Classes**

Topics:
Environmental management system: ISO 14001; Environmental risk assessment
Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.

Self-learning topics: Environmental audit and impact assessment; Eco labeling /Eco mark scheme

Module 8	**Environmental Treaties and Legislation**	Case study	Data analysis	**01 Classes**

Topics:
Major International Environmental Agreements: Convention on Biological Diversity (CBD), Major Indian Environmental Legislations: Environmental Protection Act, Forest Conservation Act, Public awareness.

Self-learning topics: Paris Agreement, Conference of the Parties (COP), India's status as a party to major conventions: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act.

List of laboratory tasks : Any eight experiments will be conducted
  1. Determination of total alkalinity of a water sample (knowledge)
  2. Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)
  3. Estimation of copper from industrial effluents by colorimetric method (Comprehensive)
  4. Estimation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)

5. Estimation of nickel from industrial effluents by titrimetric method (Comprehensive)
6. Estimation of chloride in drinking water by titrimetric method (Comprehensive)
7. Estimation of fluoride in ground water by colorimetric method (Comprehensive)
8. Determination of calcium in aqueous solution (Comprehensive)
9. Determination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)
10. Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)
11. Biological oxygen demand of waste water sample (Comprehensive)
12. Determination of dissolved oxygen of an industrial effluent (Comprehensive)
13. Quality monitoring analysis of a soil sample (knowledge)
14. Flame photometric estimation of Sodium and potassium (Application)
15. Gas Chromatographic analysis of volatile organic compounds (Application)

Targeted Application & Tools that can be used:
Application areas are Energy, Environment and sustainability
Tools: Statistical analysis of environmental pollutants using excel, origin etc.

Project work/Assignment:

Assessment Type
- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.)
- Lab evaluation/Assignment
- End Term Exam
- Self-learning

Assignment 1: Write a Statement of Environment report of your town/city/state/country

Assignment 2: Individual students will carry out the analyses of polluted solid, liquid, and gaseous samples and propose suitable mitigation measures. A detailed and in-depth report needs to be submitted for each case. This may include preparation of reagents, sample preparation (extraction), chemical analysis carried out, instruments and tools used, data collected and processed, inferences made and conclusions arrived at. Necessary support is given in the form of
lab manual and reference links to e-books.

Text Book
1. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
2. Krishnamurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.
3. Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

Reference Books
1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8th Edition, McGraw-Hill Education, USA.
3. Sinha N., (2020) Wild and Wilful. Harper Collins, India.
4. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/
5. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
6. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

E-resources:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AB_1_06082022_18126
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AB_1_06082022_8761
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AJ_1_02082022_3333
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AB_1_06082022_3063
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AB_1_06082022_20719
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AB_1_06082022_16824
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AB_1_06082022_3954
8. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=DO   AB_1_06082022_491
9. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG UE_BASED&unique_id=CU STOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE _488
10.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECAT ALOGUE_BASED&unique_id=CU STOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE _583
11.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECAT ALOGUE_BASED&unique_id=SP   RINGER_INDEST_1_171
12.   https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle &_t=1687427221129
13.   https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labellin g&_t=1687427279979
14.   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECAT

ALOGUE_BASED&unique_id=TE
XTBOOK_LIBRARY01_06082022_395&xIndex=4

15.   https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

Topics relevant to Skill Development:
Industrial revolution and its impact on the environment, Environmental impact of over-exploitation of water resources, pollution and ill effects, lab experiments for Skills development through Problem solving Techniques. This is attained through assessment component mentioned in course handout. All topics in theory component are relevant to Environment and Sustainability.

Course Code: PPS 1001	Course Title: Introduction to Soft Skills Type of Course: Practical Only Course	L- T-P- C	0	2	1
Version No.	1.0				
Course Pre-requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.				
Anti-requisites	NIL				
Course Description	This course is designed to enable students understand soft skills concepts and improve confidence, communication and professional skills to give the students a competitive advantage and increase chances of success in the professional world. The course will benefit learners in presenting themselves effectively through various activities and learning methodologies.				
Course Objective	The objective of the course is to **familiarize the learners with the** ncepts of "Soft Skills" and attain SKILL DEVELOPMENT through RTICIPATIVE LEARNING techniques.				

Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: **Recognize** significance of soft skills CO2: **Illustrate** effective communication while introducing oneself and others CO3: **List** techniques of forming healthy habits CO4: **Apply** SMART technique to achieve goals and increase productivity
Course Content:	

Module 1	INTRODUCTION TO SOFT SKILLS	**Classroom activity**	**04 Hours**

Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality

Module 2	EFFECTIVE COMMUNICATION	**Individual Assessment**	**10 Hours**

Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume Building- Digital, Video, Traditional.

Module 3	HABIT FORMATION	**Worksheets & Assignment**	**4 Hours**

Topics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right

Module 4	Goal setting & Time Management	**Goal sheet**	**8 Hours**

A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, Time Management Matrix, steps to managing time through outbound group activity, making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity

Targeted Application & Tools that can be used: LMS

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

	1) Individual Assessment
	2) LMS MCQ

Course Code: CHE1018	Course Title: Environmental Science	L- T- P- C	1	0	2	0
	Type of Course: School Core- Theory and Lab	Contact hours	1	0	2	3
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	**NIL**					
Course Description	This course emphasizes the need to conserve biodiversity and adopt a more sustainable lifestyle by utilizing resources in a responsible way. Topics covered include basic principles of ecosystem functions; biodiversity and its conservation; human population growth; water resources, pollution; climate change; energy resources, and sustainability; Sustaining human societies, policies, and education. **This course is designed to cater to Environment and Sustainability**					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Environmental Science" and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.**					
Course Outcomes	On successful completion of this course the students shall be able to: 1) Appreciate the historical context of human interactions with the environment and the need for eco-balance. 2) Describe basic knowledge about global climate change with particular reference to the Indian context. 3) Understand biodiversity and its conservation 4) Develop an understanding on types of pollution and ways to protect the environment 5) Learn about various strategies on Global environmental management systems					
Course Content:						
Module 1	**Humans and the Environment**	Assignment	Data Collection		**01 class**	

Topics: The man-environment interaction: Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment.

Self-learning topics: Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism.

Module 2	Natural Resources and Sustainable Development	Assignment		03 Classes

Topics:
Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. **Water resources**: Types of water resources- fresh water and marine resources;

Soil and mineral resources: Important minerals; Mineral exploitation Soil as a resource and its degradation.

Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Advantages and disadvantages.

Self- learning topics: Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges.; Environmental problems due to extraction of minerals and use; Sustainable Development Goals (SDGs)- targets, indicators, and challenges for SDGs.

Module 3	Environmental Issues: Local, Regional and Global	Case study		02 Classes

Topics:
Environmental Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans-boundary air pollution; Acid rain; Smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Global change: Ozone layer depletion; Climate change

Self -learning topics: Environmental issues and scales

Module 4	Conservation of Biodiversity and Ecosystems	Assignment		02 Classes

Topics:
Biodiversity-Introduction, types, Species interactions, Extinct, endemic, endangered and rare species, Threats to biodiversity: Natural and anthropogenic activities.

Self-learning topics: Mega-biodiversity, Hot-spots, Major conservation policies. Biodiversity loss: past and current trends, impact.

Module 5	Environmental Pollution and Health	Case study		03 Classes

Topics:
Pollution, Definition, point and nonpoint sources of pollution, **Air pollution**- sources, major air pollutants, health impacts of air pollution.

Water pollution– Pollution sources, adverse health impacts on human and aquatic life and mitigation, Water quality parameters and standards.

Soil pollution and solid waste- Soil pollutants and their sources, solid and hazardous waste, Impact on human health.

Self-learning topics: Noise pollution, Thermal and radioactive pollution.

Module 6	Climate Change: Impacts, Adaptation and Mitigation	Assignment/case		02 Classes

Topics:
Understanding climate change: Natural variations in climate; Projections of global climate change with special reference to temperature, rainfall and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts

Vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Indigenous knowledge for adaptation to climate change.

Self-learning topics: Mitigation of climate change: Synergies between adaptation and mitigation measures; National and international policy instruments for mitigation.

Module 7	Environmental Management	Case study	Data analysis	02 Classes

Topics:
Environmental management system: ISO 14001; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.

Self-learning topics: Environmental audit and impact assessment; Eco labeling /Eco mark scheme

Module 8	Environmental Treaties and Legislation	Case study	Data analysis	01 Classes

Topics:
Major International Environmental Agreements: Convention on Biological Diversity (CBD), Major Indian Environmental Legislations: Environmental Protection Act, Forest Conservation Act, Public awareness.

Self-learning topics: Paris Agreement, Conference of the Parties (COP), India's status as a party to major conventions: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act.

List of laboratory tasks : Any eight experiments will be conducted
16. Determination of total alkalinity of a water sample (knowledge)
17. Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)
18. Estimation of copper from industrial effluents by colorimetric method (Comprehensive)
19. Estimation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)
20. Estimation of nickel from industrial effluents by titrimetric method (Comprehensive)
21. Estimation of chloride in drinking water by titrimetric method (Comprehensive)
22. Estimation of fluoride in ground water by colorimetric method (Comprehensive)
23. Determination of calcium in aqueous solution (Comprehensive)
24. Determination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)
25. Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)
26. Biological oxygen demand of waste water sample (Comprehensive)
27. Determination of dissolved oxygen of an industrial effluent (Comprehensive)
28. Quality monitoring analysis of a soil sample (knowledge)
29. Flame photometric estimation of Sodium and potassium (Application)
30. Gas Chromatographic analysis of volatile organic compounds (Application)

Targeted Application & Tools that can be used:
Application areas are Energy, Environment and sustainability
Tools: Statistical analysis of environmental pollutants using excel, origin etc.

Project work/Assignment:

Assessment Type
- **Midterm exam**
- **Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.)**
- **Lab evaluation/Assignment**
- **End Term Exam**
- **Self-learning**

Assignment 1: Write a Statement of Environment report of your town/city/state/country

Assignment 2: Individual students will carry out the analyses of polluted solid, liquid, and gaseous samples and propose suitable mitigation measures. A detailed and in-depth report needs to be submitted for each case. This may include preparation of reagents, sample preparation (extraction), chemical analysis carried out, instruments and tools used, data collected and processed, inferences made and conclusions arrived at. Necessary support is given in the form of lab manual and reference links to e-books.

Text Book
4. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
5. Krishnamurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.
6. Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

Reference Books

7. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
8. William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8th Edition, McGraw-Hill Education, USA.
9. Sinha N., (2020) Wild and Wilful. Harper Collins, India.
10. www.ipcc.org;   https://www.ipcc.ch/report/sixth-assessment-report-cycle/
11. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
12. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

E-resources:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_18126
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_8761
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAJ_1_02082022_3333
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3063
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_20719
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_16824
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3954
8. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_491
9. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488
10. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583
11. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER_INDEST_1_171
12. https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129
13. https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979
14. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_395&xIndex=4
15. https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

SEMESTER II

Course Code: MAT1003	Course Title: Applied Statistics Type of Course: School Core	L –T-P- C	1	0	2	2
Version No.	3.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of** "Applied Statistics" and attain **Skill Development Through Problem Solving techniques**.					
Expected Outcome:	At the end of this course, students will be in a position to 1. apply the techniques of descriptive statistics effectively 2. interpret the ideas of probability and conditional probability 3. demonstrate the knowledge of probability distributions 4. Compute statistical parameters, correlation and regression, probability and sampling distributions using R software.					
Module 1	**Descriptive Statistics**	Assignment	Coding needed		**10 classes**	

Introduction to Statistics, Data and statistical thinking, review of basic statistical parameters, Covariance, Correlation, Types of Measures of Correlation - Karl Pearson's Correlation Coefficient, Spearman Rank Correlation, linear regression, Multi linear regression **.**

Module 2	Probability			6 classes

Introduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional Probability, Total Probability and Baye's theorem with examples

Module 3	Random Variables and Probability Distributions		Coding needed	14 classes

Introduction to Random variables, Discrete Random Variables and Continuous Random Variables, Probability Distributions, Probability Mass Function and Probability Density Function, Various Probability distributions, Binomial, **Negative Binominal (Self Study)**, Poisson, Normal and Exponential distributions

Module 4	Sampling Theory		Coding needed	15 classes

Introduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard Error. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between Parametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and **Difference of Means (Self Study)**, Small Sample Tests: Student's t-Test for Single Mean and **Difference of Means,** F-Test, Chi-Square Test.

Targeted Application & Tools that can be used:

The objective of the course is to familiarize students with the theoretical concepts of probability and statistics and to equip them with basic statistical tools to tackle engineering and real-life problems.

Tools used: R Software / MS-Excel

Text Book
1. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, 2016.

References
1. James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 2018.

2. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020.

3. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Statistics for Business and Economics, 2019.

4. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2018.

5. Richard A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 2018.

6. Kishor S Trivedi, Probability and Statistics with reliability, Queuing and Computer Science Applications, John Wiley & Sons, 2008.

Topics relevant to SKILL DEVELOPMENT: The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions for ==Skill Development== through ==Problem Solving methodologies.== This is attained through assessment component mentioned in course handout.

Course Code: MEC1006	Course Title: Engineering Graphics Type of Course: School Core & Theory Only	L- T-P-C	2-0-0-2
Version No.	1.2		
Course Pre-Requisites	NIL		
Anti-requisites	NIL		
Course Description	The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Engineering Graphics" and attain SKILL DEVELOPMENT through Problem solving methodologies.		
Course Outcomes	On successful completion of this course the students shall be able to: (1) Demonstrate competency of Engineering Graphics as per BIS conventionsand standards. (2) Comprehend the theory of projection for drawing projections of Points, Lines andPlanes under different conditions. (3) Prepare multiview orthographic projections of Solids by visualizing them indifferent positions.		

Module 1	Introduction to Drawing	Assignment	Standard technical drawing	**02 Sessions**

			(4) Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions.	
Module 1	Introduction to Drawing	Assignment	Standard technical drawing	**02 Sessions**

Topics:

Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Line conventions, dimensioning, Selection of drawing sheet size and scale.

[02 Hours: Comprehension Level]

Module 2	Orthographic projections of	Assignment	Projection methods Analysis	**10 Sessions**
	Points, Straight Lines and Plane Surfaces			

Topics:

Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points in all 4 quadrants.

Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only.

[10 Hours: Application Level]

Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	**10 Sessions**

Topics:

Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection).

[10 Hours: Application Level]

Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	**8 Sessions**

Topics:

Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects.

[8 Hours: Application Level]

Text Book:
1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.

References:
1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore.

2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.

3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.

Web resources:

https://nptel.ac.in/courses/112103019

Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Course Code: ECE2007	Course Title: Digital Design Type of Course: Theory &Integrated Laboratory	L- T-P- C	2	0	2	3
Version No.	2.0					
Course Pre-requisites	[1] Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc. The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.					

Course Outcomes	On successful completion of this course the students shall be able to:
	i. **Describe** the concepts of number systems, Boolean algebra and logic gates.
	ii. **Apply** minimization techniques to simplify Boolean expressions.
	iii. **Demonstrate** the Combinational circuits for a given logic
	iv. Demonstrate the Sequential and programmable logic circuits
	v. **Implement** various combinational and sequential logic circuits using gates.

Course Content:				
Module 1	**Fundamentals of Number systems- Boolean algebra and digital logic**	Application Assignment	Data Analysis task	**06 classes**

Topics:
Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.

Module 2	**Boolean function simplification**	Application Assignment	Data Analysis task	**08 Classes**

Topics:
Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.

Module 3	**Combinational Logic circuits:**	Application Assignment	Programming Task & Data Analysis task	**08 Classes**

Topics:
Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.

List of Laboratory Tasks:
Experiment N0 1: Verify the Logic Gates truth table
Level 1: By using Digital Logic Trainer kit
Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 2: Verify the Boolean Function and Rules
Level 1: By using Digital Logic Trainer kit
Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 3: Design and Implementations of HA/FA
Level 1: By using basic logic gates and Trainer Kit
Level 2: By using Universal logic gates and Trainer Kit

Experiment No. 4: Design and Implementations of HS/FS
Level 1: By using basic logic gates and Trainer Kit
Level 2: By using Universal logic gates and Trainer Kit

Experiment No. 5: Design and Implementations of combinational logic circuit for specifications
Level 1: Specifications given in the form of Truth table
Level 2: Specification should be extracted from the given scenario

 Experiment No. 6: Study of Flip flops

Experiment No. 7: Design and Implementations of sequential logic circuit for specifications
Level 1: Specifications given in the form of Truth table
Level 2: Specification should be extracted from the given scenario

Experiment No.8: HDL coding for basic combinational logic circuits
Level 1: Gate level Modeling
Level 2: Behavioral Modeling

Experiment No.9: HDL coding for basic sequential logic circuit
Level 1: Gate level Modeling
Level 2: Behavioral Modeling

Targeted Application & Tools that can be used:

Digital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, Home Automation, Communication in systems in industries

Professionally Used Software: HDL/VHDL/Verilog HDL/ OOPS

Text Book(s):
1. Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education, 6th edition

2. Thomas L. Floyd "DIGITAL LOGIC DESIGN" , Pearson Education, fourth edition.

Reference(s):
Reference Book(s):
R1. Jain, R. P., "Modern Digital Electronics", McGraw Hill Education (India), 4th Edition

R2. Roth, Charles H., Jr and Kinney Larry L., "Fundamentals of logic Design", Cengage Learning, 7th   Edition

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download
       (studymaterialz.in)
    1. **eBook1**: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
    2. {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download
}
    3. **eBook2:**Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
    4. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
    5. Digital Logic Design PPT Slide 1 (iare.ac.in)
    6. Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video
CircuitVerse - Digital Circuit Simulator online
Learn Logisim➠ Beginners Tutorial | Easy Explanation! - Bing video
       Digital Design 5: LOGISIM Tutorial & Demo
       7. https://presiuniv.knimbus.com/user#/home
E-content:

    1. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
    2. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir   Ahmed   Tarique;Sultan   Uddin   Ahmed;Md.

Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)

3. A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.

4. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

Topics relevant to "SKILL DEVELOPMENT": Adders, Multiplexers, Decoders / Encoders; Flip-Flops, Counters and Registers for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE1006	Course Title: Problem Solving using JAVA		1	0	4	3
	Type of Course: **Integrated**	L- T-P- C				
Version No.		2.0				
Course Pre-requisites		CSE1004 – Problem Solving Using C				
Anti-requisites		Nil				
Course Description		This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.				
Course Objective		The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain **SKILL DEVELOPMENT** through **EXPERIENTIAL LEARNING** techniques				
Course Out Comes		**On successful completion of the course the students shall be able to:** **C.O. 1:** Describe the basic programming concepts. [Knowledge] **C.O. 2:** Apply the concept of classes, objects and methods to solve problems. [Application] **C.O. 3:** Apply the concept of arrays and strings. [Application] **C.O. 4:** Implement inheritance and polymorphism building secure applications. [Application] **C.O. 5:** Apply the concepts of interface and error handling mechanism. [Application]				
Course Content:						
Module 1	**Basic Concepts of Programming and Java**	Assignment	Data Collection/Interpretation			**12 Sessions**

Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.					
Module 2	**Classes, objects, methods and Constructors**	Case studies / Case let		Case studies / Case let	**12 Sessions**
Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.					
Module 3	**Arrays, String and String buffer**	Quiz		Case studies / Case let	**14 Sessions**
Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.					
Module 4	**Inheritance and Polymorphism**	Quiz	Case studies / Case let		**14 Sessions**
Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.					
Module 5	**Input & Output Operation in Java**	Quiz	Case studies / Case let		**14 Sessions**
Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.					

List of Laboratory Tasks:
P1 - Problem Solving using Basic Concepts.
P2 - Problem Solving using Basic Concepts and Command Line Arguments.
P3 - Programming assignment with class, objects, methods and Constructors.
P4 - Programming assignment with method overloading.
P5 - Programming assignment with constructor overloading.
P6 - Programming assignment with Static members and static methods.
P7 - Programming assignment with Nested classes.

P8 - Programming assignment using Arrays.
P9 - Programming assignment using Strings.
P10 - Programming assignment using String Builder.

P11 - Programming assignment using Inheritance and super keyword.
P12 - Programming assignment using Method overriding and Dynamic method invocation.
P13 - Programming assignment using Final keywords.
P14 - Programming assignment using Abstract keywords.
P15 - Programming assignment using Interface.
P16 - Programming assignment using Interface.
P17 - Programming assignment CharacterStream Classes
P18 - Programming assignment Read/Write Operations with File Channel

Targeted Application & Tools that can be used : JDK /eclipse IDE/ net Beans IDE.

Text Book

T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education.

References

R1: Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.

 E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf

 E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)

 Web **resources**

ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q

ps://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":
1. Static Polymorphism
2. Method overloading, constructors
3. constructor overloading
4. this keyword
5. static keyword and Inner classes
6. Inheritance and Polymorphism.

for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 2014	Course Title: Software Engineering Type of Course: School Core [Theory Only]	L-T-P- C	3	0	3
Version No.	1.0				
Course Pre-requisites	**NIL**				
Anti-requisites	**NIL**				
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge)				

	4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)			
Module 1	**Introduction to Software Engineering and Process Models (Knowledge level)**	Quiz		**09 Hours**

Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle
Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.

Module 2	**Software Requirements, Analysis and Design (Comprehension level)**	Assignment	Development of SRS documents for a given scenario	**11 Hours**

Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment.
Design: Design concepts, Architectural design, Component based design, User interface design.

Module 3	**Agile Principles & Devops (Knowledge level)**	Quiz		**09 Hours**

Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method.
Devops: Introduction, definition, history, tools.

Module 4	**Software Testing and Maintenance (Application Level)**	Assignment	Apply the testing concepts using Programing	**12 Hours**

Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.
Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).
Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.

Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools

Text Book
1] Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII tion, McGraw-Hill, 2017.
2] Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI tion, McGraw-Hill, 2018.

References
Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning ate limited, 2015.
Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.

e Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002						

Topics Relevant to "Skill Development: Balck box Testing, White box Testing, Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout

ENG2001	**Advanced English**		**L- T- P- C**	**1**	**0**	**2**	**2**
Version No.	1.3						
Course Pre-requisites	ENG1002 Technical English						
Anti-requisites	**NIL**						
Course Description	The course emphasizes on technical communication at advanced level by exploring critical reading, technical presentation and review writing. The purpose of the course is to enable learners to review literature in any form or any technical article and deliver technical presentations. Extensive activities in practical sessions equip to express themselves in various forms of technical communications. Technical presentations and the module on career setting focus on learners' area of interests and enhance their English language writing skills to communicate effectively.						
Course Out Come	On successful completion of the course the students shall be able to: 1. Develop a critical and informed response reflectively, analytically, discursively, and creatively to their reading. 2. Communicate effectively, creatively, accurately and appropriately in their writing. 3. Deliver technical presentations 4. Design resume and create professional portfolio to find a suitable career						
Course Content: Theory							

Module 1	**Critical Reasoning and Writing**	**Writing Essays**	**Critical Reading**	**4 Classes**
Topics: • A Catalog of Reading Strategies • The Myth of Multitasking • A Guide to Writing Essays Speculating about Causes or Effects • Is Google Making Us Stupid (Self Study)				
Module 2	**Technical Presentation**	**Presentation**	**Oral Skills**	**3 Classes**
Topics: • Planning the presentation • Creating the presentation • Giving the presentation				

Module 3	Writing Reviews	Prezi	Review Writing	4 Classes

Topics:
- Review Writing
- Short film reviews
- Advanced English Grammar (Self Study)

Module 4	Starting your Career	Online Writing Lab	Writing Skills	4 Classes

Topics:
- Preparing a Resume
- Writing Effective Application Letter
- Creating a Professional Portfolio

Course Content: Practical Sessions

Module 1	Critical Reasoning and Writing	8 Classes

1. Reading and Analyzing
   Level 1 – Annotation
   Level 2 - Assumptions
2. Writing Narrative Essays
   Level 1 – Draft 1
   Level 2 – Draft 2

Module 2	Technical Presentation	10 Classes

3. Fishbowl
   In Fishbowl, students form concentric circles with a small group inside and a larger group outside. Students in the inner circle engage in an in-depth discussion, while students in the outer circle listen and critique content, logic, and group interaction.
   Level 1 – within group
   Level 2 – Among 2 group
4. Technical Group Presentation

Module 3	Writing Reviews	4 Classes

5. Practice Worksheets
   Level 1 – Eliminating the Passive Voice
   Level 2 – Simple, compound and complex sentences
6. Writing Short Film Reviews

Module 4	Starting your Career	6 Classes

7. Collaborative Project
   Job search and writing report
   Writing Resume

Module 1-4	Academic Journal	2 Classes

8. Academic Journal Writing
   Level 1- Mid Term
   Level 2 – End Term

Targeted Application & Tools that can be used: Writing reports, Review writing, Group Discussion, Dyadic interviews, Grammarly.com

Project work/Assignment:

Academic Journal – Assignment

In Academic Journal (CIJ), students compile task and activities completed in each module and submit to the instructor at the middle and end of the semester.

References

1. Hering, Heik. *How to Write Technical Reports: Understanding Structure, Good Design, Convincing Presentation*. Springer.
2. Johnson, Richard. (2010) *Technical Communication Today.* Pearson, 2015
3. Rice B. Adelrod, Charles R. Cooper and Ellen C. Carillo. (2020) *Reading Critically Writing Well: A Reader and Guide*. Beford/St. Martin's Macmillan Learning, New York.
4. The Princeton Review. (2010) *MCAT Verbal Reasoning & Writing.* The Princeton Review, Inc.
5. https://www.hitbullseye.com/Strong-and-Weak-Arguments.php Accessed on 10 Dec 2021
6. https://www.inc.com/guides/how-to-improve-your-presentation-skills.html Accessed on 10 Dec 2021

Topics Relevant to "employability": Critical Reasoning, Presentation, Review Writing and Starting Career

Topics Relevant to "Human Values and Professional Ethics": Critical reasoning

SEMESTER III

Course Code: CSE1005	Course Title: Programming in Python	L- T-P- C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of Computers and Mathematics					
Anti-requisites	NIL					

Course Description	The purpose of this course is to enable the students to develop python scripts using its basic programming features and also to familiarize the Python IDLE and other software's. This course develops analytical skills to enhance the programming abilities.
	The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to build real time applications.
Course Object	The objective of the course is to familiarize the learners with the concepts of Programming in Python and attain Employability through Problem Solving Methodologies.
Course Outcomes	On successful completion of this course the students shall be able to:
	Summarize the basic Concepts of python.
	2. Demonstrate proficiency in using data structures.
	3. Illustrate user-defined functions and exception handling.
	4. Identify the various python libraries.
Course Content:	

Module 1	Basics of Python programming	Assignment	Programming	14 Classes

Topics: Data types, operators and Expressions, Input and Output Statements. Control Structures – Selective and Repetitive structures

Module 2	Indexed and Associative Data Structures	Simple applications	Programming	20 Classes

Topics: Strings, Lists, Sets, Tuples, Dictionaries

Module 3	Functions, Exception handling and libraries	Case study	Programming	10 Classes

Topics: User defined functions, exception handling, Introduction to python built-in libraries

List of Laboratory Tasks:

Sl. No.	Experiment Name
1	PROGRAMS ON OPERATORS AND EXPRESSIONS
	Level - 1 : Basic programs on Operators and Expressions

	Level - 2 : Develop applications to solve mathematical equations
2	PROGRAMS ON CONTROL STRUCTURES Level - 1 : Basic programs on Control structures Level - 2 : Create applications to solve the real time problems
3	PROGRAMS ON SELECTIVE AND REPETITIVE STRUCTURES Level - 1 : Basic programs on Selective and Repetitive structures Level - 2 : Create applications to solve the real time problems
4	PROGRAMS ON STRINGS Level - 1 : Basic programs on Strings and its manipulation Level - 2 : Develop Real world applications that involves string matching
5	PROGRAMS ON LISTS, TUPLES and SETS Level - 1 : Basic programs on lists, Tuples and Sets Level - 2 : Create applications that involves sequential and Random access of data
6	PROGRAMS ON DICTIONARIES Level - 1 : Basic programs on dictionaries Level - 2 : Create applications that involves structuring of data.
7	PROGRAMS ON FUNCTIONS Level - 1 : Basic programs on Functions Level - 2 : Develop Real world applications using functions
8	PROGRAMS ON EXCEPTION HANDLING Level - 1 : Basic programs on exception handling Level - 2 : Develop applications that involves exception handling
9	BASIC PROGRAMS ON BUILT-IN LIBRARIES Level - 1 : Basic programs on python modules

	Level – 2: Develop applications using python libraries

Targeted Application & Tools that can be used:

Targeted Application : Web application development, AI, Operating systems

Tools: Python IDLE, ANACONDA

Application Areas:

Web Development

Game Development

Scientific and Numeric Applications

Artificial Intelligence and Machine Learning

Software Development

Enterprise-level/Business Applications

Education programs and training courses

Language Development

Operating Systems

Web Scrapping Applications

Image Processing and Graphic Design Applications

Professionally Used Software: Python IDLE, Spyder, Jupyter Notebook, Google Colab

Project work/Assignment:

Project Assignment: Developing python scripts using built in methods and functions

Text Books:

Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, Forth
edition   (20 March 2018).

Alex Campbell, "Python for Beginners: Comprehensive Guide to the Basics of Programming, Machine Learning, Data Science and Analysis with Python", August 29, 2021.

Charles Dierbach, "Introduction to Computer Science Using Python", Wiley India Edition,2015.

References:

E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", Tata McGraw-Hill, 2016

Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2017

Brady Ellison, "Python for Beginners: A crash course to learn Python Programming in 1 Week (Programming Languages for Beginners)", August 25, 2021.

Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code execution

https://practice.geeksforgeeks.org/courses/Python-Foundation

Topics relevant to development of "FOUNDATIONS SKILLS"- Solve the real time problems by analyzing and visualizing the data.

Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS"- Data collection and its arrangement

Course Code: CSE 2001	Course Title: Data Structures and Algorithms Type of Course: Integrated	L-T-P- C	3-0	2	4
Version No.	1.0				
Course Pre-requisites	Problem Solving Using Java				
Anti-requisites	NIL				
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Structures and Algorithms and attain Skill Development through Experiential Learning techniques.				

	On successful completion of the course the students shall be able to:
Course Out C omes	**CO1:** Implement program for given problems using fundamentals of data structures. [Application] **CO2:** Apply an appropriate linear data structure for a given scenarios. [Application] **CO3:** Apply an appropriate non-linear data structure for a given scenarios. [Application] **CO4:** Explain the performance analysis of given searching and sorting algorithms.
Course Content:	

Module 1	**Introduction to Data Structure and Linear Data Structure – Stacks and Queues**	Assignment	Program activity	**18 Sessions**

Introduction – Introduction to Data Structures, Types and concept of Arrays.
Stack - Concepts and representation, Stack operations, stack implementation using array and Applications of Stack.
Queues - Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.

Module 2	**Linear Data Structure- Linked List**	Assignment	Program activity	**17 Sessions**

Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list.
Recursion - Recursive Definition and Processes, Programming examples.

Module 3	**Non-linear Data Structures - Trees and Graph**	Assignment	Program activity	**15 Sessions**

Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal. **Graph** - Basic Concept of Graph Theory and its Properties, Representation of Graphs.

Module 4	**Searching & Sorting Performance Analysis**	Assignment	Program activity	**14sessions**

Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort.
Performance Analysis - Time and space analysis of algorithms – Average, best and worst case analysis.

List of Laboratory Tasks:
Lab sheet -1
Level 1: Prompt the user, read input and print messages.Programs using class, methods and objects
Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.
Lab sheet -2
Level 1: Programming Exercises on Stack and its operations
Level 2: Programming Exercises on Stack and its operations with condition

Lab sheet -3
Level 1: Programming on Stack application infix to postfix Conversion
Level 2: -
Lab sheet -4
Level 1: Programming Exercises on Queues and its operations with conditions
Level 2: -
Lab sheet -5
Level 1: Programming Exercises on Linked list and its operations.
Level 2: Programming Exercises on Linked list and its operations with various positions
Lab sheet -6
Level 1: -
Level 2: Programming scenario based application using Linked List
Lab sheet -7
Level 1: Programming Exercises on factorial of a number
Level 2: Programming the tower of Hanoi using recursion
Lab sheet -8
Level 1: -
Level 2: Programming the tower of Hanoi using recursion
Lab sheet -9
Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -
Lab sheet -10
Level 1: Program to Construct Binary Search Tree and Graph
Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS
Lab sheet -11
Level 1: Program to Implement the Linear Search & Binary Search
Level 2: Program to Estimate the Time complexity of Linear Search
Lab sheet -12
Level 1: Program to Implement and Estimate the Time complexity of Insertion Sort
Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort
Lab sheet -13
Level 1: Program to Implement and Estimate the Time complexity of Selection Sort
Level 2: Program to Implement and Estimate the Time complexity of Selection Sort

Targeted Application & Tools that can be used
Use of PowerPoint software for lecture slides and use of Ubuntu for lab programs to execute. Tool is Codetantra tool.
Project work/Assignment:
Assignment: Students should complete the lab programs by end of each practical session and module wise assignments before the deadline.
Text Book
T1 Narasimha Karumanchi: *"Data Structures and Algorithms Made Easy in Java"*, 5th Edition, CareerMonk Publications, 2017.

References

 R1   Mark Allen Weiss: *"Data Structures and Algorithm Analysis in Java",* 4th Edition, Pearson Educational Limited, 2014.

R2 Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser: *"Data Structures and Algorithms in Java"*, 6th Edition, John Wiley & Sons, Inc., ISBN: 978-1-118-77133-4, 2014.

R3 Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, 2017: *"Introduction to Algorithms",* 3rd Edition, PHI Learning Private Limited.

Web resources:
1.   For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
2.   For Lab : codetantra tool
3.   https://puniversity.informaticsglobal.com/login

Topics relevant to "SKILL DEVELOPMENT": Llinked list and its type, Tree traversal and hashing tables for Skill Development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE2011	Course Title: Data Communications and Computer Networks Type of Course: Program Core - Theory	L-T- P-C	3-0	0	3
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites					
Course Description	This is the first course on data communication and computer networks. This course gives a thorough introduction to all the layers of a computer network following the top-down approach. Application, Transport, Network, and data link layer protocols are taught with analysis wherever applicable. All-important concepts required to take up advanced courses and to face placement tests by an undergraduate student will be covered in this course. This course also covers necessary foundational topics pertaining to data communications. This course can be followed up with an advanced computer network by the student to get a complete understanding of this domain.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain Skill Development through Participative Learning techniques.				

Course Outcomes	1. Explain the concepts of Computer Networks and Working Principles of Application Layer and Transport Layer (Comprehension)			
	2. Apply the Knowledge of IP Addressing and Routing Mechanism in Computer Networks. (Application)			
	3. Discuss the functionalities of Data Link Layer (Comprehension)			
	4. Explain the Basic Concepts of Data communication. (Comprehension)			

| Course Content: | ||||

Module 1	Overview, Application and Transport Layers.	Assignment	Comprehension	13 Sessions
Introduction: Computer Networks, Topologies, OSI Reference Model, TCP/IP model. Principles of Network Applications, The Web and HTTP, DNS—The Internet's Directory Service, Socket Programming: Creating Network Applications. Introduction and Transport-Layer Services, Connection-less Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.				
Module 2	Network Layer	Assignment	Application	12 Sessions
Overview of Network Layer, Forwarding and Routing, The Data and Control Planes.The Internet Protocol (IP): IPv4, Addressing, IPv6, IPv4 Datagram Format, IPv4 Addressing, Network Address Translation (NAT), IPv6. Introduction Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Intra-AS Routing in the Internet, OSPF Routing Among the ISPs: BGP, Introduction to BGP. ICMP: The Internet Control Message Protocol.				
Module 3	Data Link Layer	Assignment	Comprehension	10 Sessions
Introduction to the Link Layer, The Services Provided by the Link Layer, Error-Detection and - Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols. Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs),DHCP,UDP,IP and Ethernet.				
Module 4	Physical Layer with Data Communication	Assignment	Comprehension	O7 Sessions
Data communications: Components, Data Representation, Data Flow, Analog and Digital Signals, Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Transmission Impairment, Data Rate Limits: Noiseless Channel, Nyquist Bit Rate, Noisy Channel: Shannon Capacity, Performance: Bandwidth, Throughput, Latency (Delay), Bandwidth-Delay Product, Parallel/Serial				

Transmission, Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing.

Targeted Application & Tools that can be used: Instant Messaging Telnet File Transfer Protocol Video Conferencing	
Textbooks: T1. James F. Kurose, Keith W. Ross, "Computer Networking A Top down Approach", 8th Edition, Pearson, 2021. T2. Behrouz A. Forouzan, "Data Communications and Networking", 6th Edition, Tata McGraw-Hill, 2021.	
References: R1. William Stallings: "Data and Computer Communication", 10th Edition, Pearson Education, 2017. R2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2012. Web references: Digital Learning Resources (Library Resources) W1. https://puniversity.informaticsglobal.com/login https://nptel.ac.in/courses/105106053	
Topics relevant to "Skill Development": Virtual Local Area Networks (VLANs), DHCP, UDP, IP and Ethernet for Skill Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.	

Course Code: CSE2009	Course Title: Computer Organization and Architecture	L-T- P- C	3-0	0	3
Version No.	2.0				

Course Pre-requisites	CSE 2015 Digital Design			
Anti-requisites	NIL			
Course Description	This course introduces the core principles of computer architecture and organization from basic to intermediate level. This theory based course emphasizes on understanding the interaction between computer hardware and software. It equips the students with the intuition behind assembly-level instruction set architectures. It helps the students to interpret the operational concepts of computer technology as well as performance enhancement.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computer Organization and Architecture and attain Skill Development through Participative Learning techniques.			
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the basic components of a computer, their interconnections, and instruction set architecture [Comprehension] 2] Apply appropriate techniques to carry out selected arithmetic operations 3] Explain the organization of memory and processor sub-system			
Course Content:				
Module 1	Basic Structure of computers	Assignment	Data Analysis task	12 Classes

 Topics:

Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.

Module 2	Instruction Set Architecture and Memory Unit	Assignment	Analysis, Data Collection	12 Classes

 Topics:

Instruction Set Architecture: Addressing Modes, Stacks and Subroutines.

Memory System: Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.

Module 3	Arithmetic and Input/output Design	Case Study	Data analysis task	10 Classes

Topics:

Arithmetic: Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations.

Input/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits

Module 4	BPU and Pipelining	Assignment	Analysis, Data Collection	11 Classes

Topics:

Basic Processing Unit: Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization.

Pipelining: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards.

Targeted Application & Tools that can be used:

Targeted employment sector is processor manufacturing and memory chip fabrication vendors like Intel, AMD, Motorola, NVidia, Samsung, Micron Technology, western Digital etc. Targeted job profiles include Memory circuit design and verification engineers, Physical system design engineer, System programmer, Fabrication engineer etc.

Tools:

Virtual Lab, IIT KGP

Tejas – Java Based Architectural Simulator, IIT Delhi

Text Book

Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Fifth Edition, McGraw-Hill Higher Education, 2016 reprint.

References

William Stallings, "Computer Organization & Architecture – Designing for Performance", 11th

Edition, Pearson Education Inc., 2019

David A. Patterson & John L. Hennessy, "Computer Organization and Design MIPS Edition-The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020.

Web References:

NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta, Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163

NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman. https://nptel.ac.in/courses/106106092

https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to "SKILL DEVELOPMENT": Generation of Computers, CISC and RISC processors, Bus Arbitration, Collaboration and Data collection for Term assignments and Case Studies for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

SEMESTER IV

Course Code: CSE2074	Course Title: Database Management Systems Type of Course: 1) School Core	L-T- P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course introduces the core principles and techniques required in the design and implementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve the information efficiently. It helps the students to learn and practice data modeling and database designs. The associated laboratory is designed to implement database design using MySQL (My Structured Query Language-Open Source) in information technology applications. All the exercises will focus on the fundamentals for creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Outcomes:	On successful completion of the course the students shall be able to: 1] Understand core concepts of database (Knowledge) 2] Apply normalization techniques to refine database schema (Application) 3] Develop database with concurrent transactions execution feature (Application)				

Course Content				
Module 1	Introduction to Database and its Conceptual Model (Knowledge)	Assignment	Problem Solving	6 Classes

Topics:

Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems.

Conceptual Data Modelling: Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.

Module 2	Query Languages (Application)	Assignment	Problem Solving	7 Classes

Topics:

Relational Algebra with selection, projection, rename, set operations, cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.

MySQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.

Module 3	Designing and Refining Database Schema (Application)	Assignment	Programming Task	7 Classes

Topics:

Schema Design: Problems in schema design, redundancy and anomalies.

Schema refinement: Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions.

Module 4	Transaction Management and Concurrency Control (Application)	Assignment	Problem Solving	6 Classes

Topics:

Transaction: Desirable properties (ACID) of Transactions, Simultaneous Transactions and their problems like dirty read, lost update and incorrect summary, Serializability, Conflict Serializability, View Serializability;

Concurrency Control: Locking and Time-stamping concurrency schemes.

List of Laboratory Tasks:

Create Employee, Student, Banking and Library databases and populate them with required data. Do the following experiments of different lab sheets on those databases.

Labsheet-1 [3 Practical Sessions]

Experiment No 1: [1 Session]

To study and implement Data Definition Language (DDL) commands and   Data Manipulation Language (DML) commands of MySQL.

Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.

Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]

Experiment No. 2: [2 Sessions]

To implement different types of MySQL constraints and relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators.

Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.

Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical Sessions]

Experiment No. 3: [1 Session]

To try for aggregation of data in to groups and sub-groups using Group by, HAVING clauses and sort data using Order By Clauses.

Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database.

Level 2: Implement MySQL queries on library database using appropriate clauses and aggregate functions. Also order the data either in ascending and descending order using corresponding clause. [Library databases].

Experiment No. 4: [2 Session]

To study and implement different types of Set and Join Operations [3 Slots]

Level 1: Demonstrate different types of Set Operations (UNION, UNION ALL, INTERSECT, MINUS) and Join Operations (INNER JOINs, OUTER JOINS, CROSS JOIN, NATURAL JOIN) on two or more tables of Banking Database.

Level 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given scenario. [Library databases]

Labsheet-3 [3 Practical Sessions]

Experiment No. 5: [3 sessions]

To study and implement Views, and Procedures in MySQL.

Level 1: Implement MySQL Views, and Procedures in MySQL on Employee database.

Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database]

Labsheet-4 [3 Practical Sessions]

Experiment No. 6: [3 Sessions]

To study and implement Functions, and Triggers in MySQL.

Level 1: Implement MySQL Functions and Triggers in MySQL on Employee database.

Level 2: Analyze the requirement and construct Functions and Triggers on Mini Project Domain. [Banking Database]

Targeted Application & Tools that can be used:

Application Area: Relational database systems for Business, Scientific and Engineering Applications.

Tools/Simulator used: MySQL

Text Book

1] Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2017.

References

1] Hector Garcia Molina, Jeffery D Ullman, Jennifferwidom , "Database systems: The Complete Book", Pearson Publication, 2nd edition.

2] Avi Silberschatz, Henry F. Korth , S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.

Topics relevant to development of "Skill Development": Relational database design using ER- Relational mapping, Implementation of given database scenario using MySQL for Skill development through Experiential Learning Techniques. This is attained through assessment component in the course handout.

Course Code: CAI3428	Course Title: Practical Deep Learning with TensorFlow Type of Course: Discipline Elective - Theory & Integrated Laboratory		L- T-P- C	2	0	2	3
Version No.	1.0						
Course Pre-requisites	CSE 3001-Artificial Intelligence and Machine Learning						
Anti-requisites	NIL						
Course Description	This course introduces students to the concepts of deep neural networks and state of the art approaches to develop deep learning models. In this course students will be given an exposure to the details of neural networks as well as deep learning architectures and to develop end-to-end models for such tasks. It will help to design and develop an application-specific deep learning models and also provide the practical knowledge handling and analyzing end user realistic applications.						
Course Objective	This course is designed to improve the learners EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.						
Course Outcomes	On successful completion of this course the students shall be able to: 1. Implement backpropagation and gradient descent techniques to train neural networks effectively. (Apply) 2. Build and train deep learning models using Python libraries such as TensorFlow and Keras for real-world applications. (Apply) 3. Utilize deep learning techniques for image classification, object detection, sentiment analysis, and language modeling. (Apply)						
Course Content:							

Module 1	**Basics of Neural Networks**	Assignment		**18[8L+10P] Sessions**

Topics:
Understanding Perceptron with Excel, Understanding Multilayer Perceptron with Excel, From Multilayer Perceptron to Deep Learning, Error Backpropagation and Gradient Descent to reduce errors, Activation Functions, Deep Learning, Problems with Deep Learning with solutions.

Module 2	**TensorFlow Basics**	Assignment		**14[7L+7P] Sessions**

Topics:
Introduction to TensorFlow, TensorFlow dataset, Machine Learning with TensorFlow

Module 3	Deep Learning methods with Tensor Flow and Keras	Assignment		14[6L+8P] Sessions

Topics:

Main Features of TensorFlow, Keras basics, AI with Keras.

Project work/Assignment:
1. **Assignment 1 on (Module 1 and Module 2)**
2. **Assignment 2 on (Module 3)**

List of Laboratory Tasks:

Lab 1: Working with Deep Learning Frameworks

Objective: Explore various Deep Learning Frameworks

Tasks: Identify deep learning frameworks (Keras, Tensorflow, Matplotlib, etc)

Activity: Practice with various methods available in DL Frameworks to develop a Model.

Lab 2: Build a Basic Artificial Neural Network

Objective: Create a ANN with DL frameworks.

Task: Identify suitable ANN Layers using Keras and Tensorflow.

Activity: Design a basic Artificial Neural Networks using Keras with TensorFlow (pima-indians-diabetes)

Lab 3: Build a MultiLayer Perceptron

Objective: Create a MLP for classification task.

Task: Identify suitable model for house price prediction.

Activity: Design a MLP for implementing classification and fine-tuning using House price.csv

Lab 4: Create a Tensor in TensorFlow using List or Numpy array.

Objective: To understand how to create a tensor in TensorFlow using a Python list or NumPy array

Task: Create a simple tensor using both a Python list and a NumPy array in TensorFlow.

Activity: Create a tensor using a Python list and Numpy array

Lab 5: Apply math operations on tensor using various mathematical functions.

Objective: To learn how to apply mathematical operations on tensors using various TensorFlow mathematical functions.

Task: Perform basic mathematical operations (addition, subtraction, multiplication, division) and advanced functions (square, square root, exponential) on tensors.

Activity: Perform basic math operations: Add, Subtract, Multiply, Divide and Apply advanced math functions: Square, Square root, Exponential.

Lab 6: Connecting two tensors in dataset.

Objective: Combine two tensors using concatenation and stacking operations in TensorFlow.

Task: Combine two tensors using concatenation and stacking operations in TensorFlow

Activity: Concatenate them along a specific axis and Stack them along a new axis.

Lab 7: Building dataset from a file stored in a local drive

Objective: To learn how to build a dataset in TensorFlow from a file stored in a local drive.

Task: Load a dataset from a CSV file stored on the local drive and process it using TensorFlow

Activity: Load the file using TensorFlow's tf.data API and Process the dataset (e.g., convert it into tensors)

Lab 8: Loading Dataset from TensorFlow.dataset Library

Objective: To learn how to load a dataset from the tensorflow_datasets library and use it in machine learning models.

Task: Load a dataset from TensorFlow Datasets (tfds), preprocess it, and display sample data

Activity: Load a dataset (e.g., MNIST, CIFAR-10, IMDB Reviews) and Split the dataset into training and testing sets.

Lab 9: Build a Convolutional Neural Network

Objective: Create a CNN model.

Task: Build CNN architecture for Dog-Cat classification problem.

Activity: Implement a Convolution Neural Network (CNN) for dog/cat classification problem using keras.

Lab 10: **Build a Time-Series Model**

Objective: Create a RNN and LSTM Model

Task: Build RNN/LSTM Model for predicting time series data.

Activity Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes.

REFERENCE MATERIALS:

TEXTBOOKS

1. François Chollet, "Deep Learning with Python", 2nd Edition, Manning Publications, 2022
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.

REFERENCES

1. Amlan Chakrabarti Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra , "Deep Learning", Pearson Publication, 2021.
2. David Foster, "Generative Deep Learning" O'Reilly Publishers, 2020.
3. John D Kellehar, "Deep Learning", MIT Press, 2020.

JOURNALS/MAGAZINES

1. IEEE Transactions on Neural Networks and Learning Systems https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385
2. IEEE Transactions on Pattern Analysis and Machine Intelligence https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_papers/IT032.pdf
3. International Journal of Intelligent Systems https://onlinelibrary.wiley.com/journal/1098111x

SWAYAM/NPTEL/MOOCs:

4. Swayam Nptel – Deep Learning – IIT Ropar https://onlinecourses.nptel.ac.in/noc21_cs35/preview
5. Coursera – Neural Networks and Deep Learning Andrew Ng
6. Coursera - Neural Networks for Machine Learning by Geoffrey Hinton in Coursera

Course Code: CAI3427	Course Title: Language Models for Text Mining Type of Course: Discipline Elective - Theory & Integrated Laboratory	L-T-P-C	2	0	0	2
Version No.	1.0					
Course Pre-requisites	CSE3001 – Artificial Intelligence and Machine Learning					
Anti-requisites	NIL					
Course Description	This course introduces the basics of Text Mining and Natural Language Processing. The course will teach students different concepts such as text mining, NLP, Sequence Labeling, etc. Topics: Text Mining, NLP, Tokenization, Lemmatization, Stemming, One-hot encoding, Language modelling, Bag-of-words, Term-document Matrix, Cosine similarity, Viterbi Algorithm, etc.					
Course Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1. **Process** text data to derive information from text. [Apply] 2. **Apply** insights from textual information to real-world business. [Apply] 3. **Develop** solutions for a particular NLP problem using different machine learning and deep learning techniques. [Apply] 4. **Utilize** different NLP tools and packages. [Apply]					

Course Content:

Module 1	Text Mining	Adversarial Quiz Tests	Module Tests	No. of Sessions: 09
Introduction to Text Mining. Text Mining vs. NLP. Text Mining Algorithms. Steps in Text Mining - Extraction, Preprocessing, Analysis and Evaluation. Lexical Resource Creation (NEW). Data collection. String Manipulation to Clean Data. Natural Language Processing. Research Paradigms in NLP. Sequential Data. Sequence				

Module 2	Text Preprocessing	Adversarial Quiz Tests	Module Tests	No. of sessions: 06

Introduction to Preprocessing. Tokenization. Stop Words Removal. Lemmatization and Stemming. PoS Tagging. Integer Encoding. Padding. One-Hot Encoding.

Module 3	Text Representations	Adversarial Quiz Tests	Module Tests	No. of sessions: 08

Language Modeling. N-Gram Language Model. Bag-of-Words Model. Term-Document Matrix. Term Frequency. Inverse Document Frequency. TF-IDF. Cosine Similarity. Naive Bayes Classifier using Bag-of-Words. Topic Modeling. Latent Semantic Analysis. Singular Value Decomposition. Truncated SVD and Topic Vector. LDA Algorithm.

Module 4	Natural Language Processing with Keras	Adversarial Quiz Tests	Module Tests	No. of Sessions: 06

Word Embeddings vs. One-Hot Encoding. Contextual Bag of Words (CBOW). Skipgram. Deep Learning for Document Classification.

List of Laboratory Tasks:

Experiment No. 1: File Handling
Level 1: Read text files using Python and extract meaningful content.
Level 2: Parse text files using Python to preprocess the data for NLP tasks.

Experiment No. 2: Introduction to NLP Tools
Level 1: Install and use NLTK for basic text processing.
Level 2: Install and use SpaCy for tokenization, PoS tagging, and Named Entity Recognition.

Experiment No. 3: Corpus Cleaning Techniques
Level 1: Use NLTK for corpus cleaning techniques such as tokenization, stopword removal, and stemming.
Level 2: Prepare cleaned text data for downstream NLP tasks like classification or translation.

Experiment No. 4: Word Vector Usage
Level 1: Download and use pre-trained word vectors (e.g., Word2Vec, GloVe, or FastText).
Level 2: Compute similarity between two words, find the most similar word, and complete word analogies (e.g., king - man + woman = queen).

Experiment No. 5 & 6: Language Identification
Level 1: Build a simple language identifier using Bag-of-Words (BoW) features.
Level 2: Predict the language of a given text using the trained model.

Experiment No. 7 & 8: Lexical Simplification
Level 1: Implement a lexical simplifier to replace complex words with simpler alternatives.

Level 2: Generate a simplified version of a given word or sentence while preserving meaning.

Experiment No. 9 & 10: Sentiment Analysis
Level 1: Implement a basic sentiment classifier using a lexicon-based or machine learning approach.
Level 2: Compare the performance of an existing sentiment classifier (e.g., VADER, TextBlob, or a pre-trained Transformer model).

Experiment No. 11: Named Entity Recognition (NER)
Level 1: Extract named entities from a text using NLTK.
Level 2: Extract named entities using SpaCy and compare results.

Experiment No. 12 & 13: Implement a Hidden Markov Model (HMM)
Level 1: Implement a generic HMM for sequence prediction.
Level 2: Calculate the forward probability of a given sequence using HMM.

Experiment No. 14: Linguistic HMM
Level 1: Develop a Hidden Markov Model (HMM) for NLP tasks such as PoS tagging.
Level 2: Evaluate the performance of the HMM on a specific NLP task (e.g., Named Entity Recognition or Chunking).

Experiment No. 15: Machine Translation
Level 1: Implement Machine Translation (MT) using a pre-trained model from Hugging Face Transformers.
Level 2: Evaluate the quality of MT output via Round-Trip Translation (translate text to another language and back to check accuracy).

Targeted Application & Tools that can be used:
1. Google Colab
2. Python IDEs like PyCharm

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
1. Group project on some NLP Task like text classification (Creating a Simple Text Classifier: Use Scikit-learn to classify positive vs. negative reviews from a dataset), sentiment analysis, etc.

Textbook(s):
1. Daniel Jurafsky, James H. Martin. "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech, Pearson Publication, 2025 (3rd Edition Draft).
2. Aditya Joshi, Pushpak Bhattacharyya. "Natural Language Processing", Wiley Publication, 2023 (1st Edition).

References:
R1. Chris Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", 1st Edition, MIT Press. 1999.

R2. Pawan Goyal. "Natural Language Processing". 1st Edition, 2016.

Weblinks
W1. E-Book link or R2: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view

W2. Web Resource for T1: https://web.stanford.edu/~jurafsky/slp3/ - VERY VERY IMPORTANT!!!
W3. NPTEL Courses: https://nptel.ac.in/courses/106106211 CMI),
https://nptel.ac.in/courses/106105158 (IIT Kgp), https://nptel.ac.in/courses/106101007 (IITB),
https://nptel.ac.in/courses/106105572 (IIT Kgp - NEW)

Course Code: UG COURSE: CAI3429	Course Title: Deep Learning for Computer Vision Type of Course: Discipline Elective - Theory & Integrated Laboratory	L~T~ P~C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	MAT1003 Applied Statistics, Knowledge of Python, Machine Learning, and Digital image processing					
Anti-requisites	NIL					
Course Description	This course covers the fundamentals and advanced concepts of deep learning for computer vision applications. Students will explore convolutional neural networks (CNNs), object detection, image segmentation, and generative models. Hands-on lab experiments will reinforce theoretical concepts using frameworks like TensorFlow and PyTorch.					
Course Out Comes	**On successful completion of the course the students shall be able to:** 1. Understand the Fundamentals of Deep Learning for Vision Explain the core concepts of neural networks and deep learning architectures for image processing. Implement and optimize convolutional neural networks (CNNs) for classification tasks. 2. Apply Object Detection and Image Segmentation Techniques Implement and analyze state-of-the-art object detection algorithms such as YOLO, Faster R-CNN, and SSD. Develop and evaluate image segmentation models like U-Net and Mask R-CNN. 3. Explore Advanced Deep Learning Techniques for Vision Utilize Vision Transformers (ViTs) and attention mechanisms for image classification. Generate and manipulate images using Generative Adversarial Networks (GANs). 4. **Deploy and Optimize Deep Learning Models for Real-World Applications**					
Course Content:						

Module 1	Fundamentals of Deep Learning for Vision	Assignment	Practical	No. of Classes:8
Introduction to Deep Learning & Neural Networks, Convolutional Neural Networks (CNNs) Architecture Backpropagation & Optimization in CNNs, Transfer Learning & Pretrained Models.				

Module 2	Object Detection & Image Segmentation	Assignment	Practical	No. of Classes:14

Introduction to Object Detection (R-CNN, SSD, YOLO), Region Proposal Networks (Faster R-CNN) Semantic & Instance Segmentation (U-Net, Mask R-CNN), Real-time Object Detection Applications

Module 3	Advanced Topics in Vision	Assignment	Practical	No. of Classes:8

Attention Mechanisms & Vision Transformers (ViTs), Generative Adversarial Networks (GANs) for Image Generation, Self-supervised Learning for Vision, Multi-modal Learning (CLIP, DALL·E)

Module 4	Applications & Deployment	Assignment	Practical	No. of Classes:8

Edge AI & Mobile Deployment (TensorFlow Lite, ONNX), Adversarial Attacks & Robustness in Vision Models, Explainability & Interpretability of Vision Models, Case Studies & Industry Applications

Lab Experiments are to be conducted on the following topics:-

Lab Sheet 1:

Keras Sequential API model

1. Read in the data and explore
2. Define a Sequential API model
3. Define the hyperparameters and optimizer
4. Train the model and visualize the history
5. Testing

Keras Functional API model:

1. Define a Functional API model
2. Train the model and visualize the history

Lab Sheet 2:
Softmax regression with Keras
1. Read in the data and prepare
2. Define a Sequential API model
3. Define the hyperparameters and optimizer
4. Train the model and visualize the history
5. Testing

Lab Sheet 3:
Convolutional Neural Network with Keras (grayscale images)
1. Read in the data:
2. Visualize the data:
3. Prepare the data:

4. Define a CNN model:
5. Define the hyperparameters and optimizer:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 4:
Convolutional Neural Network with Keras (color images):
1. Read in the data:
2. Visualize the data:
3. Prepare the data:
4. Define a CNN model:
5. Define the hyperparameters and optimizer:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 5:
Time series and prediction:
1. Read in the data and explore:
2. Apply the exponential smoothing method and predict

Recurrent neural network (RNN):
1. Pre-processing:
2. Do the necessary definitions: (Hyper parameters, Model,
3. Train the model:
4. Predict the future:

Lab Sheet 6:
Document classification with LSTM network:
1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:
5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 7:
Document classification with LSTM network (Binary):
1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:
5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 8:
Document classification with LSTM + CNN network (Binary):
1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:

5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 9:

Softmax regression to recognize the handswritten digits:
1. Download the MNIST data:
2. Take a look at the dataset:
3. Do the necessary definitions:
4. Training and Testing:

Multi-layer neural network to recognize the handswritten digits:
1. Download the MNIST data:
2. Take a look at the dataset:
3. Do the necessary definitions:

Training and Testing:

Lab Sheet 10:

Object Detection using YOLOv5

Lab Sheet 11:

Image Segmentation using U-Net
Custom Object Detection using Faster R-CNN

Lab Sheet 12:

Implementing Vision Transformers for Image Classification
Generating Images using GANs (DCGAN, StyleGAN)

(Group Project)

8. Object Detection and Recognition:
    a. Haar cascade object detection (e.g., face detection or object detection using pre-trained classifiers).
    b. Feature-based object detection using techniques like Speeded-Up Robust Features (SURF) or Scale-Invariant Feature Transform (SIFT).
    c. Deep learning-based object detection using Convolutional Neural Networks (CNNs) or You Only Look Once (YOLO) algorithm.
9. Optical Character Recognition (OCR):
    a. Preprocessing of text images (e.g., binarization, noise removal, or skew correction).
    b. Text localization using techniques like connected component analysis or Stroke Width Transform (SWT).
    c. Character recognition using machine learning algorithms like Support Vector Machines (SVM) or Convolutional Neural Networks (CNNs).
10. Gesture Recognition:
    a. Hand segmentation using techniques like background subtraction or skin color detection.
    b. Feature extraction from hand regions (e.g., finger counting, hand shape descriptors).
    c. Classification of gestures using machine learning algorithms (e.g., k-Nearest Neighbors or Support Vector Machines).

Tools/Software Required :
1. OpenCV 4
2. Python 3.7
3. MATLAB

Text Books
1. "Deep Learning for Computer Vision Image Classification, Object Detection and Face Recognition in Python" **Jason Brownlee (2019)**

2. "Deep Learning for Computer Vision with python" **Adrian Rosebrock (2017)**

References
3. **Goodfellow, I., Bengio, Y., & Courville, A. (2016).** *Deep Learning.* MIT Press.

   A foundational book covering deep learning principles, including CNNs, optimization, and generative models.

4. **Raschka, S., & Mirjalili, V. (2022).** *Machine Learning with PyTorch and Scikit-Learn.* Packt Publishing.

   Covers practical deep learning techniques using PyTorch, including CNNs and transfer learning.

5. **Geron, A. (2022).** *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Edition).* O'Reilly Media.

   Provides hands-on implementations of deep learning for computer vision using TensorFlow and Keras.

6. **Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J. (2021).** *Dive into Deep Learning.* Available online (https://d2l.ai).

   Open-access book covering CNNs, object detection, and advanced vision techniques with PyTorch and TensorFlow.

7. **Chollet, F. (2021).** *Deep Learning with Python (2nd Edition).* Manning Publications.

   Explains deep learning fundamentals and applications with Keras, including image classification and segmentation.

8. **Ballé, J., Laparra, V., & Simoncelli, E. P. (2017).** *Deep Learning for Computer Vision: A Brief Introduction.*

   A concise introduction to CNNs, object detection, and generative models.

Course Code:	Course Title: Operating Systems	L-T- P- C	3	0	0	3

CSE2010	Type of Course: Program Core and Theory Only					
Version No.	1.0					
Course Pre-requisites	CSE2009- Computer Organization, Problem solving using C Students should have basic knowledge on computers, computer software & hardware, and Computer Organization. Prior programming experience in C is recommended.					
Anti-requisites	NIL					
Course Description	This course introduces the concepts of operating system operations, operating system structure and its design and implementation. It covers the classical operating systems internal algorithms such as process scheduling, synchronization, deadlocks detection and recovery and memory management. The course also enhances the problem solving, systems programming ability and case studies.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain Employability through Problem Solving Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamental concepts of operating Systems and case studies. [Knowledge] 2] Demonstrate various CPU scheduling algorithms. .[Application] 3] Apply various tools to handle synchronization problems. [Application] 4] Demonstrate deadlock detection and recovery methods [Application] 5] Illustrate various memory management techniques.[Application]					
Course Content:						
Module 1	Introduction to Operating System	Assignment	Programming	9 Hours		
Topics:						
Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system						
Module 2	Process Management	Assignment/Case Study	Programming/Simulation	11 Hours		
Topics:						

Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.

Module 3	Process Synchronization and Deadlocks	Assignment	Programming	11 Hours

Topics:

The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Semaphores, Classic Problems of Synchronization with Semaphore Solution- Producer-Consumer Problem, Reader-Writer problems, Dining Philosopher's Problem, . Introduction to Deadlocks, Necessary conditions for deadlock, Resource allocation Graph, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation, Deadlock detection & Recovery from Deadlock.

Module 4	Memory Management	Assignment	Programming/Simulation	10 Hours

Topics:

Introduction to Memory Management, Basic hardware-Base and Limit Registers, Memory Management Unit(MMU), Dynamic loading and linking, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Virtual Memory and Demand Paging – Page Faults and Page Replacement Algorithms, Copy-on-write, Allocation of Frames, Thrashing

Introduction to File system management: File System Interface (access methods, directory structures), File system implementation.

Targeted Application:

Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.

Software Tools:

Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS. Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.

Project work/Assignment

Demonstrate process concepts in LINUX OS.

Simulation of CPU scheduling algorithms.

Develop program to demonstrate use of Semaphores in threads.

Develop program to demonstrate use of deadlock avoidance algorithms.

Develop program to demonstrate use of page replacement algorithms.

Simulation of memory allocation strategies [first fit, best fit and worst fit].						

Text Book

Silberschatz A, Galvin P B and Gagne G , "Silberschatz's Operating System Concepts", Paperback, Global Edition Wiley, 2019

References

Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 10th edition Wiley, 2018.

William Stallings, "Operating Systems",Ninth Edition, By Pearson Paperback ,1 March 2018.

Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, " Cracking the Operating System skills", Dreamtech, paperback, 2020

Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , "Operating Systems: Three Easy Pieces, Amazon digital Services", September 2018.

E-resources/Weblinks

https://www.os-book.com/OS9/

https://pages.cs.wisc.edu/~remzi/OSTEP/

https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: CSE 3078	Cryptography and Network Security	L-T- P- C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	Basic Knowledge in Number Theory, Binary Operations				
Anti-requisites	NIL				
Course Description	The Course deals with the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cryptography and Network Security above and attain Skill Development through Problem Solving methodologies.				

Course Outcomes	On successful completion of this course the students shall be able to: Describe the basic concept of Cryptography Classify different types of Cryptographic Algorithms Solve Mathematical problems required for Cryptography Illustrate Network Security concepts			
Course Content:				
Module 1	Introduction to Cryptography	Assignment	Recognize the techniques	07 Sessions
Topics: Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active attacks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution Ciphers : Play-fair and Hill Cipher, Vigenere cipher, Introduction to Block Cipher and Stream Cipher, Feistel Structure, ECB modes of block cipher				
Module 2	Symmetric Encryption Algorithms	Assignment	Analysis of results	09 Sessions
Topics: Symmetric Encryption Algorithms : Data Encryption Standard, Introduction to Galois Field, Advanced Encryption Standard, Modular Arithmetic, Prime numbers, Fermat's little theorem, Applications of Fermat's little theorem in modular athematic, brief about primality testing and factorization, Euclidean and Extended Euclidean Algorithm, Euler Totient Function, Chinese remainder theorem.				
Module 3	Public Key Cryptography	Assignment	Analysis of solutions	09 Sessions
Topics: Overview of Public Key Cryptography, RSA, Diffie-Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Ei-gamal Encryption, Elliptic curve cryptography overview.				
Module 4	Network Security	Assignment	Analysis of solutions	05 Sessions
Topics:				

Network Security fundamentals, Network Security applications: Authentication: Kerberos, PKI, Network Security applications: e-mail security: PGP, MIME, Network Security applications: IP Security: IPSec architecture, Network Security applications: DNS Security.	

Targeted Application & Tools that can be used:

Students get the knowledge about cryptography techniques followed, the algorithms used for encryption and decryptions & the techniques for authentication and confidentiality of messages.

Textbooks:

T1 William Stallings, "Cryptography and Network Security - Principles and Practices", 7th Edition, Pearson publication, ISBN: 978-93-325-8522-5, 2017

References:

R1 Bruice Schneier, "Applied Cryptography – Protocols, Algorithms and Source code in C", Second Edition, Wiley Publication, ISBN: 978-81-265-1368-0, 2017

R2 Cryptography and Network Security, Express Learning, ITL Education Solution Limited.

R3 e-pg pathshala UGC lecture series

 Web references: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&site=ehost-live

https://nptel.ac.in/courses/106105031.

Topics relevant to "Skill Development":   Topics relevant to "Skill Development":

Play-fair and Hill Cipher

Euclidean and Extended Euclidean Algorithm

Secure Hash Algorithm

Diffie-Helman Key exchange

Totient Function.

Fermat's little theorem

SEMESTER V

Course Code:	Course Title: Artificial Intelligence and Machine Learning	L-T- P-C	2-0	2	3
CSE3001	Type of Course: Integrated				
Version No.	2.0				

Course Pre-requisites	CSE1003 Innovation Project - Raspberry Pi Using Python			
Anti-requisites	NIL			
Course Description	This course introduces the basic concepts of artificial intelligence. It introduces students to the basic concepts and techniques of Machine Learning (ML), a subset of Artificial Intelligence (AI), is an important set of techniques and algorithms used for solving several business and social problems. The objective of this course is to discuss machine learning model development using Python. Topics include: Working with Collections and Data Frames; Regression algorithms; Classification algorithms; Optimization techniques – Gradient Descent algorithm, Gradient Descent for simple Linear Regression; Ensemble Learning – Random Forest, Boosting techniques – AdaBoost and Gradient Boosting; Grid Search for optimal parameters; Clustering algorithms; Forecasting with Time-Series data : Auto-Regressive Integrated Moving Average Models, Recommender Systems : Association Rule Mining, Collaborative Filtering, Text Analytics – Sentiment Classification using Naïve Bayesian model.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Artificial Intelligence and Machine Learning and attain Skill Development through experiential Learning techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: CO1: To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents. [Comprehension] CO2: Produce machine learning models for predictive analytics. [Application] CO3: Apply ensemble learning, optimization and hyper parameter tuning techniques for machine learning algorithms. [Application] CO4: Demonstrate different types of clustering techniques. [Application] CO5: Employ time series forecasting techniques/models for real world problems. [Application]			
Course Content:				
Module 1	Introduction to Artificial Intelligence and Knowledge based systems	Assignment	Theory	6 Sessions
Topics:				

Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agent, Structure of Intelligent agent and its functions, Agents and Environment; Introduction to Knowledge representation, approaches and issues in knowledge representation, Introduction to searching algorithm in AI,Conceptual graphs, Methods for Logic representation(POL, FOL).

Module 2	Supervised Machine Learning Algorithms	Assignment	Programming activity	16 Sessions

Topics:

  Introduction to the Machine Learning (ML) Framework, types of ML, types of variables/features used in ML algorithms, Feature engineering-Normalization, One-hot encoding, Simple Linear Regression, Multiple Linear Regression,Validation and Accuracy measures for Regression models. Classification models – Decision Tree algorithms using Entropy and Gini Index as measures of node impurity, model evaluation metrics for classification algorithms,Logistic regression, Naïve Bayes Classifiers and Naive Bayes model for sentiment classification – an introduction..

Module 3	Advanced Machine Learning Concepts	Assignment	Programming activity	14 Sessions

Topics:

Nearest Neighbor techniques, Cost functions and Optimization Technique – introduction to Gradient Descent, its applications on Linear Regression. C.Ensemble Learning algorithms – Bagging (Random Forest), Boosting(AdaBoost), XGBoost.

Module 4	Clustering and Forecasting with Time-Series Data	Assignment	Programming activity	10 Sessions

Topics:

Partitioned Clustering – K-means and Hierarchical Clustering techniques, cluster validity measures, Components of Time Series data, Basic Concepts of Forecasting , An introduction to Forecasting from Time Series Models, calculating forecast accuracy, Association Rule Mining, Collaborative Filtering – User based and item based similarity, closed and maximal frequent item sets.

List of Laboratory Tasks:

Lab sheet -1

Level 1: A review of Python programming - Introduction to Python Stack for Data Science, Core Python Libraries for data analysis, Anaconda platform and its installation, Executing programs on Jupyter IDE/ Colab.

Level2: Programming exercises to revise variables, control statements and collections – lists, list comprehension

Lab sheet -2

Level 1 -   Programming exercises on Tuples

Level 2-   Nested data structures

Lab sheet -3

Level 1: Introduction to Numpy, Pandas,

Level 2: Scikit-learn and Visualization techniques.

Lab sheet -4

Level 1 -   Dictionaries, dictionary comprehension.

Level 2 -   Introduction to Data Frames using Pandas and working with frames

Lab sheet -5

Level 1- Regression Models Simple linear regression, outlier detection.

Level 2 - multiple linear regressions – model evaluation, multi-co linearity and handling multi-co linearity, outlier detection.

Lab sheet -6

Level 1-   Decision Tree Classifiers - Decision Tree classifier using Gini Index- measuring test accuracy, displaying the tree, confusion matrix and ROC.

Level 2-   Decision Tree Classifier using Entropy.

Lab sheet -7

Level 1 - Optimization Techniques Developing a Gradient Descent Algorithm for linear regression – using NumPy and using sklearn.

Level 2 -   cohen_kappa_score.

Lab sheet -8

Level 1-   Hyper parameter Tuning methods Hyper parameter tuning using Grid Search for Nearest Neighbor Classifiers and

Level 2-   Hyper parameter tuning using Grid Search for Decision Tree Classifiers.

Lab sheet -9

Level 1 - Hyper parameter Tuning for Ensemble models Ensemble Learning – Random Forest – Building the model, Grid Search for optimal parameters,

Level 2 - Feature Importance. Ada Boost Classifiers and Gradient Boosting Classifiers

Lab sheet -10

Level 2 - Clustering – Kmeans – cluster centers and interpreting the clusters, finding the optimal number of clusters using Elbow Curve method.

Level 2 - Agglomerative Hierarchical Clustering – Compare the clusters formed by kmeans and Agglomerative Clustering

Lab sheet -1 1

Level 1 – Probability theory(Conditional Probability)

Level 2 - Naïve Bayes Model

Lab sheet -12 Level 1- Models forecasting Applications Level 2 - Models for Forecasting Time Series data Lab sheet -13 Level 1-   Recommender Systems - Association Rule Mining using Apriori for frequent Itemset Generation. Level 2 - Recommender Systems – user based similarity
Targeted Application & Tools that can be used Use of PowerPoint software for lecture slides and use of Google's Colab cloud service https://www.tutorialspoint.com/google_colab/index.html for executing and sharing of lab exercises.
Project work/Assignment:
Assignment: Programming: Implementation of given scenario using Python and Colab. Assignment: Learning courses for 4 Hours from the following link https://learn.datacamp.com/courses?topics=Machine%20Learning

Text Book
 	
  T1.   Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with Python :A Guide for Data Scientists", Oreilly, First Edition, 2016
 	
  T2.   Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, 3rd edition, Upper Saddle River, Prentice Hall.

References R1. Tan P. N., Steinbach M & Kumar V. "Introduction to Data Mining", Pearson Education, 2016. R2. Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017. R3. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python", Wiley, First Edition 2019. E-References https://presiuniv.knimbus.com/user#/home

Topics relevant to development of "Skill Development":
Regression Models
Decision Tree Classifiers
Hyper parameter Tuning methods
Agglomerative Hierarchical clustering
Decision tree classifiers
for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2037	Course Title: Cyber Forensics Type of Course: Program Core	L-T- P-C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Cryptography and Network Security				
Anti-requisites	NIL				
Course Description	The purpose of this course is to introduce to the students Cyber Forensic concepts. The course is both conceptual and analytical and is understood with various open-source software's. The course develops critical thinking like correctly collect and analyze computer forensic evidence, analyze and validate Forensics Data, study the tools and tactics associated with Cyber Forensics. The course involves quizzes, assignments with various open-source software.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cyber Forensics and attain Skill Development through Experiential Learning techniques.				
Course Outcomes	On successful completion of this course the students shall be able to: (1) understand various digital investigation terminologies and methods (knowledge) (2) understand various file formats (knowledge) (3) Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications (Comprehension) (4) Apply techniques for forensic investigation (Application)				
Course Content:					

Module 1	DIGITAL INVESTIGATION	Quiz	MCQ/Based on Investigation process	No. of Sessions: 09

Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process -Investigative Reconstruction - Modus Operandi, Motive and Technology -Digital Evidence in the Courtroom.

Module 2	UNDERSTANDING INFORMATION	Quiz	MCQ/Based on file format	No. of Sessions: 09

Methods of storing data: number systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats - Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers - Extraction of forensic artifacts– understanding the dimensions of other latest storage devices – SSD Devices.

Module 3	COMPUTER BASICS FOR DIGITAL INVESTIGATORS	Assignment	Writing task	No. of Sessions: 09

Computer Forensic Fundamentals - Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology -Steps taken by computer forensic specialists.

Information warfare: Arsenal – Surveillance Tools – Hackers and Theft of Components – Contemporary Computer Crime-Identity Theft and Identity Fraud – Organized Crime &Terrorism.

Computer forensic cases: Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence –Processing Evidence and Report Preparation – Future Issues.

Assignment: Computer Crime

Module 4	Computer Forensic Evidence and Data Recovery	Assignment	Writing task	No. of Sessions: 09

Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden Data.

Data Collection and Data seizure: why collect evidence? - Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody. Reconstructing the Attack.

Assignment: Data Recovery

List of Laboratory Tasks:
Case Studies of Opensource Forensic Tools
FTK Forensic Tool kit for taking mirror image
Disk Forensics-
Identify digital evidences
Acquire the evidence
Authenticate the evidence
Preserve the evidence
Analyze the evidence
Report the findings
Network Forensics:
Intrusion detection
Logging
Correlating intrusion detection and logging
Device Forensics
Mobile phone
Digital Music
Printer Forensics
Scanner Forensics
Credit Card Forensics
Telecommunications Forensics
Forensic Analysis of a Virtual Machine
Forensic analysis of Cloud storage and data remnants
RAM Dumping Tool
Targeted Application & Tools that can be used:
FTK Forensic Toolkit
Encase
Kali Linux- Vinetto, galatta
Autopsy – Disk Forensics
Project work/Assignment:

Each batch of students (self-selected batch mates) will identify projects based on the content and implement with the most suitable 2 or 3 antecedents.

Textbook(s):

John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2019

References

1. Ravi Kumar & B Jain,2006," Cyber Forensics - Concepts and Approaches", icfai university press

2. ChristofPaar, Jan Pelzl," Understanding Cryptography: A Textbook for Students and Practitioners", Springer's, Second Edition, 2010,

3. Ali Jahangiri," Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts", First edition, 2009

4. Computer Forensics: Investigating Network Intrusions and Cyber Crime", Ec-Council Press, 2010.

5. C. Altheide& H. Carvey," Digital Forensics with OpenSource Tools, Syngress", 2011, ISBN: 781597495868.,https://esu.desire2learn.com

NPTEL: https://onlinecourses.swayam2.ac.in/cec21_ge10/preview

Udemy: https://www.udemy.com/topic/digital-forensics/

E-book Link(PU):

Links

http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14073&query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC

Topics relevant to "Skill Developemnt":

Cyber Forensics techniques for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE3343	Course Title: Cloud Computing Type of Course: Theory and Lab Integrated	L-T- P-C	2-0-2-3
Version No.	2.0		
Course Pre-requisites	[1] Data Communication and Computer Networks (CSE2011)		
Anti-requisites	NIL		

Course Description	This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.
Course Objective	The course aims to impart knowledge to students that can provide easy, scalable access to computing resources and IT services. This course is designed to improve the learner's EMPLOYABILITY SKILLS using EXPERIENTIAL LEARNING techniques.
Course Outcomes	Upon successful completion of the course, the students shall be able to: 1) Describe the significance of Cloud computing technologies [Understand] 2) Select appropriate Virtualization techniques to virtualize infrastructures [Understand] 3) Use Cloud mechanisms to optimize the QoS parameters [Understand] 4) Utilize cloud platforms to develop applications [Apply]

Course Content:

Module 1	Introduction to Cloud Services	Assignment	Theory	No. of SESSIONS:17 (Theory: 9, Lab:8)

Topics: A Facility for Flexible Computing, from Clusters to Web Sites and Load Balancing, Cloud Stakeholders as per NIST, Historical Developments, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, Building Cloud Computing Environments, Computing Platforms and Technologies.

Module 2	Virtualization Techniques	Lab-based Assignments	Theory	No. of SESSIONS:15 (Theory: 7, Lab:8)

Topics: Basics of Virtualization - Types of Virtualizations, Taxonomy of Virtualization Techniques, Implementation Levels of Virtualization.

Module 3	QoS and Management	Application Development	Theory	No. of SESSIONS:13 (Theory: 5, Lab:8)

Topics: Cloud Infrastructure Mechanisms, Specialized Cloud Mechanisms, Cloud Management Mechanisms, Cloud Infrastructure Mechanisms, Service Level Agreements (SLAs), Specialized Cloud Mechanisms

Module 4	Security and advancements	Case Study	Case Study	No. of SESSIONS:15 (Theory: 9, Lab:6)

Topics: Cloud Management Mechanisms, The Zero Trust Security Model, Identity Management, Privileged Access Management, AI Technologies And Their Effect on Security, Protecting Remote Access, Privacy in a Cloud Environment, Application development in Cloud, Recent trends in Cloud Computing, Fog Computing, Dew Computing, Case Studies, and Recent Advancements

Targeted Applications & Tools that can be used:

Targeted Applications:

Developing applications on Cloud Platforms via Virtual machines

Cloud Tools:
- VMWare
- Amazon EC2
- Google Compute Engine
- Microsoft Azure
- Cloudsim

Project work/Assignment:

1. **Automation of performance analysis of students through the Cloud**
2. **Chatbots development using Cloud resources**
3. **Blog creation using Cloud computing**

Analysis of Case Studies: When deciding to adopt cloud computing architecture, decide if the cloud is right for your requirements (for the application identified).

Suggested List of Hands-on Activities:

Sl. No	Title
1	**Cloud Services** Create a simple cloud software application and provide it as a service using any Cloud Service Provider to demonstrate Software as a Service (SaaS).
2	**Virtualization** Create a Virtual Machine with 1 vCPU, 2GB RAM and 15GB storage disk using a Type 2 Virtualization Software
3	**Virtualization Techniques** Create a Virtual Hard Disk and allocate the storage using VM ware Workstation
4	**Implementation Levels of Virtualization** Create a Snapshot and Cloning of a VM and Test it by loading the Previous Version/Cloned VM
5	**Cloud Infrastructure Mechanisms** Using Cloud Simulator to create a Datacenter with one host and run one cloudlet on Datacenter.
6	**Cloud Infrastructure Mechanisms** Create a Simple Web Application using Java or Python and host it in any Public Cloud Service Provider to demonstrate Platform as a Service (PaaS)
7	**Specialized Cloud Mechanisms** Analyze different service broker policies that can be used in Cloud environment through CloudAnalyst Tool
8	**Specialized Cloud Mechanisms** Using Saturn Cloud (Online), execute python programs by selecting appropriate GPU processors.
9	**Application development in the Cloud** Perform the basic configuration setup for Installing Hadoop 2.x like Creating the HDUSER and SSH localhost

10	**Application development in the Cloud** Install Hadoop 2.x and configure the Name Node and Data Node.
11	**Application development in the Cloud** Configure the Name Node and Data Node.
12	**Application development in the Cloud** Launch the Hadoop 2.x and perform MapReduce Program for a Word Count problem
13	**Simulation of the Cloud Service** To simulate a cloud service with virtual machine creation and task allocation without using a real cloud provider like AWS
14	**Simulation of the Cloud Service** Write a simple Java program to simulate the creation of virtual machines for CPU-intensive tasks, storage-intensive tasks, and RAM-intensive tasks separately
15	**Simulation of the Cloud Service** Write a Java program to handle multiple user requests to a cloud service provider. Case 1: Request a CPU resource from the cloud. Case 2: Request a RAM resource from the cloud. Case 3: Request a storage resource from the cloud

Text Book(s)

1. Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", Chapman and Hall/CRC; 1st edition, July 2021.
2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013 edition.

References

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", PHI publisher 2013 edition.
2. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw-Hill, 2010 edition.
3. David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press, 2018 edition.
4. Manvi, Sunilkumar, and Gopal K. Shyam. "Cloud Computing: Concepts and Technologies". CRC Press, 2021.

Web Resources and Research Articles links:

1. IEEE Transactions on Cloud Computing-

https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519

2. **International Journal of Cloud Computing**-
    https://www.inderscience.com/jhome.php?jcode=ijcc

3. CloudSim Resources-
https://javadoc.io/doc/org.cloudsimplus/cloudsim-plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html

4. Journal of Network and Computer Networking-
https://www.journals.elsevier.com/journal-of-network-and-computer-applications
5. Cloud Stakeholders as per NIST
- **https://www.geeksforgeeks.org/cloud-stakeholders-as-per-nist/**

Course Code: CSE2067	Course Title: Web Technology Type of Course: Program core	L-T- P-C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course highlights the basic web design using Hypertext Markup Language and Cascading Style Sheets. Students will be trained in planning and designing effective web pages by writing code using current leading trends in the web domain, enhancing web pages with the use of page layout techniques, text formatting, graphics, images, and multimedia. The focus is on popular key technologies that will help students to build Internet- and web-based applications that interact with other applications and with databases.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.				
Course Outcomes	On successful completion of this course the students shall be able to:				

	CO1: Implement web-based application using client-side scripting languages. (Application level)			
	CO2: Apply various constructs to enhance the appearance of a website. (Application level)			
	CO3: Illustrate java-script concepts to demonstration dynamic web site(Application level)			
	CO4: Apply server-side scripting languages to develop a web page linked to a database. (Application level)			
Course Content:				
Module 1	Introduction to XHTML	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications	10 Sessions

Topics:

Basics: Web, WWW, Web browsers, Web servers, Internet.

XHTML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML.

| Module 2 | Advanced CSS | Quizzes and assignments | Comprehension based Quizzes and assignments; Application of CSS in designing webpages | 8 Sessions |

Topics:

CSS: Introduction to CSS, Defining & Applying a style, Creating style sheets, types of style sheet, selectors, CSS font properties, border properties, Box model, opacity, CSS pseudo class and pseudo-elements.

Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Responsive Design, CSS Frameworks XML: Basics, demonstration of applications using XML

| Module 3 | Fundamentals of JavaScript | Quizzes and assignments | Application of JavaScript for dynamic web page designing | 10 Sessions |

Topics:

JavaScript: Introduction to JavaScript, Basic JavaScript Instructions, Functions, Methods & Objects, Decisions and Loops, Document Object Model, Event handling, handling window pop-ups, JavaScript validation.

Module 4	PHP – Application Level	Quizzes and assignments	Application of PHP in web designing	14 Sessions

Topics:

PHP: Introduction to server-side Development with PHP, Arrays, $GET and $ POST, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.

Targeted Application & Tools that can be used:

Xampp web server to be used to demonstrate PHP.

Project work/Assignment:

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

Textbook(s):

1] Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition, 2015.

2] CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)

3] Deitel, Deitel, Goldberg,"Internet & World Wide Web How to Program", Fifth Edition, Pearson

Education, 2021.

References

1] Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

 2] Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Topics related to development of "FOUNDATION":

Web, WWW, Web browsers, Web servers, Internet.

CSS, PHP.

Designing for healthcare.

for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

E-References

pu.informatics.global, https://sm-nitk.vlabs.ac.in/

SEMESTER VI

Course Code: CSE2040	Course Title: Cyber threats for IOT and Cloud	L-T- P- C	3 -0	0	3
	Type of Course:1] Program Core				
Version No.	1.0				
Course Pre-requisites	Cyber Security, Information Security and Networks				
Anti-requisites	NIL				
Course Description	Objective of the course is to understand the most important cyber threats for IOT and Cloud. Cyber attackers discover new possibilities in the areas of Internet of Things and cloud services. It mainly focuses on multiple security challenges facing the IoT and cloud computing especially concerns surrounding privacy and cyber security threats of the users and the how can the cyber risks relating to them be mitigated.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Cyber threats for IOT and Cloud and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the different types of cyber threats for IOT and cloud Develop a deeper understanding and familiarity with various types of cyber-attacks, cybercrimes, vulnerabilities and remedies thereto. Plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets.				
Course Content:					
Module 1	Introduction to IOT and Cloud computing	Assignment	Programming Task	12 Sessions	
Topics					

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, IoT Challenges, IOT Architecture and protocols, Various platforms for IoT, Real-Time examples of IoT, Overview of IoT components and IoT communication Technologies. Introduction to Cloud Computing, The Vision of Cloud Computing, Defining a Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Distributed Systems, Virtualization, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies.

Assignment:				
Module 2	Cyber Threats	Assignment	Programming Task	8 Sessions

Topics:

What are Cyber Security Threats? Common Sources of Cyber Threats, Types of Cyber security Threats-Malware attacks, Social Engineering attacks, Supply chain attacks, Man-in-the middle Attack, Threat Detection Tools, Cyber Defense for Individuals.

Assignment:

Module 3	Cyber Threats in Internet of Things	Assignment	Programming/Data analysis task	10 Sessions

Topics:

 IoT threats and vulnerabilities- IoT attack surface, Attack surface areas of the IoT, Types of IoT security threats-Botnets, Denial of service, Man-in-the-Middle, Identity and data theft, Social engineering, Advanced persistent threats, Ransomware, Remote recording, How does the IoT influence security?, Best practices to reduce risks and prevent threats. Security guidelines for IoT. Managing IoT Security Threats.

 Assignment:

Module 4	Cyber Threats in Cloud computing	Assignment	Programming/Data analysis task	9 Sessions

Topics:

Cybersecurity Threats to Cloud Computing-Identity First Security, Cloud misconfiguration, Denial of Service, Insider Threats, Reduced Infrastructure Visibility, Unauthorized use of Cloud workloads, Insecure API's, Compliance and regulation issues, Mitigating cyber risks in cloud computing

 Assignment:

Text Books

T1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives" ,Wiley India Pvt Ltd,2013

T2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)

T3. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

References
R1. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons,2018
R2. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond", NCC Group, 2014
R3.   Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier) - 978-1-59749-592-9
Weblinks: https://www.coursera.org/learn/cloud-security-basics   https://www.imperva.com/learn/application-security/cyber-security-threats/   https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT":   Cyber threats in IoT and Cloud Computing for skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE3145	Course Title: Intrusion Detection and Prevention System Type of Course:1] Program Core	L-T- P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	Fundamental knowledge in Operating Systems, Information Security and Networks				
Anti-requisites	NIL				
Course Description	Objective of the course is to Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems and Analyze intrusion detection alerts and logs to distinguish attack types from false alarms.				

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Intrusion Detection and Prevention System and attain Skill Development through Participative Learning techniques.
Course Out Comes	On successful completion of the course the students shall be able to: Understand about the intruders. Define intrusion detection and prevention policies Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets. Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.
Course Content:	

Module 1	Introduction to Intrusion Detection and Prevention System	Assignment	Programming Task	10 Sessions

Topics

Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anomaly detection – specification based detection – hybrid detection. Internal and external threats to data, Need and types of IDS, Information sources,Host based information sources, Network based information sources.

 Assignment: Demonstrating the skills to capture and analyze network packets using network packet analyzer.

Module 2	Intrusion Prevention System	Assignment	Programming Task	10 Sessions

Topics:

Intrusion Prevention Systems, Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis, techniques, Responses, requirement of responses, Types of responses, mapping responses to policy Vulnerability analysis, credential analysis, non-credential analysis. Architecture models of IDs and IPs.

Assignment: Applying Intrusion detection in security applications.

Module 3	Applications and tools	Assignment	Programming/Data analysis task	12 Sessions

Topics:

Tool Selection and Acquisition Process – Bro Intrusion Detection – Prelude Intrusion Detection – Cisco Security IDS – Snorts Intrusion Detection – NFR security. Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes

Assignment: Demonstrate the working with Snort Rules, Rule Headers, Rule Options and The Snort Configuration File.

Module 4	Legal issues and organizations standards	Assignment	Programming/Data analysis task	9 Sessions

Law Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and Standardizations.

Assignment: Addressing common legal concerns and myths about Intrusion Detection system

Textbooks

T1. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.

T2. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

References

R1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition,

Prentice Hall , 2003.

R2. Christopher Kruegel, Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.

R3. Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall , 2001.

Weblinks:

https://www.youtube.com/watch?v=RYB4cG8G2xo

Topics relevant to "SKILL DEVELOPMENT": Agent development for intrusion detection for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3097	Course Title: Web Security Type of Course: Integrated course		L- T-P- C	2	0	2	3
Version No.	1.0						
Course Pre-requisites	**Advanced Computer Networks (CSE3070)**						
Anti-requisites	**NIL**						
Course Description	The purpose of this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web encryption.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.						
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. **Define** the fundamentals of Web applications and validation. (Remember) 2. **Recognize** the significance of password and authentication in web applications. (Understand) 3. **Explain** the importance of session management in web. (Understand) 4. **Apply** web attack techniques to find vulnerabilities in web applications. (Apply)						
Course Content:							
Module 1	**Introduction to Web Security**	Quiz	Knowledge		**14 Sessions - L[08]+P[06]**		

	Topics:				
	Web Functionality, Encoding Schemes, Mapping the Application - Enumerating the Content and Functionality, Analyzing the Application Bypassing, Client-Side Controls: Transmitting Data Via the Client, Capturing User Data, Handling Client-Side Data Securely - Input Validation, Blacklist Validation, Whitelist Validation. The Defense in-Depth Approach - Attack Surface Reduction, Rules of Thumb, Classifying and Prioritizing Threats.				
Module 2	**Web Application Authentication**	Assignments	Comprehension		**16 Sessions L[08] +P[08]**
	Topics:				
	Authentication Fundamentals- Two Factor and Three Factor Authentication - Password Based, Built-in, HTTP, Single Sign-on Custom Authentication- Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity, Design Flaws in Authentication Mechanisms - Implementation, Flaws in Authentication Mechanisms - Securing Authentication.				
Module 3	**Session Management &Web Security Principles**	Quiz	Comprehension		**16 Sessions L[08] +P[08]**
	Topics:				
	Need for Session Management, Weaknesses in Session Token Generation, Weaknesses in Session Token Handling, Securing Session Management; Access Control: Access Control Overview, Common Vulnerabilities, Attacking Access Controls, Securing Access Control. Origin Policy, Exceptions, Browser security Principles- Cross Site Scripting and Cross Site Request Forgery, File Security Principles: Source Code Security, Forceful Browsing, Directory Traversals.				
Module 4	**Web Application Vulnerability**	Assignment	Application		**14 Sessions L[06] +P[08]**
	Topics:				
	Attacking data-stores and backend components- Injecting into Interpreted Contexts, injecting into SQL, NoSQL, XPath, LDAP, Injecting OS Commands, Manipulating File Paths, Injecting into XML Interpreters, Injecting into Back-end HTTP Requests, Injecting into Mail Services, Attacking application logic-real world logic flaws, Attacking users-Cross site scripting-varieties of XSS,XSS attacks in action, finding and exploiting XSS vulnerabilities, preventing XSS attacks, Other techniques-cookie based Attacks, HTTP Header Injection				

List of Laboratory Tasks:

1. **Practical knowledge of known vulnerabilities in CGI, LAMP stacks, REST APIs cross-site scripting**

Practical knowledge of known vulnerabilities in CGI, LAMP stacks, REST APIs cross-site scripting: Use the **Nessus tool** to scan the network for vulnerabilities.

i.	Basic Network scanning
ii.	Advanced scanning in general search
iii.	Ntstat port scanning:
iv.	Vulnerability Mapping
v.	Policies:
vi.	Plugins:
vii.	General Scanning
viii.	Port Scanning

Level 1: Identification of vulnerabilities

Level 2: Apply the concept

2. **HTTP and setting up stacks, the various types of databases Access Controls, Vulnerabilities**

HTTP and setting up stacks

i. Create a simple web application that can store information sent to it. For example, you could create a web application that will store to a text file anything provided in a URL parameter

ii. Write or modify an existing application that legitimately needs access to a sensitive resource ,but uses it at a time when it does not actually need it

Various types of databases Access Controls

i. Role-Based Access Control (RBAC)

iii. Mandatory Access Control (MAC)

Vulnerability: Study and work with KF Sensor

STEP1: Download **KF** Sensor tool Evaluation Setup File from KF Sensor Website.

STEP-2: Install with License Agreement and appropriate directory path.

STEP-3: Reboot the Computer now. The KF Sensor automatically starts during

Windows boot.

STEP-4: Click Next to setup wizard.

STEP-5: Select all port classes to include and Click Next.

STEP-6: "Send the email and Send from email", enter the ID and Click Next.

STEP-7: Select the options such as Denial of Service[DOS], Port Activity,

        Proxy Emulsion, Network Port Analyzer, Click Next.

STEP-8: Select Install as System service and Click Next.

Level 1: Identification of vulnerabilities
Level 2: Apply the concept

3. **Study of web authoring tools (any 2-3 tools)**
    i. Study and work with Net Stumbler tool
    ii. Study and work with Snort
    iii. Study and work with Nmap

   Level 1: Install the tools required

   Level 2: Apply the concept

4. **Testing web applications**
Study and work with Word press tool
    i. Create an Online Community website and test the website
    ii. Showcase Your Work Online and test its worth
    iii. Create a Local Business Website and test the website.

   Level 1: Define the test cases

   Level 2: Apply the concept to test the web application

5. **SQL injection and prevention**
From the given data set ,

    i.   Put limits on all result sets
    ii.   Cleanse and Validate Freeform User Input
    iii.   Remove Freeform User Input When Possible
    iv.   Validate Data Prior to Processing
    v.   Ensure Errors are Not User-Facing
    vi.   Use Stored Procedures to Abstract Business Logic and Control parameters
    vii.   Use LIKE Operators Carefully
    viii.   Limit Use of xp_cmdshell and Other Extended Stored Procedures
    ix.   Perform Penetration Tests
    x.   Code Review
    xi.   Minimizing the Impact of SQL Injection
    xii.   Principle of Least Privilege & Login Security
    xiii.   Secure Linked Servers and Data Sources

Level 1: Recognize and acquire the data

Level 2: Apply the concept

6. Cross site request forgery attack lab
With the usage of Virtual Machines

    i.   Configure the Virtual Machines:
    ii.   Observing HTTP Request in Victim VM
    iii.   CSRF Attack using GET Request
    iv.   CSRF Attack using POST Request
    v.   Implementing a countermeasure

Level 1: Identify and acquire the data
Level 2: Apply the concept
7. Web tracking
Tracking the Web based scenario by

- Environment Configuration
- clear history and cookies
- open a new private window in Firefox

Task 1: Understand the basic working of the web tracking

Task 2: Importance of cookie in Web tracking

Task 3: Tracked user interests and data

Task 4: How ads are displayed in a website

Task 5: Tracking in a Private browser window

Task 6: Real world tracking

Task 7: Countermeasures

Level 1: Identify and acquire the data logs

Level 2: Apply the concept

Targeted Application & Tools that can be used:

(1)   **Word press tool can be used for building websites with possible vulnerabilities.**
(2)   **Tools such as Nmap and Nessus can be used for web attack demonstration.**
(3)   **KF Sensor advanced 'honeypot' intrusion and insider threat detection system for Windows networks**
(4)   **Snort can be used for network intrusion detection system and intrusion prevention system**
(5)   **Net Stumbler tool for Windows that facilitates detection of Wireless LANs using the 802.11b, 802.11a and 802.11g WLAN standards.**

Topics related to development of "Skills":
   Web technology fundamentals, web security measures and web vulnerability/attacks.

Topics related to development of "Experimental Learning":
   Writing different web exploits to demonstrate vulnerabilities in web applications.

Course Code: CSE 1004	Course Title: Problem Solving Using C Type of Course: School Core & Practical Only.	L- T-P-C 2-0-2-3	2	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.				

Course Outcomes	On successful completion of this course the students shall be able to:
	1. Write algorithms and to draw flowcharts for solving problems 2. Demonstrate knowledge and develop simple applications in C programming constructs 3. Develop and implement applications using arrays and strings 4. Decompose a problem into functions and develop modular reusable code 5. Solve applications in C using structures and Union 6. Design applications using Sequential and Random Access File Processing.

Course Content:				

Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.

Topics:

Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.

Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.

Topics:
Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. **Strings:** Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.

Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.

Topics:
Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion.

Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.

Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.

Topics:
Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – **Union:** Introduction – Defining and Declaring Union – Difference Between Union and Structure.

Module 5	File handling	Case Study	Problem Solving	**9 Hrs.**

Topics:

Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files

List of Practical Tasks
Lab Sheet 1 (Module I)
Programs using IO Statements, Conditional Statements and Looping Statements
Lab Sheet 2 (Module II)
Programs using Arrays and Strings
Lab Sheet 3 (Module III)
Programs using Functions and Pointers
Lab Sheet 4 (Module IV)
Programs using Structures and Unions
Lab Sheet 5 (Module V)
Programs using Files

Text Book(s):
1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0. By

Reference Book(s):
1. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
2. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015
4. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
5. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

Web Links and Video Lectures:
1. https://nptel.ac.in/courses/106/105/106105171/
2. https://archive.nptel.ac.in/courses/106/104/106104128/

Course Code: **CSE 1004**	**Course Title: Problem Solving Using C** **Type of Course: School Core & Practical Only.**	**L- T-P- C** **2-0-2-3**	2	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.				

Course Outcomes	On successful completion of this course the students shall be able to:
	7. Write algorithms and to draw flowcharts for solving problems 8. Demonstrate knowledge and develop simple applications in C programming constructs 9. Develop and implement applications using arrays and strings 10. Decompose a problem into functions and develop modular reusable code 11. Solve applications in C using structures and Union 12. Design applications using Sequential and Random Access File Processing.

Course Content:				

Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.

Topics:

Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.

Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.

Topics:
Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. **Strings:** Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.

Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.

Topics:
Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion.

Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.

Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.

Topics:
Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – **Union:** Introduction – Defining and Declaring Union – Difference Between Union and Structure.

Module 5	File handling	Case Study	Problem Solving	9 Hrs.

Topics:

Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files

List of Practical Tasks
Lab Sheet 1 (Module I)
Programs using IO Statements, Conditional Statements and Looping Statements
Lab Sheet 2 (Module II)
Programs using Arrays and Strings
Lab Sheet 3 (Module III)
Programs using Functions and Pointers
Lab Sheet 4 (Module IV)
Programs using Structures and Unions
Lab Sheet 5 (Module V)
Programs using Files

Text Book(s):
2. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0. By

Reference Book(s):
6. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
7. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
8. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015
9. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
10. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

Web Links and Video Lectures:
3. https://nptel.ac.in/courses/106/105/106105171/
4. https://archive.nptel.ac.in/courses/106/104/106104128/

Course Code: CSE 3039	Course Title: Social Media Analytics Type of Course: Integrated	L–T– P–C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	• Python Programming				
Anti-requisites					
Course Description	This course will introduce concepts and approaches to mining social media data. It focuses on obtaining and exploring those data, mining networks, and mining text from social platforms. Students will learn how to apply previously learned data mining concepts to a domain that will likely be familiar to all of them: social media. Students will learn to explore, model, and predict with network and textual data from existing social platforms.				

Course Objective	The objective of the course is to familiarize the learners with the concepts of **Social Media Analytics** and attain **Employability** through **Experiential Learning** techniques.			
Course Out Comes	**On successful completion of the course the students shall be able to:** • Introduce the idea of social media analytics to the students and assist them in comprehending its importance. • Introduce the learners to the social media analytics tools. • Give the students the tools they need to learn how to analyse the efficiency of social media for business.			
Course Content:				
Module 1	**Introduction to Social Media Analytics**	Assignment	Data Collection/Interpretation	**10 Sessions**

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas.

Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization

Module 2	**Making connections: & Web analytics tools:**	Case studies / Case let	Case studies / Case let	**10 Sessions**

Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity.
Web analytics tools: Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis

Module 3	**Network Data Analytics:**	Quiz	Case studies / Case let	**11 Sessions**

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on Social Network. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.
(LinkedIn, Instagram, YouTube Twitter etc. Google analytics. Introduction. (Websites)

Module 4	**Processing and Visualizing Data**	Quiz	Case studies / Case let	**08 Sessions**

Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration.

Practical: Students should analyze the social media of any ongoing campaigns and present the findings.

Project work/Assignment:	
Assignment on: Types of Data, Data Transfer, Fundamental Twitter Terminology	
Text Book	

| **T1** | Mathew A. Russell, "*Mining the Social Web*", O'Reilly, 3rd Edition, 2019. |
| **T2** | Marco Bonzanini, "*Mastering Social Media Mining with Python*", PacktPub, 2016 |

References
  R1 Michal Krystyanczuk and Siddhartha Chatterjee, "Python Social Media Analytics", Packt Publishing, 2017
  R2 Sponder, M "*Social media analytics: Effective tools for building, interpreting, and using metrics"*. McGraw Hill Professional.

  E book link R1:

E book link R2
 Web resources:
  a.   https://www.coursera.org/learn/social-media-data-analytics
  b.   https://www.udemy.com/course/introduction-to-social-analytics/
  c.   https://onlinecourses.nptel.ac.in/noc21_cs28
  d.   https://research.facebook.com/publications/realtime-data-processing-at-facebook/

Weblinks:
    1.   **https://www.coursera.org/learn/social-media-analytics-introduction**
    2.   **https://academy.quintly.com/courses/free-social-media-analytics**
  3. **https://presidencyuniversity.in/facility/library/**

Topics relevant to "EMPLOYABILITY SKILLS":
Handling Unstructed Data for Employability skills through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 3035	**Course Title: R Programming For Data Science** **Type of Course: Integrated**	**L- T-P- C**	1 -0	4	3
Version No.	1				
Course Pre-requisites	**NIL**				
Anti-requisites	**NIL**				
Course Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of R Programming For Data Science and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	**On successful completion of this course the students shall be able to:** • Apply basic R functions pertaining to fundamental data analysis. [**Application**] • Interpret data using appropriate statistical methods [**Application**] • Demonstrate the decision trees concept with the given dataset. [**Application**]				

		• Demonstrate the Mining concepts for both Data and Text. [**Application**]			
Course Content:					
Module 1	**Introduction**	Assignment	Data Collection/Interpretation	**6 Sessions**	

Topics:
Introduction to R, Overview of data analysis, Working with directory in R, Loading and handling data in R, Data Visualization with ggplot2, Data Transformation with dplyr.

Module 2	**Exploratory Data Analysis**	Coding Assignment	Case Study	**11 Sessions**

Topics:
Exploring a new dataset, Anomalies in numerical data, Visualizing relations between variables, Assumptions of Linear Regression, Validating Linear Assumption, Missing Values, Covariation, Patterns and Models, gglot2 Calls.

Module 3	**Regression Analysis**	Coding Assignment	Project	**12 Sessions**

Topics:
  Introduction, Types of Regression Analysis Models, Linear Regression, Simple Linear Regression, Non-Linear Regression, Regression Analysis with Multiple Variables, Cross Validation, Principal Component Analysis, Factor Analysis.

Module 4	**Classification**	Quiz	Project	**8 Sessions**

Topics:
Introduction, Different types of Classification, Logistic Regression, Support Vector Machines, K-Neatest Neighbors, Naïve Bayes Classifier, Decision Tree Classification, Random Forest Classification, Evaluation.

List of Laboratory Tasks:
1. Using with and without R objects on console
2. Using mathematical functions on console
3. Write an R script, to create R objects for calculator
4. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.
5. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location. b. Reading Excel data sheet in R
6.Find the data distributions using box and scatter plot.
7. Find the outliers using plot.
8. Plot the histogram, bar chart and pie chart on sample data
9.Find the correlation matrix.
10. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data
11.Create a regression model for a given dataset
12.Install relevant package for classification.
13. Choose classifier for classification problem. c. Evaluate the performance of classifier.
14.Install relevant package for classification.
15. Choose classifier for classification problem. c. Evaluate the performance of classifier.

Targeted Application & Tools that can be used
Tools: RStudio / Google Colab

<div align="center">

Project work/Assignment:

</div>

Assignment:
During the course, students would need to do coding assignments to learn to train and use different models. Sample coding assignments include:
Analysis of Sales Report of a Clothes Manufacturing Outlet.
Comcast Telecom Consumer Complaints.
Web Data Anslysis

Text Book
  T1 Hadley Wickham and Garrett Grolemund, "R for Data Science", O'reilly, 2017.

References
  R1   Dr. Bharati Motwani, "Data Analytics using R", Wiley, 2019.

Web resources:
  1. **https://www.geeksforgeeks.org/r-programming-for-data-science/**
     2.   **https://r4ds.had.co.nz/**

Topics relevant to "SKILL DEVELOPMENT": Regression model, classifier for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3002	Course Title: Big Data Technologies Type of Course: Program Core Theory and Lab Integrated Course	L-T-P- C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	CSE2012-Database Management System, CSE1001- Problem solving using Java.				
Anti-requisites	NIL				
Course Description	The purpose of the course is to provide the fundamentals of Big data technology, to emphasize the importance of choosing suitable tools for processing and analyzing big data to gain insights. The student should have knowledge and skill to select and use most appropriate big data tools to solve business problems. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills. With a good knowledge in the fundamentals of Big data technology the student can gain practical experience in implementing them, enabling the student to be an effective solution provider for applications that involve huge volume of data.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Big Data Technologies and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Outcomes	On successful completion of the course the students shall be able to: • Apply Map-Reduce programming on the given datasets to extract required insights. (Application). • Employ appropriate Hadoop Ecosystem tools such as scoop, Hbase, Hive, to perform data analytics for a given problem. (Application). • Use Spark tool to analyze the given dataset for a given problem. (Application).				

Course Content:				
Module 1	Introduction to Hadoop	Programming Assignment	Data Collection and Analysis	**10 Classes**

Introduction to Big Data and its importance: Basics of Distributed File System, Four Vs, Drivers for Big data, Big data applications, Structured, unstructured, semi-structured and quasi structured data. Big data Challenges-Traditional versus big data approach, The Big Data Technology Landscape: No-SQL.

The Hadoop: History of Hadoop-Hadoop use cases, The Design of HDFS, Blocks and replication management, Rack awareness, HDFS architecture, HDFS Federation, Name node and data node, Anatomy of File write. Anatomy of File read, Hadoop Map Reduce paradigm, Map and reduce tasks, Job Tracker and task tracker, Map reduce execution pipeline, Key value pair, Shuffle and sort, Combiner and Partitioner, APIs used to Write/Read files into/from Hadoop, Need for Flume and Sqoop.

Anatomy of a YARN: Hadoop 2.0 Features, Name Node High Availability, YARN Architecture, Introduction to Schedulers, YARN scheduler policies, FIFO, Fair And Capacity scheduler.

Module 2	Hadoop Ecosystem Tools	Programming Assignment	Data Collection and Analysis	**8 Classes**

Introduction to SQOOP: SQOOP features, Sqoop Architecture, Sqoop Import All Tables, Sqoop Export All Tables, Sqoop Connectors, Sqoop Import from MySQL to HDFS, Sqoop vs flume.

Hive: Apache Hive with Hive Installation, Hive Data Types, Hive Table partitioning, Hive DDL commands, Hive DML commands, and Hive sort by vs. order by, Hive Joining tables, Hive bucketing.

Hbase: Introduction to HBase and its working architecture- Commands for creation and listing of tables- disabled and is disabled of table - enable and is enabled of table-describing and dropping of table-Put and Get command - delete and delete all command-commands for scan, count, truncate of tables.

Module 3	Spark	Programming Assignment	Data analysis	**8 Classes**

Introduction to Apache Spark A unified Spark, Who uses Spark and for what?, A Brief History of Spark, Spark version and releases, Storage layers for Spark. Programming with RDDs: RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. Spark SQL: Linking with Spark SQL, Using Spark SQL in Applications, Loading and Saving Data, JDBC/ODBC Server, User-defined functions, Spark SQL Performance.

Scala: The Basics, Control Structures and functions, Working with arrays, Maps and Tuples.

List of Laboratory Tasks:
1. **Level 1:** To install the Hadoop in pseudo cluster mode.
   Level 1: HDFS Shell Commands – Files and Folders.
   Level 2: HDFS Shell Commands – Management.

2. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
   Level 1: Find the number of occurrence of each word appearing in the input file(s)
   Level 2: Performing a Map Reduce Job for word search count (look for specific keywords in a file).

3. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with Map Reduce, since it is record-oriented. Data available at: https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all.
   Level 1: Find average, max and min temperature for each year in NCDC data set?
   Level 2: Programming assignment to analyze the social media data for business analytics.

4. **Level 1:** Finding out Number of Products Sold in Each Country using map reduce with sample

              dataset

   Level 2: Find matrix multiplication using map reduce

5. **Level 1:** Installation of Hive, working on basic hive commands. (Create, Alter and Drop tables)

   Level 2: Apply Hive commands to student database/employee database.

6. **Level 1:** Working on advance hive commands. (Static Partitioning & Dynamic partitioning)

   Level 2: Continue the previous experiment, select and apply suitable partitioning technique.

7. **Level 1:** Working on advance hive commands-2. (Bucketing)

   Level 2: Continue the previous experiment, apply bucketing technique to bring out the

              difference between partitioning and bucketing.

8. **Level 1:** Installing Ecosystem tools such as Scoop, Hbase.

   Level 2: Scoop – Move Data into Hadoop.

9. **Level 1:** Working on basic Hbase commands (General commands, DDL Commands)

   Level 2: Apply Hbase commands on Insurance database/employee dataset.

10. **Level 1:** Working on advanced Hbase commands. (DML).

    Level 2: Continue the previous experiment to demonstrate CRUD operations.

11. **Level 1:** Install, Deploy & configure Apache Spark.

    Level 2: Using RDD and FlatMap count how many times each word appears in a file and

             write out a list of words whose count is strictly greater than 4 using Spark

12. **Level 1:** Write a program in Apache spark to count the occurrences words in a given text file

            and display only those words starting with 'a' in ascending order of count.

    Level 2: Apache access logs are responsible for recording data for all web page requests

            processed by the Apache server. An access log record written in the Common Log

            Format will look something like this: 127.0.0.1 - Scott [10/Dec/2019:13:55:36 –

            0700] "GET /server-status HTTP/1.1" 200 2326 Where, HTTP 200 status response

            code indicates that the request has succeeded. Write a program to read the records of

            access log file log.txt and display the number of successful requests using Spark.

13. **Level 1:** Chess king moves horizontally, vertically or diagonally to any adjacent cell. Given

            two different cells of the chessboard, determine whether a king can go from the first

            cell to the second in one move.

| | Write a scala program that receives input of four numbers from 1 to 8, each specifying the column and row number, first two - for the first cell, and then the last two - for the second cell. The program should output YES if a king can go from the first cell to the second in one move, or NO otherwise. |
| | **Level 2:** Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.
 Write a single Spark application that:
 • Transposes the original Amazon food dataset, obtaining a Pair RDD of the type:
 • Counts the frequencies of all the pairs of products reviewed together;
 • Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency. |

Targeted Application & Tools that can be used:
- **Business Analytical Applications**
- **Social media Data Analysis**
- **Predictive Analytics**

Tools: Hadoop Framework tools like map reduce, Hive, Hbase, Scoop, Spark.

Text Book

Seema Acharya, Subhashini Chellappan. 2015. *Big Data and Analytics*. Wiley Publication.

Matei Zaharia, Bill Chambers. 2018. *SPARK: The Definitive Guide*. Oreilly.

References

Tom White. 2016. *Hadoop: The Definitive Guide*. O'Reilley.

Cay S. Horstmann. 2017. *Scala for the Impatient*. Wesley.

Topics relevant to development of "Skill Development": Real time application development using Hadoop Ecosystem tools through Experiential Learning as mentioned in the course handout.

Course Code: CSE3125/CSE265	**Course Title: Service Oriented Architecture** **Type of Course: Program Core**	**L-T-P- C**	3-0	0	3
Version No.	2.0				
Course Pre-requisites	CSE207-Data Base Management System, CSE264 -Web Technology				
Anti-requisites	NIL				
Course Description	The study of the course is to enable the students to understand the different architectural styles and XML based web applications which is required to explore the basics of service-oriented Architecture(SOA) in two approaches i.e. Web Services (WS) and Representational State Transfer (REST) architecture.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Service Oriented Architecture and attain Skill Development through Participative Learning techniques.				

Course Out Comes	On successful completion of this course the students shall be able to:			
	1.Discuss the XML Fundamentals and to manipulate the data using XML. [Comprehension] 2.Define the key principles of SOA [Knowledge] 3.Discuss the web services technology elements for realizing SOA[Comprehension] 4. Illustrate the various Web Service Standards[Application]			
Course Content:				
Version No.	2.0			
Module 1	**Introduction to XML**	**Assignment**	**Programming Task**	**08 Sessions**
Topics: XML document structure ,Well formed and valid documents ,Namespaces – DTD – xml Schema – X-Files,Parsing XML – using DOM, SAX – XML Transformation and XSL Formatting – Modelling Databases in XML.				
Module 2	**Service Oriented Architecture**	**Assignment**	**Architectural study**	**10 Sessions**
Topics: Types of Architecture,Objectives of Software architecture,SOA Planning and analysis,Architecture patterns and styles ,Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA ,Security and implementation ,Principles of Service orientation ,Service Layers, Application development process,SOA methodology for Enterprise.				
Module 3	**Web Services**	**Quiz**	**Data patterns**	**08 Sessions**
Topics: Service Descriptions – WSDL – Messaging with SOAP – Service Discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography – WS Transactions.				
Module 4	**Building SOA based Applications**	**Quiz**	**Security aspects**	**11 Sessions**
Topics: Business Process Design,Business case for SOA, Stake holder objectives, Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines – Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security , Tools available for implementing SOA, SOA Security, approach for enterprise wide SOA implementation,Trends in SOA,Technologies in Relation to SOA, Advances in SOA, SOA Support in J2EE.				
Targeted Application & Tools that can be used: **Basic HTML and XML**				
Textbook(s):				
1. Thomas Erl, "*Service Oriented Architecture: Concepts, Technology, and Design*", Pearson Education, 2016. http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6532 2. Ron Schmelzer et al. "*XML and Web Services*", Pearson Education, 2013 http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6645				
References				

1. Frank P.Coyle, "*XML, Web Services and the Data Revolution*", Pearson Education, 2002
   http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6647

2. Eric Newcomer, Greg Lomow, "*Understanding SOA with Web Services*", Pearson Education, 2005
   http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6619

3. Sandeep Chatterjee and James Webber, "*Developing Enterprise Web Services: An Architect's Guide*", Prentice Hall, 2004.
   http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5906

4. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "*Java Web Services Architecture*", Morgan Kaufmann Publishers, 2003.
   https://www.elsevier.com/books/java-web-services-architecture/mcgovern/978-1-55860-900-6

   Web Resources:

1. https;//presiuniv.knimbus.com/user#/home
2. https://www.coursera.org/learn/service-oriented-architecture
3. https://nptel.ac.in/courses/soa

Topics relevant to "SKILL DEVELOPMENT": Based on an understanding of architectural styles, understanding web applications based on XML, review architectures for web applications, Service-Oriented Architecture (SOA) in two approaches: Web Services (WS*) and Representational State Transfer (REST) architecture for Skill Development through Participative Learning techniques. This is attained through the Presentation as mentioned in the assessment component.

Course Code: CSE324	Course Title: Internet and Web Technologies Type of Course: Integrated	L-T-P- C	1 -0	4	3
Version No.	1				
Course Pre-requisites	nil				
Anti-requisites	nil				
Course Description	The purpose of the course is to provide a comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Internet and Web Technologies and attain Skill Development through Participative Learning techniques.				
Course Out Comes	**On successful completion of the course the students shall be able to:** Implement web-based application using markup languages. **[Application]** Illustrate the use of various constructs to enhance the appearance of a website. **[Application]** Apply server-side scripting languages for web page design and link to a database. **[Application]**				

Course Content:	**Module: 1:** [20 Hrs - L[10] + T[10]] [Application] **Module: 2: Advanced CSS** [16 Hrs – L[8] + T[8]] [Application] **XML:** Basics, demonstration of applications using XML **Module 3: PHP** [20 Hrs – L[10] + T[10]] [Application] **PHP:** Introduction to server-side Development with PHP, Arrays, and Superglobals, Arrays, $GET and $ POST, Super global Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object, Classes and Objects in PHP, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP

Module 1	**Introduction to XHTML**	Assignment	Data Collection/Interpretation	**16 Sessions**

Topics:
Basics: Web, WWW, Web browsers, Web servers, Internet.
XHTML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML

Module 2	**Advanced CSS**	Experiment	Case studies / Case let	**20 Sessions**

Topics:
Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks

Module 3	**PHP**	Quiz	Case studies / Case let	**20 Sessions**

Topics:
Introduction to server-side Development with PHP, Arrays, and Superglobals, Arrays, $GET and $ POST, Super global Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object, Classes and Objects in PHP, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP

List of Laboratory Tasks:
1. HTML with tables
2. HTML with frames
3. Html with form
4. Web site with links
5. Website with advanced CSS
6. WAMP installation & introduction
7. PHP for website
8. Form validation
9. PHP and MySQL for website

Targeted Application & Tools that can be used
1. Notepad++
2. WAMP

<div align="center">

Project work/Assignment:

</div>

Assignment: Mini Project on development of a Website

Text Book

T1   Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition,2015.

T2.   CSS   Notes   for   Professionals,   ebook   available   at https://books.goalkicker.com/CSSBook/ (Retrieved
   on Jan. 20, 2022)

T3. Deitel, Deitel, Goldberg,"Internet & World Wide Web How to Program", Fifth Edition, Pearson
   Education,2021.

References

R1. Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

R3 **Web resources:**

W1. **Journal resources**

1. Pallavi Yadav, Paras Nath Barwal,"Designing Responsive Websites Using HTML And CSS" INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 3, ISSUE 11, NOVEMBER 2014, ISSN 2277-8616

2. Thomas H. Park, Brian Dorn, Andrea Forte," An Analysis of HTML and CSS Syntax Errors in a Web Development Course" ACM Transactions on Computing Education Volume 15Issue 1March 2015 Article No. 4pp 1–21,https://doi.org/10.1145/2700514

3. Thomas H. Park,Ankur Saxena, Swathi Jagannath, Susan Wiedenbeck, Andrea Forte, "Towards a taxonomy of errors in HTML and CSS" ACM Transactions on Computing Education, Pages 75–82 , https://doi.org/10.1145/2493394.2493405

4. A. Veglis; M. Leclercq; V. Quema; J.-B. Stefani, "PHP and SQL made simple", Published in: IEEE Distributed Systems Online (Volume: 6, Issue: 8, August 2005) DOI: 10.1109/MDSO.2005.42

W2. Course NPTEL / Swayam Link : https://nptel.ac.in/courses/106105084

W3.   Coursera Link   :https://www.coursera.org/learn/html-css-javascript-for-web-developers

W4. PU Library Link : https://puniversity.informaticsglobal.com/login

Or

: http://182.72.188.193/

Topics relevant to development of "Skill Development": Form Design and Validation for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 2058	Course Title: Firewall and Internet security Type of Course: Integrated	L-T- P-C	2-0	2	3
Version No.	1				
Course Pre-requisites	Computer Networks				

Anti-requisites	
Course Description	This course provides an in-depth study of various network attacks techniques and methods to defend against them. A number of threats and vulnerabilities of the Internet will be covered, including various vulnerabilities of TCP/IP protocols, denial of service (DOS), attacks on routing, attacks on DNS servers, TCP session hijacking, and so on. This course will also cover defending mechanisms, including intrusion detection, firewalls, tracing the source of attacks, anonymous communication, IPsec, virtual private network, and PKI. To make it easy for students to understand these attacks, basics of the TCP/IP protocols will also be covered in the course.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Firewall and Internet security and attain Skill Development through Problem Solving Methodologies.
Course Out Comes	On successful completion of the course the students shall be able to: To identify elements of firewall design, types of security threats and responses to security attacks. Examine security incident postmortem reporting and ongoing network security activities. Construct code for authentication algorithms. Develop a signature scheme using Digital signature standard. Demonstrate the network security system using open source tools
Course Content:	

Module 1	Introduction to Firewall	Assignment	Data Collection/Interpretation	12 Sessions
Introduction of Firewall in computer network,Categories of firewall,How firewall works,Types of firewall, Firewall location and Configuration,Firewall Policies,Firewall Biasing,Network Architecture,Net masks,Packet filters,Stateful firewalls,Resources				
Module 2	Computer security	Case studies / Case let	Case studies / Case let	12 Sessions
Topics: Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH)				
Module 3	Network Security	Quiz	Case studies / Case let	10 Sessions

Topics: Overview of Network Security:Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures.				
Module 4	Cyber laws and Compliance Standards	Quiz	Case studies / Case let	11 Sessions

Topics:

Kerberos:Working ,ASS,TGS,SS-Internet security protocols-AH,ESP,Models-Transport and tunnel-Email security,Public key Infrasturcture,Certificates,certificates authority.Cyber Crime: Introduction,Hacking,Digital forgery,Cyber Stalking,Identify theft and Fraud,Cyber terrorism,Cyber defamation,Crime against individual,Government,Property.

List of Laboratory Tasks:

Perform encryption, decryption using the following substitution techniques
(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher

Perform encryption and decryption using following transposition techniques
i) Rail fence ii) row & Column Transformation

Apply DES algorithm for practical applications.

Apply AES algorithm for practical applications.

Implement RSA Algorithm using HTML and JavaScript

Implement the Diffie-Hellman Key Exchange algorithm for a given problem.

Calculate the message digest of a text using the SHA-1 algorithm.

Implement the SIGNATURE SCHEME – Digital Signature Standard.

Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.

Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool

Defeating Malware
i) Building Trojans ii) Rootkit Hunter

Targeted Application & Tools that can be used

Text Book

T1 : Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition

T2: James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017

References
R1: Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson Edition

R2: Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

Web resources:

https://networklessons.com/cisco/asa-firewall

https://www.udemy.com/course/cisco-asa-firewall-lab-guide

https://geekflare.com/learn-network-security

Topics relevant to development of "Skill Development": AES, Network Security for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE2034	Course Title: Edge Computing Type of Course: Theory Only Course Discipline Elective	L-T- P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Distributed Systems and Algorithms				
Anti-requisites	Nil				
Course Description	In this course, we will study significant tools and applications that comprise today's cloud computing platform, with a special focus on using the cloud for big data applications. The course covers various topics such as the evolution of computing industry, cloud computing basics and edge computing. The course provides information on the different types of edge compute deployments, different types of edge compute services (such as CDN Edge, IOT Edge, and Multi-access Edge (MEC)). The course also educates the students on the different vendor platforms,				

	software services, standard bodies and open source communities available for edge computing. Students will also create a research project of their choosing.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Edge Computing and attain Employability through Problem Solving Methodologies.			
Course Out Comes	On successful completion of the course the students shall be able to: CO1 Understand the principles, architectures of edge computing (Knowledge) CO2 Describe IoT Architecture and Core IoT Modules (Comprehension) CO3 Summarize edge to Cloud Protocols (Comprehension) CO4 Describe Edge computing with RaspberryPi (Comprehension)			
Course Content:				
Module 1	IoT and Edge Computing Definition and Use Cases	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	9 Sessions
Topics: Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.				
Module 2	IoT Architecture and Core IoT Modules	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	9 Sessions
Topics: A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.				
Module 3	RaspberryPi	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	10 Sessions
Topics: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.				

Module 4	Edge to Cloud Protocols	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	7 Sessions

Topics: Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols,MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions,MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

Module 5	Edge computing with RaspberryPi	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	7 Sessions

Topics: Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Targeted Application & Tools that can be used:

Application : Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking.

Tools :Eclipse ioFog : An integrated development environment built by the Eclipse Foundation, backed by IBM. Eclipse ioFog is the organization's open-source edge computing platform.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Exploring topics such as developing scalable architectures, moving from closed systems to open systems, and ethical issues rising from data sensing, addresses both the challenges and opportunities of Edge computing presents. Students can harness federating Edge resources, middleware design issues, data management and predictive analysis, smart transportation and surveillance applications, and more. A coordinated and integrated solutions can be provided by thorough knowledge of the foundations, applications, and issues that are central to Edge computing.

Text Book

IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt

Publishing, 2020, ISBN: 9781839214806

    2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc.,

2019, ISBN: 978149204322.

Topics relevant to "EMPLOYABILITY SKILLS": Implementation of Microcomputer RaspberryPi and device Interfacing for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE3068	Course Title: Advance Database Management System Type of Course: Integrated	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Basics about DBMS MYSQL software tool usage				
Anti-requisites	Nil				
Course Description	This course covers advanced aspects of database management including normalization and renormalizations, query optimization, distributed databases, data warehousing, and big data. There is extensive coverage and hands on work with SQL, and database instance tuning. Course covers various modern database architectures including relational, key value, object relational and document store models as well as various approaches to scale out, integrate and implement database systems through replication and cloud based instances. Students learn about unstructured "big data" architectures and databases, and gain hands-on experience with Spark and MongoDB.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Advance Database Management System and attain Employability through Experiential Learning techniques				
Course Out Comes	On successful completion of the course the students shall be able to: 1.Select the appropriate high-performance database like parallel and distributed database 2.Infer and represent the real-world data using object-oriented database 3.Interpret rule set in the database to implement data warehousing of mining				
Course Content:					
Module 1	Review of Relational Data Model and Relational Database Constraints:	Assignment	Data Collection/Interpretation		15 Sessions

Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations.

Object and Object-Relational Databases: Overview of Object Database Concepts, Object Database Extensions to SQL, The ODMG Object Model and the Object Definition Language ODL, Object Database Conceptual Design, The Object Query Language OQL, Overview of the C++ Language Binding in the ODMG Standard.

Module 2	Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures:	Assignment	Case studies / Case let	15 Sessions

Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk Operations on Files, Files of Unordered Records (Heap Files), Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures.

Distributed Database Concepts: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control and Recovery in Distributed Databases, Overview of Transaction Management in Distributed Databases,Query Processing and Optimization in Distributed Databases, Types of Distributed Database Systems , Distributed Database Architectures, Distributed Catalogue Management

Module 3	NOSQL Databases and Big Data Storage Systems	Assignment	Case studies / Case let	15 Sessions

Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. Big Data Technologies Based on MapReduce and Hadoop: What Is Big Data? Introduction to MapReduce and Hadoop, Hadoop Distributed File System (HDFS), MapReduce: Additional Details Hadoop v2 alias YARN, General Discussion

List of Laboratory Tasks:

Lab sheet -1 [2 Practical Sessions]

Experiment No 1:

Level 1 – Study and Configure Hadoop for Big Data

 Lab sheet – 2 [2Practical Sessions]

Experiment No. 2:

Level 1– Study of NoSQL Databases such as Hive/Hbase/Cassendra/DynamoD

Level 2 - Design Data Model using NoSQL Databases such as Hive/Hbase/Cassendra/DynamoDB

 Lab sheet – 3 [2 Practical Sessions]

Experiment No. 1:

Level 1 - Implement any one Partitioning technique in Parallel Databases

Level 2 – Implement Two Phase commit protocol in Distributed Databases

Lab sheet – 4 [2 Practical Sessions]

Experiment No. 1: Level 1 - Design Persistent Objects using JDO and implement min 10 queries on objects using JDOQL in ObjectDB NOSQL DATABASE Level 2 - Design database schemas and implement min 10 queries using Hive/ Hbase/ Cassendra column based databases   Lab sheet -5 [2 Practical Sessions] Experiment No. 1: Level 1 - Design database schemas and implement min 10 queries using DynamoDBkeyValue based databases Level 2 – Design and Implement social web mining application using NoSQL databases, machine learning algorithm, Hadoop and Java/.Net
Targeted Application & Tools that can be used MangoDB
Project work/Assignment:
Assignment: CASE STUDY OF TRADITIONAL RDBMS AND NOSQL DATABASE SYSTEM and submit the report
Text Book 1. Elmasri R and Navathe S B, "Fundamentals of Database System", 7th Edition, Pearson Publication, 2017.
References 1. Hector Garcia Molina, Jeffery D Ullman, JennifferWidom, "Database systems: The Complete Book", 2nd edition, Pearson Publication,2013. 2.AviSilberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2019. https://www.classcentral.com/course/youtube-sql-tutorial-for-beginners-in-hindi-dbms-tutorial-sql-full-course-in-hindi-great-learning-99143/classroom https://www.udemy.com/course/sql-for-beginners-course/ https://onlinecourses.nptel.ac.in/noc22_cs51/preview https://www.coursera.org/learn/database-management https://www.youtube.com/watch?v=HXV3zeQKqGY   PU Library Link : https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&curPage=0&layout=grid&sorFieldId=none&topresult=false&content=*cloud*

Topics relevant to "EMPLOYABILITY SKILLS": Distributed Database for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE384	Course Title: Data Warehousing and Mining Type of Course: Theory	L-T- P-C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	Data Mining				
Anti-requisites	NIL				
Course Description	The course is an intermediary course and aims to provide students with an in-depth understanding of the design and implementation of data warehousing and data mining. The course will help students to enhance their understanding of various classification, clustering, and outlier analysis methods. An interest to understand the concepts of data warehousing, and data mining and a desire to be a successful data scientist are key to enabling students to complete the course successfully. Topics include: Data Models for Data Warehouses, data extraction, cleansing, transformation and loading, data cube computation, materialized view selection, and OLAP query processing. Data mining-Fundamentals. Mining Techniques and Application: Classification, Clustering, Outlier Analysis.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Data Warehousing and Mining and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: Describe data warehousing architecture and considerations to build data warehouse. [Knowledge] Discuss different multidimensional data models for data warehouse. [Comprehension] Apply various classification and clustering methods for mining information from data. [Application] Apply different techniques to find outliers in data. [Application]				
COURSE CONTENT (SYLLABUS):	Module 1: Introduction to Data Warehousing [07 Hrs] [Knowledge] The need for data warehousing, paradigm shift, data warehouse definition and characteristics, Data warehouse architecture, sourcing, acquisition, cleanup and transformation, metadata, access tools, data marts, data warehouse administration and management, building a data warehouse: business consideration, technical consideration, design consideration, implementation consideration, integrated solutions, benefits of data warehousing.				

Module 2: Data Warehouse modelling   [12 Hrs]
[Comprehension]

Data cube: A multidimensional data model, stars, snowflakes, and fact constellations: schemas for multidimensional data models, dimensions: the role of concept hierarchies, measures: their categorization and computation, typical OLAP operations, efficient data cube computation, the compute cube operator and the curse of dimensionality, partial materialization: selected computation of cuboids, indexing olap data: bitmap index and join index.

Module 3: Classification & Clustering methods   [14 Hrs]
[Application]

Bayesian Belief Networks, Support Vector Machines, Classification by Back propagation, Fuzzy clusters, Probabilistic Model-Based Clusters, Expectation-Maximization Algorithm.

Module 4: Outlier detection   [06 Hrs]
[Application]

1. Outliers and Outlier Analysis, Types of Outliers,

2. Outlier Detection Methods: Detection of univariate Outliers Based on Normal Distribution,

3. Statistical Approaches,

4. Proximity-Based Approaches.

Report and PPT for 2 topics

That means 2 PPTs and 2 reports.

1st topic should be from Module 4

2nd topics can be from module 4 or module 3.

DELIVERY PROCEDURE (PEDAGOGY):

Classroom Lecture, PPT

Self-learning: Article review of journals on Data mining.

Participative Learning: Implementation of discussed algorithm with graphical visualization using any suitable language/platform.

REFERENCE MATERIALS:

Text Books:

T1. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", McGraw Hill, 2016

T2. Jiawei Han, Micheline Kamber, Jian Pei, "Data-Mining.-Concepts-and-Techniques ", The-Morgan-Kaufmann, 3rd-Edition-Morgan-Kaufmann, 2012

Reference Books:

	R1. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", Pearson, 2016
	R2. Tan P. N, Steinbach M and Kumar V, "Introduction to Data Mining", Pearson Education, 2016
	Web Based Resources and E-books:
	W1. NPTEL Course on "Business Analytics & Data Mining Modeling Using R", Prof. Gaurav Dixit.
	https://onlinecourses.nptel.ac.in/noc22_mg67/preview
	W2. NPTEL Course on "Data Mining", Mr. L. Abraham David
	https://onlinecourses.swayam2.ac.in/cec22_cs06/preview
	W3. Coursera course on "Data Warehousing for Business Intelligence Specialization", Michael
	Mannino, Jahangir Karimi
	https://www.coursera.org/specializations/data-warehousing
	W4. Journal on "Data Mining and Knowledge Discovery"
	https://www.springer.com/journal/10618/
	Topics relevant to "SKILL DEVELOPMENT": Bayesian Belief Networks, Support Vector Machines, Classification by Back propagation, Fuzzy clusters for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in the course handout.

Course Code: CSE2034	Course Title: Edge Computing Type of Course: Discipline Elective	L-T- P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Distributed Systems and Algorithms				
Anti-requisites	Nil				
Course Description	In this course, we will study significant tools and applications that comprise today's cloud computing platform, with a special focus on using the cloud for big data applications. The course covers various topics such as the evolution of computing industry, cloud computing basics and edge computing. The course provides information on the different types of edge compute deployments, different types of edge compute services (such as CDN Edge, IOT Edge, and Multi-access Edge (MEC)). The course also educates the students on the different vendor platforms,				

	software services, standard bodies and open source communities available for edge computing. Students will also create a research project of their choosing.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Edge Computing and attain Employability through Problem Solving Methodologies.			
Course Out Comes	On successful completion of the course the students shall be able to: CO1 Understand the principles, architectures of edge computing (Knowledge) CO2 Describe IoT Architecture and Core IoT Modules (Comprehension) CO3 Summarize edge to Cloud Protocols (Comprehension) CO4 Describe Edge computing with RaspberryPi (Comprehension)			
Course Content:				
Module 1	IoT and Edge Computing Definition and Use Cases	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	9 Sessions

Topics:

Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

Module 2	IoT Architecture and Core IoT Modules	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	9 Sessions

Topics: A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

Module 3	RaspberryPi	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	10 Sessions

Topics: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

Module 4	Edge to Cloud Protocols	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	7 Sessions

Topics: Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols,MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions,MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

Module 5	Edge computing with RaspberryPi	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	7 Sessions

Topics: Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Targeted Application & Tools that can be used:

Application : Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking. Tools :Eclipse ioFog : An integrated development environment built by the Eclipse Foundation, backed by IBM. Eclipse ioFog is the organization's open-source edge computing platform.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Exploring topics such as developing scalable architectures, moving from closed systems to open systems, and ethical issues rising from data sensing, addresses both the challenges and opportunities of Edge computing presents. Students can harness federating Edge resources, middleware design issues, data management and predictive analysis, smart transportation and surveillance applications, and more. A coordinated and integrated solutions can be provided by thorough knowledge of the foundations, applications, and issues that are central to Edge computing.

Text Book

IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt

Publishing, 2020, ISBN: 9781839214806

    2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc.,

2019, ISBN: 978149204322.

Topics relevant to "EMPLOYABILITY SKILLS": Implementation of Microcomputer RaspberryPi and device Interfacing for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: 5G Networking Type of Course: Theory Only Course	L-T- P-C	3-0	0	3

CSE 3090					
Version No.	1				
Course Pre-requisites	Digital communications, Mobile Communication Systems, Wireless Networks				
Anti-requisites	Nil				
Course Description	The aim of this course is to let the students understand that air Interface is one of the most important elements that differentiate between 2G, 3G, 4G and 5G. While 3G was CDMA based, 4G was OFDMA based; this course reveals the contents of air interface for 5G. While 4G brought in a deluge of infotainment services, 5G aims to provide extremely low delay services, great service in crowd, enhanced mobile broadband (virtual reality being made real), ultra-reliable and secure connectivity, ubiquitous QoS, and highly energy efficient networks.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of 5G Networking and attain Employability through Participative Learning techniques				
Course Out Comes	On successful completion of the course the students shall be able to: • Explain the channel models of 5G and the use cases for 5G. • Analyze use of MIMO in 5G and its techniques. • Understand device to device (D2D) communication and standardization. • Illustrate the in-depth functioning of 5G radio access technologies and security issues in 5G.				
Course Content:					

Module 1	5G channel modelling and use cases	Assignment	Data Collection/Interpretation	10 Sessions
Topics: 5G channel modelling and use cases, Modeling requirements and scenarios, Channel model requirements, Propagation scenarios, Relaying multi-hop and cooperative communications: Principles of relaying, fundamentals of relaying, Cognitive radio: Architecture, spectrum sensing, Software Defined Radio (SDR), Multiple-input multiple-output (MIMO) systems, Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems. Diversity, exploiting multipath diversity, Transmit diversity, Space-time codes.				

Module 2	The 5G architecture	Case studies / Case let	Case studies / Case let	8 Sessions
Topics: Introduction, NFV and SDN, Basics about RAN architecture, High-level requirements for the 5G architecture, Functional architecture and 5G flexibility, Functional split criteria, Functional split alternatives, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G Requirements, Enhanced Multi-RAT coordination features, Physical architecture and 5G deployment.				

Module 3	Device-to-device (D2D) communications	Quiz	Case studies / Case let	10 Sessions

Topics: D2D: from 4G to 5G, D2D standardization: 4G LTE D2D, D2D in 5G: research challenges, Radio resource management for mobile broadband D2D, RRM techniques for mobile broadband D2D, RRM and system design for D2D, 5G D2D RRM concept: an example, Multi-hop D2D communications for proximity and emergency, services, National security and public safety requirements in 3GPP and METIS, Device discovery without and with network assistance.

Module 4	The 5G radio-access technologies	Quiz	Case studies / Case let	8 Sessions

Topics: Access design principles for multi-user communications, Orthogonal multiple-access systems, Spread spectrum multiple access systems, Capacity limits of multiple-access methods, Sparse code multiple access (SCMA), Interleave division multiple access (IDMA), Radio access for dense deployments, OFDM numerology for small-cell deployments, Small-cell sub-frame structure, Radio access for V2X communication, Medium access control for nodes on the move, Radio access for massive machine type communication.

Targeted Application & Tools that can be used:

Project work/Assignment:

Assignment: Quiz

Text Book

  T1 : Afif Osseiran, Jose F. Monserrat, Patrick Marsch, 5G Mobile and Wireless Communications Technology, Cambridge University Press Second Edition, 2015.

  T2 : Erik Dahlman, Stefan Parkvall, Johan Sko˙ld, 5G NR: The Next Generation Wireless Access Technology, Elsevier First Edition, 2016.

References

  R1   : Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, Wiley First Edition 2015

        E book link R1:   https://www.wiley.com/en-in/Fundamentals+of+5G+Mobile+Networks-p-9781118867525

  Web resources:

  https://nptel.ac.in/courses/108/105/108105134/

https://www.udemy.com/course/5g-mobile-networksmodern-wireless-communication-technology/

https://presiuniv.knimbus.com/user#/home

Topics relevant to "EMPLOYABILITY SKILLS": D2D: from 4G to 5G, D2D standardization: 4G LTE D2D for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3068	Course Title: Advance Database Management System		2 -0	2	3
	Type of Course: Integrated	L-T- P- C			
Version No.	1.0				
Course Pre-requisites	Basics about DBMS MYSQL software tool usage				
Anti-requisites	Nil				
Course Description	This course covers advanced aspects of database management including normalization and renormalizations, query optimization, distributed databases, data warehousing, and big data. There is extensive coverage and hands on work with SQL, and database instance tuning. Course covers various modern database architectures including relational, key value, object relational and document store models as well as various approaches to scale out, integrate and implement database systems through replication and cloud based instances. Students learn about unstructured "big data" architectures and databases, and gain hands-on experience with Spark and MongoDB.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Advance Database Management System and attain Employability through Experiential Learning techniques				
Course Out Comes	On successful completion of the course the students shall be able to: 1.Select the appropriate high-performance database like parallel and distributed database 2.Infer and represent the real-world data using object-oriented database 3.Interpret rule set in the database to implement data warehousing of mining				
Course Content:					
Module 1	Review of Relational Data Model and Relational Database Constraints:	Assignment	Data Collection/Interpretation		15 Sessions

Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations.

Object and Object-Relational Databases: Overview of Object Database Concepts, Object Database Extensions to SQL, The ODMG Object Model and the Object Definition Language ODL, Object Database Conceptual Design, The Object Query Language OQL, Overview of the C++ Language Binding in the ODMG Standard.

Module 2	Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures:	Assignment	Case studies / Case let	15 Sessions

Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk Operations on Files, Files of Unordered Records (Heap Files), Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures.

Distributed Database Concepts: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control and Recovery in Distributed Databases, Overview of Transaction Management in Distributed Databases,Query Processing and Optimization in Distributed Databases, Types of Distributed Database Systems , Distributed Database Architectures, Distributed Catalogue Management

Module 3	NOSQL Databases and Big Data Storage Systems	Assignment	Case studies / Case let	15 Sessions

Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. Big Data Technologies Based on MapReduce and Hadoop: What Is Big Data? Introduction to MapReduce and Hadoop, Hadoop Distributed File System (HDFS), MapReduce: Additional Details Hadoop v2 alias YARN, General Discussion

List of Laboratory Tasks:

Lab sheet -1 [2 Practical Sessions]

Experiment No 1:

Level 1 – Study and Configure Hadoop for Big Data

Lab sheet – 2 [2Practical Sessions]

Experiment No. 2:

Level 1– Study of NoSQL Databases such as Hive/Hbase/Cassendra/DynamoD

Level 2 - Design Data Model using NoSQL Databases such as Hive/Hbase/Cassendra/DynamoDB

Lab sheet – 3 [2 Practical Sessions]

Experiment No. 1:

Level 1 - Implement any one Partitioning technique in Parallel Databases

Level 2 – Implement Two Phase commit protocol in Distributed Databases

Lab sheet – 4 [2 Practical Sessions]

Experiment No. 1:

Level 1 - Design Persistent Objects using JDO and implement min 10 queries on objects using JDOQL in ObjectDB NOSQL DATABASE

Level 2 - Design database schemas and implement min 10 queries using Hive/ Hbase/ Cassendra column based databases

Lab sheet -5 [2 Practical Sessions]

Experiment No. 1:

Level 1 - Design database schemas and implement min 10 queries using DynamoDBkeyValue based databases

Level 2 – Design and Implement social web mining application using NoSQL databases, machine learning algorithm, Hadoop and Java/.Net

Targeted Application & Tools that can be used
MangoDB
Project work/Assignment:
Assignment: CASE STUDY OF TRADITIONAL RDBMS AND NOSQL DATABASE SYSTEM and submit the report
Text Book
1. Elmasri R and Navathe S B, "Fundamentals of Database System", 7th Edition, Pearson Publication, 2017.
References
1. Hector Garcia Molina, Jeffery D Ullman, JennifferWidom, "Database systems: The Complete Book", 2nd edition, Pearson Publication,2013. 2.AviSilberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2019. https://www.classcentral.com/course/youtube-sql-tutorial-for-beginners-in-hindi-dbms-tutorial-sql-full-course-in-hindi-great-learning-99143/classroom https://www.udemy.com/course/sql-for-beginners-course/ https://onlinecourses.nptel.ac.in/noc22_cs51/preview https://www.coursera.org/learn/database-management https://www.youtube.com/watch?v=HXV3zeQKqGY

PU Library Link :
https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&curPage=0&layout=grid&sorFieldId=none&topresult=false&content=*cloud*
Topics relevant to "EMPLOYABILITY SKILLS": Distributed Database for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3015	Course Title: ADVANCED NATURAL LANGUAGE PROCESSING Type of Course: Integrated	L-T- P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	CSE 3014 – Fundamentals of Natural Language Processing				
Anti-requisites					
Course Description	This course is an advanced course for Natural Language Processing. As a part of the course, students will be introduced to solving multiple problems in natural language processing, such as sentiment analysis, machine translation, cognitive natural language processing, etc. Topics include: Machine translation, Text summarization, Sentiment analysis, Cognitive NLP, Gaze behaviour, Evaluation Metrics, etc.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Advanced Natural Language Processingand attain Employability through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand how to solve different problems in natural language processing. [Comprehension] Solve natural language generation problems such as machine translation and text summarization. [Application] Perform sentiment analysis on reviews to discern the stance of the writer. [Application] Use public gaze behaviour data to improve the performance of different NLP systems. [Application]				
Course Content:					
Module 1	Pre-trained Language Models			4 Sessions	

Topics: Introduction to Pre-Trained Language Models. BERT. Multi-lingual variants of BERT. Introduction to NLTK and Huggingface Transformers.

Module 2	Machine Translation and Text Summarization			7 Sessions

Topics: Introduction to machine translation – source and target languages. Pivot-based machine translation. Using Transformers for machine translation. Monolingual machine translation examples. Machine translation evaluation metrics – BLEU. Implementation of BLEU score calculation using NLTK in Python. Other MT metrics – METEOR, TER, etc. Text summarization – definition. Types of summarizations – Extractive and Abstractive Summarization. Summarization evaluation metrics – ROUGE score.

Module 3	Sentiment Analysis			6 Sessions

Topics: Introduction to Sentiment Analysis. Solving sentiment analysis using text classification. Classification of sentiment analysis based on different levels – polarity-based and intensity-based. Challenges in sentiment analysis – sarcasm, thwarting, negations. Case studies in sentiment analysis – Reviewer rating prediction, short-text classifications, etc.

Module 4	Cognitive NLP Using Gaze Behaviour			7 Sessions

Topics: Eye-Mind Hypothesis and gaze behaviour terminology. Using gaze behaviour for prediction of translation complexity, sentiment analysis complexity, sarcasm understandability, text complexity, text quality prediction, etc. Challenges with recording gaze behaviour at run time. Comparison of gaze behaviour across different people – normalization and binning. Gaze behaviour datasets. Mitigation of recording gaze behaviour at run time using type aggregation.

List of Laboratory Tasks:

Familiarization with Python. Using Python to read text files, basic tokenization and other preprocessing.

Introduction to NLTK and Huggingface Transformers in Python.

Using Huggingface Transformers to create a simple MT application.

Implementation of pivot-based machine translation using Huggingface Transformers.

Calculation of BLEU using NLTK – difference between sentence_bleu and corpus_bleu methods.

Implementation of extractive summarization.

Polarity classification of text using VADER.

Intensity prediction of text using Weighted Normalized Polarity Intensity.

Estimating gaze behaviour for a user using normalization and binning

	Calculating gaze behaviour for a text based on type aggregation in multiple languages.
	Complex word identification using gaze behaviour.

Targeted Application & Tools that can be used:

Google Colab

Python IDE (Eg. PyCharm)

Huggingface Transformers

NLTK

Project work/Assignment:

Assignment: Students will have to do a course group assignment over the course of the semester. The assignment topics can be taken from Modules 2 or 3 as per the instructor-in-charge.

Text Books

  T1 Daniel Jurafsky, and James Martin. "Speech and Language Processing" (3rd edition draft, 2022).

  T2 Abhijit Mishra, and Pushpak Bhattacharyya. "Cognitively Inspired Natural Language Processing: An Investigation Based on Eye Tracking". Springer, Singapore. 2018.

References

   R1 Steven Bird, Ewan Klein, and Edward Loper. "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit". O'Reilly Publishers. 2009.

  R2 Chris Manning, and Heinrich Schutze. "Foundations of Statistical Natural Language Processing". MIT Press. 1999.

    E book link R1: https://www.nltk.org/book/

E book link R2: https://nlp.stanford.edu/fsnlp/

R3 Web resources: http://pu.informatics.global

Topics relevant to "EMPLOYABILITY SKILLS": Calculation of BLEU and ROUGE scores using NLTK , Estimating gaze behaviour through type aggregation, Using Hugging face Transformers for machine translation for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3038	Course Title: Applied Data Science with Python	L-T- P-C	2 -0	2	3
	Type of Course: Program Core				
Version No.	1.0				

Course Pre-requisites	Fundamentals of Python concepts
Anti-requisites	NIL
Course Description	The aim of the course is to give complete overview of Python's data analytics tools and techniques. Learning python is a crucial skill for many data science roles, and this course helps to understand and develop feature engineering. With a blended learning approach, Python for data science along with concepts like data wrangling, mathematical computing, and more can be learnt.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Applied Data Science and attain Employability through Experiential Learning techniques.
Course Out Comes	On successful completion of this course the students shall be able to: Understand Numpy and Matrix Operations [Knowledge] Analyze the need for data preprocessing and visualization techniques. [Comprehensive] Demonstrate the performance of different supervised learning algorithms like decision Tree, Random Forest, Linear Regression, Logistic Regression etc. [Application] Apply unsupervised learning algorithms like K-Means, K-Medoids etc for grouping the given data. [Applicaion]
Course Content:	

Module 1	Introduction to Data Science, Python Data Structures, Python Numpy Package	Quiz	Knowledge based quiz	No. of sessions:8

Data Science - Need, Applications, Difference between data analysis and data analytics. Python- Variables, data types, control structures, Operators, Simple operations, Array and its operations, Numpy operations, Matrix and its operations

Module 2	Data preparation and preprocessing using Pandas dataframe, Exploratory Data Analysis, Data Visualization	Assignment	Data Visualization	No. of sessions:10

Dealing missing values, Normalization, statistical description about the data, Accessing the data, Summary of the data, Relationship between the data, Data Visualization using matplotlib

Module 3	Supervised Learning Algorithms	Design an algorithm using Example	Random Forest	No. of sessions:10
Decision Tree Algorithm, ID3 Classifier, Random Forest, Classifier Accuracy, Linear Prediction, Logistic Regression – Case study				
Module 4	Unsupervised Learning Algorithms	Case Study	Conduct a case study on how data sets can be gathered and implemented in real time application.	No. of sessions:10
Various distance Function, Dissimilarity between the mixed types of data, K-Means Algorithm, K- Medoids Algorithm -Case Study				

List of Laboratory Tasks:

Introduction to R tool for data analytics science

Basic Statistics and Visualization in R

K-means Clustering

Association Rules

Linear Regression

Logistic Regression

Naive Bayesian Classifier

Decision Trees

Simulate Principal component analysis

Simulate Singular Value Decomposition

Targeted Application & Tools that can be used:

IBM SPSS

Julia and Jupyter Notebook

Matplotlib

Project work/Assignment:

Design forest fire and wildfire prediction system.

Driver Drowsiness Detection System with OpenCV & Keras

Credit Card Fraud Detection using Python.

Textbook(s):

Applied Data Science with Python and Jupyter-Alex Galea,Packt Publishing,October2018

Data Visualization in Python with Pandas and Matplotlib Paperback –DavidLandup, June 16, 2021

References:

1.Data Science with Python and Dask- Jesse Daniel,1st Edition,July30,2019

Weblinks:

Udemy: https://www.udemy.com/course/applied-data-science-with-python-specialization-mhm/

NPTEL online course : https://nptel.ac.in/courses/106106179

https://presiuniv.knimbus.com/user#/home

Topics relevant to "EMPLOYABILITY SKILLS": Data Science, Decision Tree Algorithm for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3017	Course Title: Autonomous Navigation and Vehicles Type of Course: Theory	L-T- P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Real-time embedded programming Optimal estimation and control Linear algebra				
Anti-requisites	NIL				
Course Description	Overview of technologies vehicles including sensors, sensing algorithms, machine learning, localization, mapping, object detection, tracking, communication and security. Hands-on implementation of robotic sensing and navigation algorithms on both simulated and physical mobile platforms. This course covers the mathematical foundations and state-of-the-art implementations of algorithms for vision-based navigation of autonomous vehicles (e.g., mobile robots, self-driving cars, drones). It culminates in a critical review of recent advances in the field and a team project aimed at advancing the state-of-the-art. Topics include: Autonomous driving technologies overview, Object Recognition and Tracking, Localization with GNSS, Visual Odometry, Perceptions In Autonomous driving, Deep learning in Autonomous Driving Perception, Prediction and Routing, Decision planning and control				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Autonomous Navigation and Vehicles and attain Employability through Participative Learning techniques.				

Course Out Comes	On successful completion of the course the students shall be able to: CO1. Understand the Autonomous system's and its requirements. Explain algorithm, sensing, object recognition and tracking of an Autonomous system [Understand] CO2. Do the error analysis of Localization systems and use the tools and techniques [Application] CO3. Explain, plan and control the traffic behavior, and shall be able to do lane level routing and create simple algorithms [Understand] CO4. Explain Plan and control motion, choose proper client systems for automotive vehicles and understand the cloud platform. [Understand]
Course Content:	

Module 1	12 Sessions
Introduction to autonomous driving: Autonomous driving technologies overview, autonomous driving algorithms: Sensing, Perception. Object Recognition and Tracking: Autonomous driving client system, driving cloud platform, Robot Operating System, HD Map Production, Deep learning Model Training, Localization with GNSS: GNSS overview, GNSS error analysis, satellite based augmentation systems, real time kinematic and differential GPS, precise point positioning, Visual Odometry: Stereo Visual Odometry, Monocular Visual Odometry, Visual Inertial Odometry, Dead Reckoning and Wheel Odometry.	

Module 2	8 Sessions
Perceptions In Autonomous driving: Introduction, Datasets, Detection, Segmentation, Sterio, Optical flow and Scene flow. Deep learning in Autonomous Driving Perception: Convolutional Neural Networks, Detection, Semantic segmentation, Stereo and optical flow.	

Module 3	10 Sessions
Prediction and Routing: Planning and control overview, Traffic prediction: Behaviour prediction as classification, Vehicle trajectory generation, Lane level routing: Constructing a weighted directed graph for routing, typical routing algorithms, routing graph cost.	

Module 4	08 Sessions
Decision planning and control: Behavioral decisions, Motion planning, Feedback control Reinforcement Learning Based Planning and Control, Client systems for Autonomous Driving: Operating systems and computing platform Cloud platform for Autonomous driving: Introduction, infrastructure, simulation.	

Text Book
T1: Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc, Creating Autonomous Vehicle Systems Morgan & Claypool Publishers 1st Edition, 2018

T2: Ronald K. Jurgen Autonomous Vehicles for Safer Driving SAE International Edition, 2013

References

R1. Hod Lipson, Melba Kurman Driverless: Intelligent Cars and the Road ahead MIT Press. 1st Edition, 2016

R2. Markus Maurer, J. Christian Gerdes, Barbara Lenz Autonomous Driving: Technical, Legal and Social Aspects 1st Edition, 2016

   R3. Hannah YeeFen Lim, Autonomous Vehicles and the Law: Technology, Algorithms and Ethics ,Edward Elgar Publishing. 1st Edition, 2018

Web resources: http://pu.informatics.global

Topics relevant to "EMPLOYABILITY SKILLS": Autonomous driving for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3021	Course Title: BLOCKCHAIN FOR PUBLIC SECTOR	L-T- P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	Foundations of Blockchain Technology				
Anti-requisites	NIL				
Course Description	Blockchain Technology is being increasingly employed in the public sector, specifically where trustworthiness and security are of importance. This course discusses about the blockchain technology and its potential applications, emerging technologies and their role in the implementation of blockchain technologies in the digital government and the public sector particularly in Smart City, Electronic Health Care monitoring and Digital Certificates. It also analyses effects, impacts, and outcomes from the implementation of blockchain technologies in the public sector in the selected case studies.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Blockchain For Public Sector and attain Employability through Participative Learning techniques..				

Course Out Comes	On successful completion of the course the students shall be able to: 1] Understand the Standards and Protocols of Blockchain and data management in the public sector [COMPREHENSION] 2] Apply Artificial intelligence and machine learning approaches for implementation of Smart cities using blockchain architecture [APPLICATION] 3] Discuss about Electronic Healthcare Records Monitoring using Blockchain Technology [COMPREHENSION] 4] Describe the Blockchain Technology use cases in Indian and Foreign Countries [KNOWLEDGE]			
Course Content:				
Module 1	Blockchain in Government and the Public Sector	Quiz	Data Collection	9 Sessions
Blockchain in Government and the Public Sector use cases – Benefits – Standards and Protocols of Blockchain - data management in the public sector - Building networked public services - Understanding and addressing risks and challenges. Blockchain Applications to Public Sector Governance. Case Study – Keyless Signature Infrastructure (KSI)				
Module 2	Blockchain in Smart City Applications	Assignment	Data Collection	9 Sessions
The Application of Blockchain Technology to Smart City Infrastructure - Artificial intelligence and machine learning approaches for smart transportation in smart cities using blockchain architecture - Blockchain architecture for intelligent water management system in smart cities - Blockchain-based energy-efficient smart green city in IoT environments - Citizen e-governance using blockchain - Cloud/edge computing for smart cities.				
Module 3	Blockchain in Healthcare	Case Study	Data Collection	9 Sessions
Blockchain in Healthcare Applications – Use cases - Blockchain and Data Security – Blockchain Medical Records - Healthcare Blockchain Use Case: Supply Chain Transparency – Electronic Health Records, A novel Blockchain-based Access Control Manager to Electronic Health Records. Case Study – Avaneer Health, MEDICALCHAIN, BurstIQ, Guardtime				

Module 4	Implementation of Blockchain in Indian System and Foreign Countries	Case Study	Data Collection	9 Sessions

Implementation of Blockchain in India - land registration - Blockchain Fit Assessment: Digital certificates, SuperCert: Anti certificates fraud identity intelligence blockchain solution for educational certificates.

Case study- Implementation of Blockchain in Foreign Countries - Vehicle Wallet – BenBen – Project Ubin

Targeted Application & Tools that can be used:

Remix IDE - Solidity Programming

Project Work / Assignment / Case Study

Assignment 1: Blockchain architecture for intelligent water management system in smart cities.

Case Study: Blockchain-based health care monitoring for privacy preservation of COVID-19 medical records.

Case Study: Implementation of Blockchain in Government of Estonia - Digital Certification by DNV GL.

Text Books

Saravanan Krishnan, Valentina Emilia Balas, Raghvendra Kumar, "Blockchain for Smart Cities", Elsevier, 2021.

https://doi.org/10.1016/C2020-0-01958-4

Christopher G. Reddick, Manuel Pedro Rodríguez-Bolívar, Hans Jochen Scholl, "Blockchain and the Public Sector Theories, Reforms, and Case Studies", Stanford University Press, 2021.

Blockchain and the Public Sector: Theories, Reforms, and Case Studies (Public Administration and Information Technology Book 36) eBook : Reddick, Christopher G., Rodríguez-Bolívar, Manuel Pedro, Scholl, Hans Jochen: Amazon.in: Kindle Store

References

Sheikh Mohammad Idrees, Parul Agarwal, M. Afshar Alam, "Blockchain for Healthcare Systems: Challenges, Privacy, and Securing of Data", CRC Press, 2021 .

https://books.google.co.in/books/about/Blockchain_for_Healthcare_Systems.html?id=hiU7EAA AQBAJ&redir_esc=y

Web Resources:

https://link.springer.com/book/10.1007/978-3-030-55746-1

https://consensys.net/blockchain-use-cases/government-and-the-public-sector/

https://www.oecd.org/gov/innovative-government/oecd-guide-to-blockchain-technology-and-its-use-in-the-public-sector.htm

https://www2.deloitte.com/in/en/pages/public-sector/articles/blockchain-in-public-sector.html

https://www.ibm.com/in-en/blockchain/industries/government

https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/using-blockchain-to-improve-data-management-in-the-public-sector

https://www.frontiersin.org/articles/10.3389/fbloc.2022.869665/full

https://www.settlemint.com/government-blockchain-use-cases/

https://stlpartners.com/articles/digital-health/5-blockchain-healthcare-use-cases/

https://www.oecd.org/finance/Opportunities-and-Challenges-of-Blockchain-Technologies-in-Health-Care.pdf

https://builtin.com/blockchain/blockchain-healthcare-applications-companies

https://www.hhs.gov/sites/default/files/blockchain-for-healthcare-tlpwhite.pdf

https://healthitanalytics.com/features/3-use-cases-for-blockchain-in-healthcare

https://www2.deloitte.com/us/en/pages/public-sector/articles/blockchain-opportunities-for-health-care.html

https://www.niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_ Strategy_Part_I.pdf

https://www.bigchaindb.com/usecases/government/benben/

Topics relevant to "EMPLOYABILITY SKILLS": Keyless Signature Infrastructure for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3044	Course Title: BUILD AND RELEASE MANAGEMENT Type of Course: Theory Only Course	L-T- P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	CSE 2014 – Software Engineering				
Anti-requisites	-				

Course Description	Build and Release management course guides the software development efforts from planning to deployment, resulting in better customer satisfaction with the end product. The benefits of Build and release is essential to high-performing software development and delivery. Build and release enhanced by safely testing features in production environments, gathering valuable feedback and releasing new and improved features continuously. In this course, Students will learn about the benefits of using a release management process to manage and improve the development of a software build. This course covers the key concepts and principles that apply to release management, as well as common considerations and potential challenges to be aware of.
Course Objective	The objective of the course is to familiarize the learners with the concepts Of Build And Release Management and attain Employability through Participative Learning techniques.
Course Out Comes	On successful completion of the course the students shall be able to: Learn about the common Infrastructure build servers, scalability and availability Understand the Continuous Integration and Deployment (CI/CD) Implement Automated, build, Installations and deployments and release
Course Content:	

Module 1	UNDERSTANDING COMMON AGILE PRACTICES IN DEVOPS	Assignment	Data Collection/Interpretation	12 Sessions

Topics:

Introduction to Product Management, Product Design and Requirement gathering, Product Design Challenges, UX Design, Product Development Methodologies, Product Marketing and Presentation, Traditional Software Development Methodologies, Problem/issues with traditional approach, Agile Development, Agile Manifesto, Scrum Model, Agile Estimations and Planning, Soft skills in agile

Kanban - What is Kanban, Understanding the Principle of Kanban, Value System of Kanban, WIP Limits, Classes of Service in Kanban, Sample Kanban Boards (Proto Kanban) , How to read a Kanban Board, Meetings in Kanban System, Extreme Programming.

Module 2	CODE DESIGN	Case studies / Case let	Case studies / Case let	12 Sessions

Topics:

Good design is good design regardless of paradigm, Fundamental characteristics of good design: modular, loosely coupled, etc., Using design to simplify code structure, how programming languages are designed to support good code design, best practices of design in OO program development, First Fundamental OO principle: Interface and implementation

design, Second Fundamental OO Principle: Recursive design, Design Patterns: reusing best practices., SOLID Design Principles

Module 3	TESTING AND DEBUGGING	Quiz	Case studies / Case let	14 Sessions

Topics:

TESTING AND DEBUGGING

 Planning for errors and exceptions, Basic test-driven development: writing tests first, How TDD improves the quality of the resulting code, automating testing: using Junit, etc, Avoiding creeping errors.

REFACTORING: IMPROVING STRUCTURE

Code smells: symptoms of poorly designed code, Refactoring: changing code structure without changing functionality, Using TDD for controlled code changes, the refactoring process, using refactoring to make better code faster, Collective Code Ownership

Targeted Application & Tools that can be used:

Common frameworks and code architectures: Spring, Hibernate, Microservices, Spring Boot.

IDEs: Eclipse, Visual Studio, IntelliJ

Project work/Assignment:

Assignment:

Each student have to submit assignment as 4 to 5 pages report on Agile Frameworks and tools

Text Book

T1.Eric Breachner, "Agile Project Management with Kanban", 1st Edition, 2019, MSPress Publishers.

T2. Peter Measey and Radtac, "Agile Foundations: Principles, Practices and Frameworks", Whitshire publishers, 2015.

References

R1. Dave Howard, "IT Release Management: Hands on Guide", CRC Press , 2016.

R2. Lyssa Adkins, "Coaching Agile teams", Addison-wesley publications, 2012.

E book link R1:   https://download.manageengine.com/academy/it-release-management-e-book.pdf

E book link R2: https://www.smartsheet.com/release-management-process

R3   Web resources:

https://presiuniv.knimbus.com/user#/home

https://www.youtube.com/watch?v=dvFQrsY_tKg

https://www.youtube.com/watch?v=vlsLxaY4P7M

Topics relevant to "EMPLOYABILITY SKILLS": Build and release management Process, Frameworks and tools for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2025	Course Title: Business Continuity and Risk Analysis Type of Course: Theory	L-T- P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Through the study of incident response and contingency planning, including incident response plans, disaster recovery plans, and business continuity plans, this course aims to help students comprehend the principles of risk management.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Business Continuity and Risk Analysis and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: • Describe concepts of risk management [Knowledge] • Define and be able to discuss incident response options [Comprehension] • Design an incident response plan for sustained organizational operations [Comprehension] • Discuss and recommend contingency strategies, including data backup and recovery and alternate site selection for business resumption planning. [Knowledge]				
Course Content:					
Module 1 Sources of disaster and types of disasters		10 Sessions			
Disaster Recovery Operational cycle of disaster recovery, disaster recovery cost, incidents that requires disaster recovery plans, evaluating disaster recovery - methods, team, phases, objectives, checklist. Best practices for disaster recovery - Business continuity - Business continuity vs. disaster recovery					

Module 2 Business continuity management:	10	Sessions

Introduction - Elements of business continuity management. Business continuity plan – Business continuity planning and strategies - BCP standards and guidelines - BCP Project Organization - Crisis communication plan - Emergency response plan - Contingency planning

Module 3 Managing, assessing and evaluating risks:	09	Sessions

Importance of risk management - Risk management methodology - Attack methods and Countermeasures - Cost benefits analysis of risk management - Risk assessment responsibilities - Responsibilities of security professional - Information system auditing and monitoring – Verification tools and techniques.

Module 4 Risk control policies and Counter measures	09	Sessions

Introduction - Counter measures - Risk control policy development factors-Development of information assurance principles and practices - Laws and procedures in information assurance policy implementation, Security test and evaluation, Automated security tools, Cost benefit analysis, Developing a risk assessment methodology, Security requirements, Information categorization, Risk management methodologies to develop life cycle management policies and procedures, Education, training and awareness. Policy development Information security policy, change control policies, system acquisition policies and procedures, Risk analysis policies and General risk control policies.

Text Book

John W. Rittinghouse and James F. Ransome, Business Continuity and Disaster Recovery for Info Sec Managers. Elsevier: Elsevier Digital Press, 2005. (ISBN: 978-0-52-119019-0)

EC Council Press. Disaster Recovery, 1st Ed. Course Technology, 2011. (ISBN: 978-1-55558-339-2)

References

ISO 27001:2013 A specification for an information security management system

David Alexander, Amanda Finch, David Sutton, Andy Taylor. Information Security Management Principles, 2nd Ed. BCS Shop, 2013. (ISBN: 9781780171753)

Mark Talabis, Jason Martin. Information Security Risk Assessment Toolkit Practical Assessments through Data Collection and Data Analysis. Syngress Imprint, 2013. (ISBN: 978-1-59-749735-0).

Web resources: http://pu.informatics.global

Topics relevant to "EMPLOYABILITY SKILLS": Business continuity vs. disaster recovery , risk management, Storage disaster recovery services tools, Verification tools and techniques for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3088	Course Title: Business Intelligence and Analytics Type of Course: Theory		L-T- P- C	3 -0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	Business Intelligence (BI) refers to technologies, applications, and practices for the collection, integration, analysis, and presentation of business information. The purpose of business intelligence is to support better business decision making. This course provides an overview of the technology of BI and the application of BI to an organization's strategies and goals.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Business Intelligence and Analytics and attain Employability through Problem Solving Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: Introduce the concepts and components of Business Intelligence (BI) [Knowledge] Evaluate the technologies that make up BI (data warehousing, OLAP) [COMPREHENSION] Define how BI will help an organization and whether it will helpful [COMPREHENSION] Identify the technological architecture that makes up BI systems [COMPREHENSION]					
Course Content:						
Module 1	Basics of Insights	Assignment	Programming Task		10 Sessions	

Topics:

The importance of data in the information age – the data value chain – tools for generating insights – job roles available in the data insights market

Module 2	Basics Statistics: Foundation of Quantitative Insights	Assignment		12 Sessions

Topics:				
Basic statistics – Variables - Measures of central tendency - Measures of dispersion - Normal distribution and histograms - The empirical rule - Covariance and correlation				
Module 3	Data Visualization	Assignment		10 Sessions
Topics:				
Data visualisation and Anscombe's Quartet - Data cleaning using SAS Data Studio - Bar and Pie Charts				
Module 4	Advanced charts and dashboards			13 Sessions
Topics:				
Multi variation correlation matrix and bar and line chart - SAS Visual Analytics filtering and controls - KPIs and targeted bar charts - Dashboard theory – Demand forecasting - Linear regression analysis – Forecasting - Forecasting and smoothing methods				

Targeted Application & Tools that can be used:

Professionally used software

Project work/Assignment:

Text Book

Business Intelligence Guidebook: From Data Integration to Analytics 1st Edition, Kindle Edition.

Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications (Addison-Wesley Information Technology Series) 1st Edition, Kindle Edition

References

Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big Data 2nd Edition, Kindle Edition

Weblinks:

W1: https://www.coursera.org/learn/business-intelligence-data-analytics#

W2: https://onlinecourses.nptel.ac.in/noc20_mg11/preview

Topics relevant to "EMPLOYABILITY SKILLS": information age , data value chain for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3127	Course Title: Cloud Application Development		3-0	0	3
	Type of Course: Theory Only	L-T-P- C			
Version No.	1.0				
Course Pre-requisites	Cloud Computing Basics				
Anti-requisites	NIL				
Course Description	The Cloud Application Development Foundations Specialization program will teach students the tools and technologies that successful software developers use to build, deploy, test, run, and manage Cloud Native applications – putting them in an advantageous position to begin a new career in a highly in-demand area. The course will provide the students' knowledge on cloud computing and related concepts, cloud services, applications developments of Amazon web services, Cloud architecture and programming model, map reducing in cloud, virtualization, applying virtualization, Cloud Resource Management and Scheduling, Cloud Security issues.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cloud Application Development and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: Understand the Define cloud computing and related concepts and Memorize the Cloud architecture and programming model. [Comprehension] Identify compute intensive model and date intensive model and Understand the Cloud Resource Management and Scheduling. [Comprehension] Understand the Cloud Security issues and Identify the how standards deal with cloud services and virtualization. [Application] Understand the cloud resource virtualization and Identify the application virtualization, applying virtualization. [Application] Understand compliance for the cloud provider vs compliance for the customer. [Comprehension]				
Course Content:					
Module 1	INTRODUCTION AND CLOUD APPLICATION DEVELOPMENT	Assignment	Knowledge, Quizzes	No. of Classes:8	

Topics: Introduction: Definition, Characteristics, Benefits, challenges of cloud computing, cloud models: service IaaS(infrastructure as service),PaaS(platform as a service),SaaS(software as a service), deployment models-public, private, hybrid, community; Types of cloud computing: Grid computing utility computing, cluster; computing Cloud services: Amazon, Google, Azure, online services, open source private clouds, SLA; Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development. Assignment: Types of cloud and their comparisons.				
Module 2	CLOUD ARCHITECTURE, PROGRAMMING MODEL	Assignment	Knowledge, Quizzes	No. of Classes:7
Topics: Cloud Architecture, programming model: NIST reference architecture, architectural styles of cloud applications, single, multi, hybrid cloud site, redundant, non-redundant, 3 tier, multi-tier architectures; Programming model: Compute and data intensive. Assignment: Cloud Architecture, architectural styles of cloud applications.				
Module 3	CLOUD RESOURCE VIRTUALIZATION	Case Study	Application, Quizzes	No. of Classes:8
Topics: Cloud resource virtualization: Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, Full vs Para - virtualization, virtual machine monitor/hypervisor. Virtual machine basics, taxonomy of virtual machines, process vs system virtual machines. Case Study: Cloud resource virtualization: Basics of virtualization, types of virtualization techniques.				
Module 4	CLOUD RESOURCE MANAGEMENT AND SCHEDULING	Case study	Application, Quizzes	No. of Classes:9
Topics: Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, resource bundling, combinatorial, fair queuing, start time fair				

queuing, borrowed virtual time, cloud scheduling subject to deadlines, scheduling map reduce applications subject to deadlines, resource management and application scaling.

Case Study: Cloud Resource Management and Scheduling.

Module 5	CLOUD RESOURCE MANAGEMENT AND SCHEDULING	Case study	Application, Quizzes	No. of Classes:8

Topics:

Cloud Security: Risks, privacy and privacy impacts assessments; Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities; Virtualization system-specific attacks: Technologies for virtualization-based security enhancement, legal.

Case Study: Cloud Security: Risks, privacy and privacy impacts assessments.

Targeted Application & Tools that can be used:

Public cloud platforms like AWS, GCP and Azure.

Project work/Assignment:

Create an Amazon EC2 Instance (Linux) or use equivalent other cloud platform such as Google Cloud or Azure to create a virtual machine service.

Create an Amazon S3 Bucket or use equivalent other cloud platform such as Google Cloud or Azure to create a storage service.

Create a static website in AWS using S3 and cloud front.

Textbook(s):

Dan Marinescu, "Cloud Computing: Theory and Practice‖", M K Publishers, 1st Edition, 2013,

Kai Hwang, Jack Dongarra, Geoffrey Fox," Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖", M K Publishers, 1st Edition, 2011.

References

Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw Hill, 1st Edition, 2009.

Arshdeep Bahga, "Cloud Computing: A Hands on Approach", Vijay Madisetti Universities Publications, 1 st Edition, 2013.

Web Resources and Research Articles:

https://www.oracle.com/in/cloud/application-development

http://computingcareers.acm.org/?page_id=12

http://en.wikibooks.org/wiki/cloud application

http://www.acadmix.com/eBooks_Download

http://www.ibm.com

pu.informatics.global, https://sm-nitk.vlabs.ac.in/

Topics relevant to "EMPLOYABILITY SKILLS": EC2 for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3095	Course Title: Cloud Security		L-T- P-C	3 -0	0	3
	Type of Course: Theory					
Version No.	1.0					
Course Pre-requisites	Cloud Computing and Services (CSE322)					
Anti-requisites	NIL					
Course Description	This course provides ground-up coverage on the high-level concepts of cloud landscape, architectural principles, and techniques. It describes the Cloud security architecture and explores the guiding security for Infrastructure and Softwares.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cloud Security and attain Employability through Participative Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: Describe fundamentals of cloud computing [Knowledge]. Explain cloud computing security architecture and associated challenges [Comprehension]. Discuss cloud computing software security essentials [Comprehension]. Apply infrastructure security and data security in cloud computing enviroment. [Application].					
Course Content:						

Module 1:	Fundamentals of Cloud Computing	Quiz	Knowledge based Quiz	10 Sessions
Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.				
Module 2:	Cloud Security Challenges and Cloud Security Architecture	Quiz	Comprehension based Quiz	10 Sessions
Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security.				
Module 3	Cloud Computing Software Security Essentials	Assignment	Batch-wise Assignments	9 Sessions

Topics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software Requirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.				
Module 4:	Infrastructure Security and Data Security	Assignment and Presentation	Batch-wise Assignment and Presentations	9 Sessions

Topics: Infrastructure Security: The Network Level, The Host Level, The Application Level.

Data Security : Aspects of Data Security, Data Security Mitigation, Provider Data and its Security.

Targeted Application & Tools that can be used: Use of CloudSim simulator.

Project work/Assignment:

Survey on Cloud Service Providers

Text Book

Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, July 2017.

Roland L Krutz and Russell Dean Vines, "Cloud Security - A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, Inc. 2010.

References

Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, "Secure Cloud Computing", Springer, ISBN 978-1-4614-9278-8 (eBook).

John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press, 2010.

Tim Mather, Subra Kumaraswamy and Shahed Latif", "Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance", Oreily Publication, 2009.

WEB RESOURCES:

 https://presiuniv.knimbus.com/user#/home

Topics relevant to "EMPLOYABILITY SKILLS": Cloud computing architecture, Security policy implementation, Infrastructure security and Data security for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3103	Course Title: Cognitive Science & Analytics Type of Course:		L-T- P- C	3 -0	0		3
Version No.	1.1						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	This course is an introduction to computational theories of human cognition. Drawing on formal models from classic and contemporary artificial intelligence, it will explore fundamental issues in human knowledge representation, inductive learning and reasoning. What are the forms that our knowledge of the world takes? What are the inductive principles that allow us to acquire new knowledge from the interaction of prior knowledge with observed data? What kinds of data must be available to human learners, and what kinds of innate knowledge (if any) must they have?						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cognitive Science & Analytics and attain Employability through Participative Learning techniques.						
Course Out Comes	On successful completion of the course the students shall be able to: Introduce the concepts and components of Cognitive Science Evaluate the technologies that make up Cognitive Science . Define how CS will help an organization and whether it will helpful Identify the technological architecture that makes up this systems						
Course Content:							
Module 1	Introduction	Assignment	Programming Task			12 Sessions	

Topics:

Cognition Process, Cognitive Psychology, Cognitive Science; Foundations of Cognitive Science, Cognitive Science and Multi-disciplinary; Machines and Minds; Laws thoughts to binary logic; Classical Cognitive Science; Connectionist Cognitive Science; Mind body Problem; Turing Response to Mind Body Problem; Pinker, Penerose and Searle"s Responses to Mind Body Problem; Representational Theory of Mind; Theories of Mental Representation: Minimal Analysis of mental representation, Resemblance theories of mental representation, Casual covariation theories of mental representation, internal roles theories of mental representation

Module 2	Precursors of Cognitive Science	Assignment		10 Sessions

Topics:

Behaviorism; Theory of Computation and Algorithms; Algorithms and Turing Machines; Marr"s Three Level of Computation; Linguistics and Formal Language; Information Processing Models in Psychology

Module 3	Psycological Perspective of Cognition	Assignment		10 Sessions

Topics:

Cognitive Models of Memory, Atkinson-Shiffrin"s Model, Tulving"s Model, Mental Imagery, Kosslyn"s View, Moyer"s View, Peterson"s View, Cognitive Maps, Problem Understanding, States of Cognition, Cognition in AI

Module 4	Cognitive System and analytics			13 Sessions

Topics:

Cognitive System; Architecture for intelligent agents; Modularity of Mind; Modularity Hypothesis; The ACT-R/PM architecture

Data Analytics overview, Importance of DA, Types of DA, Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Benefits of DA, Data Visualization for Decision Making, Data types, Measure of central tendency, Measures of Dispersion

Targeted Application & Tools that can be used:

Professionally used software

Project work/Assignment:

Text Book

1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, Cambridge University Press

2. Michael R. W. Dawson , Mind, Body, World: Foundations of Cognitive Science, UBC Press

References

1. Daniel Kolak, William Hirstein, Peter Mandik, Jonathan Waskan, Cognitive Science, An Introduction to Mind and Brain, Routledge Taylor and Francis Group

2. Amit Konar – Artificial Intelligence and Soft computing: Behavioral and Cognitive Modeling of the Human Brain, CRC Press

Weblinks:

W1: Top Cognitive Science Courses - Learn Cognitive Science Online | Coursera

Topics relevant to "EMPLOYABILITY SKILLS": Cognitive System for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3022	Course Title: Cryptocurrency Technology Type of Course: Theory Only Course	L-T- P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Basics of cryptography and Blockchain				
Anti-requisites					
Course Description	The course is designed to provide an introductory understanding of decentralized digital currencies (cryptocurrencies) such as bitcoin, a basic understanding of its underlying technology 'Blockchain' and why this new and innovative technology is so important, since it has the potential to disrupt a number of industries in the immediate near future. In particular, the course will survey the theory and principles by which cryptocurrencies operate, practical examples of basic cryptocurrency transactions, the likely interaction of cryptocurrencies with the banking, financial, legal and regulatory systems, and how cryptocurrencies could be viewed within a framework of innovation and development.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cryptocurrency Technology and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the technology components of blockchain-based digital currencies. [Comprehensive] Explain the transactions from a digital currency wallet. [Comprehensive] Understand alternatives to bitcoin, such as alt-coins, Ethereum and Bitcoin Cash. [Comprehensive] Use cryptocurrencies in the context of disruptive innovations [Application]				

Course Content:				
Module 1	Introduction to Cryptography	Assignment	Data Interpretation	8 Sessions

Topics: Cryptography, Digital Signatures, Cryptographic Hash Functions.

Cryptographic Data Structures: Hash Pointers, Append-Only Ledgers (BlockChains), Merkle Trees.

Module 2	Bitcoin's Protocol	Assignment	Data Interpretation	10 Sessions

Topics: Bitcoin's Protocol Keys as Identities, Simple Cryptocurrencies, Decentralization through Distributed Consensus, Incentives, Proof of Work (Mining), Application-Specific Integrated Circuit (ASIC) Mining and ASIC-resistant Mining, Virtual Mining (Peer coin).

Module 3	Bitcoin Engineering	Quiz	Questions Set	10 Sessions

Topics: Engineering Details, Bitcoin Blocks, Hot and Cold Storage, Splitting and Sharing Keys, Proof of Reserve Proof of Liabilities.

Anonymity, Pseudonymity, Unlinkability: Statistical Attacks (Transaction Graph Analysis), Network-layer De-anonymization, Chaum's Blind Signatures, Single Mix and Mix Chains, Decentralized Mixing, Zero-Knowledge Proof Cryptocurrencies.

Module 4	Cryptocurrency Technologies	Quiz	Questions Set	10 Sessions

Topics: Cryptocurrency Technologies, Smart Property, Efficient micro-payments, Coupling Transactions and Payment (Interdependent Transactions,) Public Randomness Source, Prediction Markets, Escrow transactions, Green addresses, Auctions and Markets, Multi-party Lotteries.

Targeted Application & Tools that can be used:

A cryptocurrency is a digital or virtual currency, it is secured by cryptography which makes it impossible to simulate or double-spend. Many cryptocurrencies are decentralized networks based on blockchain technology. Cryptocurrency caters to the promise of making the easier transaction of funds directly between two groups or parties without the need for any third party like bank or credit card company. Applications are Money transfer, Smart contracts, Internet of Things (IoT), Personal identity security, Healthcare, Logistics.

Tools: Messari, Glass node, Lunar Crush, Coin Metrics, Coin Market Cal.

Project work/Assignment:

Assignment:

Beyond a method for payment, what are other functions of cryptocurrencies?

How are cryptocurrency transactions recorded?

What are the top cryptocurrencies?

What is the market capitalization of all cryptocurrencies and which ones make up largest % of that capitalization?

Explain briefly efficient micro-payments

Text Books:
T1. Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. T2. Schar, Fabian, and Aleksander Berentsen. Bitcoin, Blockchain, and Cryptoassets: A Comprehensive Introduction. MIT press, 2020. T3. Karame, Ghassan O., and Elli Androulaki. Bitcoin and blockchain security. Artech House, 2016.

References:
R1. Antonopoulos, Andreas M., and Gavin Wood. Mastering ethereum: building smart contracts and dapps. O'reilly Media, 2018. R2. Antonopoulos, Andreas M. Mastering Bitcoin: unlocking digital cryptocurrencies. " O'Reilly Media, Inc.", 2014. R3. Day, Mark Stuart. Bits to bitcoin: how our digital stuff works. MIT Press, 2018.   E book link R1: http://fincen.gov/statutes_regs/guidance/html/FIN-2013-G001.html   E book link R2: http://www.scribd.com/doc/212058352/Bit-Coin R   Web resources: H   W1. http://www.usv.com/posts/bitcoin-as-protocol W2. http://startupboy.com/2013/11/07/bitcoin-the-internet-of-money/ W3. http://startupboy.com/2014/03/09/the-bitcoin-model-for-crowdfunding/ W3. http://www.hmrc.gov.uk/briefs/vat/brief0914.html

Topics relevant to "EMPLOYABILITY SKILLS": Cryptography, Digital Signatures, Hash Pointers,   BlockChains, ASIC-resistant Mining,   Hot and Cold Storage, Transaction Graph Analysis, Zero-Knowledge Proof Cryptocurrencies, Escrow transactions, Multi-party Lotteries. for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3096	Course Title: Cyber Digital Twin Type of Course: Theory Only Course	L-T- P-C	3-0	0	3
Version No.	1.0				

Course Pre-requisites	CSE2013
Anti-requisites	NIL
Course Description	This course is designed to improve the learners 'Skill Development' by using modeling, optimizing, and risk management approach. The course objective is to get familiar with the Cyber digital twin-working principal, Development considerations, Data-Modelling Environment, Digital Twin Optimization, Risk Management and Applications.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cyber Digital Twin and attain Employability through Participative Learning techniques.
Course Out Comes	On successful completion of the course the students shall be able to: Understand the basic concepts of Cyber Digital twin, and its working principle. [KNOWLEDGE] Explain Data modeling and development consideration in digital twin model for cloud and IoT technology.[COMPREHENSION] Observe digital twin-human behavior modeling in digital twin-optimization [COMPREHENSION] Show Risk Assessment-Digital twin reference model-Implementation. [APPLICATION] Apply Digital twin in various area like Manufacturing, Automotive and Healthcare.[APPLICATION]
Course Content:	

Module 1	Introduction	Assignment	Theory	No. of Classes:09
Introduction- Cyber Digital twin-definition-uses and benefits-need for digital twin-working principal Technology Digital thread-digital shadow-building blocks of digital twin-digital twin technology drivers and enablers.				

Module 2	Data Modelling Environment	Assignment	Theory	No. of Classes:10
Types of digital twin-Based on Product and Process-Based on Functionality-Based on Maturity. Development considerations-Overview of Data-Modelling Environment. Modelling-model and data management-Managing data-implementing the model- Cloud and IOT technologies.				

Module 3	Digital Twin Optimization	Assignment	Theory	No. of Classes:10
Cyber range vs digital twin-human behavior modeling in digital twin-optimization using digital twin-digital twin and cyber security-Techniques. Technologies-Industrial IOT and Digital Twin-simulation and digital twin-Machine learning and digital twin-virtual reality and digital twin-cloud technology and digital twin.				

Module 4	Risk Management and Applications	Assignment	Case Study	No. of Classes:10

Digital twin and Risk Assessment-Digital twin reference model-Implementation-Development of risk assessment plan-Development of communication and control system-Development of digital twin tools-Integration-platform validation-Difficulties-Practical implications. Applications: Digital Twin in Manufacturing-Digital Twin in Automotive-Digital Twin in Healthcare-Digital Twin in Utilities-Digital Twin in Construction

Targeted Application & Tools that can be used:

Ansys Twin Builder is a powerful solution for building, validation and deploying simulation-based systems and digital twins: Build, validate, and deploy digital twins. Digital twin models integrate real-world data. Increase efficiency with digital twins.

Project work/Assignment:

Project Assignment:

Text Book

Clint Bodungen, Bryan Singer, Aaron Shbeeb, Kyle Wilhoit, and Stephen Hilt," Hacking Exposed Industrial Control Systems: ICS and SCADA Security Secrets & Solutions",1st Edition, ISBN: 978-1259589713.

Eric D. Knapp and Raj Samani," Applied Cyber Security and the Smart Grid: Implementing Security Controls into the Modern Power Infrastructure ",1st Edition. Kevin Mitnick," The Art of Invisibility",2017.

References

Michael E. AuerKalyan Ram B. Digital," Cyber-physical System and Digital Twins - Part of the Lecture Notes in Networks and Systems book series".

Nassim Khaed, Bibin Pattel and Affan Siddiqui," Development and Deployment on the Cloud", Elsevier, 2020.

Weblinks:

https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-live%26ebv%3dEB%26ppid%3dpp_xiii

https://www.udemy.com/course/digital-twin-a-comprehensive-overview/

Topics relevant to "EMPLOYABILITY SKILLS":Digital thread-digital shadow-building blocks of digital twin, Digital Twin in Manufacturing-Digital Twin in Automotive, Cyber range vs digital twin-human behavior modeling in digital twin-optimization for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3094	Course Title: Cyber Security Type of Course:1] Discipline Elective 2] Theory Only	L- T-P- C	3-0	0	3
Version No.	1.1				
Course Pre-requisites	Fundamental knowledge in Information Security and Networks				
Anti-requisites	NIL				
Course Description	This is a foundation program geared towards generating and enhancing awareness about cyber security challenges and the concept of Cyber Security and Cyber Ethics among the stakeholders to help them become responsible Cyber Citizens and participate safely and securely in the rapidly evolving information-age society. The important topics include: Network Security model, attacks, malware, firewall, IT act and Cyber forensics				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Cyber Security and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe the basic concept of Cyber Security [Knowledge] 2)Classify different types of attacks for a scenario [Comprehension] 3) Prepare a mitigation policy for security threat [Comprehension] 4) Demonstrate Cyber Security tools [Application]				
Course Content:					
Module 1	Introduction to Cyber Security	Quiz	Knowledge	10 Sessions	
Topics					
History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Guidelines to choose web browsers, Securing web browser, Antivirus, Email security,					

Guidelines for setting up a Secure password , Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques .

Module 2	Security in Networks	Assignment	Comprehension	10 Sessions

Topics:

Security in Networks – Concepts, threats in Network, website vulnerabilities, man in the middle attack, denial of Service attack, distributed denial of service attack, Firewalls – introduction and design, types of firewalls, personal firewalls, Program Security – non malicious program errors, malicious program flaws, virus and other malicious code, prevention of virus infection.

Assignment: Program Security – non malicious program errors.

Module 3	Smartphone Security	Assignment	Comprehension	12 Sessions

Topics:

Introduction to mobile phones, Smartphone Security, Android Security, IOS Security, Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance, Guidelines for social media security, Tips and best practices for safer Social Networking ,Basic Security for Windows, User Account Password
Assignment: Social Media Security

Module 4	Ethical Issues in Cyber Security	Assignment	Programming/Data analysis task	9 Sessions

Legal and ethical issues in Cyber Security – protecting program and data, copyright, patents and trade secrets, IT Act, EDP audit, Overview of CISA, Privacy in computing, Cyber Forensic Tools – types and categories, Cyber forensic suite. Forensic tools: types, categories, open source proprietary

 Assignment: Cyber Forensic Tools

Textbooks

T1. Charles P. Pfleeger and Shari Lawrence Pfleeger, "Security in Computing", Pearson Education, 5th Edition,2012

T2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons, 2018 .

T3. Dejey and Murugan, "Cyber Forensics", Oxford University Press, 2018.

References
R1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th Ed, Pearson Education, 2015. R2. Behrouz A Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, Mc Graw Hill Publication, ISBN 13: 978-93-392-2094-5.2008. Web links: W1. https://www.youtube.com/watch?v=RYB4cG8G2xo W2. https://www.coursera.org/lecture/detecting-cyber-attacks/Cyber Security-UeDqJ ,https://presiuniv.knimbus.com/user#/home
Topics relevant to "EMPLOYABILITY SKILLS": Mobile Security for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2023	Course Title: Data Warehousing and its Applications Type of Course: Theory	L-T- P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	Basics of data mining & Python				
Course Description	The Objective of this course is to create a trove of historical data that can be retrieved and analyzed to provide useful insight into the organization's operations. A data warehouse is a vital component of business intelligence. This course will introduce basic concepts of data warehousing, architecture, design principles, building data warehouse, data mining techniques and major application areas of data warehouse.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Warehousing and its Applications and attain Employability through Participative Learning techniques.				
Course Outcomes	On completion of this course, the students will be able to Describe data warehousing architecture and considerations to build data warehouse. [Knowledge]				

	Discuss different multidimensional data models for data warehouse. [Comprehension]
	Apply various techniques to build data warehouse [Application]
	Apply different data mining techniques to mine insights [Application]

Course Content:				

Module 1	Introduction To Data Warehousing	Assignment/Quiz	Benefits of data warehousing	8 Session

Topics:

The need for data warehousing, paradigm shift, data warehouse definition and characteristics, Data warehouse architecture, sourcing, acquisition, cleanup and transformation, metadata, access tools, data marts, data warehouse administration and management, building a data warehouse: business consideration, technical consideration, design consideration, implementation consideration, integrated solutions, benefits of data warehousing.   Data Warehouse Architecture: Two and Three tier Data Warehouse architecture.

Assignment: Benefits of data warehousing

Module 2	Data Warehouse modelling	Assignment/Quiz	Data cube	12 Session

Topics:

Data cube: A multidimensional data model, stars, snowflakes, and fact constellations: schemas for multidimensional data models, dimensions: the role of concept hierarchies, measures: their categorization and computation, typical OLAP operations, efficient data cube computation, the compute cube operator and the curse of dimensionality, partial materialization: selected computation of cuboids, indexing olap data: bitmap index and join index.

Assignment: Data cube

Module 3	8	Case Study	Data Warehouse design principles	12 Session

Topics:

Building a data warehouse: Introduction, Critical Success Factors, Requirement Analysis, Planning for the data Warehouse-The data Warehouse design stage, Building and implementing data marts. Building data warehouses, Backup and Recovery, Establish the data quality framework, Operating the Warehouse, Recipe for a successful warehouse, Data warehouse pitfalls.

Assignment: Data Warehouse design principles

Module 4	Introduction to Data Mining	Case Study	Data Mining Techniques	8 Session

Topics:

Introduction to Data mining, KDD versus data mining, data mining techniques, tools and applications. Mining complex data objects, Spatial databases, Multimedia databases, Time series and Sequence data; mining Text Databases and mining Word Wide Web. Applications of data warehousing across different industries- Retail industry, Manufacturing and distribution, Bank, insurance company, Government agencies etc

Assignment: Data Mining Techniques

Targeted Application & Tools that can be used:

Application Area includes Ecommerce, retail, manufacturing industry, government agencies, Finance, banking etc

Professionally Used Software: Microsoft Azure Synapse SQL, IBM DB2 warehouse, Terradata vantage, SAP data warehouse cloud, Google Bigtable, google sheets, BigQuery, MongoDB, MarkLogic, Talend, Informatica, Arm Treasure data, Micro focus vertica, Cloudera Enterprise data platform.

Assignment:

1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .

 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

Text Book(s):

T1. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", McGraw Hill, 2016

T2. Jiawei Han, Micheline Kamber, Jian Pei, "Data-Mining.-Concepts-and-Techniques ", The-Morgan-Kaufmann, 3rd-Edition-Morgan-Kaufmann, 2015

Reference(s):

R1. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", Pearson, 2016

R2. Tan P. N, Steinbach M and Kumar V, "Introduction to Data Mining", Pearson Education, 2016

Web Based Resources and E-books:

W1. NPTEL Course on "Business Analytics & Data Mining Modeling Using R", Prof. Gaurav Dixit.

        https://onlinecourses.nptel.ac.in/noc22_mg67/preview

W2. NPTEL Course on "Data Mining", Mr. L. Abraham David

https://onlinecourses.swayam2.ac.in/cec22_cs06/preview

W3. Coursera course on "Data Warehousing for Business Intelligence Specialization", Michael

Mannino, Jahangir Karimi

https://www.coursera.org/specializations/data-warehousing

W4. Journal on "Data Mining and Knowledge Discovery"

https://www.springer.com/journal/10618/

https://presiuniv.knimbus.com/user#/home

Topics relevant to "EMPLOYABILITY SKILLS": Building a data warehouse, data mining tools, for developing Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSE3018	Course Title: Digital Health and Imaging Type of Course: Program Core& Theory Only	L-T- P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	CSE3008: Machine Learning Techniques				
Anti-requisites	-				
Course Description	This course will give an overview of digital health and its impact on healthcare, Image enhancement techniques, filtering, and restoration. Medical Imaging, health informatics, Health data analytics and predictive modeling.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of : Digital Health and Imaging and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: 1.Understand the role of digital health's impact in ethical and legal considerations. [Understand] 2. Apply Machine learning techniques for medical image analysis. [Application] 3. Apply Computer-aided detection and diagnosis in medical imaging. [Application] 4. Apply Health data analytics and predictive modeling. [Application]				
Course Content:					
Module 1	Introduction to Digital Health and Digital Image	Assignment	Theory		L : 8
Introduction to Digital Health Overview of digital health and its impact on healthcare, Introduction to telemedicine, wearables, and health monitoring devices, Ethical and legal considerations in digital health. Digital Image Processing Fundamentals: Digital image representation and properties, Image enhancement techniques, Image filtering and restoration, Image segmentation and feature extraction					
Module 2	Medical Imaging Modalities	Assignment	Case studies can be assigned to students, where they analyze real-world scenarios and		L: 10

			propose AI-based solutions	

Medical Imaging Modalities: Principles and applications of various medical imaging modalities. X-ray imaging, computed tomography (CT), and magnetic resonance imaging (MRI) , Ultrasound imaging and nuclear medicine imaging, Imaging modalities for specific healthcare domains (e.g., radiology, cardiology)				

Module 3	Image Analysis in Healthcare	Assignment /Quiz	Researching and reviewing academic papers or industry publications on specific AI applications	L:12

Image registration and fusion techniques, Quantitative image analysis for disease diagnosis and treatment planning, Computer-aided detection and diagnosis in medical imaging, Machine learning in medical image analysis.
Health Informatics and Electronic Health Records, Introduction to health informatics and electronic health records (EHR), EHR systems and interoperability, Data privacy, security, and regulatory considerations in health informatics.

Module 4	Digital Health Applications and Innovations	Assignment	Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.	L: 10

Mobile health (mHealth) applications and remote patient monitoring, Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health. Emerging technologies and trends in digital health.

Targeted Application & Tools that can be used:
Applications: Quantitative image analysis for disease diagnosis, Mobile health (mHealth
Tools: TensorFlow, PyTorch, Computer-aided detection

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assignments can involve researching and reviewing academic papers or industry publications on specific AI applications in engineering / Students may be given programming assignments to implement AI algorithms / Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions / Students may work with

real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.

Text Book
"Digital Health: Scaling Healthcare to the World" by Paul Sonnier-2020
Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods
"Biomedical Signal and Image Processing" by Kayvan Najarian and Robert Splinter

References
Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley , 2021..
"Introduction to Health Informatics" by Mark S. Braunstein
https://talentsprint.com/course/ai-digital-health
https://www.udemy.com/topic/medical-imaging/

Topics relevant to "EMPLOYABILITY SKILLS": Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3101	Course Title: Digital Watermarking and Steganography Type of Course: Theory Only	L-T- P- C	3-0	0	3
Version No.	1.1				
Course Pre-requisites	Fundamental knowledge in Operating Systems, Cryptography & Network Security and Computer Networks				
Anti-requisites	NIL				
Course Description	The purpose of this course is to enable the students to Comprehend the need for Digital Watermarking and Steganography and to develop the basic abilities of design and use Digital Watermarking and Steganography- information hiding technique. The course is both conceptual in nature and needs fair knowledge of Mathematical and computing. The course develops critical thinking and analytical skills. The course also enhances the abilities through assignments.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Digital Watermarking and Steganography and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Discuss the Introduction of Digital Watermarking Classify the various Digital Watermarking techniques.				

		Explain the Fundamentals of Steganography. Summarize the Steganographic Techniques.		
Course Content:				
Module 1	Introduction to digital watermarking	Assignment	Programming Task	7 Sessions

Topics

Introduction to Digital Watermarking, Digital Steganography differences, brief History, Watermarking Applications, Classification in Digital Water Marking- Classification based on Characteristics, Classification based on Applications.

Module 2	Types and tools of digital watermarking	Assignment	Programming Task	14 Sessions

Topics:

Digital Watermarking Fundamentals, Least Significant bit substitution, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform, Random Sequence Generation, Chaotic Map, Error Detection Code. Spatial domain watermarking, frequency Domain watermarking, Fragile Watermark, Robust Water Mark, Watermarking attacks and Tools, Image processing techniques, Water Mark (software Analysis).

Module 3	Introduction to Steganography	Assignment	Programming/Data analysis task	8 Sessions

Topics:

Steganography, Watermarking vs Steganography, Need for Steganography, Application of Steganography, Methods of Hiding, properties of Steganography, Performance measure of Steganography Approaches, Mathematical Notation and Terminology, Steganography Software (S-tools, StegoDos, EzStezo, JSteg,Jpeg,).

Module 4	Techniques of Steganography	Assignment	Programming/Data analysis task	7 Sessions

Substitution Systems and Bit-plane Tools- Least Significant Bit Substitution, Pseudorandom Permutations, Image Downgrading and Covert Channels, Practical Approach towards Steganography, Embedding of a secret Message.

Textbooks

T1. Frank Y Shih. Digital Water marking and Steganography Fundamentals and Techniques, 2017, CRC Press, second edition.

T2. Jsjit. S. Suri Shivendra Shivani, Suneeth Agarwal, Handbook on Image based Security Techniques,

CRC Press, 2018.

References

R1. Abid Yahya, Steganography Techniques for Digital Images, Springer, 2019.

 Weblinks:

W1. Digital Watermarking | ScienceDirect (informaticsglobal.com)

W2. Digital Watermarking and Steganography | ScienceDirect (informaticsglobal.com)

Topics relevant to "EMPLOYABILITY SKILLS": Building a data warehouse, data mining tools, for developing Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSE3136	Course Title:E – Business and Marketing Analytics Type of Course: Discipline Theory		L-T- P-C	3-0	0	3
Version No.	1.0					
Course Pre-requisites	Basic Communication skills General Knowledge in information technology Basic knowledge about online business					
Anti-requisites	Nil					
Course Description	The course intends to provide the basis of electronic business applications. This course will help the students understand the dynamics of E – Business and demonstrate the ability to identify, describe and apply the essential current practices in the contemporary scenario and provides a conceptual understanding of how marketing decisions are aided by analytics.					
Course Out Comes	At the end of the course, the student shall be able to: CO 1: Describe the fundamentals of E – Business(Knowledge) CO 2: Discuss the various E – Business models (Comprehension) CO 3: Identify how to manage E – Business (Comprehension) CO4: Describe the basics of marketing analytics for decision making (Knowledge)					
Course Objective:	The objective of the course is to familiarize the learners with the concepts of E – Business and Marketing Analytics and attain Employability through Participative Learning techniques.					
Module 1	Introduction to Electronic Business	Case study	Case study on Types of Networking for E-Business		6 Sessions	

Electronic Business: Overview, Definitions, Advantages & Disadvantages of E - Business, History of Electronic Business, Threats of E – Business, Types of E – Business and related Industries, E – Business Technology: Different Types of Networking for E-Business, Internet, Intranet, EDI Systems, Development of the Internet, Advantages of Internet, E-Business Infrastructure: An Overview, Hardware, Server Operating System, Software, Network Website, Roadmap of E – Business in India

Module 2	E-business Markets and Models	Case study	Case study on One-to-One Marketing and E – Governance	7 Sessions

E-business Markets and Models: Introduction, E-business Environment, E – Marketplaces, E – Business Markets, Types of E – Business Models: Model based on Transaction Type, Model based on Transaction Party – B2B, B2C, C2B, C2C, E-commerce Sales Life Cycle (ESLC) Model, E – Marketing: Key Issues, Introduction, The Scope of E – Marketing, Internet Marketing Techniques, E – Marketing Plan, The Marketing Mix, Branding, Online Advertising, Targeting Online Customers, One-to-One Marketing, E – Governance

Module 3	The Management of E – Business:	Group Discussion	Group Discussion on E – Payment Mechanism	10 Sessions

Managing Knowledge, Managing Applications Systems for E – Business, Management Skills for E – Business, Comparison between Conventional Design and E – Organisation, Supply Chain Management (SCM), Customer Relationship Management, E – Payment Mechanism: Payment through Card System, E – Cheque, E – Cash, E – Payment Threats & Protections.

Module 4	Introduction to Marketing Analytics	Assignment	E-resource Review	8 Sessions

Marketing analytics-data for marketing analytics-Exploratory data analysis-descriptive analysis-predictiveanalytics-prescriptive analytics-Customer analytics-benefits-Segmentation analytics-applications of cluster analysis

DELIVERY PROCEDURE (PEDAGOGY):

Self-learning: An Overview, Hardware, Server Operating System, Software, Network Website, Roadmap of E – Business in India

Experiential Learning: Case Studies on E-business

Participative learning: Group discussion on E-Payment Mechanism

Textbook

T1- Colin Combe, Introduction to E-business Management and Strategy, Elsevier Ltd,1st edition,2006

T2- Gupta, Seema. Marketing Analytics,1st Edition,Wiley,1st October 2021.

References

R1: Tokuro Matsuo and Ricardo Colomo-Palacios , Electronic Business and Marketing: NewTrends on its Process and Applications, Springer,2015.

R2: Joseph, P.T, E-COMMERCE AN INDIAN PERSPECTIVE (2e), New Delhi Prentice-Hall of India,2019

R3: Chaffey, E-Business and E-Commerce Management: Strategy, Implementation and Practice, 5e, Pearson Education India,2013

R4: Kenneth C. Laudon and Carol Guercio Traver, E-Commerce, Pearson Education,2017

R5. Winston, Wayne, Marketing Analytics: Data –driven techniques with Microsoft Excel,Wiley,2014.

R6. Grigsby, Mike,Marketing analytics: A practical guide to improving consumer insights using data techniques. Kogan Page,2022.

Project /Assignment :Case study on Legal and Regulatory Environment for E - Business

PU E-Resource Links:

1. Ng, E. (2005), "An empirical framework developed for selecting B2B e☐business models: the case of Australian agribusiness firms", Journal of Business & Industrial Marketing, Vol. 20 No. 4/5, pp. 218-225.

Link:https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/08858620510603891/full/html

PU1:: https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/17505930710734125/full/htm

PU2:https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/JCM-02-2019-3080/full/pdf?title=the-internet-of-everything-implications-of-marketing-analytics-from-a-consumer-policy-perspective

NPTEL Videos:

https://www.digimat.in/nptel/courses/video/110105083/L01.html

https://www.digimat.in/nptel/courses/video/110105083/L60.html

http://www.digimat.in/nptel/courses/video/110105083/L22.html

https://onlinecourses.nptel.ac.in/noc20_mg30/preview (Sessions on Marketing Analytics)

Web Based Resources:

W1. https://hbr.org/2018/05/why-marketing-analytics-hasnt-lived-up-to-its-promise

W2. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Deloitte-

Analytics/dttl-analytics-us-da-pricinganalytics3minguide.pdf

W3. https://hbr.org/2010/11/using-customer-journey-maps-to improve customer satisfaction

W4. https://www.zoho.com/subscriptions/guides/what-is-customer-lifetime-val

W5. https://www.mediassociates.com/wp-content/uploads/2018/12/Mediassociates-

whitepaper-Predictive-Analytics_2018.pdf

Topics relevant to "EMPLOYABILITY SKILLS": Managing Knowledge, Managing Applications Systems for E – Business, Management Skills for E – Business, Comparison between Conventional Design and E – Organisation, for developing Employability Skills through Participative learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3024	Course Title: Emerging Areas in Blockchain Type of Course: Theory Only Course	L-T- P- C	3	0	3
Version No.	1				
Course Pre-requisites	Basic concepts in networking. Cryptography Techniques Data Structures and Algorithms Introduction to Programming				
Anti-requisites					
Course Description	This course will be on the fundamentals of Blockchain and Blockchain Technology. The most well-known example of Blockchain Technology in wide use today is as the storage and transaction mechanism for the cryptocurrency Bitcoin. We will use historical examples, key concepts, key challenges, and their proposed (and implemented) solutions to help explain Blockchain Fundamentals. A key focus for the class will be on the decisions between challenge and implementation. This 'design' process can take a very long time, and the design and research process that ultimately led to a 'successful' implementation for a cryptocurrency took decades. Bitcoin represents an elegant technical solution to a series of long posed problems and partial solutions.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Emerging Areas in Blockchain and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: CO1: To understand the mechanism of Blockchain and Cryptocurrency. CO2: To understand the functionality of current implementation of blockchain technology. CO3: To explore the applications of Blockchain to cryptocurrencies and understanding limitations of current Blockchain.				
Course Content:					
Module 1	Blockchain: A new perspective in cyber technology	Assignment	Data Interpretation	8 Sessions	
Topics: 1. Introduction, Blockchain architecture, Blockchain concepts ,Consensus algorithms, Blockchain validity, Blockchain attacks, Merkle trees					
Module 2	Blockchain-enabled cyber-physical systems	Assignment	Data Interpretation	10 Sessions	

Topics: Background of CPS, Background of blockchain, Blockchain-enabled cyber-physical systems, Characteristics of blockchain-enabled CPS systems, Challenges in blockchain-enabled CPS systems				
Module 3	Blockchain for intrusion detection systems	Quiz	Questions Set	10 Sessions
Topics: . Intrusion detection system, About blockchain, Host-based intrusion detection system, Blockchain-based intrusion detection, Collaborative intrusion detection system, Applications of IDS: Snort, Limitations Comparison with firewalls				
Module 4	Blockchain for digital rights management	Quiz	Questions Set	10 Sessions
Topics: Introduction, Illustrations, DRM requirement, Parts of a traditional DRM, Compatibility of blockchain for DRM, Various cryptographic hash functions in blockchain, Methodologies and technology in use, Effects and applications of using blockchain in DRM, Methodologies for coupling DRM with blockchain, Advantages of integrating blockchain with digital content, Limitation of blockchain in DRM,				
Targeted Application & Tools that can be used: Blockchain has so many applications in every sector you can imagine such as healthcare, finance, government, identity, etc. And that's not including its most popular application which is Bitcoin. Tools: Geth, Solc, Remix IDE, Truffle				
Project work/Assignment:				
Assignment:				
T1.Blockchain Technology for Emerging Applications, A Comprehensive Approach 1st Edition - May 21, 2022, SK Hafizul Islam, Arup Kumar Pal, Debabrata Samanta, Siddhartha Bhattacharyya				
References R1. Applications of Blockchain Technology in Business Challenges and Opportunities , Mohsen Attaran, Angappa Gunasekaran · Springer International Publishing 2019 E book link R1: https://www.blockchain-council.org/e-books/				

E book link R2:   https://101blockchains.com/ebooks/blockchain-for-enterprise/

R3 Web resources:

H   W1. https://www.coursera.org/specializations/blockchain.

 W2. https://nptel.ac.in/courses/106105184/

 W3. https://swayam.gov.in/nd1_noc20_cs01/preview

Topics relevant to development of "EMPLOYABILITY SKILLS":   Byzantine Generals, Public-Key Cryptography, Bitcoin Blockchain, Incentive Model, Ethereum Structure, Ethereum Blockchain, for developing Employability Skills through Participative learning techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSE 3108	Course Title: Expert Systems 　　　Course type : Theory Only		L-T- P- C	3 -0	0	3
Version No.	1.0					
Course Pre- requisites	"CSE 3108 – Expert systems" course					
Anti-requisites	NIL					
Course Description	The purpose of this course is to present the concepts of intelligent agents, searching, knowledge and reasoning, planning, learning and expert systems, to study the idea of intelligent agents and search methods, to study about representing knowledge, to study the reasoning and decision making in uncertain world, to construct plans and methods for generating knowledge, to study the concepts of expert systems.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Expert Systems and attain Employability through Participative Learning techniques .					
Course Out Comes	On successful completion of this course the students shall be able to: CO1: Describe the modern view of AI as the study of agents that receive percepts from the Environment and perform actions. CO2: Demonstrate awareness of informed search and exploration methods. CO3: Explain about AI techniques for knowledge representation, planning and uncertainty Management. CO4: Develop knowledge of decision making and learning methods.					
Course Content:						
Module 1	Introduction	Assignment	Theory		9 Hours	

Topics:

Introduction to AI: Intelligent agents – Perception –

Natural language processing – Problem – Solving agents – Searching for solutions: Uniformed search strategies – Informed search strategies.

Module 2	Knowledge and Reasoning	Assignment	Theory		9 Hours	

Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents: Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic.

Module 3	Uncertain knowledge and Reasoning	Assignment	Theory	8 Hours

Uncertainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye's rule – Probabilistic reasoning – Making simple decisions.

Module 4	Planning and Learning	Assignment	Theory	9 Hours

Planning: Planning problem – Partial order planning – Planning and acting in non-deterministic domains –

Learning: Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning – Passive and active.

Module 5	Expert Systems	Assignment	Theory	10hrs

Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN.

Targeted Application & Tools that can be used:

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Text Book

Stuart Russel and Peter Norvig, 'Artificial Intelligence A Modern Approach', Second Edition, Pearson Education, 2003 / PHI.

2. Donald A.Waterman, 'A Guide to Expert Systems', Pearson Education.

References

1. George F.Luger, 'Artificial Intelligence – Structures and Strategies for Complex Problem Solving', Fourth Edition, Pearson Education, 2002.

2. Elain Rich and Kevin Knight, 'Artificial Intelligence', Second Edition Tata McGraw Hill, 1995.

3. Janakiraman, K.Sarukesi, 'Foundations of Artificial Intelligence and Expert Systems', Macmillan Series in Computer Science.

4. W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2003.

Links :

pu.informatics.global, https://sm-nitk.vlabs.ac.in/

Topics relevant to "EMPLOYABILITY SKILLS": Optimal and imperfect decisions, Logical agents, for developing Employability Skills through Participative Learning Techniques. This is attained through Review of digital/e resource as mentioned in course handout.

Course Code: CSA3073	Course Title: Game design and Development Type of Course: Program Core	L-T-P- C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	NIL				
Course Description	The Game Design and development course is a hands-on learning experience that focuses on teaching students how to design, develop, and test game prototypes. Students will learn game design concepts such as player engagement, game mechanics, and game balance, as well as the basics of game art, sound, and programming. Throughout the course, students will work in teams to develop and refine their game prototypes, receiving feedback and guidance from the instructor and their peers. Topics covered include prototyping tools, sample game engines, and the creation of simple 2D and 3D game prototypes. The course will culminate in a final project where students will present and demonstrate their completed game prototypes to the class.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Game design and Development** and attain **Employability** through **Participative Learning** techniques.				
Course Out Comes	At the end of the course the student should be able to: CO1 Recognize the elements of Game Mechanics. [Knowledge] CO2 Distinguish between various types of prototypes. [Comprehension] CO3 Apply concepts to create prototypes of games. [Application]				
Course Content:	Game mechanics, emergence and progression, resource mechanics, feedback structures. Uses and importance of prototyping, different types of prototypes, stages of prototyping, identifying key features, create functioning prototypes.				
Version No.	1.0				
Module 1	Game Mechanics	Assignment	Evolution of prototyping		No. of Classes:12
Topics:					

Introduction to Game Mechanics, different types of game mechanics and applications, concepts of emergence and progression, Resource mechanics and economies, level design and progression in levels, feedback structures and semiotics.

Module 2	**Designing**	**Case Study**	Importance of prototyping	**No. of Classes:13**

Topics:
Introduction to prototyping, uses and importance of prototyping. Different types of prototypes such as paper, physical, playable, art and sound prototypes, interface, low fidelity and high fidelity code, core game and complete game prototypes.

Module 3	**Creating and Testing Prototypes**	**Assignment**	Prepare physical prototype of a popular game	**No. of Classes:20**

Topics:
Documentation, identifying key features, stages of prototyping, testing and feedback, application of different prototyping techniques such as paper, physical, playable, art and sound prototypes, interface, code, low fidelity and high fidelity prototyping techniques to create functioning prototypes.

Targeted Application & Tools that can be used:
Algodoo

Project work/Assignment:
1. 2D Platformer Design
2. Game Development
3. UI/UX Design

Textbook(s):

1. Jeremy G. Bond, "Introduction to Game Design, Prototyping, and Development", 2nd Edition, Addison-Wesley Professional, 2017.

References
1. Ennio De Nucci, Adam Kramarzewski, "Practical Game Design : Learn the Art of Game Design Through Applicable Skills and Cutting-edge Insights", Packt Publishing, 2018.
2. Ernest Adams, "Fundamentals of Game Design", Pearson Education, 2012.

Weblinks:

https://learn.unity.com/
https://starloopstudios.com/rapid-game-prototyping-why-is-it-important-in-game-development/

Topics relevant to "EMPLOYABILITY SKILLS": Progression, prototyping, for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2060	Course Title: Information Security and Management Type of Course: Theory Only Course	L-T- P-C	3 -0	0	3
Version No.	1				

Course Pre-requisites	Data Communication and Computer Networks, Information Security, Database Management Systems and Concepts of cryptography.			
Anti-requisites				
Course Description	The course explores information security through some introductory material and helps gain an appreciation of the scope and context of information security. It includes a brief introduction to cryptography, security management, network and computer security. It allows a student to begin a fascinating journey into the study of information security and develop an appreciation of some key security concepts. The course concludes with a discussion of a simple model of the information security in industry and explores skills, knowledge and roles required for employability. A student will be able to determine and analyze potential career opportunities in this profession.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Information Security and Management and attain Employability through Participative Learning techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: Describe the basic concept of information security. (Knowledge) Explain the concepts and methods of cryptography. (Comprehension) Demonstrate the aspects of risk management. (Application)			
Course Content:				
Module 1	Information Security Management:	Assignment	Data Collection/Interpretation	10 Sessions
Topics: Information Security Overview, Threat and Attack Vectors, Types of Attacks, Common Vulnerabilities and Exposure (CVE), Security Attacks, Fundamentals of Information Security, Computer Security Concerns, Information Security Measures.				
Module 2	Fundamentals of Information Security and Data Leakage	Case studies / Case let	Case studies / Case let	13 Sessions
Topics: Key Elements of Networks, Logical Elements of Networks, Critical Information Characteristics, Information States. What is Data Leakage and Statistics, Data Leakage Threats, Reducing the Risk of Data Loss, Key Performance Indicators (KPI), Database Security.				
Module 3	Information Security Policies and Management	Case studies / Case let	Case studies / Case let	14 Sessions

Topics: Information Security Policies-Necessity-Key Elements and Characteristics, Security Policy Implementation, Configuration, Security Standards-Guidelines and Frameworks, Security Roles and Responsibilities, Accountability, Roles and Responsibilities of Information Security Management, Team Responding to Emergency Situation- Risk Analysis Process.

Targeted Application & Tools that can be used:

An ISMS is a systematic approach to managing sensitive company information so that it remains secure. It includes people, processes and IT systems by applying a risk management process.

It can help small, medium and large businesses in any sector keep information assets secure.

The ISO 27000 family of standards helps organizations keep information assets secure.

Using this family of standards will help your organization manage the security of assets such as financial information, intellectual property, employee details or information entrusted to you by third parties.

ISO/IEC 27001 is the best-known standard in the family providing requirements for an information security management system (ISMS).

Project work/Assignment:

Assignment:

Text Book

   T1   Management of Information Security by Michael E.Whilman and Herbert J.Mattord

   T2   Information Security: The Complete Reference, Second Edition, 2nd Edition. by Mark Rhodes-Ousley. Released April 2013. Publisher(s): McGraw-Hill.

.

References

   R1   Title, Cryptography & Network Security (Sie) 2E. Author, Forouzan. Publisher, McGraw-Hill Education (India) Pvt Limited.

   R2   Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices. Nina Godbole.

E book link R1: http://www.iso.org/iso/home/standards/management-standards/iso27001.html
E book link R2: http://csrc.nist.gov/publications/nistpubs/800-55-Rev1/SP800-55-rev1.pdf
WEBLINKS: pu.informatics.global , https://sm-nitk.vlabs.ac.in.
Topics relevant to development of "SKILL DEVELOPMENT": Security Policy Implementation, Security Roles, for development of Skill Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3086	Course Title: Information Theory and Coding Type of Course: Theory Only	L-T- P-C	3 -0	0	0
Version No.	1.1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Information Theory is the science for measuring, preserving, transmitting, and estimating information in random data. It was initially proposed by Shannon as a mathematical theory of communication more than five decades ago. It provides the fundamental limits of performance for transmission of messages generated by a random source over a noisy communication channel. On the one hand, Information Theory has been the driving force behind the revolution in digital communication and has led to various practical data compression and error correcting codes that meet the fundamental theoretical limits of performance. On the other hand, over the years, techniques and concepts from Information Theory have found applications well beyond communication theory. In this course, we will introduce the basic notions and results of Information Theory, keeping in mind both its fundamental role in communication theory and its varied applications beyond communication theory. This course, and the follow-up advanced courses to be offered in the future, will be of interest to students from various backgrounds.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Information Theory and Coding and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:				

	Calculate the entropy of Zero memory; Analyze Markov sources and Apply the properties of Entropy for a given source statistic.	
	For the given source message, Determine the code words and Calculate coding efficiency using Shannon, Shannon-Fano, Huffman and Arithmetic coding algorithm for memoryless sources given the source statistics and LZ algorithm for sources with memory.	
	Determine and Analyze the channel entropies, mutual information and the channel capacities for Discrete Memoryless Channels for the given channel diagram or channel matrix and to Discuss Shannon Hartley Law and Shannon's limit.	
	For the given (n, k) Linear Block Codes and Binary Cyclic Codes Determine the code words, syndrome, error detecting & correcting capability of the code and the corrected received vector; Design a single error correcting Linear Block Code for the given message length.	
	Evaluate the code words for a given (n, k, m) convolution encoder and Use Sequential search and Viterbi algorithm to decode the information from the given received vector and Discuss BCH, RS, Golay, shortened cyclic, burst error correcting, Burst and Random error correcting codes and Turbo codes.	
Course Content:		
Module 1	Information Theory	8 Sessions
Topics: Introduction, Measure of information, Average information content (entropy) of symbols in long independent sequences, Information rate, Properties of entropy, Extension of discrete memory less (zero-memory) sources, Average information content (entropy) of symbols in long dependent sequences, Mark off statistical model for information source, Entropy and information rate of Mark off sources.		
Module 2	Source Coding	8 Sessions
Topics: Properties of codes- Block codes, on-singular codes, Uniquely decodable codes. Instantaneous codes and Optimal codes, Prefix of a code, Test for instantaneous property, Construction of Instantaneous code, Decision tree, Kraft's inequality, Source coding theorem (Shannon's Noiseless coding theorem), Shannon's encoding algorithm, Shannon Fano Algorithm, Huffman minimum redundancy code (binary, ternary and quaternary), Code efficiency and redundancy, Extended Huffman Coding, Arithmetic Codes, Lempel – Ziv Algorithm.		
Module 3	Channels and Mutual Information	8 Sessions
Topics: Introduction, Discrete communication channels, Representation of a channel, Probability relations- Apriori, Posteriori entropy, Equivocation, Mutual information, Properties, Rate of		

information transmission over a discrete channel, Capacity of a discrete memoryless channel, Shannon"s theorem on channel capacity (Shannon"s second theorem), Special channels- Symmetric, Binary symmetric, Binary erasure, Noiseless, Deterministic and cascaded channels, Estimation of channel capacity by Muroga"s method, Continuous channels, Shannon-Hartley theorem and its implications, Shannon"s limit, Rate Distortion Theory.

Module 4	Linear Block Codes	8 Sessions

Topics:

Introduction to Fields and Vector Spaces, Types of errors, Examples, Methods of controlling errors, Types of codes, Linear Block Codes- Matrix description, Encoding circuit, Syndrome and error detection, Syndrome circuit, hamming weight, hamming distance, Minimum distance of a block code error detection and correction capabilities of a linear block code, Single error-correcting Hamming codes, Table lookup decoding using standard array, General decoder for a linear block code. Binary cyclic codes: Algebraic structures of cyclic codes, Encoding using (n-k) bit shift register, Syndrome calculation.

Text Book

T1- K. Sam Shanmugham,"Digital and Analog Communication Systems", John Wiley Publications, 1996.

T2- Simon Haykin, "Digital Communications", John Wiley Publications, 2003.

T3-. Shu Lin, Daniel J. Costello, "Error Control Coding", Pearson / Prentice Hall, 2ndEdition, 2004.

References

R1-Muralidhar Kulkarni and K. S. Shivaprakasha, "Information Theory and Coding", Wiley (India), 2015.

R2-Glover and Grant, "Digital Communications", Pearson 2nd Edition, 2008.

R3-Abramson, "Information Theory &Coding", McGraw-Hill, 1963.

Weblinks: pu.informatics.global.

Topics relevant to development of "EMPLOYABILITY SKILL": Algebraic structures of cyclic codes, Encoding using (n-k) bit shift register, Syndrome calculation, for developing Employability Skills through Problem Solving Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3033	Course Title: INFORMATION VISUALIZATION Type of Course: Integrated	L-T- P-C	2 -0	2	3
Version No.	1.0				

Course Pre-requisites	Basic Programming Concepts.			
Anti-requisites	NIL			
Course Description	This course offers foundational principles, methods, and techniques of visualization to enable creation of effective information representations suitable for exploration and discovery. Covers the design and evaluation process of visualization creation, visual representations of data, relevant principles of human vision and perception, and basic interactivity principles.			
Course Objective	The objective of the course is to familiarize the learners with the concepts Of Information Visualization and attain Employability through Experiential Learning techniques.			
Course Out Comes	On successful completion of the course the students shall be able to CO 1: Choose appropriate visualization methods for a given data type. CO 2: Implement interactive visualization interface for different types of data such as time oriented, textual, and spatial. CO 3: Design an effective visualization using design and human perception principles.			
Course Content:				
Module 1	Data Visualization & Techniques	Quiz	Data Collection/Interpretation	08 Sessions
Topics: Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Human Visual Perception, Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data.				
Module 2	Visual Analysis of data from various domains	Assignment	Programming	09 Sessions
Topics: Time-oriented data visualization – Spatial data visualization and case studies, Text data visualization – Multivariate data visualization, and case studies,				
Module 3	Designing Effective Dashboard and Visual Story Telling	Assignment	Programming	09 Sessions
Topics: Guidelines for designing successful visualizations, Data visualization dos and don'ts, Dashboard Design principles, Effective Dashboard Display Media, Dashboard				

creation using visualization tools for the use cases: Finance- marketing-insurance-healthcare etc.
List of Laboratory Tasks:
Targeted Application & Tools that can be used Targeted application: Business intelligence tools. Tools: Tableau, Google data studio, Openheatmap
Project work/Assignment:
Assignment: Programming

Text Book
 	
   T1 Tamara Munzer, "Visualization Analysis and Design", CRC Press, 2018.
 	
   T2 Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations,
 	
        Techniques, and Applications", CRC Press, Second Edition, 2015.

References
 	
    R1 Stephen Few, "Now You See It", Analytics Press, 2019. .
 	
   R2 Stephen Few, "Information Dashboard Design: the effective visual communication of data", Oreilly,
 	
        2016.
 	
    Web resources: https://www.coursera.org/specializations/information-visualization , https://presiuniv.knimbus.com

Topics relevant to development of "EMPLOYABILITY SKILLS": Human Visual Perception, Effective Dashboard Display, for development of Employability Skills through Experiential Learning techniques. This is attained through assessment component as mentioned in course handout.

Course Code: CSE3102	Course Title: Malware Analysis Type of Course:Discipline Elective in Cyber Security Basket	L-T- P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Should Have the knowledge of Cryptography and Network Security				
Anti-requisites	NIL				
Course Description	The purpose of the course is to explore malware analysis tools and techniques in depth. Understanding the capabilities of malware is critical to an organization's ability to derive threat intelligence, respond to information security incidents, and fortify defenses. This course builds a strong foundation for reverse-engineering malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger, and other tools useful for turning malware inside-out.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Malware Analysis and attain Employability through Participative Learning techniques.				
Course OutComes	On successful completion of this course the students shall be able to: Understanding the nature of malware, its capabilities, and how it is combated through detection and classification. Apply the methodologies and tools to perform static and dynamic analysis on unknown executables. Analyze scientific and logical limitations on society's ability to combat malware.. Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti analysis techniques in future malware samples.				
Course Content:					

Module 1	Introduction to MALWARE ANALYSIS		Assignment	Programming activity	12 Hours

Topics:

Introduction to malware, OS security concepts, malware threats, evolution of malware, malware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.

Assignment: Brief study on types of spyware

Module 2	Static Analysis		Assignment	Programming activity	11 Hours

Topics:

X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture

Assignment: Static analysis on malware (PeStudio & ProcMon)

Module 3	Dynamic Analysis		Assignment	Programming activity	11 Hours

Topics:

Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark

Assignment: Demonstration of wireshark

Module 4	Malware Functionality and Detection Techniques		Assignment	Programming activity	12 Hours

Topics:

Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences

Assignment: Packet malware signature

Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Any appropriate tool can be given to demonstrate.

Text Book

Michael Sikorski and Andrew Honig, 2012: " Practical Malware Analysis", No Starch Press.

E-Resources

W1. https://www.geeksforgeeks.org/introduction-to-malware-analysis/

W2. https://ine.com/learning/courses/malware-analysis

W3: https://sm-nitk.vlabs.ac.in/

References

Jamie Butler and Greg Hoglund, 2005: "Rootkits: Subverting the Windows Kernel", Addison-Wesley.

Dang, Gazet and Bachaalany, 2014: "Practical Reverse Engineering",Wiley.

Reverend Bill Blunden, 2012: "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition,Jones& Bartlett.

Topics relevant to "EMPLOYABILITY SKILLS": X86 Architecture, Packet Sniffing, Wireshark, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSE3009	Course Title: Optimization Techniques for Machine Learning Type of Course: Discipline Elective in Artificial Intelligence and Machine Learning Basket Theory		L-T- P-C	3 -0	0	3
Version No.	1.0					
Course Pre-requisites	CSE3008 Machine Learning Techniques					
Anti-requisites	NIL					
Course Description	This course introduces a range of machine learning models and optimization tools that are used to apply these models in practice. Course will introduce what lies behind the optimization tools often used as a black box as well as an understanding of the trade-offs of numerical accuracy and theoretical and empirical complexity. For the students with some optimization background this course will introduce a variety of applications arising in machine learning and statistics as well as novel optimization methods targeting these applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Optimization Techniques for Machine Learning and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: Describe fundamentals of Machine learning [Knowledge]. Explain Machine learning models [Comprehension]. Discuss Convex optimization models [Comprehension]. Apply Methods for convex optimization [Application].					
Course Content:						
Module 1:	Fundamentals of Machine learning	Quiz		Knowledge based Quiz		8 Sessions
Topics: Machine learning paradigm, empirical risk minimization, structural risk minimization, learning guarantees, introduction of VC-dimension.						
Module 2:	Machine learning models	Quiz		Comprehension based Quiz		10 Sessions

Topics: logistic regression, support vector machines, sparse regression, low dimensional embedding, low rank matrix factorization, sparse PCA, multiple kernel learning.				
Module 3	Convex optimization models	Assignment	Batch-wise Assignments	9 Sessions
Topics: linear optimization, convex quadratic optimization, second order cone optimization, semidefinite optimization, convex composite optimization				
Module 4:	Methods for convex optimization	Assignment and Presentation	Batch-wise Assignment and Presentations	11 Sessions
Topics: gradient descent, Newton method, interior point methods, active set, prox methods, accelerated gradient methods, coordinate descent, cutting plances, stochastic gradient.				

Targeted Application & Tools that can be used: Use of Matlab tool
Project work/Assignment: Survey on Methods for convex optimization
Text Book   T1. Charu C. Aggarwal, " Linear Algebra and Optimization for Machine Learning", Springer, 2020.   T2. Sra Suvrit, Nowozin Sebastian, and Wright Stephen J, "Optimization for Machine Learning", The MIT Press,2012.

References
 	
 R1.Guanghui Lan, "First-order and Stochastic Optimization Methods for Machine Learning", Springer Cham, 2020.
 	
 Web References
 	
  W1. https://sm-nitk.vlabs.ac.in/
 	
  W2. https://nptel.ac.in/courses/

Topics related to development of "EMPLOYABILITY SKILL":   Convex optimization models and Methods for convex optimization, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSE3063	Course Title: Privacy and Security in IoT		3-0	0	3
	Type of Course: Program Core & Theory only	L-T- P-C			
Version No.	1.0				
Course Pre-requisites	[1] The primary prerequisite is a working knowledge of basic algebraic number theory, which includes number fields, rings of integers, factorization of ideals into primes [2] A working knowledge of basic algebraic number theory. [3] Basic concepts of cryptography like encryption decryption, Signature generation and verifications.				
Anti-requisites	NIL				
Course Description	The purpose of this course is to enable the students to appreciate the need for cryptography and to identify the applications of cryptography in Internet of Things (IoT). The course is both conceptual and analytical in nature and needs fair knowledge of mathematics and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in IoT and attain Skill Development through Problem Solving Methodologies.				
Course Outcomes	On successful completion of this course the students shall be able to: Explain benefits of modern cryptographic algorithms Apply the Elliptic curve Diffie Hellman and digital signature algorithms to encrypt-decrypt , generate and verify the signatures Estimate the performance of ECC with other traditional cryptography algorithms.				
Course Content:					

Module 1	Introduction to Elliptic Curves	Quiz	Comprehension based Quizzes and assignments;	15 Classes

Topics:

Elliptic Curve Cryptosystems (ECC): Introduction to ECC, Method of Diophantus, Elliptic curves in Cryptography, Discrete Logarithms in Finite Fields, Elliptic Curve on a finite set of Integers, Definition of Elliptic curves,General form of a EC, Weierstrass Equation, Points on the Elliptic Curve (EC),The Abelian Group, Operations on ECC- Point addition, Point doubling.

Module 2	Elliptic Curve Cryptosystems	Quizzes and assignments	Comprehension based Quizzes and assignments;	15 Classes

Topics:

Elliptic Curve Cryptosystems (ECC): Public-Key Cryptosystems, Public-Key Cryptography, What Is Elliptic Curve Cryptography (ECC)?,Using Elliptic Curves In Cryptography, Generic Procedures of ECC, Example – Elliptic Curve Cryptosystem Analog to El Gamal, Diffie-Hellman (DH) Key Exchange, ECC Diffie-Hellman, Example – Elliptic Curve Diffie-Hellman Exchange, Elliptic Curve Digital Signature Algorithm (ECDSA) Why use ECC?, Security of ECC, Applications of ECC, Benefits of ECC.

Module 3	IOT Protocols	Assignment and Lab projects with presentation	Project implementations in software, batch wise presentations	10 Classes

Topics:

IoT Communication model and Protocols :

Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (COAP), Advanced Message Queuing Protocol (AMQP), Extensible Messaging and Presence Protocol (XMPP), Introduction, Principle of RFID, Components of an RFID system.

Targeted Application & Tools that can be used:

Application areas are to secure crypto currency- Bitcoin, Ethereum and Ripple using ECC in key agreement, digital signatures.

Professionally Used Software: elliptic2

: https://www.graui.de/code/elliptic2/

Project work/Assignment:

Each batch of students (self-selected batch mates) will identify projects from searching on Google, and implement with the most suitable 2 or 3 NIST /SECP curves

Project Assignment:

Assignment: 1] Collect the running time of ECC on different standard NIST curves.

Assignment 2: Prepare a compressive report on the efficiency of NIST Vs SECP curves.

Textbook(s):

I. Blake,   G. Seroussi,   N. Smart,   Elliptic Curves in Cryptography , Cambridge University 2020

Arshdeep Bagha, Vijay Madisetti, "Internet of Things - A hands on approach", Universities Press, 2021.

References

Joseph H Silver man The Arithmetic of Elliptic Curves: Springer; 2nd Edition April 2016

Darrel Hankerson, Scott Vanstone, Alfred J. Menezes Guide to Elliptic Curve Cryptography Springer 2018

Topics related to development of "SKILL DEVELOPMENT":   IOT Protocols, Elliptic Curve Cryptosystem, for Skill Development through Participative Learning Techniques. This is attained through assessment components as mentioned in the course handout.

Course Code: CSE2038	Course Title: Privacy and Security in Online Social Media Type of Course: Program Core & Theory Only	L-T- P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Basic of Network security and cryptography.					
Anti-requisites	NIL					
Course Description	Objective of this course is to make students learn the basics of privacy and security in online social media and develop ability to understand the importance of privacy in anyone's life and their consequences if it is in peril. This course is both conceptual and analytical in nature that would help the student to predict the effects of any activity on Social Media. The students should have prior knowledge of some Social media platforms. After successful completion of the Course, the students would acquire knowledge to protect themselves from the online data theft on social media from attacker.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in Online Social Media and attain Employability through Participative Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Recognize the significance of the Privacy and how to protect it [Knowledge] 2] Summarize the privacy and security Encryption for Peer to Peer Social Networks. [Comprehension] 3] Understand the function of stealing Reality and K-Anonymity. [Knowledge]					

	4]Use the Link Reconstruction attack in privacy Social Networks. [Application]				

Course Content:					

Module 1	ANALYSIS OF PRIVACY IN SOCIAL NETWORKS	Assignment	Knowledge	8 Sessions

Topics:

Three-Layered Framework-Characteristics Used to Analyze Social Web Privacy-Privacy Issues Related to Social Web Users-Privacy Issues Related to Service Providers-Security and Privacy for Digital Facets-Identifiable Facets-Private Facets.

Assignment: Find real world problems and suggest solutions.

Module 2	ENCRYPTION FOR PEER-TO-PEER SOCIAL NETWORKS	Assignment	Comprehension	8 Sessions

Topics:

Essential Criteria for the P2P Encryption Systems-Existing P2P OSN Architectures-Evaluations of Existing Encryption Schemes Based on Our Criteria-Broadcast Encryption-Predicate Encryption.

 Assignment: - Survey of Unethical Behavior and Influencing factors.

Module 3	STEALING REALITY AND K-ANONYMITY	Quiz	Comprehension	11 Sessions

Topics:

Stealing Reality- Social Attack Model- Social Learnability- k-Anonymity- k-Degree Anonymity- k-Neighborhood

Anonymity- k- Automorphism- k-Isomorphism-L-diversity- Attack Model and Privacy Guarantee-Insights from an ℓ-Diversified Graph.

Module 4	PRIVACY IN SOCIAL NETWORKS- LINKS RECONSTRUCTION ATTACK	Assignment/Case study	Application	11 Sessions

Privacy in Social Networks- Link Prediction- Feature Extraction- Communities Datasets-Electronic Currencies- Anonymity- The Bit coin System- The Transaction Network- The User

Network- Anonymity Analysis- Integrating Off-Network Information. Use Case and the Threat Model- Use Case for Private Record Linkage- Use Case for Privacy-Preserving Record Linkage-

Assignment: - The Bit coin Faucet- Voluntary Disclosures- TCP/IP Layer Information- Context Discovery- Flow and Temporal Analyses.

Text Book / References

T1. Yaniv Altshuler, Yuval Elovici, Armin B. Cremers Nadav Aharony, Alex Pentland," Security and Privacy in Social Networks", Springer Publisher,2012,1st Edition

Online Resources: -

W1: https://presiuniv.knimbus.com/user#/searchresult?searchId=Privacy%20and%20Security%20in%20Online%20

Social%20Media%20&curPage=0&layout=list&sortFieldId=none&topresult=false

W2:   https://onlinecourses.nptel.ac.in/noc21_cs28/preview

Topics relevant to "EMPLOYABILITY SKILLS": Link Prediction, features extraction, for developing Employability Skills through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 2028	Course Title: Software Project Management Type of Course: Theory Only Course	L-T-P- C	3-0	0	3
Version No.	1				
Course Pre-requisites	Basics of Programming				
Anti-requisites					
Course Description	Effective software project management is crucial to the success of any software development or maintenance project. The roles and responsibilities of the project manager is numerous and varied. However, at the broad level, these can be classified in to the project planning and monitoring and control activities. Project planning involves making cost, effort, and duration estimation and preparing various types of plans such as schedule, configuration management, risk management, quality management. Staffing plan etc. The monitoring and control activities encompass keeping track of progress and removing bottlenecks using techniques such as PERT, GANTT, and also effective risk management, team building etc.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Software Project Management and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the different project contexts and appropriate management strategy. Practice the role of professional ethics in successful software development. Identify the key phases of project management. Determine an appropriate project management approach through an evaluation of the business context and scope of the project.				
Course Content:					
Module 1	Conventional & Modern Software Management	Assignment	Case studies		9 Sessions

Topics:

Waterfall Model, Conventional Software Management Performance; Evolution of Software Economics - Software economics, Pragmatic software cost estimation, Reducing software product size, Improving software processes. Principles of Conventional Software Engineering, Principles of Modern Software Management, Transitioning to an interactive Process.

Module 2	Software Management Process Framework	Case studies / Case let	Case studies	9 Sessions

Topics:

Life cycle phases, The artifact sets, Management artifacts, Engineering artifacts, Pragmatic artifacts; ModelBased Software Architectures - A management perspective and A technical perspective.

Module 3	Project Organization and Planning	Quiz	Case studies	10 Sessions

Topics:

Work breakdown structures, Planning guidelines, The cost and schedule estimating process, The iteration planning process, Pragmatic planning, Line-of-Business organizations, Project organizations, Evolution of organizations; Process automation - Automation building blocks, The project environment.

Module 4	Project Control and Process Instrumentation	Quiz	Case studies	10 Sessions

Topics:

PROJECT CONTROL AND PROCESS INSTRUMENTATION :The Seven-Core metrics, Management indicators, Quality indicators, Life-Cycle expectations, Pragmatic software metrics, Metrics automation, Modern project profiles, Next generation software economics, Modern process transitions.

Targeted Application & Tools that can be used:

Project work/Assignment:

Assignment:

Text Book

   T1.   Walker Royce, "Software Project Management : A unified Framework", 1st Edition, Pearson Education, 2021

References

R1. Bob Hughes and Mike Cotterell, "Software Project Management", 3rd Edition, Tata McGraw Hill Edition, 2005.

R2. Joel Henry, "Software Project Management", 1st Edition, Pearson Education, 2006.

E book link T1:

https://www.edutechlearners.com/download/Software%20Project%20Management.pdf

Web resources: https://onlinecourses.nptel.ac.in/noc19_cs70/preview

Library resources: https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&curPage=0&layout=grid&sortFieldId=doc_title_str&topresult=false&content=*software%20project%20management*&sub_category_name=Computer%20Science%20and%20IT

Topics relevant to development of "EMPLOYABILITY SKILLS": Life cycle Phases, Seven Core Metrics, for development of Employability Skills through the Participative Learning Techniques. This is attained through the assessment components mentioned in the course handout.

Course Code: PIP103	Course Title: Professional Practice– II	L- T-P- C	-	-	-	15
	Type of Course: NTCC					
Version No.	1.0					
Course Pre-requisites	Knowledge and Skills related to all the courses studied in previous semesters.					
Anti-requisites	NIL					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: Identify the engineering problems related to local, regional, national or global needs. Apply appropriate techniques or modern tools for solving the intended problem. Design the experiments as per the standards and specifications. Interpret the events and results for meaningful conclusions. Appraise project findings and communicate effectively through scholarly publications.					

Course Code: CSE 2010	Course Title: Operating Systems Type of Course: Theory Only	L-T- P-C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	Basic knowledge on computers, computer software & hardware, and Computer Organization.				
Anti-requisites	Nil				
Course Description	Operating systems being central to computing activities, this Course provide understanding of the functions and functional modules of operating systems. The design and implementation of Operating systems is also covered.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques				
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the fundamental concepts of operating Systems [Knowledge Level] CO2: Demonstrate various CPU scheduling algorithms. [Application Level] CO3: Apply synchronization tools to a given problem. [Application Level] CO4: Discuss various memory management techniques.[Comprehension Level]				
Course Content:					

Module 1	Introduction	Assignment	Data Analysis task	7 Sessions

Topics: Overview of OS and design, Introduction- Computer System Architecture, Operating System Structure, Operations, Computing environments, OS implementation, Operating System Services, User and OS interface, System Calls and its types, System Programs [loaders, linkers], UNIX/LINUX commands: System Programs[CLI/SHELL, loaders, linkers]

Module 2	Process Management	Assignments	Analysis, Data Collection	10 Sessions

Topics: Process Concept, Operations on Processes, Inter Process Communication, Introduction to threads - Multithreading Models, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, RR, Priority, Multilevel Queue, Linux Scheduler, CASE STUDY: Linux Scheduler

Module 3	Process Synchronization and Deadlocks	Quiz	Case studies / Case let	10 Sessions

Topics: The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Test and Set, Mutex locks, Semaphores, Advanced Synchronization Problems-IBM Quality and implementation, Monitors. Introduction to Deadlocks, Deadlock Characterization, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation Deadlock detection & Recovery from Deadlock.			

Module 4	Memory Management and File Systems	Assignment	Case Studies / Case let	11 Sessions

Topics: Introduction to Memory Management, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Demand Paging – Page Replacement, Allocation of Frames – Thrashing. RAID Structures: Disk Scheduling, RAID LEVELS

Targeted Application & Tools that can be used: UNIX

Project work/Assignment: Mini Project: Demonstration of File Handling techniques/Memory and Disk Management.

Text Book   T1: Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 9th edition Wiley, 2013.

References   R1. William Stallings, "Operating systems", Prentice Hall, 7th Edition, Pearson, 2013.   R2. Andrew S Tanenbaum and Albert S Woodhull, "Operating Systems Design and Implementation", 3rd Edition, Pearson, 2015.   E book link R1: Details for: Operating systems : internals and design principles › Koha online catalog   E book link R2: Details for: Operating systems : design and implementation › Koha online catalog   R3 Web resources:

1)https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O

2)https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeR-n6mkO

3)https://www.youtube.com/watch?v=HW2Wcx-ktsc

4)https://www.youtube.com/watch?v=MYgmmJJfdBg

5) https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to "Skill Development":

Page replacement algorithms, Scheduling policies, Deadlocks for Skill Development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE203	Course Title: Discrete Mathematics Type of Course: Program Core& Theory Only	L-T- P-C	4-0	0	4
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course highlights the basics of discrete structures and develop ability to solve problems involving mathematical logic, sets, functions, relations, principles of counting, pigeonhole principles, recurrence relations, Principles of Inclusion and Exclusion. forces, and moments with their applications in allied subjects. It is a prerequisite for several Courses involving Compiler Design, Artificial Intelligence. This course is both conceptual and analytical in nature that would help the student to use the concepts of discrete structures to solve and prediction of data analytics. The students should have prior knowledge of basic mathematics pursue the Course. After successful completion of the Course, the students would acquire knowledge to solve problems involving mathematical logic, sets, functions, relations, principles of counting, pigeon hole principles, recurrence relations, Principles of Inclusion and Exclusion with an emphasis on real-world engineering applications and problem solving.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Discrete Mathematics and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe a logic sentence in terms of predicates, quantifiers, and logical connectives. 2] Solve problems on Functions and Relations using basic principles of Set Theory. 3] Explain the concepts of Boolean Algebra. 4] Apply basic counting techniques to combinatorial problem.				

Course Content:				
Module 1	Foundations of Logics and Proofs	Assignment	Problem Solving	10 Sessions

Topics:

Propositional Logic, Propositional Logic Equivalences, Inference rules, Normal forms, Introduction to Proofs, Resolution by Refutation, Predicates and Quantifiers, Introduction to Proofs.

Assignment: Problems.

Module 2	Basic Structures: Sets, Functions, Relations	Assignment	Problem Solving	10 Sessions

Topics:

Sets and set-operations, Venn Diagram, Cardinality of Sets, Functions: Types, Invertible Functions, Composition, Sequences and Summations, Relations and their properties & representations, Equivalence Relations, Closure of Relations.

Assignment: Problems and applications

Module 3	Posets, Lattices and Boolean Algebra	Assignment	Problem Solving	10 Sessions

Topics:

Partial ordering, Posset, Hasse Diagram, Lattices & Algebraic structures, Basic properties of algebraic systems by lattices, Distributive lattices, complement of an element in a lattice, Boolean lattice & Boolean algebra,Topological Sorting.

Assignment: Problems and Applications

Module 4	Principles of Counting Techniques	Assignment	Problem Solving	12 Sessions

Topics:

Number Theory: Integers and Division, GCD, Chinese Remainder Theorem, Solving Congruences, Pigeon Hole Principle, Mathematical Induction, Generalized Permutations and Combinations, Recurrence Relations, Applications of Recurrence Relations, Generating Functions, Principle of Inclusion and Exclusion, Applications of Inclusion and Exclusion.

Assignment: Problems and Applications

Targeted Application & Tools that can be used:

NIL

Project work/Assignment:
Problems on all the topics and relevance with field of computer science
Text Book T1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill,s 7th Edition,2018.
References R1: Susanna EPP, "Discrete Mathematics with Applications", Cengage Learning, 4th Edition, 2010 R2. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier, India, 2009. R3: Discrete mathematics for Computer Scientists and Mathematicians, Paperback (Rs. 533), Joel Mott, Abraham Kandel, Theodore Baker; Pearson Education India; 2 edition (2015), ISBN-13: 978-9332550490 Weblinks: W1: https://puniversity.informaticsglobal.com:2229/login.aspx W2: https://www.youtube.com/playlist?list=PLBlnK6fEyqRhqJPDXcvYlLfXPh37L89g3
Topics relevant to development of "SKILL": Mathematical Logic, Permutation and Combinations for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE225	Course Title: Introduction to Combinatorics and Graph Theory Type of Course:	L-T- P-C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	Discrete Mathematical Structures				
Anti-requisites	NIL				

Course Description	This course is a blend of the mathematical techniques applicable to Computer science, Information Technology and Statistics. Graph Theory gives us, both an easy way to pictorially represent many major mathematical results, and insights into the deep theories behind them. In this course, among other intriguing applications, we will see how GPS systems find shortest routes, how engineers design integrated circuits, how biologists assemble genomes, why a political map can always be colored using a few colors.
	Topics Include: Principles of Inclusion and Exclusion, Rook Polynomial, Derangements. Graph Theory: Graph Terminologies, Isomorphism, Coloring, Matching, Planar Graphs, Trees Terminologies, Traversals, Spanning Trees, Shortest path algorithms, Prefix Codes.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Introduction to Combinatorics and Graph Theory and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies.
Course Out Comes	On successful completion of the course the students shall be able to:
	CO1: Discuss the fundamental concepts of Graph theory, theorems of matching, connectivity, coloring, and planar graphs. [L2: Comprehension]
	CO2: Discuss different types of trees and traversal techniques. [L2: Comprehension]
	CO3: Apply different algorithms to find optimal path for a given graph. [L3: Applications]
	CO4: Application of different mathematical proofs techniques in proving theorems. [L3: Applications]

Module 1	Principles of Counting	Assignment and Quiz	Comprehension based Quizzes and Assignment	12 Sessions

The Principle of Inclusion and Exclusion, Generalizing Inclusion – Exclusion Principles, Derangements – Nothing is in its Right Place, First order and second order homogeneous recurrence relations – Non-homogeneous recurrence relations, Generating functions – Exponential generating function.

Module 2	Introduction to Graph Theory	Assignment and Quiz	Comprehension based Quizzes and Assignment	18 Sessions

Basic Concepts: definition, types of graphs, Graph Terminology and Special Types of Graph, representation of a graph and connectedness graph: (paths, walk. cycles, edge deleted and vertex deleted). Graph isomorphism, Eulerian graph, Hamiltonian graph, Planar graph (three utility problem), Graph traversal- BFS, DFS, Transport network-Max-flow/Min-cut algorithm ,Graph coloring.

Module 3	Trees	Assignment and Quiz	Comprehension based Quizzes and Assignment	18 Sessions

Tree: Definitions, properties, Binary search tree, Rooted trees-M-ary tree, weighted tree, Prefix code-Huffman code, Game Tree, Decision tree, Tree traversal: in-order, pre-order, post-order, infix, postfix, prefix, spanning tree,

Algorithm on networks: Shortest path algorithm- Dijikstra's algorithm, Minimal spanning tree-Kruskal algorithm and Prim's algorithm.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Text Book

K H Rosen, "Discrete Mathematics and its Application", McGraw Hill.

Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education. 2004.

References

1. Harris, Hirst amd Mossinghoff," Combinatorics and Graph theory", Springer. [R1]

2. Grimaldi," Graph Theory and Combinatorics", Pearson Education. [R2]

3. J Nestril and etal," Introduction to Discrete Mathematics", Oxford University Press. [R3]

Weblinks

https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to "SKILL DEVELOPMENT": Rooted trees-M-ary tree, weighted tree, Prefix code-Huffman code, Game Tree for Skill Development through Problem Solving Methodologies. This is attained through assessment component mentioned in the course handout.

Course Code:	Course Title: COMPUTER NETWORKS				
CSE 211	Type of Course: Program Core Theory	L-T-P- C	3-0	0	3

Version No.	2.0
Course Pre-requisites	Analog and digital signals, Number representation-binary, decimal, hexadecimal, Binary-Logical, Operations, Frequency, Amplitude and Phase, Knowledge about directed and undirected graphs and Basics of Communications.
Anti-requisites	NIL
Course Description	The main emphasis of this Course is on the organization and management of networks. The Course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and protocols, and gaining practical experience in the installation, monitoring, and troubleshooting of LAN systems.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of COMPUTER NETWORKS and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe The Basic Concepts Of Computer Networks And Reference Models. [Knowledge] CO2: Describe The Physical And Data Link Layer Functionalities. [Comprehension] CO3: Apply the knowledge of IP addressing and routing mechanisms to connect to a computer network. [Application] CO4:Explain The Functionalities Of Transport Layer And Application Layer.[Comprehension]
Course Content:	

Module 1	Introduction to data communication and computer networks:	Assignment	Knowledge	No. of Sessions:9
Topics: Introduction, Networks, Network Types, Internet History, Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Networking Devices				

Module 2	Physical And Data Link Layer	Assignment	Comprehension	No. of Sessions: 9

Topics: Data And Signals, Digital Signals, Transmission Impairment, Data Rate Limits: Noiseless Channel, Nyquist Bit Rate, Noisy Channel: Shannon Capacity Performance, Error – Detection And Correction – Parity, CRC, Flow Control And Error Control-Stop And Wait, Go Back-N ARQ, Selective Repeat ARQ, Sliding Window, MAC, Wired LAN Ethernet

Module 3	Network Layer:	Assignment	Application	No. of Sessions:12

Topics: Network Layer Services, Packet Switching, Ipv4 Addresses, IPv4 Header, Basic Routing Algorithm, Unicast Routing Protocols: Interior Gateway Protocols, Exterior Gateway Protocols, Introduction To Troubleshooting And The Future Of Networking, Ping: Internet Control Message Protocol, Traceroute, Ipv6 Headers, Transition From Ipv4 To Ipv6

Module 4	Transport layer and Application Layer	Assignment	Application	No. of Sessions: 12

Topics: Introduction To The Transport Layers, UDP, TCP, The Application Layer: Domain Name System (DNS), Domain Name Space, Name/Address Mapping, Telnet, SSH, HTTP, SMTP, FTP.

Text Books

Behrouz A. Forouzan, Data Communications and Networking , 4th Edition, Tata McGraw-Hill, 2013.

References

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.

2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

E-references

https://nptel.ac.in/courses/106105183

Topics relevant to "SKILL DEVELOPMENT": Domain Name Space, Name/Address Mapping for Skill Development through Participative Learning. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE255	Course Title: ANALYSIS OF ALGORITHMS LAB Type of Course: Practical	L- T-P-C	0	0	2	1
Version No.	2.0					
Course Pre-requisites	Meaning of Analysis and various analysis and its extension, Mathematical Induction and its importance to analysis of Algorithms, Introduction to Pseudo code, Knowledge of Recursive and Non Recursive algorithms.					
Anti-requisites						
Course Description	This Course introduces techniques for the design and analysis of efficient algorithms and methods of applications. It deals with analyzing time and space complexity of algorithms, and to evaluate trade-offs between different algorithms. Topics include: Brute force- Bubble sort, linear search, Divide-and-conquer- Merge sort, Quick sort. Dynamic programming and greedy technique- Prim's, Kruskal's, Dijkstra's Algorithm, Warshall's algorithm, Floy'd algorithm, Coin changing problem, Multi stage graph – Optimal Binary Search Trees ,Backtracking – N Queens Problem, Hamiltonian Path Problem, M Coloring Problem. Backtracking.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Analysis of Algorithms Lab and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: Compute time complexities for various Recursive and non-recursive Algorithms [Application]. Demonstrate the Brute Force Technique for real world problems [Application] Apply divide and conquer technique for searching and sorting [Application] Demonstrate the Dynamic Programming and Greedy Algorithms for various applications [Application]					
Course Content:	Non-recursive algorithms: Factorial, Max. Recursive algorithms: Factorial, GCD, Search, Tower of Hanoi. Brute Force Technique: Bubble sort, Linear Search. Divide and Conquer: merge sort, quick sort.					

	Dynamic programming: Coin changing problem, Multi stage graph – Optimal Binary Search Trees ,The knapsack problem, Warshall's Algorithm, Floyd's Algorithm.
	The Greedy Method: Prim's and Kruskal's algorithm to find Minimum Spanning Tree, Single source shortest path (Djikstra's Algorithm), Boolean Satisfiability Problem (SAT).
	Hamiltonian Path Problem, M Coloring Problem.
	Backtracking: N-Queens problem.

List of Laboratory Tasks

Apply non recursive algorithmic designing technique to solve Factorial of a number, Linear Search , finding max element problem and calculate the time efficiency (best, average & worst).

Apply recursive algorithmic designing technique to solve Factorial, GCD, , Tower of Hanoi, problems and calculate time (Best, average & worst) efficiency.

Apply Brute force algorithmic designing technique to sort elements using bubble sort algorithm and calculate time (Best, average & worst) efficiency.

Apply divide and conquer algorithmic designing technique to sort elements using merge sort algorithm and calculate time (Best, average & worst) efficiency.

Apply divide and conquer algorithmic designing technique to sort elements using Quick sort algorithm and calculate time (Best, average & worst) efficiency

Apply dynamic programming algorithmic designing technique to find All pair Shortest Path for a given graph using Floyds and Warshall's algorithm

Apply dynamic programming algorithmic designing technique for Solving 0/1 knapsack problem and find its efficiency.

Apply dynamic programming algorithmic designing technique for Solving Coin changing problem and find its efficiency.

Apply dynamic programming algorithmic designing technique to find Optimal Binary Search Trees.

Apply greedy algorithmic designing technique for constructing MST for a given graph using prim's algorithm

Apply greedy algorithmic designing technique for constructing minimum spanning tree using Kruskal's algorithm

Apply backtracking algorithmic designing technique for M Coloring Problem

Apply backtracking algorithmic designing technique for solving queen's problems for 4, 8 and 16 inputs.

Targeted Application & Tools that can be used:

Social media networks, GPS applications, Google search, e-commerce platforms, Netflix recommendation systems, etc.

Text Book Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI Learning Private Limited.
References Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd edition. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson E-Resources NPTEL course – https://nptel.ac.in/courses/106106131
Topics relevant to the development of SKILLS: Quick sort The knapsack problem Warshall's Algorithm Floyd's Algorithm. Prim's and Kruskal's algorithm to find Minimum Spanning Tree Single source shortest path (Dijkstra's Algorithm). Backtracking: N-Queens problem. for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE218	Course Title: Human-Computer Interaction Type of Course: Theory Only	L- T- P- C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Basic knowledge of HTML and web design					
Anti-requisites						
Course Description	This course highlights the fundamental theories to introduce students about the basic concepts of human-computer interaction. It will cover the theory and methods that exist in the field. Human-computer interaction is an interdisciplinary field that integrates theories and methodologies from computer science, cognitive psychology, design, and many other areas. It stresses the importance of good interfaces and the relationship of interface design to effective human interaction with computers. It helps in categorizing the interfaces based on the processes, methods and programming used. It focuses on applications of emerging fields in human computer interaction.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Human Computer Interaction and attain Skill Development through Participative Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Identify the factors influencing user interfaces; [Knowledge] 2) Apply guidelines, principles, theories and methodologies for designing interfaces; [Application] 3) Select user interfaces based on interface design evaluation. [Comprehension] 4) Identify the applications of emerging fields in human computer interaction; [Comprehension]					
Course Content:						
Module 1	Introduction to HCI		Knowledge			20 Sessions
Introduction to HCI – Importance of HCI - Human Perception - Input output channels, Human memory, Thinking: Reasoning and problem solving, Emotion, Psychology and the design of						

interactive systems – Cognition – Cognitive frameworks – Models of interaction, Frameworks and HCI – Ergonomics – Universal usability.

Module 2	Interface design	Application		10 Sessions

Good and Bad design – Interaction design – Guidelines – Principles – Theories – The process of design –Prototyping and Construction - Conceptual design – Physical design – The four pillars of design – Development methodologies – Participatory design – Scenarios development – Social impact statement for early design review – Legal issues.

Module 3	Evaluating interface design	Comprehension		11 Sessions

Evaluating interface design – Evaluation, Goals of evaluation, Expert Reviews, Usability testing and Laboratories, Survey Instruments, Acceptance Tests, evaluating during Active Use, Controlled Psychologically Oriented Experiments, Choosing an evaluation method, Natural Language in Computing

Module 4	Information presentation	Term paper/Assignment	Comprehension	9 Sessions

Information presentation – Data type by task taxonomy, Challenges for Information Visualization – Groupware – Goals of collaboration and participation, Asynchronous distributed interfaces, Synchronous distributed interfaces, Face to Face interfaces - Speech and auditory interfaces – Multi modal interaction - Design for diversity – Graphical user interfaces – The web mobile devices.

Targeted Application & Tools that can be used:

Assignment:

Explain the role of cognition in human computer interaction.

Explain any three expert review methods

Text Book

T1. Ben Shneiderman and Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 6th Edition, Pearson Addison Wesley, 2016.

T2. Dix A. et al. "Human-Computer Interaction", 3rd Edition, Pearson Prentice Hall, 2004.

References

R1. Yvonne Rogers, Helen sharp, Jenny Preece, "Interaction Design: Beyond Human Computer Interaction", 5th Edition, Wiley, 2019.

R2. The Essentials of Interaction Design, Fourth Edition by Cooper, Reimann, Cronin, & Noessel (2014).

E-Resources

Topics relevant to the development of SKILLS:

Screen navigation and flow

Statistical graphics

Human interaction speeds

Icons and increases – Multimedia

for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:\nCSE325	Course Title: Introduction to Bioinformatics\nType of Course: General CSE Basket, Theory based	L-T- P-C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	Basics of Biology, basics of Computers.				
Anti-requisites	NIL				
Course Description	This course is designed to provide the knowledge of the concepts related to bioinformatics. The course is aimed at understanding the DNA and Protein sequences and databases. It also deals with Pairwise comparison and calculating the scoring matrix. Further, it focuses on Sequence Alignment techniques, discovering the Motifs in the sequence. Students will also learn the overview of Structural Bioinformatics and Genome sequencing.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Introduction to Bioinformatics and attain Employability through Participative Learning techniques.				
Course Outcomes	C.O.1: Understand the DNA Protein sequence and structures. (Bloom's Level: Knowledge)\n\nC.O.2: Explain the file formats and sequence alignments of DNA sequence. (Bloom's Level: Comprehension)\n\nC.O.3: Apply the techniques of the motifs discovery for the analysis of Protein Sequence. (Bloom's Level: Application)				
Course Content:					

Module 1	Fundamentals of Bioinformatics	Quiz	Comprehension based Quizzes and assignments;	9 Classes

Topics:

Introduction to Bioinformatics: Introduction to molecular biology, Cell, DNA, RNA, Transcription, Translation, Folding, Gene Structure, Introduction to Bioinformatics, Components and fields of bioinformatics, Omics, basic principles of structural/functional analysis of biological molecules, Biological Data Acquisition, Types of DNA sequences,Genomic DNA ,Mitochondrial DNA,DNA Sequencing tools, Protein sequencing and structure determination methods, Finding Reverse complement of a sequence.

Module 2	Genome databases and Sequence Similarity	Quizzes and assignments	Comprehension based Quizzes and assignments	8 Classes

Topics:

Types and classification of genome databases, DNA sequence retrieval system, various DNA and protein sequence file formats, Common sequence file formats; Files for multiple sequence alignment; Files for structural data, Frequent words and k-mers in Text, String Reconstruction problem, Sequence Similarity searching, Sequence Similarity searching tools, NCBI BLAST, PSI BLAST, Significance of sequence alignments, Alignment scores and gap penalties.

Module 3	DNA sequence analysis and applications	Quizzes and assignments	Comprehension based Quizzes and assignments	10 Classes

Sequence similarity searches and alignment tools, Finding alignment using Needleman-Wunsch and Smith-Waterman algorithm, Heuristic Methods of sequence alignment, Pair-wise and multiple sequence alignments, DNA sequence analysis, Motif in protein sequence ,Motif discovery using Gibbs sampling,Motif finding, Gene Prediction models: Hidden Markov model(HMM), Generalized Hidden Markov model(GHMM), Bayesian method.

Targeted Application & Tools that can be used:

  BLAST, FastA, , ClustalW, MEGA

Project work/Assignment:

Each batch of students (self-selected batch mates – up to 4 in a batch) will be allocated case studies/assignments

Textbook(s):

1. Bioinformatics: Sequence and Genome Analysis, David W. Mount, Cold Spring Harbor Laboratory Press, 2004.

2. Introduction to Bioinformatics, Arthur Lesk, Fifth Edition, Oxford University Press, 2019

References

1. Bioinformatics Methods and Applications, S. C. Rastogi, N.Mendiratta, P.Rastogi, Fourth Edition, Prentice Hall India.

2.Bioinformatics Algorithms- An Active Learning Approach, Phillip Compeau & Pavel Pevzner, 2nd Edition, Vol. I & II, Active Learning Publishers, 2015

E-References

1. https://puniversity.informaticsglobal.com:2229/login.aspx

Topics related to development of "Employability skills": Batch wise presentations on selected topics

String Reconstruction problem

Sequence Similarity searching

Alignment scores and gap penalties

Protein sequencing

Gene Prediction models: Hidden Markov model(HMM)

Finding similarities by performing pairwise and multiple sequence alignment,

Evaluating phylogenetic trees.

for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE396	Course Title: Software Testing and Quality assurance Type of Course: Lab Integrated	L- T-P-C	2	0	2	3
Version No.	2.0					
Course Pre-requisites	Basic knowledge of software engineering and programming knowledge					
Anti-requisites						
Course Description	This Course is designed to make the students understand the strategies, methods and technologies of software testing effectively. It aims at Designing test plans and test cases, doing automatic testing; reporting on software defects; assessing the software product correctly; and distinguish the relationship between software testing and quality assurance. In addition,					

| | students are expected to do a group assignment on software testing tools of their choice.

Topics include: Testing techniques, integration, code inspection, peer reviews, verification and validation, statistical testing methods, preventing and detecting errors, selecting and implementing project metrics, and defining test plans and strategies that map to system requirements. Testing principles, formal models of testing, all aspects of quality assurance, performance measuring and monitoring. | | | |
|---|---|---|---|---|
| Course Objective | This course is designed to develop ENTREPRENEURIAL SKILLS by using EXPERIENTIAL
LEARNING Techniques. | | | |
| Course

Outcomes | On successful completion of the course the students shall be able to:

1.   Describe the fundamentals of software testing for Quality assurance

2.   Select the appropriate Testing type to test Applications/Softwares

3.   Report the bugs found in Testing | | | |
| Course Content: | | | | |
| Module 1 | Basics of software testing | Knowledge | | 8 Sessions |
| Phases of Software Project, Quality, Quality assurance and Quality Control, Testing, Verification and Validation, Life Cycle Models. Software Testing life Cycle (STLC) | | | | |
| Module 2 | Types of testing | Comprehension | | 10 Sessions |
| Introduction to White Box Testing, Static Testing, structural Testing. Challenges in White Box Testing, Fundamentals of Black Box Testing, When and How to do Black Box Testing. Problems on Boundary value Analysis. Equivalence Partition ,Problems on Equivalence Partition | | | | |
| Module 3 | TYPES OF TESTING, continued | Comprehension | | 12 Sessions |
| Integration Testing overview, Integration Testing as a Phase of Testing, Defect Bash

System Testing Overview, Functional and Non-Functional Testing, Acceptance Testing. Compatibility Testing , Stress and Interoperability Testing , Test case Preparation. | | | | |
| Module 4 | Specialized testing techniques | Comprehension | | 9 Sessions |
| Performance Testing, Regression Testing, Internationalization Testing, Ad-hoc testing | | | | |

Defect Life Cycle, Bug Reporting, Basics of Software Test Automation, Metrics, Metrics Types, Project Metrics.
Targeted Application & Tools that can be used: MS office
Assignment: Writing Test Cases and Bug Reports for simple Applications
Text Book 1. . Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education
References 1 Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Pearson Education. 2. KshirasagarNaik, PriyadarshiTripathy "Software Testing and Quality Assurance Theory and Practice", Wiley and sons. E-Resources https://puniversity.informaticsglobal.com:2229/login.aspx
Topics relevant to "EMPLOYABILITY SKILLS": Black Box testing White Box Testing Test Case preparations Bug Reports for developing Entrepreneurial Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 299	Course Title: Data Analytics using R Type of Course: Integrated	L-T- P-C	2-0	2	3
Version No.	2.0				
Course Pre-requisites	Fundamentals of Computers and Basic Knowledge of Statistics.				
Anti-requisites	NIL				

Course Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tool in the world.			
Course Objective	This course is designed to develop ENTREPRENEURIAL SKILLS by using EXPERIENTIAL LEARNING Techniques			
Course Outcomes	On successful completion of this course the students shall be able to: 1). Apply basic R functions pertaining to fundamental data analysis. [Application] 2). Interpret data using appropriate statistical methods. [Application] 3). Demonstrate the decision trees concept with the given dataset. [Application] 4). Demonstrate the Mining concepts for both Data and Text. [Application]			
Course Content:				
Module 1	Introduction to Data Analysis and R	Quiz	Coding Assignment	6 Sessions
Topics: Introduction to R, Overview of data analysis, Working with Directory in R, Loading and Handling data in R, Exploring Data in R, Classification of Data: Structured, Semi-Structured, Applications of Data Analytics, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages.				
Module 2	Exploratory Data Analytics	Coding Assignment	Case Study	11 Sessions
Topics: Exploring a new dataset, Anomalies in numerical data, Visualizing relations between variables, Analysis of Variance and Correlation, Data Transformation, Merging Data Frames, Outlier Detection, Combining multiple vectors, Assumptions of Linear Regression, Simple and multi linear regression, KNN, Support Vector Machine, Logistic Regression, PCA.				
Module 3	Decision Tree and Clustering	Coding Assignment	Project	12 Sessions
Topics:				

What is Decision Tree, Decision Tree Representation in R, Basic Decision Tree Learning Algorithm, Measuring Features, Issues in Decision Tree Learning, performance evaluation of Decision tree. Basic concepts of Clustering, Hierarchical Clustering, k-means Algorithm, CURE Algorithm.

Module 4	Association Rules and Text Mining	Quiz	Project	8 Sessions

Topics:

Frequent Itemset, Mining Algorithm Interfaces, Distance-based Clustering Transaction and Associations, Definition of Text Mining, A few Challenges in Text Mining, Text Mining Vs Data Mining, Text Mining in R, Core Text Mining Operations.

Targeted Application & Tools that can be used:

Tools: RStudio / Google Colab

Project work/Test:

During the course, students would need to do coding assignments to learn to train and use different models. Sample coding assignments include:

Analysis of Sales Report of a Clothes Manufacturing Outlet.

Comcast Telecom Consumer Complaints.

Web Data Anslysis

Text Book(s):

Data Analytics Using R – Seema Acharya, Mc Graw Hill.

Reference(s):

Exploratory Data Analytics Using R, Ronald K Pearson, CRC Press

Web link(s):

https://r4ds.had.co.nz/

https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to "Entrepreneurial SKILLS":

Linear Regression

Logistic Regression

K-means Algorithm

Hierarchical clustering

CURE Algorithm

Decision Tree Learning

for developing Entrepreneurial Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CAI3427	Course Title: Language Models for Text Mining Type of Course: Discipline Elective - Theory & Integrated Laboratory	L-T-P-C	2	0	0	2
Version No.	1.0					
Course Pre-requisites	CSE3001 – Artificial Intelligence and Machine Learning					
Anti-requisites	NIL					
Course Description	This course introduces the basics of Text Mining and Natural Language Processing. The course will teach students different concepts such as text mining, NLP, Sequence Labeling, etc. Topics: Text Mining, NLP, Tokenization, Lemmatization, Stemming, One-hot encoding, Language modelling, Bag-of-words, Term-document Matrix, Cosine similarity, Viterbi Algorithm, etc.					
Course Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 5. **Process** text data to derive information from text. [Apply] 6. **Apply** insights from textual information to real-world business. [Apply] 7. **Develop** solutions for a particular NLP problem using different machine learning and deep learning techniques. [Apply] 8. **Utilize** different NLP tools and packages. [Apply]					

Course Content:

Module 1	Text Mining	Adversarial Quiz Tests	Module Tests	No. of Sessions: 09
Introduction to Text Mining. Text Mining vs. NLP. Text Mining Algorithms. Steps in Text Mining - Extraction, Preprocessing, Analysis and Evaluation. Lexical Resource Creation (NEW). Data collection. String Manipulation to Clean Data. Natural Language Processing. Research Paradigms in NLP. Sequential Data. Sequence Labeling (NEW). Viterbi Algorithm (NEW). Corpus. Building a HMM using a Corpus (NEW). Unknown word handling (NEW).				
Module 2	Text Preprocessing	Adversarial Quiz Tests	Module Tests	No. of sessions: 06

Introduction to Preprocessing. Tokenization. Stop Words Removal. Lemmatization and Stemming. PoS Tagging. Integer Encoding. Padding. One-Hot Encoding.				
Module 3	**Text Representations**	**Adversarial Quiz Tests**	**Module Tests**	**No. of sessions: 08**
Language Modeling. N-Gram Language Model. Bag-of-Words Model. Term-Document Matrix. Term Frequency. Inverse Document Frequency. TF-IDF. Cosine Similarity. Naive Bayes Classifier using Bag-of-Words. Topic Modeling. Latent Semantic Analysis. Singular Value Decomposition. Truncated SVD and Topic Vector. LDA Algorithm.				
Module 4	**Natural Language Processing with Keras**	**Adversarial Quiz Tests**	**Module Tests**	**No. of Sessions: 06**
Word Embeddings vs. One-Hot Encoding. Contextual Bag of Words (CBOW). Skipgram. Deep Learning for Document Classification.				

List of Laboratory Tasks:

Experiment No. 1: File Handling
Level 1: Read text files using Python and extract meaningful content.
Level 2: Parse text files using Python to preprocess the data for NLP tasks.

Experiment No. 2: Introduction to NLP Tools
Level 1: Install and use NLTK for basic text processing.
Level 2: Install and use SpaCy for tokenization, PoS tagging, and Named Entity Recognition.

Experiment No. 3: Corpus Cleaning Techniques
Level 1: Use NLTK for corpus cleaning techniques such as tokenization, stopword removal, and stemming.
Level 2: Prepare cleaned text data for downstream NLP tasks like classification or translation.

Experiment No. 4: Word Vector Usage
Level 1: Download and use pre-trained word vectors (e.g., Word2Vec, GloVe, or FastText).
Level 2: Compute similarity between two words, find the most similar word, and complete word analogies (e.g., king - man + woman = queen).

Experiment No. 5 & 6: Language Identification
Level 1: Build a simple language identifier using Bag-of-Words (BoW) features.
Level 2: Predict the language of a given text using the trained model.

Experiment No. 7 & 8: Lexical Simplification
Level 1: Implement a lexical simplifier to replace complex words with simpler alternatives.
Level 2: Generate a simplified version of a given word or sentence while preserving meaning.

Experiment No. 9 & 10: Sentiment Analysis

Level 1: Implement a basic sentiment classifier using a lexicon-based or machine learning approach.
Level 2: Compare the performance of an existing sentiment classifier (e.g., VADER, TextBlob, or a pre-trained Transformer model).

Experiment No. 11: Named Entity Recognition (NER)
Level 1: Extract named entities from a text using NLTK.
Level 2: Extract named entities using SpaCy and compare results.

Experiment No. 12 & 13: Implement a Hidden Markov Model (HMM)
Level 1: Implement a generic HMM for sequence prediction.
Level 2: Calculate the forward probability of a given sequence using HMM.

Experiment No. 14: Linguistic HMM
Level 1: Develop a Hidden Markov Model (HMM) for NLP tasks such as PoS tagging.
Level 2: Evaluate the performance of the HMM on a specific NLP task (e.g., Named Entity Recognition or Chunking).

Experiment No. 15: Machine Translation
Level 1: Implement Machine Translation (MT) using a pre-trained model from Hugging Face Transformers.
Level 2: Evaluate the quality of MT output via Round-Trip Translation (translate text to another language and back to check accuracy).

Targeted Application & Tools that can be used:
3. Google Colab
4. Python IDEs like PyCharm

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
2. Group project on some NLP Task like text classification (Creating a Simple Text Classifier: Use Scikit-learn to classify positive vs. negative reviews from a dataset), sentiment analysis, etc.

Textbook(s):
3. Daniel Jurafsky, James H. Martin. "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech, Pearson Publication, 2025 (3rd Edition Draft).
4. Aditya Joshi, Pushpak Bhattacharyya. "Natural Language Processing", Wiley Publication, 2023 (1st Edition).

References:
R1. Chris Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", 1st Edition, MIT Press. 1999.

R2. Pawan Goyal. "Natural Language Processing". 1st Edition, 2016.

Weblinks
W1. E-Book link or R2: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view
W2. Web Resource for T1: https://web.stanford.edu/~jurafsky/slp3/ - VERY VERY IMPORTANT!!!
W3. NPTEL Courses: https://nptel.ac.in/courses/106106211 CMI), https://nptel.ac.in/courses/106105158 (IIT Kgp), https://nptel.ac.in/courses/106101007 (IITB), https://nptel.ac.in/courses/106105572 (IIT Kgp - NEW)

Course Code: CAI3428	Course Title: Practical Deep Learning with TensorFlow Type of Course: Discipline Elective - Theory & Integrated Laboratory		L- T-P- C	2	0	2	3
Version No.	1.0						
Course Pre-requisites	CSE 3001-Artificial Intelligence and Machine Learning						
Anti-requisites	NIL						
Course Description	This course introduces students to the concepts of deep neural networks and state of the art approaches to develop deep learning models. In this course students will be given an exposure to the details of neural networks as well as deep learning architectures and to develop end-to-end models for such tasks. It will help to design and develop an application-specific deep learning models and also provide the practical knowledge handling and analyzing end user realistic applications.						
Course Objective	This course is designed to improve the learners <u>EMPLOYABILITY SKILLS</u> by using <u>EXPERIENTIAL LEARNING</u> techniques.						
Course Outcomes	On successful completion of this course the students shall be able to: 4. Implement backpropagation and gradient descent techniques to train neural networks effectively. (Apply) 5. Build and train deep learning models using Python libraries such as TensorFlow and Keras for real-world applications. (Apply) 6. Utilize deep learning techniques for image classification, object detection, sentiment analysis, and language modeling. (Apply)						
Course Content:							
Module 1	**Basics of Neural Networks**	Assignment				**18[8L+10P] Sessions**	
Topics: Understanding Perceptron with Excel, Understanding Multilayer Perceptron with Excel, From Multilayer Perceptron to Deep Learning, Error Backpropagation and Gradient Descent to reduce errors, Activation Functions, Deep Learning, Problems with Deep Learning with solutions.							
Module 2	**TensorFlow Basics**	Assignment				**14[7L+7P] Sessions**	

Topics: Introduction to TensorFlow, TensorFlow dataset, Machine Learning with TensorFlow				
Module 3	**Deep Learning methods with Tensor Flow and Keras**	Assignment		**14[6L+8P] Sessions**

Topics:

Main Features of TensorFlow, Keras basics, AI with Keras.

Project work/Assignment:
3. **Assignment 1 on (Module 1 and Module 2)**
4. **Assignment 2 on (Module 3)**

List of Laboratory Tasks:

Lab 1: Working with Deep Learning Frameworks

Objective: Explore various Deep Learning Frameworks

Tasks: Identify deep learning frameworks (Keras, Tensorflow, Matplotlib, etc)

Activity: Practice with various methods available in DL Frameworks to develop a Model.

Lab 2: Build a Basic Artificial Neural Network

Objective: Create a ANN with DL frameworks.

Task: Identify suitable ANN Layers using Keras and Tensorflow.

Activity: Design a basic Artificial Neural Networks using Keras with TensorFlow (pima-indians-diabetes)

Lab 3: Build a MultiLayer Perceptron

Objective: Create a MLP for classification task.

Task: Identify suitable model for house price prediction.

Activity: Design a MLP for implementing classification and fine-tuning using House price.csv

Lab 4: Create a Tensor in TensorFlow using List or Numpy array.

Objective: To understand how to create a tensor in TensorFlow using a Python list or NumPy array

Task: Create a simple tensor using both a Python list and a NumPy array in TensorFlow.

Activity: Create a tensor using a Python list and Numpy array

Lab 5: Apply math operations on tensor using various mathematical functions.

Objective: To learn how to apply mathematical operations on tensors using various TensorFlow mathematical functions.

Task: Perform basic mathematical operations (addition, subtraction, multiplication, division) and advanced functions (square, square root, exponential) on tensors.

Activity: Perform basic math operations: Add, Subtract, Multiply, Divide and Apply advanced math functions: Square, Square root, Exponential.

Lab 6: Connecting two tensors in dataset.

Objective: Combine two tensors using concatenation and stacking operations in TensorFlow.

Task: Combine two tensors using concatenation and stacking operations in TensorFlow

Activity: Concatenate them along a specific axis and Stack them along a new axis.

Lab 7: Building dataset from a file stored in a local drive

Objective: To learn how to build a dataset in TensorFlow from a file stored in a local drive.

Task: Load a dataset from a CSV file stored on the local drive and process it using TensorFlow

Activity: Load the file using TensorFlow's tf.data API and Process the dataset (e.g., convert it into tensors)

Lab 8: Loading Dataset from TensorFlow.dataset Library

Objective: To learn how to load a dataset from the tensorflow_datasets library and use it in machine learning models.

Task: Load a dataset from TensorFlow Datasets (tfds), preprocess it, and display sample data

Activity: Load a dataset (e.g., MNIST, CIFAR-10, IMDB Reviews) and Split the dataset into training and testing sets.

Lab 9: Build a Convolutional Neural Network

Objective: Create a CNN model.

Task: Build CNN architecture for Dog-Cat classification problem.

Activity: Implement a Convolution Neural Network (CNN) for dog/cat classification problem using keras.

Lab 10: **Build a Time-Series Model**

Objective: Create a RNN and LSTM Model

Task: Build RNN/LSTM Model for predicting time series data.

Activity Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes.

REFERENCE MATERIALS:

 TEXTBOOKS

3. François Chollet, "Deep Learning with Python", 2nd Edition, Manning Publications, 2022
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.

REFERENCES

4. Amlan Chakrabarti Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra , "Deep Learning", Pearson Publication, 2021.
5. David Foster, "Generative Deep Learning" O'Reilly Publishers, 2020.
6. John D Kellehar, "Deep Learning", MIT Press, 2020.

JOURNALS/MAGAZINES

1.   IEEE Transactions on Neural Networks and Learning Systems
    https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385
2.   IEEE Transactions on Pattern Analysis and Machine Intelligence
    https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_papers/IT032.pdf
3. International   Journal   of   Intelligent   Systems
    https://onlinelibrary.wiley.com/journal/1098111x

SWAYAM/NPTEL/MOOCs:

4. Swayam   Nptel – Deep   Learning – IIT   Ropar
    https://onlinecourses.nptel.ac.in/noc21_cs35/preview
5. Coursera – Neural Networks and Deep Learning Andrew Ng
6. Coursera - Neural Networks for Machine Learning by Geoffrey Hinton in Coursera

Course Code: UG COURSE: CAI3429	Course Title: Deep Learning for Computer Vision Type of Course: Discipline Elective - Theory & Integrated Laboratory	L~T~ P~C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	MAT1003 Applied Statistics, Knowledge of Python, Machine Learning, and Digital image processing					
Anti-requisites	NIL					
Course Description	This course covers the fundamentals and advanced concepts of deep learning for computer vision applications. Students will explore convolutional neural networks (CNNs), object detection, image segmentation, and generative models. Hands-on lab experiments will reinforce theoretical concepts using frameworks like TensorFlow and PyTorch.					
Course Out Comes	**On successful completion of the course the students shall be able to:** 5. Understand the Fundamentals of Deep Learning for Vision Explain the core concepts of neural networks and deep learning architectures for image processing. Implement and optimize convolutional neural networks (CNNs) for classification tasks. 6. Apply Object Detection and Image Segmentation Techniques Implement and analyze state-of-the-art object detection algorithms such as YOLO, Faster R-CNN, and SSD. Develop and evaluate image segmentation models like U-Net and Mask R-CNN. 7. Explore Advanced Deep Learning Techniques for Vision Utilize Vision Transformers (ViTs) and attention mechanisms for image classification. Generate and manipulate images using Generative Adversarial Networks (GANs). 8. **Deploy and Optimize Deep Learning Models for Real-World Applications**					
Course Content:						
Module 1	Fundamentals of Deep Learning for Vision	Assignment	Practical		No. of Classes:8	

Introduction to Deep Learning & Neural Networks, Convolutional Neural Networks (CNNs) Architecture Backpropagation & Optimization in CNNs, Transfer Learning & Pretrained Models.				
Module 2	Object Detection & Image Segmentation	Assignment	Practical	No. of Classes:14
Introduction to Object Detection (R-CNN, SSD, YOLO), Region Proposal Networks (Faster R-CNN) Semantic & Instance Segmentation (U-Net, Mask R-CNN), Real-time Object Detection Applications				
Module 3	Advanced Topics in Vision	Assignment	Practical	No. of Classes:8
Attention Mechanisms & Vision Transformers (ViTs), Generative Adversarial Networks (GANs) for Image Generation, Self-supervised Learning for Vision, Multi-modal Learning (CLIP, DALL·E)				
Module 4	Applications & Deployment	Assignment	Practical	No. of Classes:8
Edge AI & Mobile Deployment (TensorFlow Lite, ONNX), Adversarial Attacks & Robustness in Vision Models, Explainability & Interpretability of Vision Models, Case Studies & Industry Applications				

Lab Experiments are to be conducted on the following topics:-

Lab Sheet 1:

Keras Sequential API model

6. Read in the data and explore
7. Define a Sequential API model
8. Define the hyperparameters and optimizer
9. Train the model and visualize the history
10. Testing

Keras Functional API model:

3. Define a Functional API model
4. Train the model and visualize the history

Lab Sheet 2:
Softmax regression with Keras
6. Read in the data and prepare
7. Define a Sequential API model
8. Define the hyperparameters and optimizer
9. Train the model and visualize the history
10. Testing

Lab Sheet 3:
Convolutional Neural Network with Keras (grayscale images)
8. Read in the data:

9. Visualize the data:
10. Prepare the data:
11. Define a CNN model:
12. Define the hyperparameters and optimizer:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 4:
Convolutional Neural Network with Keras (color images):
11. Read in the data:
12. Visualize the data:
13. Prepare the data:
14. Define a CNN model:
15. Define the hyperparameters and optimizer:
16. Train the model and visualize the history:
17. Testing:

Lab Sheet 5:
Time series and prediction:
3. Read in the data and explore:
4. Apply the exponential smoothing method and predict

Recurrent neural network (RNN):
5. Pre-processing:
6. Do the necessary definitions: (Hyper parameters, Model,
7. Train the model:
8. Predict the future:

Lab Sheet 6:
Document classification with LSTM network:
8. Read in the data:
9. Explore the data:
10. Data preprocessing:
11. Define the model:
12. Define the optimizer and compile:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 7:
Document classification with LSTM network (Binary):
8. Read in the data:
9. Explore the data:
10. Data preprocessing:
11. Define the model:
12. Define the optimizer and compile:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 8:
Document classification with LSTM + CNN network (Binary):
8. Read in the data:
9. Explore the data:

10. Data preprocessing:
11. Define the model:
12. Define the optimizer and compile:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 9:

Softmax regression to recognize the handswritten digits:
5. Download the MNIST data:
6. Take a look at the dataset:
7. Do the necessary definitions:
8. Training and Testing:

Multi-layer neural network to recognize the handswritten digits:
4. Download the MNIST data:
5. Take a look at the dataset:
6. Do the necessary definitions:

Training and Testing:

Lab Sheet 10:

Object Detection using YOLOv5

Lab Sheet 11:

Image Segmentation using U-Net
Custom Object Detection using Faster R-CNN

Lab Sheet 12:

Implementing Vision Transformers for Image Classification
Generating Images using GANs (DCGAN, StyleGAN)

(Group Project)

18. Object Detection and Recognition:
    a. Haar cascade object detection (e.g., face detection or object detection using pre-trained classifiers).
    b. Feature-based object detection using techniques like Speeded-Up Robust Features (SURF) or Scale-Invariant Feature Transform (SIFT).
    c. Deep learning-based object detection using Convolutional Neural Networks (CNNs) or You Only Look Once (YOLO) algorithm.
19. Optical Character Recognition (OCR):
    a. Preprocessing of text images (e.g., binarization, noise removal, or skew correction).
    b. Text localization using techniques like connected component analysis or Stroke Width Transform (SWT).
    c. Character recognition using machine learning algorithms like Support Vector Machines (SVM) or Convolutional Neural Networks (CNNs).
20. Gesture Recognition:
    a. Hand segmentation using techniques like background subtraction or skin color detection.
    b. Feature extraction from hand regions (e.g., finger counting, hand shape descriptors).
    c. Classification of gestures using machine learning algorithms (e.g., k-Nearest Neighbors or Support Vector Machines).

Tools/Software Required :
4. OpenCV 4
5. Python 3.7
6. MATLAB

Text Books
9. "Deep Learning for Computer Vision Image Classification, Object Detection and Face Recognition in Python" **Jason Brownlee (2019)**

10. "Deep Learning for Computer Vision with python" **Adrian Rosebrock (2017)**

References
11. **Goodfellow, I., Bengio, Y., & Courville, A. (2016).** *Deep Learning.* MIT Press.

    A foundational book covering deep learning principles, including CNNs, optimization, and generative models.

12. **Raschka, S., & Mirjalili, V. (2022).** *Machine Learning with PyTorch and Scikit-Learn.* Packt Publishing.

    Covers practical deep learning techniques using PyTorch, including CNNs and transfer learning.

13. **Geron, A. (2022).** *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Edition).* O'Reilly Media.

    Provides hands-on implementations of deep learning for computer vision using TensorFlow and Keras.

14. **Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J. (2021).** *Dive into Deep Learning.* Available online (https://d2l.ai).

    Open-access book covering CNNs, object detection, and advanced vision techniques with PyTorch and TensorFlow.

15. **Chollet, F. (2021).** *Deep Learning with Python (2nd Edition).* Manning Publications.

    Explains deep learning fundamentals and applications with Keras, including image classification and segmentation.

16. **Ballé, J., Laparra, V., & Simoncelli, E. P. (2017).** *Deep Learning for Computer Vision: A Brief Introduction.*

    A concise introduction to CNNs, object detection, and generative models.

Course Code: CSE3006	Course Title: Artificial Intelligence and Neural Networks			3 -0	0	3
	Type of Course: Theory only	L-T- P- C				
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This Course highlights the basic principles in Artificial Intelligence. It will cover representation schemes, problem solving paradigms, , search strategies, knowledge representation, probabilistic reasoning, elements of Artificial Neural Network. Topics include: AI methodology and fundamentals, intelligent agents, search algorithms, game playing, probabilistic reasoning in AI, Elements of Artificial Neural Network, models of neuron, architecture and learning laws. Several assignments will be given to enable the student to gain practical experience in using these techniques.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Artificial Intelligence and Neural Networks and attain EMPLOYABILITY SKILLS through PROBLEM SOLVING techniques					
Course Out Comes	On successful completion of the course the students shall be able to: CO 1: Apply techniques of Knowledge Representation [Application] CO 2: Apply Artificial Intelligence techniques for problem solving [Application] CO3: Understand the models of Neuron [Knowledge] CO4: Explain the basic elements of Artificial Neural Network [Comprehension]					
Course Content:						
Module 1	Introduction to Artificial Intelligence and Knowledge Based Systems	Assignment	Theory		14 Sessions	

Topics: Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agent, Structure of Intelligent agent and its functions; Introduction to Knowledge representation, approaches, Knowledge-Based Systems;Frame Structures, Conceptual graphs. Logic- Propositional Logic, First order Logic				
Module 2	Problem Solving by Searching	Assignment	Theory	13 Sessions
Topics: Introduction to Problem space and state space, State space search techniques solving problems by searching: Classical Search, Adversarial Search, and Constraint Satisfaction Problems, Introduction to reasoning. Probabilistic reasoning in AI, Bayesian networks, Hidden Markov Model, Certainty factors, rule-based systems and Demster Shafer Theory.				
Module 3	Introduction to Artificial Neural Network	Assignment	Theory	9 Sessions
Topics :Introduction to learning, Forms of Learning: Statistical learning, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Learning rules of AI, Learning Laws. Historical Development of Neural Network Principles, Characteristics of Neural Networks and Artificial Neural Networks: Terminology, Models of Neuron				
Module 4	Essentials of Artificial Neural Network	Assignment	Theory	07 Sessions
Topics: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Single-Layer Feed forward Networks, Multilayer Feed forward Networks, Types of Application				
Targeted Application & Tools that can be used: Use of PowerPoint software for lecture slides and use of Google's Colab cloud service https://www.tutorialspoint.com/google_colab/index.html for executing and sharing of lab exercises.				
Text Books Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, (2002) 3rd edition, Upper Saddle River, Prentice Hall. Yegnanarayana, Bayya. Artificial neural networks. PHI Learning Pvt. Ltd., 2009.				
References N J Nilsson (1997).Artificial Intelligence- A new synthesis, Elsevier Publications. N J Nilsson (1982). Principles of Artificial Intelligence, Springer.				

Elaine Rich, Kevin Knight and ShivashankarB.Nair, "Artificial Intelligence", TataMcGraw- Hill, Third Edition, 2009[R.N.].

Patterson, D. W. (1990). Introduction to artificial intelligence and expert systems. Englewood Cliffs, Prentice Hall.

Luger, G. F. (2002). Artificial intelligence: Structures and strategies for complex problem solving, Harlow, Pearson Education.

Simon Haykin(2009),Neural Networks and Learning Machines ,Third Edition, PHI

LaureneFausett(2004) , Fundamentals Of Neural Networks, Prentice-Hall, Inc,USA

E-References

https://presiuniv.knimbus.com/user#/home

Topics relevant to development of "EMPLOYABILITY SKILLS":

Statistical Concepts for Knowledge representation.

Classical Search

Constraint Satisfaction Problems

Conceptual graphs

Multilayer Feed forward Networks

for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE248	Course Title: Object Oriented analysis and Design with UML Type of Course: Integrated Only	L- T-P-C	3	0	2	4
Version No.	2.0					
Course Pre-requisites	Object Oriented Programming fundamentals, Software Engineering					
Anti-requisites						
Course Description	This course deals with producing detailed object models and designs from system requirements; using the modeling concepts provided by UML; identifying use cases and expanding them into full behavioral designs; expanding the analyzing into a design ready for implementing and constructing designs that are reliable. The course begins with an overview of the object oriented analysis and design.					

Course Objective	The objective of the course is to familiarize the learners with the concepts of A Object Oriented analysis and Design with UML and attain SKILL DEVELOPMENT through EXPERENTIAL LEARNING techniques			
Course Out Comes	CO1 : Ability to analyze and model software specifications. CO2 : Ability to abstract object-based views for generic software systems. CO3 : Ability to deliver robust software components.			
Course Content:				
Module 1	Introduction to Object oriented system-Knowledge level	Assignment	SRS	20 Sessions
Object Basics-Object Oriented System Development Life Cycle- Use case driven approach-Rumbaugh Object Model- Booch Methodology-Jacobson Methodology-Unified Approach, Framing problem statement and SRS document.				
Module 2	Object oriented analysis-Comprehensive Level	Assignment	Class diagram	10 Sessions
Identifying use cases-Object Analysis-Classification: Theory-Approaches for Identifying Classes: Noun Phrase approach, Common Class pattern approach, Use case driven approach, Classes, Responsibilities and Collaborators- Identifying Object relationships: Associations, Super–sub class relationships, Aggregation.				
Module 3	Object oriented design-Comprehensive Level	Term paper/Assignment	Object Diagram	11 Sessions
Object Oriented Design Axioms-Designing Classes -Class visibility -Redefining attributes -Designing methods and protocols -Packages and managing classes -Access Layer- Object Storage Persistence - Object oriented Database System-Designing view layer classes - Macro level process -Micro level process- Prototyping the user interface –Quality Assurance Tests-Testing Strategies.				
Module 4	Object oriented UML Modeling-Application level	Term paper/Assignment	Dynamic Diagrams	9 Sessions
Static and Dynamic Modeling-Unified Modeling Language -UML diagrams: Class Diagrams-Use case Diagram- UML Dynamic modeling: Interaction diagram, Sequence diagram, Collaboration diagram, State-chart diagram, Activity diagram				
Targeted Application & Tools that can be used: Star UML				

Text Book
Object Oriented Modeling and Design using UML, Second Edition, Michael Blaha and James Rumbaugh, Pearson Education, Second Edition, 2007
References
R1. Applying UML and Patterns, Third Edition, Craig Larman, Pearson Education, 2008 R2. Object Oriented Analysis and Design with Applications, Grady Booch, Addison-Wesly SecondEdition, 1994 R3. Object Oriented Systems Development using Unified Modeling Language, Ali Behrami, McGraw Hill International Edition, 1999 R4. Design Patterns, Gamma et. al., Pearson Education, 2006. E-Resources https://presiuniv.knimbus.com/user#/home
Topics relevant to the development of SKILLS: Aggregation Quality Assurance Tests Responsibilities and Collaborators Swimlane Diagram Pattern Model for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE1001	Course Title: Problem Solving using JAVA Type of Course: Integrated	L-T- P-C	2-0	2	3
Version No.	2.0				

Course Pre-requisites	Basic Programming knowledge.
Anti-requisites	NIL
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques
Course Out Comes	On successful completion of the course the students shall be able to: C.O. 1: Describe the basic programming concepts. [Knowledge] C.O. 2: Apply the concept of classes, objects and methods to solve problems. [Application] C.O. 3: Apply the concept of arrays and strings. [Application] C.O. 4: Implement inheritance and polymorphism building secure applications. [Application] C.O. 5: Apply the concepts of interface and error handling mechanism. [Application]
Course Content:	

Module 1	Basic Concepts of Programming and Java	Assignment	Data Collection/Interpretation	12 Sessions

Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.

Module 2	Classes, objects, methods and Constructors	Case studies / Case let	Case studies / Case let	12 Sessions

Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods.

Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.

Module 3	Arrays, String and String buffer	Quiz	Case studies / Case let	14 Sessions

Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.				
Module 4	Inheritance and Polymorphism	Quiz	Case studies / Case let	14 Sessions

Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.

Module 5	Input & Output Operation in Java	Quiz	Case studies / Case let	14 Sessions

Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.

List of Laboratory Tasks:

P1 - Problem Solving using Basic Concepts.

P2 - Problem Solving using Basic Concepts and Command Line Arguments.

P3 - Programming assignment with class, objects, methods and Constructors.

P4 - Programming assignment with method overloading.

P5 - Programming assignment with constructor overloading.

P6 - Programming assignment with Static members and static methods.

P7 - Programming assignment with Nested classes.

P8 - Programming assignment using Arrays.

P9 - Programming assignment using Strings.

P10 - Programming assignment using String Builder.

P11 - Programming assignment using Inheritance and super keyword.

P12 - Programming assignment using Method overriding and Dynamic method invocation.

P13 - Programming assignment using Final keywords.

P14 - Programming assignment using Abstract keywords.

P15 - Programming assignment using Interface.

P16 - Programming assignment using Interface.

P17 - Programming assignment CharacterStream Classes

P18 - Programming assignment Read/Write Operations with File Channel

Targeted Application & Tools that can be used : JDK /eclipse IDE/ net Beans IDE.

Text Book
T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education.

References
R1: Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson
R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.
E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf
E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)
Web resources
https://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q
https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":
Static Polymorphism
Method overloading, constructors
constructor overloading
this keyword
static keyword and Inner classes
Inheritance and Polymorphism.
for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE302	Course Title: Programming in C# and .NET Framework		L- P - C	1-0	4	3
	Type of Course: Program Core					
	Theory & Laboratory integrated					
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course is designed to teach third-year computer science students, to provide an introduction to the .net framework and C# language. This course deals with the programming skills that are required to create applications using the C# language. Helps the students to build an application that incorporates several features of the .NET Framework.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Programming in C# and .NET Framework and attain EMPLOYABILITY SKILLS through EXPERIENTIAL LEARNING techniques					
Course Out Comes	COURSE OUTCOMES: On successful completion of the course the students shall be able to:					
	Apply OOPS concepts in C# for solutions to real-world problems					
	Use ADO.NET to manage databases;					
	Write GUI applications in C#.					
Course Content:						
Module 1	C # Language Syntax	Assignment	Programming Task		12 Sessions	

Topics:

C # Language Syntax - Datatypes & Variables Declaration, Implicit and Explicit Casting, Checked and Unchecked Blocks, Enum and Constant, Operators, Control Statements, Working with Arrays, working with Methods, Pass by value and by reference and out parameters.

OOPs-Concept - Learning about Class, Object, Component, encapsulation, Inheritance, Polymorphism.Abstract Class, Types of Inheritance with example programs .

Exception Handling-Defining Exception, Understandings try and catch keywords, Using "finally" block, Throw , Throws , Throwing exceptions, Creating User-defined/Custom Exception class and basic example for the both exception.

Module 2	Developing GUI Application Using WINFORMS	Assignment	Data Collection/Excel	12 Sessions

Topics:

Developing GUI Application Using WINFORMS- Basic Controls, Panel & Layouts, Drawing and GDI Devices, MenuStrip, ToolbarStrip and ContextMenuStrip , Model and Modeless Dialog boxes ,Multiple Document Interface(MDI) ,Form Inheritance , Building Login Form, Working with Resource Files and Setting, Notify Icon Controls, Using Components like Timer, FileSystemWatcher, Solving few case studies in developing GUI Application using WINFORMS.

Database Programming Using ADO.NET -Introduction, and Evolution of ADO.NET, Understanding the Role of Managed Provider and ADO.NET Objects, Connecting to Database and Connection Pooling, Performing Insert, Update and Delete Operations, Fetching Data from the database - Executing Select Statements, basics query. Solving few case studies .

Module 3	Managing Data using DataSet	Assignment	Programming/Data analysis task	14 Sessions

Managing Data using DataSet -Introduction DataSet and its Object Model, Filling DataSet using DataAdapter, Binding DataSet to DataGridView, Updating changes to the database using DataAdapter, DataAdapter events.

A few Advanced Features-Reflection and Attributes, Delegates & Events, User Control and Custom Control. Multithreading- Threading Overview, Thread States, Methods of Thread Class, Thread Pool, Thread Synchronization, Advantages of threads and thread in built functions .Solving some real world examples on threads .

Targeted Application & Tools that can be used:

Text Book

Andrew Troelsen, "C# and the .NET Platform"

 J . Liberty, "Programming C#", O'Reilly

References

    R1:E. Balagurusamy, "Programming in C#", Tata McGraw-Hill.

   R2: Microsoft Visual C# Step by Step, 9th Edition By John Sharp, Microsoft Press

   R3:Herbert Schildt, "The Complete Reference: C#"

 Weblinks:

https://presiuniv.knimbus.com/user#/home

 https://dotnet.microsoft.com/en-us/apps/aspnet

Case study link:

https://www.researchgate.net/publication/296561714_C_and_the_NET_Framework

https://docs.microsoft.com/en-us/dotnet/csharp/getting-started/

E book link R1:

https://www.oreilly.com/library/view/mastering-c-and/9781785884375/

E book link R2:

https://www.packtpub.com/product/mastering-c-and-net-framework/9781785884375

Topics relevant to development of "Skill":

MVC — Model-View-Controller

Encapsulation

Inheritance

Polymorphism

Connection pooling

for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE397	Course Title: Digital and Mobile Forensics Type of Course: Theory	L-T- P-C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	Operating System, Computer Networks.				
Anti-requisites	Nil				
Course Description	This course demonstrates the use of Mobile phones and digital devices across the globe has increased dramatically. These devices are more susceptible to information security attacks and thus they also possess huge evidences which shall be used during crime scene investigation. This makes the Course on mobile and digital forensics an inevitable one for the security professionals. This Course on mobile and digital forensics will provide a better understanding on different forms of evidences in many digital devices, collection and interpretation of the same. Topics include: Wireless technologies and security-wireless protocols, wireless threats, cell phones and GPS, SMS and data interception in GSM. Mobile phone forensics - files present in SIM card, device data, external memory dump, Android forensics. Digital forensics: - evaluating digital evidence, Digital forensics examination principles				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain EMPLOYABILITY SKILLS through PARTICIPATIVE Learning techniques				
Course Outcomes	On successful completion of this course the students shall be able to: CO 1: Outline the basic concepts of Cybercrime and digital Forensics. (L1) CO 2: Employ various digital Forensic tools to perform Forensic investigation(L3) CO 3: Interpret security challenges and Forensic examination process of wireless devices. (L2) CO 4: Produce digital evidence through the usage of mobile device Forensic tools (L3)				
Course Content:					
Module 1	Cybercrime and Digital Forensic Principles	Assignment	Seminar		10 Sessions
Cybercrime: Definition, Nature and Scope of Cyber crime, Types of cyber crime, Categories of cyber crime, Investigating Cybercrime, Digital Evidence, Prevention of cyber crime, Overview of Digital Forensics, Phases of Digital Forensics, Digital devices in society,					

Evidential Potential of Digital Devices: closed and open systems, Digital investigation process models: Staircase Model, Evidence Flow Model, Increasing awareness of digital evidence, Case studies on Cyber Crimes.				
Module 2	Digital Forensics examination process	Case Studies	Case Study	11 Sessions
Language of Computer crime investigation, preparing a Digital Forensics Investigation, Chanllenging aspects of digital evidence, Presenting digital evidence, Device usage, Profiling and cyberprofiling, Contamination, Digital forensics examination principles: Previewing, Imaging, Continuity and hashing, Evidence locations, A seven-element security model, A developmental model of digital systems. .				
Module 3	Wireless technologies and Wireless threats	Quiz	GSM, Parben's Cell Seizure	12 Sessions
Overview of Modern Wireless Technology, Wireless Crime Prevention Techniques, War-Driving, War-Chalking, War Flying, Voice SMS, GSM and Identification Data Interception in GSM, Cell Phone Hacking and Phreaking, Who's Tracking You and Your Cell Phone? How Does Cellular Fraud Occur? Cell Phone Forensics, Forensic Rules for Cellular Phones, Cell Phone Flowchart Processes Using Paraben's Cell Seizure.				
Module 4	Mobile phone Forensics	Quiz	orensic Tools	10 Sessions
Importance and Motivation behind Mobile Forensics, Mobile Phone Forensics: Crime and Mobile Phones, the Evidence, Forensic Procedures of mobile phones, The SIM Card, Files Present in SIM Card, Device Data, SMS Spam, What Data Is Available from Mobile Phones?, Handling Instructions for Mobile Phones, Mobile Phone Forensics Tools and Methods, Social Media Forensics on Mobile Devices.				
Targeted Application & Tools that can be used: Wireless Security Digital Forensics Android Forensics				
Textbooks: T1 Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 1st Edition, September 19, 2019.				

References:

R1 Losif I. Androulidakis, "Mobile phone security and forensics: A practical approach", Springer publications, 2nd Edition, 2016.

R2 Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 1st Edition, 15th June 2011.

R3 Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, November 2008, p 180.

Web references:

https://presiuniv.knimbus.com/user#/home

Topics relevant to "Employability":

Prevention of cybercrime

preparing a Digital Forensics Investigation

Mobile Phone Forensics: Crime and Mobile Phones.

Mobile Phone Forensics Tools

for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 1002	Course Title: Innovation Project-Arduino Using Embedded C Type of Course: Lab only	L-T- P-C	0 -0	4	2
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The course deals with the fundamental concepts of 'C' and Embedded C, problem-solving using C in a systematic way to read and write the C code and to implement them on an Arduino prototype board. The course will also demonstrate how to assemble various sensory devices and program them using the Arduino platform as a basis. Students will have the opportunity of gaining real-world experience in handling IOT devices involving hardware and software combinations. The course also offers in-depth knowledge of designing, developing, coding, and implementing Arduino projects.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Innovation Project-Arduino Using Embedded C and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques				

Course Out Comes	On successful completion of the course the students shall be able to:
	
	  Write a program using Arduino programming language using Embedded 'C'.
	
	  Explain the main features of the Arduino prototype board
	
	  Demonstrate the hardware interfacing of the peripherals to Arduino system.
	
	  Demonstrate the functioning of live various projects carried out using Arduino system.				

Course Content:					
Module 1	Basics of C, Branching and looping	Quiz	Problem Solving	9 Sessions	
Topics: Structure of C programs, Variables, Keywords, Datatypes, declaration, and Initialization Decision Making and Branching: if, if-else, else-if ladder, switch statement.					

Decision making and looping: for, while, and do-while statements.				
Module 2	Arrays, functions, strings	Quiz	Problem Solving	8 Sessions
Topics:				
Arrays: Introduction ,one dimensional array, two dimensional array,				
Functions: User defined functions, Categories, searching and sorting				
Strings: Introduction, string handling functions.				
Module 3	Structures and Pointers		Problem Solving	7 Sessions
Topics:				
Structure definition, syntax and application of structures, definition of pointers ,syntax, pass –by-reference.				
Module 4	Introduction to Arduino and Sensory Devices	Project Development	Modeling and Simulation task	6 Sessions
Topics:				
Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.				
List of Laboratory Tasks				
Targeted Application & Tools that can be used: Making it a reality (Arduino Projects) : Projects will include but not limited to : 1) Intelligent home locking system. 2) Intelligent water level management system. 3) Home automation using RFID. 4) Real time clock-based home automation. 5) Intelligent Automatic Irrigation System Professionally Used Software: Arduino IDE.				
Project work/Assignment:				
Quiz1- Fundamentals of C-Programs, Quiz2- Basics of Embedded C and Arduino				

Project work	
Text Book	
T1 E Balagurusamy "Programming in ANSI C" , Mc Graw Hill Publications,7th Edition.	
T2 Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition.	
References R1 https://www.tutorialspoint.com/arduino/index.html. R2 https://create.arduino.cc/projecthub/projects/tags/sensor. Web resources: https://3dprinting.com/what-is-3d-printing. hthttps://puuniversity.informaticsglobal.com	
Topics relevant to the development of "Skill Development": Basic Concepts of C-Programming Embedded 'C' and Arduino Problem solving Creative Thinking Team work Prototype Development. for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.	

Course Code: CSE 2066	Course Title: Computer Graphics	L-T- P-C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	C Programming				
Anti-requisites	NIL				

Course Description	This course demonstrates the basics of graphics and visualization in computer science, enabling students to appreciate how the computer system displays graphics and visual effects on a display device. The course uses assignments to develop visualization skills of the students. The key topics covered in this course include algorithms for drawing basic primitives, transformations, viewing and clipping for both 2D and 3D objects along with Bezier curves and Surfaces.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computer Graphics and attain Skill Development through Participative Learning techniques.		
Course Out Comes	On successful completion of the course the students shall be able to: CO 1: Illustrate algorithms for drawing basic primitives like Point, Line and Polygon. CO 2: Illustrate algorithms for performing 2D Geometric Transformations, viewing and clipping. CO 3: Illustrate algorithms for performing 3D Geometric Transformations, clipping. CO 4: Describe plane Bezier curves and Bezier surfaces.		
Course Content:			
Module 1	Overview: Basics of Computer Graphics	Assignment	No. of Sessions 13
Topics: An Introduction Graphics System: Computer Graphics and Its Types, Application of computer graphics. Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Raster graphics Vs. Random Graphics, Flat panel Displays – emissive and non-emissive displays, Input Devices, logical inputs, Graphics tools and software Line drawing algorithms - Midpoint, DDA, Bresenham's. Circle generation algorithms - Midpoint circle drawing algorithm, Bresenham's circle algorithm. Basics of 2D and 3D objects. Assignment: Numerical problems based on Line and circle drawing algorithm			
Module 2	2D Geometric Transformations, viewing and clipping	Assignment	No. of Sessions : 12
2D Geometric Transformations: Basics of translation, scaling, rotation, reflection and shearing. Matrix representations and homogeneous coordinates for translation, scaling, rotation, reflection and shearing. 2D Composite transformations, General pivot point rotation and scaling. Introduction to OpenGL concepts and libraries. OpenGL geometric transformations functions.			

Basics of 2D viewing and Clipping: Basics of viewing and Clipping, 2D viewing pipeline, Viewing Transformation systems, Normalization and Viewport Transformation

Types of clipping: point, Line and polygon clipping, 2D line clipping algorithms: cohen-sutherland line clipping, Liang-Barsky line clipping algorithm, polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm, OpenGL 2D viewing and clipping functions.

Assignment: Numerical problems based on 2D transformations.

Module 3	3D Geometric Transformations, clipping:	Mini-project	No. of Sessions : 11

3D Geometric Transformations: 3D translation, rotation, scaling, reflection and shearing, composite 3D transformations, OpenGL 3D geometric transformations functions, Transformations between 3D Coordinate Systems.

Basics of 3D Viewing and Clipping: 3D viewing concepts, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, parallel projections - orthogonal projections and oblique projections, parallel-Projection Transformation Matrix, perspective projections, Perspective-Projection Transformation Matrix

Assignment: Based on the activities in the link: pu.informatics.global

Module 4	Plane curves and surfaces	Quiz	No. of Classes : 9

Plane Curves: Plane Curves representation, Nonparametric Curves, Parametric Curves, Curved Surfaces, Quadric Surfaces.

Basics of Curves and surfaces: Interpolation and Approximation Splines, Parametric Continuity Conditions, Geometric Continuity Conditions, Spline Specifications. Representation of Space Curves, Cubic Splines, Bezier Curves, Parametric Cubic Curves, Quadric Surfaces, Bezier Surfaces. OpenGL Quadric-Surface and Cubic-Surface Functions

Targeted Application & Tools that can be used:

Application Area: Game design and Animation

Tools/Simulator/Software used: Visual Studio 17.0 / CodeBlock

Text Book:

  T1:   Donald D. Hearn, M. Pauline Baker and Warren Carither, Computer Graphics with OpenGL, Pearson Education, 4th Edition, 2021

Reference Books:

   R1. John F Hughes, Andries van Dam, Steven K. Feiner, James D. Foley, Morga, Computer Graphics: Principles and Practice, Pearson Education India, Third Edition, 2013

   R2. John Kessenich, Graham Sellers, Dave Shreiner , OpenGL Programming guide , Addison-Wesley Ninth Edition,2016

R3. Edward Angel and Dave shreiner, Interactive Computer Graphics, A top down approach with shader based OpenGL, Pearson Education, 6th Edition, 2018

E-References

https://presiuniv.knimbus.com/user#/home

Topics relevant to development of "Skill Development":

Line drawing algorithms (DDA, Bresenham's)

Graphics tools and software

Liang-Barsky line clipping algorithm

cohen-sutherland line clipping

OpenGL 2D viewing and clipping functions

for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2027	Course Title: Fundamentals of Data Analytics			3-0	0	3
	Type of Course: Theory only		L-T- P-C			
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	Fundamentals of Data Analytics is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on data analysis to a wide range of applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Fundamentals of Data Analytics and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Explain different types of data and variables. 2) Interpret data using appropriate statistical methods. 3) Demonstrate the collection, processing and analysis of data for any given application and Illustrate various charts using visualization methods. 4) Apply the Data Analysis techniques by MAT Lab					
Course Content:						
Module 1	Introduction to Data Analysis	Assignment	Data Collection , data analysis		6 Sessions	
Topics: Introducing Data, overview of data analysis: Data in the Real World, Data vs. Information, The Many "Vs" of Data, Structured Data and Unstructured Data, Types of Data, Data Analysis Defined, Types of Variables, Central Tendency of Data, Scales of Data, Sources of Data, Data preparation: Cleaning the data, Removing variables, Data Transformations.						
Module 2	Statistical functions	Assignment	Data analysis		8 Sessions	

Topics: Descriptive Statistics, Inferential Statistics (T test, Z test,), Probability Uses In Business and Calculating Probability from a Contingency Tables.

| Module 3 | Data Collection, Processing and Analysis | Project based MAT Lab | MAT LAB | 6 Sessions |

Topics: Collection of Primary Data(Observation Method, Interview Method, Collection of Data through Questionnaires ,Collection of Data through Schedule) Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data ,Difference between Survey and Experiment Processing Operations, correlation.

Introduction: Overview, Classification, Regression, Building a prediction model

| Module 4 | Data Visualization and Charting Prediction | Project MAT Lab | Data Collection, visualization and data analysis | 6 Sessions |

Topics: Types of charts and their significance, Organize data interactively with tables , Visualizing data with charts, Analyzing data with pivot tables, Build presentation ready dashboards and turn real world data into business insights, Tracking trends and making forecasts, Interpretation and report writing

| Module 5 | Introduction to MATLAB | Project MAT Lab | Data analysis with optimization | 12 Sessions |

Topics: Defining Categories of Data, Analyzing Groups within Data, Importing Data from Multiple Files, Review Project ,Images and 3-D Surface Plots, Importing Unstructured Data

Targeted Application & Tools that can be used:

Application Area are

Decision making in business, health care, financial sector, Medical diagnosis etc...

MAT Lab

Text Books

Glenn J. Myatt and Wayne P. Johnson, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback", Import, 22 July 2014.

William Menke And Joshua Menke,"Environmental Data Analysis with MAT Lab", Elsevier, 2012.

https://matlabacademy.mathworks.com/details/matlab-for-data-processing-and-visualization/mlvi

References

Paul McFedries , "Excel Data Analysis-visual blue print",Wiley 4th Edition September 2019.

Gerald Knight, "Analyzing Business Data with Excel",O'Reilly; 1st Edition,13 January 2006.

https://people.highline.edu/mgirvin/AllClasses/348/348/AllFilesBI348Analytics.htm

Hansa Lysander,"Data Analysis and business modelling using Microsoft Excel", PHI, 2017.

Web Links:

https://presiuniv.knimbus.com/user#/home

Topics relevant to development of "FOUNDATION SKILLS":

Statistical Concepts for data, visualization techniques.

Data collection for project based assignments.

Inferential Statistics (T test, Z test)

Probability Calculation

for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE2008	Course Title: Programming in Java (Object Oriented Programming) Type of Course: Program Core Theory and Laboratory Integrated	L-T-P- C	1 -0	4	3
Version No.	1.0				
Course Pre-requisites	Basic knowledge of any structured programming: Data types, variables, constants, operators, conditional & control structures, Loops, arrays & function.				
Anti-requisites	NIL				
Course Description	This course introduces the core concepts of object-oriented programming by using Java. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications				

Course Objective	The objective of the course is to familiarize the learners with the concepts of Programming in Java and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: Write programs using basic concepts in JAVA Apply the concept of arrays, strings, polymorphism & inheritance for building desktop Implement interface & packages for building secure applications Apply the concepts of error handling mechanism and multithreading. Apply the concepts of Collections to develop high performance applications.			
Course Content:				
Module 1	INTRODUCTION	Assignment	Programming	No. of Classes:10

Topics: Introduction to Object Oriented Programming, Java Evolution, and How Java differs from C++, Features of Java,

Java Environment: Installing JDK (JVM, JRE), Java Source File Structure, Compilation and Execution of Java Programs.

TOKENS: Data types, Variables, Operators, Control Statements, Command Line Arguments.

CLASSES, OBJECTS, AND METHODS: Defining a class, access specifiers, instantiating objects, reference variable, accessing class members and methods, constructors, method overloading, static members, static methods, inner class, Wrapper class , Autoboxing and Unboxing,

Module 2	Arrays, Strings, inheritance and Polymorphism	Assignment	Programming	No. of Classes:6

Topics:Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array.

 Operation on String, Mutable & Immutable String, Creating Strings using StringBuffer or StringBuilder.

Defining a subclass, types of Inheritance, method overriding, super keyword, dynamic method invocation, dynamic polymorphism, usage of final abstract and this keyword.

Module 3	Interfaces, Packages and Exception Handling	Assignment	Programming	No. of Classes:8

Topics:Defining interfaces, extending an interface, Implementing interfaces. Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining a Package, Library Packages, import packages.

Exception handling: Introduction to Exceptions, Difference between Exceptions & Errors, Types of Exception. Handling Exceptions: Use of try, catch, finally, throw, throws. User Defined Exceptions, Checked and Un-Checked Exceptions.				
Module 4	MULTITHREADED PROGRAMMING:	Assignment	Programming	No. of Classes:12

Topics: Introduction to threads, life cycle of a thread, creating threads, extending the Thread Class, Implementing the "runnable" interface. Thread Priority, Thread synchronization, Inter communication of Threads

Module 5	Collections and Graphic Programming(AWT,Swings)	Assignment	Mini Project	No. of Classes:12

Introduction to Collections, Classification of Collection. Introduction to List, Map and Set Interface, Introduction to Applets.

Introduction to the abstract window toolkit (AWT), Frames, Event-driven programming: Mouse and Key Event handling.

Introduction to Swings, JFC, Swing GUI Components and Layout Manager.

List of Laboratory Tasks:

Experiment N0 1: Programming assignment with class, objects and basic control structures. (Application:

Build a basic menu driven application)

Level 1: Programming scenarios which use control structures to solve simple case scenarios (Eg: Check if a number is odd or even)

Level 2: Programming assignment which will build menu driven application by identifying the class and its relevant methods.

Experiment No. 2: Programming assignment using Arrays and Strings. (Application: Develop application on Matrices, build String based application like Telephone directory)

Level 1: Programming scenarios which build single dimensional and multidimensional array, apply the different methods to operate on strings.

Level 2: Programming assignment which will manipulate the data stored in matrices and identify the appropriate usage String methods.

Experiment No. 3: Programming assignment using Inheritance and Polymorphism

Level 1: Programming scenarios which use the concept the polymorphism for method overloading. Scenarios which apply the concept of inheritance (identifying parent, child class and its relationship)

Level 2: Programming assignment which build application which have same functions in different forms.

Experiment No. 4: Programming assignment using Exception Handling

Level 1: Programming assignment on building applications using built in Exceptions.

Level 2: Programming assignment on building application using user defined Exceptions.

Experiment No. 5: Programming assignment using Multithreading. (Eg: Building an application which performs different arithmetic operations and sharing the resources using threads)

Level 1: Programming scenarios to build a thread, assign priority and use the thread methods to perform operations

Level 2: Programming scenarios for building synchronized applications.

Experiment No. 8: Programming assignment using Collections

Level 1: Programming Scenarios to apply and use the Collection framework (List, SET, Map, Interface)

Experiment No. 9: Programming assignment to build GUI Applications.

Level 1: Programming Scenarios to build GUI for a given scenario using AWT and Swings concepts.

Targeted Application & Tools that can be used:

Platform independent Application Development

Secure Application Development
Data Mining
Operating Systems.
Database Management Systems
Banking software
Automobiles
Mobile Applications
Tools: JDK (Java Development Tool kit), Integrated Development Environment (IDE), Apache NetBeans, Eclipse.
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
After completion of each module a programming based Assignment/Assessment will be conducted.   A scenario will be given to the student to be developed as a Java Application.   On completion of Module 5, student will be asked to develop a Mini Project using the GUI functionalities.
Text Book   Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson.   Cay S Horstmann and Cary Gornell, "CORE JAVA volume II-Advanced Features", Pearson.
References   1)Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education.   2)James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.
Topics relevant to development of "Skill Development":   Real time application development using OOPs concept, Naming and coding convention for Project Development for Skill development through Experiential Learning Techniques. This is attained through assessment component mentioned in the course handout.

Course Code: CSE 151	Course Title: Computer Programming Type of Course: Laboratory Integrated Course	L-T- P-C	2-0	4	4
Version No.	1				
Course Pre-requisites	NA				
Anti-requisites	NA				
Course Description	This Course will provide an introduction to foundational concepts of computer programming to students of all branches of Engineering. This course includes a mix of traditional lectures and laboratory sessions. Each meeting starts with a lecture and finishes with a laboratory session. Topics covered in this Course are problem formulation and development of simple programs, Pseudo code, Flow Chart, Algorithms, data types, operators, decision making and branching, looping statements, arrays, functions, structures and union. In the lab session students are required to solve problems based on the above concepts to illustrate the features of the structured programming.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computer Programming and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques				
Course Out Comes	On successful completion of the course the students shall be able to: COURSE OUTCOMES: On successful completion of the course the students shall be able to: CO 1: Apply the basic concepts and control structures of programming to solve particular problems (L3) CO 2: Apply the concepts of array and strings to represent data and its operations.(L3) CO 3: Illustrate the concepts of functions, structure and unions in programming.(L3)				
Course Content:					
Module 1	Introduction	Quizzes			7 Sessions
Topics: Introduction to Problem Solving					

Basic organization of Computer, System software and Application software, Operating System and Programming languages.

Logical analysis using Algorithm and Flowchart. Introduction to C

Structure of C program, variables, keywords, data types and sizes, declaration and initialization of variables, storage class, operators and expression, managing input and output operations, compiling and linking.

Module 2	Branching and looping	Quizzes	Assignments	8 Sessions

Decision Making and Branching: if, if-else, if-else ladder, nested if and switch case Unconditional: break, continue, and return

Decision Making and Looping: for, while, do-while, and nested looping statements.

Module 3	Arrays and Functions	Quizzes	Assignments	12 Sessions

Arrays

Introduction, one-dimensional arrays, two dimensional arrays, multi-dimensional arrays, searching and sorting.

Functions

Introduction, user defined functions, categories of functions, nesting of functions, recursion, passing arrays to function, the scope, visibility and lifetime of a variable.

Module 4	Strings, Structures and union	Quizzes		9 Sessions

Strings

Introduction to strings, String Handling Functions, Passing string as parameter to function.

Structure and Union

Introduction, array of structure, structure within a structure, unions, passing structure and union as parameter to the function.

Targeted Application & Tools that can be used:
C

Project work/Assignment:

Assignment:
Students will have to do group assignments for Modules 2 & 3. As a part of their assignments, they will have to implement the solution to particular problems.

Text Books

1. E. Balagurusamy, "Programming in ANSI C", Seventh Edition - Tata McGraw Hill.

References

Behrouz A Forouzan, Richard F Gilberg, "Computer Science: A structured programming approach using C", Cengage Learning.

Brian W. Kernighan / Dennis Ritchie, "The C Programming Language " ,Pearson Edition.

Yashavant Kanetkar, "Let Us C", 16th edition , BPB Publications

 E-Book Link for R2: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view

Web resources: https://web.stanford.edu/~jurafsky/slp3/

NPTEL Course: https://onlinecourses.nptel.ac.in/noc22

Topics relevant to development of "Skill Development":

Assignment implementations in software, batch wise presentations.

Decision Making and Looping

Storage class

Compiling and linking

Nesting of functions

for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 304	Course Title: Mobile Communication Type of Course: Program Core - Theory	L-T- P-C	3	0	3
Version No.	1.0				
Course Pre-requisites					
Anti-requisites	NIL				
Course Description	The course helps the students to apply the engineering principles in the specification, design, development, and deployment of mobile communications. Students will develop a detailed knowledge and critical understanding of the core skills in mobile communications and networks. Topics include: Fundamental knowledge of wireless and mobile networks, mobile communication systems / networks / architecture. The cellular communications, mobile networks, including wireless transmission technology,				

Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain EMPLOYABILITY through PARTICIPATIVE LEARNING techniques			
Course Outcomes	On successful completion of this course the students shall be able to: Explain the limitations of fixed networks, the need and the trend toward mobility, the concepts of portability and mobility. Describe the network infrastructure requirements to support mobile devices and users. Explain the concepts, techniques, protocols, and architecture employed in wireless local area networks, cellular networks, and perform basic requirements analysis. Apply techniques and technologies to design a communication application for mobile devices.			
Course Content:				
Module 1	Introduction	Assignment	Multiplexing and Modulation	09 Sessions
Topics: Introduction to Wireless Communication – Mobile and Wireless Devices - Antennas - Signal Propagation - Multiplexing - Modulations - Cellular Systems.				
Module 2	MOBILE TELECOMMUNICATION SYSTEM	Assignment	GPRS, RFID	9 Sessions
Topics: Global System for Mobile Communications (GSM) - General Packet Radio Service (GPRS) - Universal Mobile Telecommunication System (UMTS) – Radio Frequency Identification (RFID) – Bluetooth – SMS and MMS.				
Module 3	WIRELESS PROTOCOLS AND STANDARDS	Seminar	Routing Protocols	09 Sessions
Topics: MAC Protocol – Wireless MAC Issues – Code Division Multiple Access (CDMA) – Wireless LANs and PANs - IEEE802.11 – Mobile Internet Protocol – DHCP – Routing Protocols.				
Module 4	MOBILE APPLICATIONS AND PLATFORMS	Case Study	Applications of Cloud and IoT	10 Sessions

wireless PAN/ LAN/ MAN/ WAN, Mobile IP, Ad-Hoc networks, sensor networks, wireless mesh networks.

Topics:
Mobile Phones - Tablet and Other Handheld Devices - Mobile Device Operating Systems - Mobile Computing: Applications, Characteristics and Structure - Mobile Computing Support: Cloud and Internet of Things - Wireless Security

Targeted Application & Tools that can be used:
Application Area:
Tools:

Textbooks:
Jochen Schiller, "Mobile Communications", Pearson Education Limited, Second Edition 2007.
Asoke K. Talukder, Hasan Ahmed, Roopa R. Yavagal, "Mobile Computing: Technology, Applications, and Service Creation", Tata McGraw-Hill, Second Edition 2010.

References:
Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.
William Stallings, "Wireless Communications and Networks" Pearson Education, Second Edition 2005.
C.K.Toh, "AdHoc Mobile Wireless Networks", Pearson Education Limited, First Edition 2002.
NPTEL: https://onlinecourses.nptel.ac.in/noc20_ee61/preview
Web references: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&site=ehost-live
https://nptel.ac.in/courses/106102064

Topics relevant to "Employability": Routing Protocols, Cloud Applications in Mobile for developing Employability Skills through Participative Learning Techniques. This is attained through assessment component in course handout.

Course Code: CSE2051	Course Title: Information Retrieval	L-T-P- C	3-0	0	3
	Type of Course: Theory Only Course				
Version No.	1				

Course Pre-requisites	Basic Knowledge in Data Structures and algorithms and probability and statistics, background in machine learning
Anti-requisites	NIL
Course Description	The course studies the theory, design and implementation of Text- based information systems. The Information Retrieval core concepts of the course include statistical characteristics of text, representation of information needs and documents. Topics Include Several important retrieval models (Basic IR Models, Boolean Model, TF-IDF (Term Frequency/Inverse Document Frequency) Weighting, Vector Model, Probabilistic Model, Latent Semantic Indexing Model, Neural Network Model). Retrieval Evaluation, Retrieval Metrics, Text Classification and Clustering algorithms, Web Retrieval and Crawling. Recommender Systems: Basics of Content-based Recommender Systems, Content-based Filtering, Collaborative Filtering, Matrix factorization models and neighborhood models.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Information Retrieval and attain SKILL DEVELOPMENT through Participative Learning techniques
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Define basic concepts of information Retrieval. [Knowledge] CO2: Evaluate the effectiveness and efficiency of different information retrieval methods. [Application] CO3: Explain different indexing methodology requirements and the concept of web retrieval and crawling. [Comprehension] CO4: Classify different recommender system and its aspect. [Comprehension]
Course Content:	

Module 1	Introduction to Information Retrieval	Assignment	Data collection	7 Sessions
Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes				
Module 2	Modeling and Retrieval Evaluation	Assignment	Problem solving	10 Sessions
Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.				
Module 3	Indexing & Web-Retrieval	Term paper/Assignment	Data analysis	8 Sessions

Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing. The Web – Search Engine Architectures – Cluster based Architecture - Search Engine Ranking – Link based Ranking – Simple Ranking Functions, Evaluations — Search Engine Ranking – Applications of a Web Crawler.

Module 4	Recommender System	Term paper/Assignment	Problem solving	8 Sessions

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models.

Targeted Application & Tools that can be used:

Information Retrieval System, Collaborative Filtering System, Feedback System, Evaluation Metrics

Assignment:

Group assignment, Quiz

Text Book

T1 Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —" Modern Information Retrieval: The Concepts and Technology behind Search", Third Edition, ACM Press Books, 2018. Link: https://people.ischool.berkeley.edu/~hearst/irbook/

T2 Ricci, F, Rokach, L. Shapira, B.Kantor, —"Recommender Systems Handbook", Fourth Edition, 2018.

References

R1 Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —"Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2017.

R2 Jian-Yun Nie Morgan & Claypool –" Cross-Language Information Retrieval", Publisher series 2011.

R3 Stefan M. Rüger Morgan & Claypool – "Multimedia Information Retrieval", Publisher series 2014.

R4 B. Liu, Springer, - "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data", Second Edition, 2013.

R5 C. Manning, P. Raghavan, and H. Schütze, —"Introduction to Information Retrieval", Cambridge University Press, 2015. Link: https://nlp.stanford.edu/IR-book/

Web Based Resources and E-books:

https://puniversity.informaticsglobal.com/login

Topics relevant to the development of SKILLS: Recommender Systems, Content-based Filtering, Collaborative Filtering, Matrix factorization models and neighborhood models for Skill Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2036	Course Title: Programming in C++				
	Type of Course: Discipline Elective Theory & Integrated Laboratory	L-T-P- C	1-0	4	3
Version No.	2.0				
Course Pre-requisites	C with Arduino CSE 1002				
Anti-requisites	Nil				
Course Description	The main goal of this course is to study the fundamentals of object-oriented paradigm with concepts of streams, classes, functions, data, and objects. The course aims to provide the basic characteristics of OOP through C++, to impart skills on various kinds of overloading and inheritance, to introduce pointers and file handling in C++ together with exception handling mechanism.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Programming in C++ and attain Employability through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Explain the need and features of OOP and idealize how C++ differs from C. Understand knowledge on various types of overloading and streams. Choose suitable inheritance while proposing solution for the given problem. Implement the concept of pointers and effective memory management, illustrate the application of pointers in virtual functions.				

	Apply the attained knowledge by applying the learned techniques to solve various real-world problems.			
Course Content:				
Module 1	Introduction to object-oriented programming	Quiz	Programming/ Problem Solving	07 Hours

Topics:

Beginning with C++ and its features:

Introduction to C++, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, Control structures, arrays, Functions, Inline function, function overloading. [Blooms 'level selected: Comprehension]

Module 2	Classes and Objects, Static member	Lab evaluation	Programming/ Problem Solving	08 Hours

Topics:

Functions, classes and Objects:

Define class, data members and member functions (methods), method overloading, arrays within a class, array of objects, static members, pointers in C++, new and delete. [Blooms 'level selected: Comprehension]

Module 3	Constructors, Destructors and Operator overloading, Strings	Lab evaluation	Programming/Problem Solving	07 Hours

Topics:

Constructors, Destructors and Operator overloading:

Constructors, constructor overloading, copy constructor, Destructors, Polymorphism: operator overloading, Overloading Unary and binary operators, friend function, operator overloading using friend function, strings and its operators. [Blooms 'level selected: Application]

Module 4	Inheritance, Virtual Functions, Polymorphism	Lab evaluation/ Assignment	Programming/Problem Solving	08 Hours

Topics:

Inheritance, Pointers, Virtual Functions, Polymorphism:

Define inheritance, base and derived Classes, types of inheritance: Single, multilevel, multiple inheritance, Multi-Path inheritance, Pointers to objects and derived classes, "this" pointer, Run time polymorphism: Virtual functions and pure virtual functions.   [Blooms 'level selected: Application]

Module 5	Streams and Working with files, Templates, Manipulators	Assignment	Programming /Problem Solving	05 Hours

Topics:

Streams and Working with files:

Controlling output with manipulators, Templates: Function templates and class templates.

[Blooms 'level selected: Comprehension]

List of Laboratory Tasks:

Experiment No 1: Demonstrate control structures, arrays, inline functions. [2 hours: Application Level]

Level 1: Demonstrate control structures in C++.

Level 2: Use of arrays in C++.

Experiment No. 2:   Demonstrate the use of functions, inline functions and function overloading. [2 hours: Application Level]

Level 1: Use of functions and inline function.

Level 2: Use of function overloading.

Experiment No. 3: Demonstrate the working of classes, objects, member functions and method overloading.[2 hours: Application Level]

Level 1: Understand use of classes, objects, member functions.

Level 2: Use of method overloading.

Experiment No. 4:   Demonstrate the working of array of objects, static members, new and delete. [2 hours: Application Level]

Level 1: Understand use of array of objects.

Level 2: Use of static members, new and delete.

Experiment No. 5: Implement the concept of constructors, destructors, constructor overloading and copy constructor. [2 hours: Application Level]

Level 1: Understand the concept of constructors and destructors and strings.

Level 2: Understand the concept of constructor overloading and copy constructor.

Experiment No. 6: Implement the concept of operator overloading and friend function. [2 hours: Application Level]

Level 1: Use of binary operator overloading.

Level 2: Importance of friend function in operator overloading.

Experiment No. 7: Implement the use of inheritance. [2 hours: Application Level]

Level 1: Understand the concept of single, multi-level inheritance.

Level 2: Passing arguments to base and derived classes using constructors.

Experiment No.8: Implement the use of Virtual functions. [2 hours: Application Level]

Level 1: Understand the concept of constructor in derived class.

Level 2: Understand the concept of virtual function.

Experiment No.9: Apply the knowledge of manipulators and function templates [2 hours: Application Level]

Level 1: Understand the concept manipulators.

Lever 2: Understand the concept of function template.

Experiment No.10: Apply the knowledge of class templates. [2 hours: Application Level]

Level 1: Understand the class templates.

Lever 2: Real time scenario problem to cover all the concepts.

Targeted Application & Tools that can be used:

Application Area is to understand and apply concept of object oriented concepts using C++.

Tools/Simulator used: GCC compiler/ Linux terminal.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Problem Solving: Understanding different OOPS and implementation of programs.

Programming: Implementation of given scenario using C++.

Text Book

Herbert Schildt, "C++: The Complete Reference", McGraw Hill Education, 4th Edition, 2017.

Behrouz A. Forouzan,Richard F. Gilberg, " C++ Programming: An Object-Oriented Approach", McGraw Hill Education, 1st edition, 2022.					

References
Robert Lafore, "Object Oriented Programming using C++", Galgotia publication, 2010.
Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 2004.
Stanley B. Lippman and Josee Louie, "C++ Primer", Pearson Education, 2003.
K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2003.
E. Balaguruswamy, "Object Oriented Programming with C++", TMH, 6th Edition, 2013.

Topics relevant to "EMPLOYABILITY SKILLS": Object, Class, Inheritance, Polymorphism, Abstraction, Encapsulation for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3070	Course Title: ADVANCED COMPUTER NETWORK Type of Course: Theory Only	L-T- P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Computer Networks and Computer Architecture Course				
Anti-requisites					
Course Description	This course aims to provide understanding of advanced computer network concepts, building on the basic functions of various layers, protocols and standards used in practice to have a comprehensive and deep knowledge in computer networks.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Advanced Computer Network and attain EMPLOYBILITY SKILL through PARTICIPATIVE LEARNING techniques				
Course Out Comes	On successful completion of the course the students shall be able to: Describe network architecture and application programming interface concepts (L2) Explain working of internetworking protocols (L2) Illustrate different routing protocols and end-to-end transmission (L3) Distinguish the various protocols used at the transport layer (L2 Summarize working of traditional, multimedia applications and overlay networks (L2)				
Course Content:					

Module 1	Introduction	Assignment	Data Collection/Interpretation	12Sessions

Topics:

Introduction: Applications, Requirements – Perspectives, Scalable Connectivity, Cost-Effective Resource Sharing, Support for Common Services. Network Architecture- Layering and Protocols, OSI Architecture, Internet Architecture. Implementing Network Software- Application Programming Interface (Sockets). Performance- Bandwidth and Latency, Delay×Bandwidth Product, Application Performance Needs.

Module 2	Internetworking	Case studies / Case let	Case studies / Case let	12 Sessions

Topics:

Internetworking (Part - I): Switching and Bridging-Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN switches. Basic Internetworking (IP)-What is an internetwork, service model, global addresses, Datagram Forwarding in IP, Subnetting and classless addressing, address translation (ARP), DHCP, ICMP, Virtual Networks and Tunnels.

Module 3	Internetworking and Advanced Internetworking	Quiz	Case studies / Case let	14 Sessions

Topics:

Inter-networking (Part - II): Routing - Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics. Implementation and Performance- Switch Basics, Ports, Fabrics, Router Implementation. Advanced Internetworking: The Global Internet – Routing Areas, Inter domain Routing (BGP), IP Version 6 (IPv6). Multicast: Multicast addresses, Multicast routing (DVMRP, PIM)

Module 4	Advanced Internetworking and End-to-End Protocols	Quiz	Case studies / Case let	14 Sessions

Topics:

Multiprotocol Label Switching (MPLS): Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels, Routing among Mobile Devices: Challenges for Mobile Networking, Routing to Mobile Hosts (Mobile IP), End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream (TCP) - End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Performance, Alternative Design Choices. Congestion Control and Resource Allocation: Issues in Resource Allocation - Network Model, Taxonomy, Evaluation Criteria. Queuing Disciplines - FIFO, Fair Queuing.

Targeted Application & Tools that can be used:
Project work/Assignment:
Assignment:
Text Book:

T1. Larry L. Peterson, Bruce S. Davie. Computer Networks, A Systems Approach, Morgan Kaufmann Publishers, Fifth Edition, 2012

References

 R1. W. R. Stevens. Unix Network Programming, Vol.1, Pearson Education, 1990

R2. Andrew S Tanenbaum and David J Wetherall, Computer Networks, 5/e, Pearson Education, 2010

  R3. Darren Spohn, Data Network Design, 3/e TMH, 2002

  R4. D. Bertsekas, R. Gallager, Data Networks, 2/e, PHI, 1992

E   E-book link R1: https://cseweb.ucsd.edu/classes/wi19/cse124-a/courseoverview/compnetworks.pdf

R3 Web resources:

                NPTEL Course -https://onlinecourses.nptel.ac.in/noc23_cs35/preview

                Coursera - https://in.coursera.org/specializations/computer-communications

https://presiuniv.knimbus.com/user#/home

pu.informatics.global, https://sm-nitk.vlabs.ac.in/

Topics relevant to development of "Employability":

IP addressing for developing Employability Skills through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: (CSE225)	Course Title: Introduction to Combinatorics and Graph Theory Type of Course: Program Core - Theory		L-T-P- C	3-0	0	3
Version No.	version 1					
Course Pre-requisites	Basic logic and Set theory					
Anti-requisites	nil					
Course Description	Graph Theory is a blend of the mathematical techniques applicable to Computer science, Information Technology and Statistics. Graph Theory gives us, both an easy way to pictorially represent many major mathematical results, and insights into the deep theories behind them. In this course, among other intriguing applications, we will see how GPS systems find shortest routes, how engineers design integrated circuits, how biologists assemble genomes, why a political map can always be colored using a few colors. Topics Include: Principles of Inclusion and Exclusion, Rook Polynomial, Derangements. Graph Theory: Graph Terminologies, Isomorphism, Coloring, Matching, Planar Graphs, Trees Terminologies, Traversals, Spanning Trees, Shortest path algorithms, Prefix Codes					
Course Objective	The objective of the course is to familiarize the learners with the concepts : Introduction to Combinatorics and Graph Theory and attain Skill Development through Participative Learning techniques.					
Course Outcomes	CO1: Explain the fundamental concepts of Graph theory. [L1: Knowledge] CO2: Discuss theorems of matching, connectivity, coloring and planar graphs. [L2: Comprehension] CO3: Discuss different types of trees and traversal techniques. [L2: Comprehension] CO4: Apply different algorithms to find optimal path for a given graph. [L3: Applications]					
Course Content:						
Module 1	Introduction to Graph Theory	Assignment	Data Collection		07 Sessions	
Introduction to Graph Theory		07H	[Knowledge Level]			

Basic Concepts: definition, types of graphs, Graph Terminology and Special Types of Graph, representation of a graph and connectedness graph: (paths, walk. cycles, edge deleted and vertex deleted).				
Module 2	Introduction to Graph Theory contd	Assignment	Analysis of test results and also can be dealt with Lab	11 Sessions

Introduction to Graph Theory contd.   11H   [Comprehension Level]

Graph isomorphism, Eulerian graph, Hamiltonian graph, Planar graph (three utility problem), Graph coloring, Combinatorics-Principle of Inclusion and Exclusion.

Module 3	Trees	Assignment	MS Excel, Using Graphs and Pi Charts and tables for analysis	13 Sessions

Trees   13H   [Comprehension Level]   Tree: Definitions, properties, Rooted trees, Binary search tree, Decision tree, prefix code, Tree traversal: in-order, pre-order, post-order, infix, postfix, prefix, spanning tree: BFS, DFS.

Module 3	Algorithm on networks	Assignment	MS Excel, Using Graphs and Pi Charts and tables for analysis	13 Sessions

Algorithm on networks Shortest path algorithm- Dijikstra's algorithm, Minimal spanning tree-Kruskal algorithm and Prim's algorithm, Transport network-Max-flow/Min-cut algorithm, Combinatorics-Rook polynomial, Derrangements .

Targeted Application & Tools that can be used:

Project work/Assignment:
Project Assignment: Assignment 1:   Assignment 2:
Textbooks: K H Rosen, "Discrete Mathematics and its Application", McGraw Hill. [T1]
References: 1. Harris, Hirst amd Mossinghoff," Combinatorics and Graph theory", Springer. [R1]   2. Grimaldi," Graph Theory and Combinatorics", Pearson Education. [R2]   3. J Nestril and etal," Introduction to Discrete Mathematics", Oxford University Press. [R3]   Web references: https://onlinecourses.nptel.ac.in/noc22_ma10/preview
Topics relevant to "SKILL DEVELOPMENT":   Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm, Transport network-Max-flow/Min-cut algorithm, Combinatorics-Rook polynomial, Derrangements for skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 261	Course Title: Machine Learning Using Python Type of Course: Laboratory Integrated	L-T-P- C	2-0	2	4
Version No.	2.0				
Course Pre-requisites	Data Structures, Statistics, Linear Algebra, Python, Database				
Anti-requisites	--				
Course Description	Machine learning (ML), a subset of Artificial Intelligence (AI), is an important set of techniques and algorithms used for solving several business and social problems. The objective of this course is to discuss machine learning model development using Python. AI and ML are important skills that every engineering graduate will require to advance in their career. Python is the leading programming language used by several organizations for creating end-to-end solutions using ML. Topics include: Working with Collections and Data Frames; Regression algorithms; Classification algorithms; Optimization techniques – Gradient Descent algorithm, Gradient Descent for simple Linear Regression; Ensemble Learning – Random Forest, Boosting techniques – AdaBoost and Gradient Boosting; Grid Search for optimal parameters; Clustering algorithms; Forecasting with Time-Series data : Auto-Regressive Integrated Moving Average Models, Recommender Systems : Association Rule Mining, Collaborative Filtering, Text Analytics – Sentiment Classification using Naïve Bayesian model.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Machine Learning Using Python and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Produce Machine Learning Models for Predictive Analytics. [Application]. CO2: Apply Ensemble Learning, Optimization and Hyper Parameter Tuning Techniques for machine learning algorithms. [Application] CO3: Demonstrate different types of Clustering Algorithms.[Application] CO4:Illustrate advanced concepts in Machine Learning such as time series forecasting techniques, Recommender systems, Sentiment Classification. [Application]				
Course Content:					

Module 1	Supervised Machine Learning Algorithms	Assignment	Data Collection/Interpretation	8 Sessions

Topics:

Introduction to the Machine Learning (ML) Framework, types of ML, Feature Engineering, One-hot encoding, Simple Linear Regression, Multiple Linear Regression, Model Evaluation, Validation and Accuracy measures for Regression models. Classification models – Decision Tree algorithms using Entropy and Gini Index as measures of node impurity, model evaluation metrics for classification algorithms, Multi-class classification and Class Imbalance problem.

Module 2	Advanced Machine Learning Concepts	Case studies / Case let	Case studies / Case let	12 Sessions

Topics: Nearest Neighbor techniques, Support Vector Machine, Cost functions and Optimization Technique – introduction to Gradient Descent, its applications on Linear Regression. Ensemble Learning algorithms – Bagging (Random Forest), Boosting(AdaBoost), Hyperparameter Tuning for nearest neighbor learning using Grid Search. Introduction to Regularization with Advanced Regression models- LASSO and Ridge Regression an introduction.

Module 3	Clustering and Forecasting with Time-Series Data	Quiz	Case studies / Case let	14 Sessions

Topics:

Partitional Clustering – K-means and Hierarchical Clustering techniques, cluster validity measures, Dimensionality Reduction Techniques-Linear Discriminant Analysis, Principal Component Analysis, Components of Time Series data, forecasting using moving average, exponential smoothing, calculating forecast accuracy, decomposing time series data.

Module 4	Recommender Systems and Text Analytics	Quiz	Case studies / Case let	14 Sessions

Topics:

Association Rule Mining, Collaborative Filtering – User based and item based similarity, Text Analytics – text preprocessing, representation using BoW and vector space model. Naïve Bayes Classifiers and Naive Bayes model for sentiment classification – an introduction.

List of Laboratory Tasks:

A review of Python programming - Introduction to Python Stack for Data Science, Core Python Libraries for data analysis, Anaconda platform and its installation, Executing programs on Jupyter IDE/Colab, Programming exercises to revise variables, control statements and collections – lists, list comprehension

Programming exercises on Tuples, dictionaries, functions using math, random modules.

Introduction to Data Frames using Pandas and working with frames – shape, summary, cross tabs, sorting by column names, creating new columns, aggregation and grouping, CO11filtering records, removing a column/row, handling missing values, Plotting using matplot
library histogram, scatter Plot

Regression Models Simple linear regression, outlier detection, multiple linear regression – model evaluation, multi-collinearity and handling multi-collinearity, outlier detection

Decision Tree Classifiers - Decision Tree classifier using Gini Index- measuring test accuracy, displaying the tree, confusion matrix and ROC, Decision Tree Classifier using Entropy.

Optimization Techniques Developing a Gradient Descent Algorithm for linear regression – using NumPy and using sklearn

Hyperparameter Tuning methods Hyperparameter tuning using Grid Search for Nearest Neighbor Classifiers and Decision Tree Classifiers

Hyperparameter Tuning for Ensemble models Ensemble Learning – Random Forest – Building the model, GridSearch for optimal parameters, Feature Importance. Ada Boost Classifiers and Gradient Boosting Classifiers

Clustering – Kmeans – cluster centers and interpreting the clusters, finding the optimal number of clusters using Elbow Curve method, Agglomerative Hierarchical Clustering – Compare the clusters formed by kmeans and Agglomerative Clustering

Models for Forecasting Time Series data

Recommender Systems - Association Rule Mining using Apriori for frequent Itemset Generation.

Recommender Systems – user based similarity

Naïve Bayes Model |
| Targeted Application & Tools that can be used

Rapid Miner

Orange

MatLab |
| Project work/Assignment: |
| Assignment: |
| Text book(s):

Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python", Wiley, First Edition 2019.

Rehan Guha, "Machine Learning Cookbook with Python", BPB Publications, First Edition, 2020. |

Reference Book(s):

Tan P. N., Steinbach M & Kumar V. "Introduction to Data Mining", Pearson Education, 2016.

Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017.

E book link R1:

https://www.pdfdrive.com/machine-learning-step-by-step-guide-to-implement-machine-learning-algorithms-with-python-e158324853.html

E book link R2:

https://www.pdfdrive.com/hands-on-machine-learning-with-scikit-learn-and-tensorflow-concepts-tools-and-techniques-to-build-intelligent-systems-e168440497.html

Web resources:

https://machinelearningmastery.com/seaborn-data-visualization-for-machine-learning/

https://link.springer.com/article/10.1007/s42979-021-00592-x

https://pu.informatics.global/

Topics relevant to "SKILL DEVELOPMENT": Data Visualization using Seaborn library, Applications of Machine Learning in different domains for Skill Development through Experiential Learning techniques. This is attained through the Lab Experiments as mentioned in the assessment component

Course Code: CSE3066	Course Title: Mobile Application for IoT Type of Course: Program Core& Theory Only	L-T- P-C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				

Course Description	Mobile Application is the essential part for IoT infrastructure, which helps in understanding the architectural overview of IOT. The purpose of this course is to expose the students to understand the IoT Reference Architecture and Real World Design Constraints along with various IOT protocols. This course is both conceptual and analytical in nature that would help the student to predict the effects of forces and its motion while carrying out creative design functions.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mobile and Application for IoT and attain Skill Development through Participative Learning techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: Able to understand the application areas of IOT Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks Able to understand building blocks of Internet of Things and characteristics. Learn about android application development			
Course Content:				
Module 1	Overview	Assignment	Programming Task	9 Sessions

Topics:

   IoT-An Architectural Overview Building an architecture, Main design principles and needed capabilities,   An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

Assignment: Case study on Business processes in IoT.

Module 2	Basic Design	Assignment	Data Collection/Excel	10 Sessions

Topics:				
Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability. Assignment: Recent trends In mobile application development				

Module 3	IOT mobile apps	Assignment	Programming/Data analysis task	9 Sessions

Topics:				
IoT Mobile App Development Trends In 2020 - Role of Mobile Apps in revolutionizing the world of IoT - UX / UI design for IoT Mobile apps - challenges of UX/UI design for IoT applications - practice tips on design for IoT mobile apps IoT App Design Solutions Assignment: Challenges faced during mobile application development				

Module 4	TECHNOLOGY I-ANDROID	Assignment	Programming/Data analysis task	10 Sessions

Topics:				
Introduction Establishing the development environment Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment Interaction with server side applications Using Google Maps, GPS and Wifi Integration with social media applications.				

Targeted Protocols & Tools that can be used:
Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread

Text Book
T1: "From machine to machine to the internet of things: Introduction to the new age of intelligence", 1st edition, Academic press, 2014.
T2: Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

References

R1: Bernd Scholz- -3-642-19156-5 e-ISBN 978-3- 642-19157-2, Springer

R2: Andrea Goldsmith, "Android in practice," Cambridge University Press, 2005

Weblinks:

W1: https://relevant.software/blog/mobile-iot-apps/

W2: https://medium.com/@its.mattfitzgerald/top-14-iot-mobile-app-development-trends-to-expect-in-2020-7fd7718155dc

W3:https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-%2520live%26ebv%3dEB%26ppid%3dpp_xiii

Topics relevant to "SKILL DEVELOPMENT":

Wifi integration and social media analysis for developing Skill Development through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE3055	Course Title: Wireless communication in IOT	L-T- P- C	3 -0	0	3
	Type of Course: Program Core& Theory Only				
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Wireless communication system is the essential part for IoT infrastructure, which acts as the bridge for dual directional communication for data collection and control message delivery. The purpose of this course is to expose the students to understand the fundamentals of wireless network and problems related to real-world scenarios. This course is both conceptual and analytical in nature.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Wireless communication in IOT and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: To understand the fundamentals of wireless networks Analyze the standards of IoT which employed for wireless networks Explain the use of various wireless technologies in IoT Design and develop various applications of IoT				
Course Content:					

Module 1	Cellular standards	Assignment	Programming Task	9 Sessions

Topics:

Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells,

Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS), Mobile IP,

WCDMA

Assignment: Case study on generation cellular systems.

Module 2	Radio Frequency (RF) Fundamentals	Assignment	Data Collection/Excel	10 Sessions

Topics:

Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards, Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements, Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM.

Assignment: Determination of RF and Microwave spectral Analysis

Module 3	WLAN: Wi-Fi Organizations and Standards	Assignment	Programming/Data analysis task	9 Sessions

Topics:

IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11-   2007,802.11a/b/g, 802.11e/h/I,802.11n

Assignment: Protocols on WLAN connectivity

Module 4	Wi-Fi Hardware & Software	Assignment	Programming/Data analysis task	10 Sessions

Topics: Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, Direct-connect Aps, Distributed connect Aps, PoE Infrastructure, Endpoint, Client hardware and software, Wi-Fi Applications

Targeted Protocols & Tools that can be used:

Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread

Text Book
T1: Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd.
T2: Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd.

References
R1:Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi 4. R2:Wilson , "Sensor Technology hand book," Elsevier publications 2005. 5.
R3: Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005
Weblinks:
W1: https://pianalytix.com/wireless-communication-protocols-in-iot/
W2: https://behrtech.com/blog/6-leading-types-of-iot-wireless-tech-and-their-best-use-cases/

Topics relevant to "SKILL DEVELOPMENT":
GSM, CDMA for developing Skill Development through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 3053	Course Title: Big Data Analytics for IoT Type of Course: Program Core Theory with embedded lab			L-T- P-C	1-0	4	3
Version No.	1.0						
Course Pre-requisites							
Anti-requisites	NIL						
Course Description	The course covers basic concepts for IOT Analytics, collection of data for IOT, Integration of IOT with Cloud, Big Data Environments. Students can learn about applying geospatial analytics and applying machine learning to the IOT data. The course also covers the organization of the IOT data, cost benefits of using IOT and review of IOT in various sectors.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Big Data Analytics for IoT and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.						
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Demonstrate IOT Data Analytics and machine learning application in IOT (Apply) CO2: Apply appropriate Hadoop Ecosystem tools to perform data analytics for a given problem (Apply) CO3: Examine concepts of cloud based IOT, Big data and IOT (Apply) CO4: Illustrate techniques and strategies for data collection and Geospatial Analytics to IOT Data (Apply)						
Course Content:							
Module 1	IOT Analytics	Assignment				5 sessions	
Introduction – IOT Data, Challenges of IOT analytics Applications – IOT analytics Lifecycle and Techniques. IOT Cloud and Big Data Integration – Cloud based IOT platform – Data Analytics for IOT, IOT devices in different domains. IOT Analytics for the Cloud.							
Module 2	Hadoop Ecosystem Tools					5 sessions	
Introduction – Big Data and Big Data Analytics – Hadoop Ecosystem – Hadoop Distributed File System (HDFS) – MapReduce – YARN Architecture – PIG Architecture – Apache HIVE – Mahout – Apache Spark – Apache HBase –Apache Zookeeper.							

Module 3	Overview of AWS and Thingworx	Assignment		5 sessions
AWS overview - AWS key services for IOT analytics. Thingworx overview. Creating an AWS Cloud Analytics environment.				
Module 4	Geospatial Analytics to IOT Data	Case Study	Data Collection and Analysis	
Strategies and Techniques in Data collection: Designing data processing for analytics – Applying big data to storage for Geospatial.				

List of Practical Tasks:

Experiment 1:[Module 1]

Level 1: Installation of Raspbian OS,working basic commands on raspberry pi

Level 2: Demonstrate to obtain the temperature using DHT22 sensors .

Experiment 2: [Module 1]

Level 1: Design and Simulate the RADAR SYSTEM Using Arduino and display on the serial monitor   using ultrasonic sensor/PIR WITH &WITH OUT BUZZER/Servo motor

Level 2: using a raspberry pi to Demonstrate to find the distance using ultrasonic sensor hc- sr04

Experiment 3: [Module 1]

Level 1 : using a raspberry pi Set the connections of healthcare sensors

Level 2: using a raspberry pi to Demonstrate to find the ECG, Temperature, etc using Healthcare sensors

Experiment 4: [Module 2]

Level 1: Hadoop Single node cluster installation on ubuntu

Level 2:   Hadoop Multiple node cluster installation, windows installation

Experiment 5: [Module 2]

Level 1: Basic hadoop commands and Word count analysis for given dataset

Level 2: Analysis on particular matching word on huge dataset

Experiment 6: [Module 2]

Level 1: Basic hadoop commands and Stock analysis on given dataset

Level 2: Analysis with max, min, average functions on particular field with missing values

Experiment 7: [Module 2]

Level 1: Basic hadoop commands and Temperature analysis on given dataset

Level 2: Analysis with max, min, average functions on particular field with missing values

Experiment 8: [Module 3]

Level 1: Working on hive commands

Level 2: Apply bucketing technique to bring out the difference between partitioning and bucketing

Experiment 9: [Module 3]

Level 1: Working on Hbase commands .

Level 2: Apply Hbase commands on Insurance database/employee dataset.

Experiment 10: [Module 3]

Level 1: Installation of spark and word count analysis

Level 2: Using RDD and FlatMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark

Experiment 11: [Module 4]

Level 1: Temperature Data stored in cloud through IoT devices

Level 2: Retrieve the data set for cloud and Apply data analytics techniques

Experiment 12: [Module 4]

Level 1: Healthcare Data stored through IoT sensors in Cloud

Level 2: Retrieve the data set for cloud and Apply data analytics techniques

---

Targeted Application & Tools that can be used:

Hadoop ecosystem tools, Thingworx , AWS Cloud

Project work/Assignment:

Student will be asked to carry out a mini project integrating IoT & data Analytics.

Text Book

T1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley., 2nd Edition, 2019.

T2. Analytics for the Internet of things,Andrew Minteer. Packt publishing, 1st Edition,2017.

T3. Big Data and the Internet of Things, Robert Stackowiak, Art Licht, Venu Mantha and Louis Nagode, Apress, 2nd Edition, 2020

References

R1. IOT and Analytics in Agriculture.,Prasant Kumar Pattnaik, Raghvendra Kumar, Souvik Pal, S. N. Panda. Springer, First Edition, 2020.

R2. Building blocks for IOT Analytics. Internet-of-Things Analytics. John Soldatos (Editor). River Publisher Series in Signal Image and Speech Processing.2020

 (iii) web resources

W1. NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs92/preview

W2. Coursera: https://www.coursera.org/learn/big-data-introduction

W3. EDX: https://www.edx.org/course/big-data-fundamentals

W4. E-book Link : https://www.wiley.com /en-us/Internet+of+Things+and+ Data+ Analytics + Handbook -p-9781119173625

https://presiuniv.knimbus.com/user#/home

Topics relevant to "SKILL DEVELOPMENT": Organize IOT data – Linked analytics datasets – Managing data lakes for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2032	Course Title: Introduction to Fog Computing Type of Course:1] Discipline Elective 　　　　　　　　2] Lab Integrated Course	L-T-P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The course will provide a solid base for understanding the challenges and problems underlying the design and development of fog computing systems and applications. Thus, this course will teach how to specify, design, program, analyze and implement such systems and applications. Fog computing is a decentralized computing infrastructure in which data, compute, storage and applications are located somewhere between the data source and the cloud. Like edge computing, fog computing brings the advantages and power of the cloud closer to where data is created and acted upon. Many people use the terms fog computing and edge computing interchangeably because both involve bringing intelligence and processing closer to where the data is created. This is often done to improve efficiency, though it might also be done for security and compliance reasons.				

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Introduction to Fog Computing and attain SKILL DEVELOPMENT through Problem Solving techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: Understand the basic principles and concepts of fog computing systems and their relation to other models such as Cloud Computing and Near-Far computing. Understand the challenges of developing fog based applications and middleware, and the possible solutions. Specifically, understand the issues mostly related to fog computing, namely: introduction to the fog programming model and related models, security, offloading, Software Defined Network, load balancing, communication, containers and orchestration, application areas. Able to decide which is the best approach for a particular problem regarding the design and development of a fog computing system. Able to design and implement an application using containers. Able to measure and analyze the performance of a fog computing application.			
Course Content:				
Module 1	INTRODUCTION TO FOG COMPUTING	Assignment	Programming activity	11 Sessions
Topics: Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing, Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT , FOG, CloudBenefits.				
Module 2	ARCHITECTURE	Assignment	Programming activity	10 Sessions
Topics: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.				

Module 3	FOG PROTOCOLS AND COMMUNICATION TECHNOLOGIES	Assignment	Programming activity	10 Sessions

Topics:

Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing protocols, Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range

Module 4	MANAGEMENT AND ORCHESTRATION	Assignment	Programming activity	11 Sessions

Topics:

Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background , Network Slicing in 5G , Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog , Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds , IoT Integration , Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics: Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.

Module 5	FOG COMPUTING REQUIREMENTS WHEN APPLIED TO IOT	Assignment	Programming activity	11 Sessions

Topics:

Fog computing requirements when applied to IoT: Scalability,Interoperability,Fog-IoT: architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, DataManagement,filtering,EventManagement,DeviceManagement,cloudification,virualization, security and privacy issues. Integrating IoT,Fog, Cloud Infrastructures: Methodology , Integrated C2F2T Literature by Modeling Technique re by Use-Case Scenarios , Integrated C2F2T Literature by Metrics.

Targeted Application & Tools that can be used: Case Study: Wind Farm - Smart Traffic Light System, Wearable Sensing Devices, Wearable Event Device ,Wearable System, Demonstrations , Post Application Example . . Event Applications Example.

Text Book

Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya.

Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by RajkumarBuyya and Satish Narayana Srirama.

Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things Paperback by SudipMisra , Subhadeep Sarkar , Subarna Chatterjee.

Web Links:

Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya.

Fog Computing | Wiley Online Books

Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by RajkumarBuyya and Satish Narayana Srirama.

Fog and Edge Computing: Principles and Paradigms | Wiley

Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things Paperback by SudipMisra , Subhadeep Sarkar , Subarna Chatterjee.

Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of (routledge.com)

References

FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, —Fog Computing and Its Role in the Internet of Thingsǁ, MCC'12, August 17, 2012, Helsinki, Finland. Copyright 2012 ACM 978- 1-4503-1519-7/12/08... $15.00.

Shanhe Yi, Cheng Li, Qun Li, —A Survey of Fog Computing: Concepts, Applications and Issuesǁ, Mobidata'15, ACM 978-1-4503-3524-9/15/06, DOI: 10.1145/2757384.2757397, June 21, 2015, Hangzhou, China..

Amir M. Rahmani ,PasiLiljeberg, Preden, Axel Jantsch, —Fog Computing in the Internet of Things - Intelligence at the Edgeǁ, Springer International Publishing, 2018.

Ivan Stojmenovic, Sheng Wen, "The Fog Computing Paradigm: Scenarios andSecurity Issues", Proceedings, Federated Conference on Computer Science and Information Systems, pp. 1–8, 2014

Fog Computing: Helping the Internet of Things Realize its Potential Amir VahidDastjerdi and RajkumarBuyya, University of Melbourne.

Multi-Dimensional payment Plan in Fog Computing with Moral Hazar,YanruZhang,Nguyen H. Tran,DusitNiyato, and Zhu Han,IEEE,2016

Topics relevant to "SKILL DEVELOPMENT":

Fog Computing requirements for SKILL DEVELOPMENT through Problem Solving Techniques. This is attained through the assessment component mentioned in course handout.

Course Code: CSE3046	Course Title: DevOps Tools And Internals Type of Course: Theory & Integrated Laboratory	L-T-P- C	2 -0	2	3
Version No.	1.2				
Course Pre-requisites	Fundamentals of Devops				
Anti-requisites	NIL				
Course Description	This course is designed to offer profound perceptions and knowledge in various tools like Git, Ansible, Selenium and Jekins. With the proficient learning of DevOps course, a student will be able to work in all the above tools and become a trained practitioner in the integration and monitoring of software. DevOps Tool is an application that helps the software development process to industrialize. It mainly focuses on communication and collaboration between product management, software development, and operations professionals. The objective of this course is to discuss and implement the various tools usage and internals practically.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of DevOps Tools And Internals and attain Skill Development through Experiential Learning techniques.				

Course Out Comes	On successful completion of this course the students shall be able to:
	
	1] Apply the features and common Git workflow. [Application]
	
	2] Practice the filters and plugins to populate, manipulate, and manage data used by Ansible Playbooks.
	
	                                                                [Application]
	
	3] Compute the features of selenium IDE. [Application]
	
	4] Interpret the installation and features of Jenkins and build jobs.
	
	                                                                [Application]				

Course Content:					
Module 1	Git	Quiz	Quiz on Git commands	5L +4P Classes	
Topics:					

Introduction to Git, Features of Git, Benefits, Workflow, Git vs GitHub, Installation of Git on Windows/Linux and Environment set up, All Git Commands-Working with local and remote repositories, Running first Git command, Fundamentals of Repository structure and file status life cycle, Working locally with staging, unstaging and commit.

Module 2	Containerization Using Docker	Quiz	Quiz on Ansible tool usage	5L +4P Classes

Topics:

Docker Life Cycle,Docker Installation, Docker Operations,Docker Concepts - Registry, Repository, Tag, Image and Containers, Create A Docker Hub Account, Docker Images and Containers, Pushing Docker To Container Hub, Docker File.

Module 3	Ansible	Assignment	Assignments on Selenium tool usage and test case	5L +4P Classes

Topics:

Ansible Workflow, Architecture, Installation in Linux/Windows, ad-hoc Commands, Playbooks, Tower, Roles, Variables open link, Tags, Galaxy, Commands Cheat Sheets, Modules, Shell, Templates, YAML, Inventory, Debug, Apt, Lineinfile, Copy, Command, File, Vault, Windows, Yum, AWX, Unarchive, Ansible Pip

Module 4	Jenkins	Assignment	Assignments on Jenkins tool usage and Build jobs	5L +4P Classes

Topics:

Introduction To Continuous Integration, Jenkins Architecture, Managing Nodes On Jenkins, Jenkins Master Node Connection, Jenkins Integration With Devops Tools, Understanding CI/CD Pipelines, Creating A CI/CD Pipeline

List of Laboratory Tasks:

Git

1. Level 1: Installation of Git on windows

   Level 2: Git commands-Local repositories

   Level 2: Git commands-Remote repositories

 2. How Git can handle automatically file modifications when they are not related to the same lines   of text.

   Level 1: You are in a new repository located in C:\Repos\Exercises\Ch2-1.

   Level 1: You have a master branch with two previous commits: the first commit with a file1.txt   file and the second commit with a file2.txt file.

Level 2: After the second commit, you created a new branch called File2Split. You realized that file2.txt is too big, and you want to split its content by creating a new file2a.txt file. Do it, and then commit the modifications.

3. How to resolve conflicts when Git cannot merge files automatically.

Level 1: You are in the same repository used earlier, C:\Repos\Exercises\Ch2-1. On the master branch, you add the file3.txt file and commit it.

Level 2: Then, you realize that it is better to create a new branch to work on file3.txt, so you create the File3Work branch. You move in this branch, and you start to work on it, committing modifications.

Level 2: The day after, you accidentally move to the master branch and make some modifications on the file3.txt file, committing it. 5. Then, you try to merge it.

4. Level 1: Installation of Ansible

Level 2: Create a basic inventory file

Level 2: Running your first Ad-Hoc Ansible command.

Ansible

5. Ansible Archive

Level 1: Compressing the Directory with TAR and tar and gz

Level 1: Compress the file – Default File Compress format and Remove the Source files after   archiving

Level 2: Create a ZIP file archive – File and Directory

Level 2: Create a BZIP archive – File and Directory

6. A Quick Syntax of Ansible Shell module – ADHOC

Level 1: A Quick Syntax of Ansible Shell module in a Playbook

Level 1: Ansible Shell Examples

Level 2: Execute a Single Command with Ansible Shell

Level 2: Execute a Command with Pipe and Redirection

7. Level 1: Run playbook

Level 2: Create the file on the target machines or servers as mentioned in the inventory file and the webserver's group, save the below code with .yml extension and run the playbook.

Level 2: Create multiple directories. To create multiple directories with one single task you can use the loop with_items statement. So when you run the below playbook it is interpreted as 3 different tasks.

Selenium

8.   Level 1: Selenium IDE Download and Install

Level 2: Selenium IDE - First Test Case, Login Test and command usage

9. Level 1: Write a script to open google.co.in using chrome browser (ChromeDriver).

Level 2: Write a script to open google.com and verify that title is Google and also verify that it is redirected to google.co.in.

10. Level 1: Write a script to open google.co.in using internet explorer (InternetExplorerDriver).

Level 2: Write a script to create browser instance based on browser name.

11. Level 1: Write a script to close all the browsers without using quit() method.

Level 2: Write a script to search for specified option in the listbox

Jenkins

12. Level 1:

Environment Setup

Level 2:

Jenkins downloading and installation

13. Level 1:

Setup a Jenkins Job with Apache Ant Build Tool

Setup a Jenkins Job with Apache Maven

Level 2 :

Setup a Jenkins Job with Batch Script.

14. Level 1: Add a Linux Node (Also Check SSH Slaves plugin plugins)

Level 1: Add a Windows Node

Level 2: Assign a Java Based Job to Linux and Build it

Level 2: Assign a MSBuild Based to Windows and Build it

Targeted Application & Tools that can be used:
Tracking changes in the source code and source code management
Automates web browsers
Configuration Management and IT automation.
Integration of Individual Jobs and Effortless Auditing
Tools: Git, Ansible, Selenium and Jekins

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Each batch of students (self-selected batch mates) will identify projects from searching on Google and implement with the most suitable 2 or 3 antecedents.

Text Book

Craig Berg, "DevOps For Beginners: A Complete Guide to DevOps Best Practices (Including How You Can Create World-Class Agility, Reliability, And Security In Technology Organizations With DevOps) (Code tutorials)", Paperback – June 12, 2020.

Ferdinando Santacroce, "Git Essentials", Packt Publishing, April 2015, ISBN: 9781785287909

John Ferguson Smart. "Jenkins: The Definitive Guide", O'Reilly Media, Inc., July 2011, ISBN: 9781449305352

References

Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", Leanpub, August 5, 2020

Unmesh Gundecha, Carl Cocchiaro, "Learn Selenium", Packt Publishing, July 2019, ISBN: 9781838983048

Gaurav Agarwal, "Modern DevOps Practices: Implement and secure DevOps in the public cloud with cutting-edge tools, tips, tricks, and techniques", July 2021.

Mikael Krief, "Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps", October 2019

Weblinks:

https://git-scm.com/book/en/v2

https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner

https://www.javatpoint.com/selenium-tutorial

https://www.javatpoint.com/ansible

https://www.tutorialspoint.com/jenkins/jenkins_managing_plugins.htm

https://nptel.ac.in/courses/128106012

Topics relevant to "SKILL DEVELOPMENT": Git&Junit, Ansible, Selenium, Jenkins for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3045	Course Title: Development Automation Type of Course: Elective in Devops Basket Theory & Integrated Laboratory	L-T- P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	NIL				

Anti-requisites	Scripting Language Knowledge, Linux Fundamentals
Course Description	The Objective of this course is to give a strong foundation of the Development Automation. DevOps refers to the integration of an organization's development (dev) and operations (ops) teams. It encompasses an organization's culture, processes, and philosophies. DevOps tools enable faster development cycles and higher software quality. DevOps speeds delivery of higher quality software by combining and automating the work of software development and IT operations teams.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Development Automation and attain SKILL DEVELOPMENT through Experiential Learning techniques.
Course Outcomes	On successful completion of the course, the students shall be able to
	Understand the automated software delivery and deployment process[Knowledge]
	Analyze the various automation scenarios .[Comprehension]
	Demonstrate the interaction with linux environment[Application]
	Implement scripts[Application]
	Implement makefiles to automate tasks[Application]

Course Content:				
Module 1	Introduction to Automation	Assignment/Quiz	Fully Automated Software delivery process	06 Session

Topics: The Software Delivery Pipeline, Overview of the Continuous Delivery Pipeline, Fully Automated

Software Delivery Process, The Build Process, Automated build, Automated Test, Automated Deployment, Benefits of Automated Deployment, Automated Deployment and DevOps Adoption, Automated Deployment and DevOps Adoption, Overview of Rapid Application Development (RAD), Phases in RAD, Essential Aspects of RAD, Code generation, Categories of Code Generators, Common.

Assignment: The build process

Module 2	Advantages of Automation	Case study	Automation scenarios	06 Session

Topics: Advantages of Automation, Automation Scenarios, Archiving Logs, Auto-Discard Old Archives, MySQL (RDBMS) Backups, Email Web Server Summary, Ensure Web Server is Running, User Command

Validation, Disk Usage Alarm, Sending Files to Recycle Bin, Restoring Files from Recycle Bin, Logging

Delete Actions, File Formatter, Decrypting Files, Bulk File Downloader, System Information, Install

LAMP Stack, Get NIC's IP, Scenarios Where Automation Prevents Errors .

Assignment: Email web server summary

Module 3	Interacting with Linux Environment	Case study	Linux File system	06 Session
Topics: The Linux System, Linux File System, Partitions, Common System Directories, Shell, User Groups and Permissions, User Accounts, The passwd File, Creating User Accounts, File Ownership, File Permissions, Working with Bash, Shell Features Assignemnt: Linux File System				
Module 4	Scripting Development Tasks	Case study	Linux commands	06 Session
Topics: Writing Automation Scripts, Task Scheduling Using Cron, Basic Linux Commands, Best Practices for Scripting, Make use of Shell's Built-In Options, Naming Conventions, Annotations Make the Logic Clean, Command Substitution, Always Begin with a Shebang, Variable Substitution, Conditionals, Regular Expressions. Assignment: Shell's built-in options				
Module 5	"Make" and "Makefiles"	Case study	Makefile arguments and source code creation	06 Session
Topics: Why "Make"? Why not Others?, Why not use "Bash Script" instead of "Makefile"?, features of "Make", Various versions and Variants of "Make", Structure of a "Makefile", What is a Rule?, Structure of a "Makefile" Rule, Targets, Some Special Built-in Target Names, Automatic Variables, Suffix Rules, Pattern Rules, The "Make" command, "Make" arguments, recu,rsive makefile, Building Binary from Source Code, Conditionals in "Makefile", Best Practices in writing "Makefiles".				

Assignment: Best practices in writing Makefiles

List of Laboratory Tasks:

Experiment No 1: Working with Basic Linux Commands, make use of shells built in options, naming conventions,

Level 1: basic linux commands

Level 2: Advanced linux commands

Experiment No 2: Working with Linux File System, Partitions, Common System Directories

Level 1: Simple commands for exploring paritions, common system directories

Level 2: configuring linux system

Experiment No 3: Working with writing automation scripts

Level 1: Simple automation scripts

Level 2: Complicated automation scripts

Experiment No 4: Working with variable substituition, conditionals, regular expressions

Level 1: Simple regular expressions, conditionals

Level 2: Advanced regular expressions, conditionals

Experiment No 5: creation of makefile , Structure of makefile

Level 1: Simple makefile creation

Level 2: Advanced program on makefile

Experiment No 6: Working with automatic variables, pattern rules , make command

Level 1: Basic pattern rules, make command

Level 2: Advanced pattern rules

Experiment No 7: Building binary from source code

Level 1: basic binary from source code

Level 2: Advanced binary from source code

Experiment No 8: Working with Conditionals in "Makefile", Best Practices in writing "Makefiles

Level 1: Basic conditionals in makefile

Level 2: Advanced conditions and best practices in writing makefiles

Targeted Application & Tools that can be used:
Application Area includes Online Financial Trading Company, Network Cycling, Car manufacturing industries, Airlines industries, GM Financial, Bug Reduction. Companies like Amazon, Target, Esty, Netflix, Google, Walmart use Devops in their day to day processes to increase efficiency and improve delivery time. Professionally Used Software: Red hat Linux Operating system, GIT Besides these software tools Visual studio code also used

Project work/Assignment:
1.Case Studies: At the end of the course students will be given a real-world scenario for any application on automating software development and deployment process, automation scenarios, working with linux environment using script and makefile. 2. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 3. Presentation: There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

Text Book(s):
a. Running Linux – Book by Matthias Kalle Dalheimer, Matt Welsh b. Mastering Linux Shell Scripting – Book by Andrew Mallett .

Reference(s):
Reference Book(s):
1.DevOps Handbook: How to Create World-Class Agility, Reliability and Security in Technology Organizations – IT Revolution Press; Illustrated edition (October 6, 2016), Gene Kim, Jez Humble, Patrick Debois, John Allspaw and John Willis
2. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale 1st Edition, O'Reilly Media; 1st edition (May 30, 2016), Jennifer davis, Ryn daneils Online Resources (e-books, notes, ppts, video lectures etc.): Coursera:

1. DevOps on AWS | Coursera

2. DevOps, Cloud, and Agile Foundations | Coursera

3.Introduction to DevOps | Coursera

E-books :

1.https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii

2.https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live

Topics relevant to "SKILL DEVELOPMENT":

Simple automation Scripts, Linux commands for SKILL DEVELOPMENT through Experiential Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 3043	Course Title: Automated Test Management Type of Course: Integrated	L-T- P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	Introductory course on Software Engineering.				
Anti-requisites	NA				
Course Description	This course is intended for understanding the principles of automation and the application of tools for the analysis and testing of software. The automated analysis encompasses both approaches to automatically generate a very large number of tests to check whether programs meet requirements, and also means by which it is possible to prove that software meets requirements and that it is free from certain commonly-occurring defects, such as divide-by-zero, overflow/underflow, deadlock, race-condition freedom, buffer/array overflow, uncaught exceptions, and several other commonly-occurring bugs that can lead to program failures or				

	security problems. The learner will become familiar with the fundamental theory and applications of such approaches, and apply a variety of automated analysis techniques on example programs.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Automated Test Management and attain SKILL DEVELOPMENT through Experiential Learning techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: Understand testing in DevOps. Learn its approaches to testing. Understand to design test cases.			
Course Content:				
Module 1		CA1	Lab Experiments	10 Sessions
Topics: Seven Principles - SDLC vs STLC - Testing Life Cycle - Usability Testing - Functional Testing - End to End Testing - Compatibility Testing - GUI Testing - API testing.				
Module 2		CA2	Lab Experiments	10 Sessions
Topics: Usability Testing - Functional Testing - End to End Testing - Compatibility Testing - GUI Testing - API testing.				
Module 3		CA3	Lab Experiments	10 Sessions
Topics:Manual Testing - Automation Testing - Unit Testing - Integration Testing - Smoke-Sanity Testing - Regression Testing , Reasons for Automated Testing: Controlling Costs, Application Coverage, Scalability, Repeatability.				
Module 4		CA4	Lab Experiments	10 Sessions
Topics :Test Scenario - Test Case Design - Test Basis - Traceability Matrix				
Module 5		CA4	Lab Experiments	8 Sessions
Topics : ESTIMATION TECHNIQUES :Estimating automation - Test Plan Document - Bug Life Cycle				
List of Laboratory Tasks:				

Introduction and installation of DevOps. SDLC, STLC, GUI and API testing modules. Unit Testing and Integration testing modules. Creating test scenarios. Bug Life Cycle
Targeted Application & Tools that can be used DevOps
Project work/Assignment:
Assignment: CA1, CA2, CA3, CA4
Text Book T1.Flexible Test Automation - by Vitaliano Inglese, Pasquale Arpaia T2.Experiences of Test Automation: Case Studies of Software Test Automation - by Mark Fewster, Dorothy Graham
References   Web resources: W1. https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT": Unit testing, Functional testing for Skill Development through Experiential Learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3040	Course Title: Agile Structures and Frameworks Type of Course: School Core	L-T- P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Software Engineering				
Anti-requisites	NIL				
Course Description	This course imparts knowledge to students in the basic concepts of Agile Software Process, methodology and its development The objective of this course is to provide the fundamentals concepts of Agile and its Significance. This course covers the Agile and its methodologies. The objective of the course is to understand the Agility and Assurance.				

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Agile Structures and Frameworks and attain Skill Development through Participative Learning techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: 1] Understand the basic concepts of Agile Software Process. (Knowledge level) 2] Comprehend the various Agile Methodologies. (Comprehension level) 3] Develop Agile Software Process. (Knowledge level) 4] Apply principles of Agile Testing. (Application level)			
Module 1	Introduction	Assignment	Agile Estimation	08 Sessions
Introduction to Agile technology, Iterative and Evolutionary Methods, Agile – Agile Development. Agile Values, Agile Principles, Compare and Contrast the agile with traditional methods. Agile Benefits. Agile Estimation Techniques. Case Study				
Module 2	Agile and Its Significance	Assignment	Comparison of Agile technologies with traditional methods	09 Sessions
Agile Story : Evolutionary delivery ,Scrum Demo, Planning game, Sprint back log, adaptive planning. Agile Motivation – Problems With The Waterfall - Research Evidence. Scrum : Method Overview ,Life cycle phases and Work product roles and practices.				
Module 3	Agile methodology		Case Study	12 Sessions
Extreme Programming: Method Overview ,Life cycle phases and Work product roles and practices. Unified process : Method Overview ,Life cycle phases and Work product roles and practices. EVO : Method Overview ,Life cycle phases and Work product roles and practices. Case Study.				
Module 4	Agility and Quality Assurance	Assignment	Apply the testing concepts using Programing	09 Sessions
Agile product development – Agile Metrics – Feature Driven Development (FDD). Agile approach to Quality Assurance. Test Driven Development – Agile approach in Global Software Development. Agile Technology Tools.				
Targeted Application & Tools that can be used: JIRA				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Agile Estimation				

Comparison of Agile technologies with traditional methods
Case Study: Student group must collaborate and report together along with assigned batch members. Collect the requirements from the client and adopt the suitable agile practice method for your project
Installation and features of JIRA tool.
Text Book 1]   Craig Larman, "Agile and Iterative Development – A Manager's Guide", Pearson Education – 2006 2] Edward Scatter "Brilliant Agile Project Management: A Practical Guide to Using Agile, Scrum and Kanban, 2015
References 1]   Chetankumar Patel, Muthu Ramachandran, Story Card Maturity Model (SMM): A Process Improvement Framework for Agile Requirements Engineering Practices, Journal of Software, Academy Publishers, Vol 4, No 5 (2009), 422-435, Jul 2009. 2] Hazza& Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer 2009 3]Kevin C. Desouza, Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007. Web resources: https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT": Agile Estimation techniques for skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE227	Course Title: SOFTWARE ENGINEERING AND PROJECT MANAGEMENT Type of Course: Theory Only	L- T-P-C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Object Oriented Concepts, Basic programming knowledge, basic understanding of algorithms.					
Anti-requisites	Nil					

| Course Description | The objective of this course is to help students understand the process and fundamental principles involved in software system development and software project management. The course covers software process models, software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course also covers project evaluation, planning, effort estimation and risk management aspects in software project planning.

Topics include: Introduction to Software Engineering, Process Life Cycle Models, Requirement Analysis and Specification, User Interface Analysis and Design, Software Testing, Project Management, Project Planning, Effort Estimation Techniques, Project Scheduling, Project Metrics & Evaluation, Risk Management. |
|---|---|
| Course Objective | The objective of the course is to familiarize the learners with the concepts of SOFTWARE ENGINEERING AND PROJECT MANAGEMENT and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques. |
| Course Outcomes | On successful completion of the course the students shall be able to:

1) Describe the software engineering principles, ethics and process models.

2) Identify the requirements and appropriate design models for a given application.

3) Discuss the various types of testing methods and Quality Assurance.

4) Apply project planning, scheduling, evaluation and risk management principles for a given project. |
| Course Content: | |

Module 1	Introduction to Software Engineering & Process Models	Knowledge level	SCRUM Models	08 Sessions
Software and Software Engineering: Nature of Software, Software Engineering Practice, Software Myths, SDLC, Software Processes: Generic Model, Prescriptive Process Model, Unified Process Model, Agile Development: Extreme Programming, Iterative Waterfall Model, Classical Waterfall Model				
Module 2	Software Requirements and Design	Comprehension level	Use Case Diagram	09 Sessions
Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, SRS, Requirements modelling: Developing Use Cases, Developing Activity diagram and Swimlane diagram, Design : Design concepts, Architectural design,, Introduction to Star UML tool				
Module 3	Software Testing and Quality	Comprehension level	Software Testing	08 Sessions

Introduction to Software Testing: verification and validation, Test Strategies for conventional Software, Validation Testing, White box Testing: Basis path testing, Black box Testing. Software Quality Assurance : Elements of software quality assurance, Software configuration management : SCM process. Introduction to JIRA and Selenium tools				
Module 4	Software Project Management	Application	CMM level	13 Sessions
Project Management Concepts, Project Planning, Overview of metrics, Estimation for Software projects, Project Scheduling, Risk Management, Maintenance and Reengineering, Introduction to DevOps				
Targeted Application & Tools that can be used: Star UML, Jira				

Text Book

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 2017.

2. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 2018.

References

Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.

Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2014.

E-Resources

Library - Presidency University https://presidencyuniversity.in › library

Practice UML based modeling using "Software Engineering Virtual Lab" made available by IIT-Kharaghpur (URL – https://vlabs.iitkgp.ernet.in/se/)

Topics relevant to "SKILL DEVELOPMENT": Software Testing Problems for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE 2014	Course Title: Software Engineering Type of Course: School Core [Theory Only]	L-T- P-C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				

Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles.
	The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development.
	The course covers software quality, configuration management and maintenance.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)

Module 1	Introduction to Software Engineering and Process Models (Knowledge level)	Quiz		09 Hours

Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle

Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.

Module 2	Software Requirements, Analysis and Design (Comprehension level)	Assignment	Development of SRS documents for a given scenario	11 Hours

Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment.

Design: Design concepts, Architectural design, Component based design, User interface design.				
Module 3	Agile Principles & Devops (Knowledge level)	Quiz		09 Hours
Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method. Devops: Introduction, definition, history, tools.				
Module 4	Software Testing and Maintenance (Application Level)	Assignment	Apply the testing concepts using Programing	12 Hours
Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing. Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub). Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.				
Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools				
Text Book 1] Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 2017. 2] Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 2018				
References Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2015. Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011. Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002				
Topics Relevant to "Skill Development: Balck box Testing, White box Testing, Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout				

Course Code: CSE 3097	Course Title: Web Security	L-T-P- C	2-0	2	3
	Type of Course: Integrated				

Version No.	1

Course Pre-requisites	Advanced Computer networks(CSE3070)

Anti-requisites	NIL

Course Description	The purpose of this course this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web encryption.

Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.

Course Out Comes	On successful completion of the course the students shall be able to: Define the fundamentals of web applications and validation [Knowledge] Recognize the significance of password and authentication in web applications [Comprehension] Explain the importance of session management in web [Comprehension] Apply web attack techniques to find vulnerabilities in web applications [Application]

Course Content:	

Module 1	Introduction	Quiz	Comprehension based Quiz on web fundamentals	10 Sessions

Topics:

Web Functionality, Encoding Schemes, Mapping the Application - Enumerating the Content and Functionality, Analyzing the Application Bypassing, Client-Side Controls: Transmitting Data Via the Client, Capturing User Data, Handling Client-Side Data Securely - Input Validation, Blacklist Validation - Whitelist Validation - The Defense in-Depth Approach - Attack Surface Reduction, Rules of Thumb, Classifying and Prioritizing Threats.

Module 2	Web Application Authentication	Assignment	Comprehensive based assignment on Web authentication	11 Sessions

Topics:

Authentication Fundamentals- Two Factor and Three Factor Authentication, Web Application Authentication- Password Based, Built-in, HTTP, Single Sign-on, Custom Authentication, Validating credentials - Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity - Design Flaws in Authentication Mechanisms - Implementation Flaws in Authentication Mechanisms - Securing Authentication.

Module 3	Session Management &Web Security Principles	Quiz	Comprehension based Quiz on web security techniques.	11 Sessions

Topics:

Need for Session Management, Weaknesses in Session Token Generation, Weaknesses in Session Token Handling, Securing Session Management; Access Control: Access Control Overview, Common Vulnerabilities, Attacking Access Controls, Securing Access Control. Origin Policy, Exceptions, Browser security Principles- Cross Site Scripting and Cross Site Request Forgery, File Security Principles: Source Code Security, Forceful Browsing, Directory Traversals.

Module 4	Web Application Vulnerability	Assignment	Comprehension based assignment on web vulnerabilities	10 Sessions

Topics:

Attacking data-stores and backend components- Injecting into Interpreted Contexts, injecting into SQL, NoSQL, XPath, LDAP, Injecting OS Commands, Manipulating File Paths, Injecting into XML Interpreters, Injecting into Back-end HTTP Requests, Injecting into Mail Services, Attacking application logic-real world logic flaws, Attacking users-Cross site scripting-varieties of XSS,XSS attacks in action, finding and exploiting XSS vulnerabilities, preventing XSS attacks, Other techniques-cookie based Attacks, HTTP Header Injection

List of Laboratory Tasks:

Task 01:   Practical knowledge of known vulnerabilities in CGI, LAMP stacks, REST APIs cross-site

       scripting

Task 02:   HTTP and setting up stacks, the various types of databases Access Controls, Vulnerabilities

Task 03:   SQL injection and prevention

Task 04: Study of web authoring tools
Task 05: Testing web applications
Task 06: Cross site request forgery attack lab
Task 07: Web tracking

Targeted Application & Tools that can be used
Wordpress tool can be used for building websites with possible vulnerabilities.
Tools such as Nmap and Nessus can be used for web attack demonstration.

Project work/Assignment:

Assignment:
Group assignment to identify and write different web exploits to demonstrate vulnerabilities in web applications.

Text Book
T1   Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook", Willey Publishing Inc.

References
R1   B. Sullivan, V. Liu, and M. Howard, "Web Application Security", A B Guide. New York: McGraw-Hill
Education, 2011.
R2   Web Application Security: Exploitation and Countermeasure for Modern Web Applications, by Andrew
Hoffman
E book link R1:   https://presiuniv.knimbus.com/user#/home
E book link R2 :   https://presiuniv.knimbus.com/user#/home
R3   Web resources:
NPTEL / Swayam Link   :   Introduction to Information Security I, IIT Madras
https://nptel.ac.in/courses/106106129
PU Library Link   :   https://puniversity.informaticsglobal.com/login

Topics relevant to "EMPLOYABILITY SKILLS":
Session Management &Web Security Principles and Web Application vulnerability for Skill Development through Experiential Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE2039	Course Title: Ethical Hacking Type of Course: Discipline Elective in Cyber Security Basket		L-T- P-C	2-0	2	3
Version No.	1.0					
Course Pre-requisites	Basic networking tools knowledge and Cryptography & Network Security					
Anti-requisites	NIL					
Course Description	This course introduces students to a wide range of topics related to ethical hacking. It also provides an in-depth understanding of how to effectively protect computer networks. These topics cover some of the tools and penetration testing methodologies used by ethical hackers and provide a thorough discussion of what and who an ethical hacker is and how important they are in protecting corporate and government data from cyber-attacks					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Ethical Hacking and attain Skill Development through experiential Learning techniques.					
Course OutComes	On successful completion of this course the students shall be able to: Illustrate the importance of ethical hacking Categorize the various techniques for performing reconnaissance. Demonstrate various types of system scanners and their functions Demonstrate the function of sniffers on a network					
Course Content:						
Module 1	Introduction to Hacking (Knowledge, Application)	Assignment	Programming activity		12 Hours	

Topics:

Introduction to Hacking-Important Terminologies - Asset - Vulnerability - Penetration Test - Vulnerability Assessments versus Penetration Test - Penetration Testing Methodologies - Categories of Penetration Test.

Assignment: Different phase methodologies on penetration testing

Module 2	Linux Basics	Assignment	Programming activity	10 Hours

Topics:

Major Linux Operating Systems - File Structure inside of Linux - BackTrack - Changing the Default Screen Resolution - Some Unforgettable Basics.

Assignment: Penetration testing distribution

Module 3	Information Gathering Techniques	Assignment	Programming activity	11 Hours

Topics:

Sources of Information Gathering - Copying Websites Locally - NeoTrace - Xcode Exploit Scanner - Interacting with DNS Servers - DNS Cache Snooping - DNS Lookup with Fierce - SNMP - SMTP.

Assignment:Domain internet groper

Module 4	Target Enumeration and Port Scanning Techniques	Assignment	Programming activity	13 Hours

Topics:

Target Enumeration and Port Scanning Techniques - Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - Vulnerability Assessment.

Assignment: Demonstrations for port scanning

List of Laboratory Tasks:

Experiments:

Installing BackTrack

Netcraft

Keyloggers

Acunetix

Nslookup

SNMP

Port Scanning

NetStumbler

Performing an IDLE Scan with NMAP

Network Sniffing

Targeted Application & Tools that can be used: Application Software and open source tools

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Any appropriate tool can be given to demonstrate i.e Sql injections.	
Text Book Rafay Baloch, 2014: "Ethical Hacking and Penetration Testing Guide" Apple Academic Press Inc.	
References Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security Testing,Penetration Testing, and Basic Security". James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and Network Defense", 2nd Edition, Cengage Learning.	
Topics relevant to "EMPLOYABILITY SKILLS": Ethical hacking techniques for Skill Development through Experiential Learning techniques. This is attained through the assessment component mentioned in course handout.	

Course Code: CSE241	Course Title: Wireless Sensor and Adhoc Networks Type of Course:1] Discipline Elective 2] Lab Integrated Course	L-T- P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course examines wireless cellular, ad hoc and sensor networks, covering topics such as wireless communication fundamentals, medium access control, network and transport protocols, unicast and multicast routing algorithms, mobility and its impact on routing protocols, application performance, quality of service guarantees, and security. Energy efficiency and the role of hardware and software architectures may also be presented for sensor networks.				
Course Objectives	The objective of the course is to familiarize the learners with the concept of Wireless Sensor and Ad-Hoc Networks for SKILL DEVELOPMENT by using PARTICIPATIVE LEARNING techniques.				

Course Out Comes	On successful completion of this course the students shall be able to:
	Explain the basic working of the Wireless systems. (Knowledge)
	Describe different protocols being used by wireless networks including ABR and MANETS.(Knowledge)
	Illustrate the Fundamental Concepts and applications of ad hoc and wireless sensor networks.(Comprehension)
	Interpret the WSN routing issues by considering related QoS measurements.(Application)

Course Content:				
Module 1	Overview of Wireless Sensor and Adhoc Networks	Assignment	Programming activity	10 Hours

Topics:

Introduction, Sensor Network Technology background, Elements of basic Sensor Network Architecture, Survey of Sensor Networks, Network Characteristics and Challenges, Applications of Wireless Sensor Networks, Range of Applications, Category 2 WSN Applications – Home Control, Industrial Automation, Medical Applications, Category 1 WSN Applications – Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Introduction to Cellular and Adhoc Networks, Issues in Adhoc Networks – Routing, Multicasting, QoS, Security, Scalability.

Module 2	Wireless Transmission Technology and MAC Protocols for Adhoc	Assignment	Programming activity	10 Hours

Topics:

Introduction, Radio Technology Primer – Propagation and Modulation, Propagation and Modulation impairments, Available Wireless Technologies, Campus Applications, MAN/WAN Applications, Medium Access Control Protocols – Fundamentals, Performance Requirements, MAC Protocols for WSNs -Schedule based Protocols and Random Access based Protocols, Sensor MAC case study, Issues in Designing MAC Protocol for Adhoc Networks - Bandwidth efficiency, QoS support, Synchronization, error-prone broadcast channel, Mobility of nodes.

Module 3	Routing Protocols for Adhoc and WSN	Assignment	Programming activity	10 Hours

Topics:

Background, Data Dissemination and gathering, Routing challenges, Network Scale and Time-Varying Characteristics,, Routing Strategies, characteristics of an ideal Routing Protocol for Adhoc Networks, WSN Routing Techniques, Classifications of Routing Protocols, Table-driven and on-demand Routing Protocols, Routing Protocols with efficient flooding mechanism.

Module 4	Demonstration of WSN Adhoc Network using Simulators	Assignment	Programming activity	6 Hours

Topics:
GloMoSim Simulator, TOSSIM, OMNeT++ and other recent available simulation tools (MATLAB wireless module, NS2, etc).

Targeted Application & Tools that can be used: Case Study: GloMoSim Simulator, TOSSIM, OMNeT++ and other recent available simulation tools -MATLAB wireless module, NS2, etc.

Text Book
T1: Kazem Soharby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks : Technology, Protocols and Applications, Wiley Publication, 2016, ISBN : 978-81-265-2730-4
T2: C. Siva Ram Murthy and B. S. Manoj, Adhoc Wireless Networks – Architecture and Protocols, Pearson Publication, 2013. ISBN : 978-81-317-0688-6
Web Links:
R3: https://networksimulationtools.com/glomosim-simulator-projects/
R4 : http://vlabs.iitkgp.ac.in/ant/8/

References
R1: Jagannathan Sarangapani, Wireless Adhoc and Sensor Networks – Protocols, Performance and Control, CRC Press 2017, e-book ISBN: 9781315221441
R2: Chai K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall Publisher 2007, ISBN : 0-13-007617-4Ivan Stojmenovic, Sheng Wen, "The Fog Computing Paradigm: Scenarios andSecurity Issues", Proceedings, Federated Conference on Computer Science and Information Systems, pp. 1–8, 2014
Fog Computing: Helping the Internet of Things Realize its Potential Amir VahidDastjerdi and RajkumarBuyya, University of Melbourne.

Topics relevant to "SKILL DEVELOPMENT": Campus Applications and Routing Protocol for Adhoc Networks for Skill Development through Participative Learning techniques. This is attained through the Presentation as mentioned in the assessment component.

Course Code: CSE 262	Course Title: CLIENT SERVER COMPUTING Type of Course: Theory Only	L-T-P-C	3-0	0	0	3
Version No.	2.0					
Course Pre-requisites	Knowledge of Computer networks.					
Anti-requisites	NIL					

Course Description	Course description: The course covers basic concepts of client server computing, client side services, server side services, protocols for implementation of client server environment. The students will learn the concepts of client server architecture, components of client server computing, Client/Server Database Architecture, Network operating system, Middleware and RPC.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Client Server Computing and attain Skill Development through Participative Learning techniques.
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe the basic concepts of client server computing and types of client server architecture [knowledge] 2) Discuss the components and operating system of client server computing [Comprehension] 3) Understand the Client/Server Database Computing. [Comprehension] 4) Distinguish the different category of client server applications. [Comprehension]
Course Content:	

Module 1	Client Server System Concepts and Architecture	Assignment	Client Server Architecture	8 Sessions

Topics:

Client Server System Concepts - Introduction – Server, Clients, client – client server topology: Single Client, Multiple Clients Single Servers, Multiple clients Multiple Server. Characteristics and types of Server: File server Print server Application server Mail server. Characteristics and types of Clients: Thin and Fat clients. Client Server Architecture: Two-Tier Architecture – Three-Tier Architecture - N-Tier Architecture- client server Advantage and Disadvantage - Client /server Building Blocks

Module 2	Client Server Computing Components and Operating system	Assignment/Quiz1	Components of Client Server Computing, Components of Server, Network operating system	8 Sessions

Topics:

Components of Client Server Computing , Client: Hardware, Operating System, communication, GUI. Role of the Client , Client Services :Request for Service , Components of Server: Server – File server, Fax server, Mail,Server Functionality in detail.Network operating system : server operating system.

Module 3	Client/Server Database Computing	Assignment/Quiz2	Client/Server Database Architecture, Database Middleware Component	10 Sessions

Topics:

Client/Server Database Computing: Service of client/server application. Client/Server Database Architecture: process per client architecture, multi-threaded architecture, Hybrid architecture. Database Middleware Component: API, Database translator, Network translator..Distributed Client/Server Database Systems: Web/Database System for Client/Server Applications , Design Approach.

Module 4	Client/Server Applications	Assignment/Quiz2	Categories Of Client/Server Applications, DDE, OLE	12 Sessions

Topics:

Client/Server Application: Technologies for client/server applications. Categories Of Client/Server Applications: File sharing, Database centered system, Groupware, Transactional processing. Inter Process Communication: socket interface -RPC-RMI. Dynamic Data Exchange (DDE)- Object Linking and Embedding (OLE)- Middleware - Role and Mechanism of Middleware- Types of Middleware.

Targeted Application & Tools that can be used:

This course helps the student to understand the concepts of client server architecture, components of client server computing, Client/Server Database Architecture, Network operating system, Middleware and RPC.

Text Book

T1. Robert Orfali, Dan Harkey and Jerri Edwards: Essential Client/Server Survival Guide, John Wiley &Sons Edition 3 2019

T2. Patrick Smith & Steave Guengerich, "Client/Server Computing". PHI 2011 Edition 2

References

R1. Subhash Chandra Yadav : An Introduction to Client/Server Computing newagepublishers; First edition January 2009

E-Resources

NPTEL course –NPTEL :: Computer Science and Engineering - NOC:Cloud computingIIT Kharagpur, Prof. Sowmya Kanti Gosh.

https;//presiuniv.knimbus.com/user#/home

Topics relevant to "SKILL DEVELOPMENT": Socket Programming, RMI and RPC for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE240	Course Title: Information Security Type of Course: Open Elective/ Theory Only Course	L-T-P- C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	CSE-236 Principles of Data Communications and Computer Networks				
Anti-requisites	NIL				
Course Description	The course explores information security through some introductory material and helps gain an appreciation of the scope and context of information security. It includes a brief introduction to cryptography, security management, network and computer security. It allows a student to begin a fascinating journey into the study of information security and develop an appreciation of some key security concepts. The course concludes with a discussion of a simple model of the information security in industry and explores skills, knowledge and roles required for employability. A student will be able to determine and analyze potential career opportunities in this profession.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Course Title_as_mentioned above and attain Entrepreneurship through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Describe the basic concept of information security. (Knowledge) Explain the concepts and methods of cryptography. (Comprehension) Demonstrate the aspects of risk management. (Application) Illustrate Network Security concepts. (Application)				
Course Content:					

Module 1	Introduction to Information Security	Assignment	Data Collection/Interpretation	08 Sessions

Topics:

What is Information Security, The CIA Triad: Confidentiality Integrity and Availability, why study information security,Basic principles of information system security, Information classification, A model for Network Security.

Module 2	Introduction to Cryptography	Assignment	Basics and Interpretation	13 Sessions

Topics: Introduction to Cryptography, Role of cryptography in information security, OSI Security architecture, Security Attacks, Security Services, Security Mechanism, Types of Cryptography, Overview of Public and Private Key Cryptography.				
Module 3	Information Security Management & Risk Analysis	Quiz	Questions Set	9Sessions
Topics: Information Security Managements, Security Policy, Standards and Procedures, Risk Analysis of Information Security, Risk Analysis.				
Module 4	Securityin Networks	Quiz	Questions Set	8Sessions
Topics: Biometrics for security, Kerberos, PKI, Network Security applications: e-mail security: PGP, MIME, IP Security,Web Security, Intrusion Detection, Firewalls.				

Targeted Application & Tools that can be used:

This course helps the students to understand the concepts related to information and network security.

InfoSec provides coverage for cryptography, mobile computing, social media, as well as infrastructure and networks containing private, financial, and corporate information, and tools includes Web vulnerability, scanning tools, Antivirus software, Network intrusion detection, Packet sniffers, Firewall tools.

Project work/Assignment:

Project Assignment:

1) Projects for students interested in thisAntivirus, Online Fund Transfers with DES Encryption, Firewall Web Application.

Assignment:

1]What do you understand by Risk, Vulnerability & Threat in a network?

2] What are the response codes that can be received from a Web Application?

3] What is the difference between Symmetric and Asymmetric encryption?

Text Book

T1: Information Security: The Complete Reference, Second Edition, 2nd Edition. by Mark Rhodes-Ousley. Released April 2013. Publisher(s): McGraw-Hill.

T2: William Stallings, "Cryptography and Network Security - Principles and Practices", 7th Edition, Pearson publication, ISBN: 978-93-325-8522-5

T3: Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003

References

R1: Cryptography & Network Security (Sie) 2E. Author, Forouzan. Publisher, McGraw-Hill Education (India) Pvt Limited.

R2:   Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices. Nina Godbole.

R3:   Information Security: Principles and Practices, 2nd Edition. Mark S. Merkow. Jim Breithaupt. 2014, Pearson

4. R4:   Roadmap to Information Security: For IT and Infosec Managers, Michael E. Whitman, Herbert J. Mattord

Case study
link:https://www.researchgate.net/publication/320960482_Information_Security_Management_Practices_Case_Studies_from_India

E book link
R1: https://d.cxcore.net/InfoSec/Information%20Security%20The%20Complete%20Reference,%202nd%20Edition/Information%20Security%20The%20Complete%20Reference,%202nd%20Edition.pdf

E book link R2:
https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/Book%20Information%20Security%20Mangement%206th%20ed.pdf

R3 Web resources: https://nptel.ac.in/courses/106106199- IIT Madra, Prof. Chester Rebeiro

Web resources: https://nptel.ac.in/courses/106106129 - IIT MadrasProf. V. Kamakoti.

https://presiuniv.knimbus.com/user#/searchresult

Topics relevant to "ENTREPRENEURIAL SKILLS":   Sustainable development tools, Integrity Availability Concepts Policies, procedures, Guidelines, Standards Administrative Measures and Technical Measures, People, Process, Technology for developing Entrepreneurial Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3034	Course Title: BIG DATA SECURITY AND PRIVACY				
	Type of Course: Elective in Big Data Basket		L-T- P- C	3-0	0	3
	Theory				
Version No.	1.0				
Course Pre-requisites	CSE219 Big Data Analytics				
Anti-requisites	NIL				
Course Description	The purpose of this course is to sensitize security in Big Data environments. This course will discover cryptographic principles, mechanisms to manage access controls in Big Data system. This course teaches the principles and practices of big data for improving the privacy and the security of computing systems. Big data is being applied in areas where there is great commercial advantage to be had, and consequently, attacks and failures have become a serious concern. It delves into a set of techniques for defending big data techniques against breaching of bigdata (the privacy aspect) and against malicious attacks (the security aspect).				
Course Objective	The objective of the course is to familiarize the learners with the concepts of BIG DATA SECURITY AND PRIVACY and attain Skill Development through Participative Learning techniques.				
Course Outcomes	On successful completion of this course the students shall be able to: Define cryptographic principles and mechanisms to manage access controls in Big Data system.[Knowledge] Explain security risks and challenges for Big Data system.[Knowledge] Recognize all security related issues in big data systems .[Comprehension] Apply Kerberos configuration for Hadoop ecosystem components.[Application]				
Course Content:					

Module 1	Big Data Privacy, Ethics And Security	Assignment/Quiz	Big data security-organizational security	08 classes

Topics:

Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self regulating? – Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security.

Assignment: Big data security-organizational security

Module 2	Security, Compliance, Auditing, And Protection	Assignment	communication protocols for each of the Hadoop ecosystem components	08 classes

Topics:				
Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems. Assignment: communication protocols for each of the Hadoop ecosystem components				
Module 3	Hadoop Security Design, Hadoop Ecosystem Security	Case study	Kerberos configuration for ecosystem tools	08 classes
Topics: Kerberos – Default Hadoop Model without security - Hadoop Kerberos Security Implementation & Configuration. Configuring Kerberos for Hadoop ecosystem components – Pig, Hive, Oozie, Flume, HBase, Sqoop. Assignment: Kerberos configuration for Hadoop ecosystem tools				
Module 4	Data Security & Event Logging	Case study	Event monitoring in Hadoop cluster	08 classes
Topics: Integrating Hadoop with Enterprise Security Systems - Securing Sensitive Data in Hadoop – SIEM system – Setting up audit logging in hadoop cluster Assignment: Event monitoring in Hadoop cluster				
Assignment:				
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format.Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.				
Text Book(s):				
Sudeesh Narayanan, "Securing Hadoop", Packt Publishing, 2013. Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2015.				

Reference(s):

Reference Book(s):

1. Mark Van Rijmenam, "Think Bigger: Developing a Successful Big Data Strategy for Your Business", Amazon, 1 edition, 2014.

2. Frank Ohlhorst John Wiley & Sons, "Big Data Analytics: Turning Big Data into Big Money", John Wiley & Sons, 2013.

 3. SherifSakr, "Large Scale and Big Data: Processing and Management", CRC Press, 2014.

Online Resources (e-books, notes, ppts, video lectures etc.):

Top Tips for Securing Big Data Environments:

e-book (http://www.ibmbigdatahub.com/whitepaper/top-tips-securing-big-data-environments-ebook)

 http://www.dataguise.com/?q=securing-hadoop-discovering-and-securing-sensitive-datahadoop-data-stores

Gazzang for Hadoop http://www.cloudera.com/content/cloudera/en/solutions/enterprisesolutions/security-for-hadoop.html

eCryptfs for Hadoop https://launchpad.net/ecryptfs.

 Project Rhino - https://github.com/intel-hadoop/project-rhino .

Weblinks:

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live

Topics relevant to "SKILL DEVELOMENT": Configuring Kerberos for Hadoop ecosystem components – Pig, Hive, Oozie, Flume for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3032	Course Title: Streaming Data Analytics Type of Course: Program Core Theory and Lab Integrated Course		L-T- P-C	2 -0	2	3
Version No.	1.0					
Course Pre-requisites	CSE3032 -Big Data Analytics					
Anti-requisites	NIL					
Course Description	The purpose of the course is to introduce theoretical foundations, algorithms, methodologies, and applications of streaming data. It also provides practical knowledge for handling and analyzing streaming data. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills. With good knowledgeof the fundamentals of streaming analytics,the student can gain practical experience in implementing them, enabling the student to be an effective solution provider for applications that involve huge volume of streaming data.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Streaming Data Analytics as mentioned above and attain Skill Development through experiential Learning techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: Recognize the characteristics of data streams that make it usefulto solve real-worldproblems. Identify and apply appropriate algorithms for analyzing the data streams for a variety ofproblems. Implement different algorithms for analyzing the data streams.					
Course Content:						
Module 1	Introduction to Data Streams	Programming Assignment	Streaming methods		8 Classes	
Introduction to Data Streams:Data Stream Models, Research Issues in Data Streams Management Systems,Knowledge Discovery from Data Streams,Basic Streaming Methods: Counting the Number of Occurrence of the Elements in a Stream, Counting the Number of Distinct Values in a Stream, Bounds of Random Variables, Poisson Processes, Sliding Windows.						

Module 2	Decision Trees and Clustering from Data Streams	Programming Assignment	Streaming Data Collection and Analysis	10 Classes

Decision Trees and Clustering from Data Streams: Introduction, The Very Fast Decision Tree Algorithm, Extensions to the Basic Algorithm: Processing Continuous Attributes, Functional Tree Leaves, Clustering Examples: Partitioning Clustering, Hierarchical Clustering, Micro Clustering,Grid Clustering .

Module 3	Frequent Pattern Mining	Programming Assignment	Streaming Data analysis	8 Classes

Frequent Pattern Mining: Introduction to Frequent Itemset Mining: The FP-growth Algorithm,Summarizing Itemsets,   Heavy Hitters, Mining Frequent Itemsets from Data Streams: Landmark Windows, Mining Recent Frequent Itemsets, Frequent Itemsets at Multiple Time Granularities, Sequence Pattern Mining

Module4				7 classes

Evaluating Streaming Algorithms Evaluation Issues, Design of Evaluation Experiments, Evaluation Metrics, Error Estimators using a Single Algorithm and a Single Dataset, Comparative Assessment, The 0-1 loss function, Evaluation Methodology in Non-Stationary Environments, The Page-Hinkley Algorithm

List of Laboratory Tasks:

1.Level 1: Exploring stream processing engine STORM

Level 2:Exploring stream processing engine STREAM

2. Implementation of decision tree algorithms

Level 1: Implementation of VFDT decision tree algorithm

Level 2:Implementation of CVFDT decision tree algorithm

3. Implementation of partitioning clustering on stream.

 Level 1:Implementation of partitioning clustering The Leader Algorithm.

  Level 2: Implementation of Single Pass k-Means partitioning ClusteringAlgorithm.

4. Implementation of micro clustering on stream.

Level 1:Implementation of Fractal Clustering algorithmInitialization phase

Level 2:Implementation of Fractal Clustering algorithm Incremental phase

5.Level 1: Implementation of The ODAC Global Algorithm.

Level 2: Implementation of The ODAC: The TestSplit Algorithm

6. Level 1Implementation of the Apriori algorithm to find frequent itemsets

Level 2:Implementation of the Apriori algorithm to find association rules

7. Level 1: Frequent Itemsetsmining of data streams using LossyCounting algorithm

Level 2:Reservoir Sampling for Sequential Pattern Mining overData Streams.

Targeted Application & Tools that can be used:

Apache Spark

Social media Data Analysis

Predictive Analytics

Project work/Assignment:

Students will be asked to develop a mini-project for streaming Data Analysis on streaming data.

Text Book

Joao Gama, "Knowledge Discovery from Data Streams", CRC Press, 2018.

References

David Luckham, "The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems", Addison Wesley, 2016.

Charu C. Aggarwal, "Data Streams: Models And Algorithms", Kluwer AcademicPublishers, 2017.

Weblinks: http://www.liaad.up.pt/area/jgama/DataStreamsCRC.pdf   https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT":   Streaming data analysis of twitter data using Apache Spark for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 212/2007	Course Title: Analysis of Algorithms Type of Course: THEORY Only		L- T-P-C	3	0	0	3
Version No.	2.0						
Course Pre-requisites	Introduction to Pseudo code, Knowledge of Recursive and Non Recursive algorithms, Meaning of correctness.						
Anti-requisites							
Course Description	This Course introduces techniques for the design and analysis of efficient algorithms and methods of applications. Deals with analyzing time and space complexity of algorithms, and to evaluate trade-offs between different algorithms.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Analysis of Algorithms and attain Skill Development through Problem Solving Methodologies.						
Course Out Comes	On successful completion of the course the students shall be able to: 1. Classify the types of asymptotic notations. 2. Discuss the Brute Force Technique used for solving a problem. 3. Explain divide and conquer technique for searching and sorting problems. 4. Discuss the Dynamic Programming Algorithm used for solving a problem. 5. Discuss the Back tracking technique and limitations of Algorithms.						
Course Content:							

Module 1	Introduction	Assignment	Simulation/Data Analysis	08 Sessions
Important Problem types, Asymptotic Notations and its properties, Mathematical analysis for Recursive and Non-recursive algorithms.				

Module 2	Algorithm design techniques-Brute force	Assignment	Numerical from E-Resources	09 Sessions
Selection Sort, sequential search, Uniqueness of Array, Exhaustive search Travelling Salesman, Knapsack Problem.				

Module 3	Divide-and-conquer	Term paper/Assignment	Simulation/Data Analysis	08 Sessions
Master Theorem, Merge sort, Quick sort, Binary search.				
Module 4	Dynamic programming and greedy technique	Term paper/Assignment	Simulation/Data Analysis	08 Sessions
Introduction, Coin changing problem, Multi stage graph – Optimal Binary Search Trees, warshall's, floyds,0/1 Knapsack, Prim's, Kruskal's, Dijkstra's Algorithm.				
Module 5	Complexity Classes	Term paper/Assignment	Simulation/Data Analysis	06 Sessions
Complexity Classes- P,NP- NP Hard and NP Complete - Boolean Satisfiability Problem (SAT).				
Hamiltonian Path Problem, M Coloring Problem. Backtracking, - Backtracking – n-Queens problem.				

Text Book

Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI Learning Private Limited.

References

AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education.

2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson.

3. Donald E. Knuth, "The Art of Computer Programming", Volumes 1and 3 Pearson.

E-Resources

NPTEL course –

https://onlinecourses.nptel.ac.in/noc19_cs47/preview

https://www.coursera.org/learn/analysis-of-algorithms

https://puuniversity.informaticsglobal.com

Topics relevant to "SKILL DEVELOPMENT": knapsack, prims, kruskals algorithm, quick sort, binary search for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE3031	Course Title: Web Intelligence and Analytics	L-T- P-C	2 -0	2	3
	Type of Course: Integrated				
Version No.	1.0				
Course Pre-requisites	CSE2021-Data Mining				
Anti-requisites					
Course Description	This course is an introduction to Web Analytics and Web Intelligence - is not intended to provide an in-depth review of marketing principles and concepts. Nor is it intended to provide an in depth explanation or review of statistical analysis principles, though some of these principals and concepts will be mentioned from time to time in the lectures and reading materials. Rather, this course will give you the mastery of analytics to a sufficient degree to deploy Web Analytics platforms within your organizations and gain meaningful insights from them that can drive the bottom line.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Intelligence and Analytics and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: A grounded understanding of web intelligence and business analytics terminology related to the above. How to deploy web intelligence to improve the outcomes of your marketing or business plan. How Analysts impact the bottom line (their role) within various businesses and lines of business Growth potentials for Web Analysts and Big Data professionals				
Course Content:					

Module 1	INTRODUCTION TO INTELLIGENT WEB	Assignment	Data Collection/Interpretation	6Sessions
INTRODUCTION TO INTELLIGENT WEB -Inside the search engine - Examples of intelligent web applications - Basic elements of intelligent applications - Machine learning, data mining – Searching, Reading, indexing, and searching.				
Module 2	LISTEN AND LOAD	Case studies / Case let	Case studies / Case let	6 Sessions

LISTEN AND LOAD- Streams, Information and Language, - Statistics of Text - Analyzing Sentiment and Intent – Load - Databases and their Evolution, Big data Technology and Trends.				
Module 3	CLUSTERING AND CLASSIFICATION	Quiz	Case studies / Case let	9 Sessions
CLUSTERING AND CLASSIFICATION An overview of clustering algorithms - Clustering issues in very large datasets - The need for classification - Automatic categorization of emails and spam filtering - Classification with very large datasets - Comparing multiple classifiers on the same data.				
Module4- REASONING (4 hours) Reasoning: Logic and its Limits, Dealing with Uncertainty - Mechanical Logic - The Semantic Web - Limits of Logic - Description and Resolution - Collective Reasoning. Module-5 PREDICTING (6 hours) Statistical Forecasting - Neural Networks - Predictive Analytics - Sparse Memories - Sequence Memory - Network Science – Data Analysis: Regression and Feature Selection - Case Study - set of retrieved and processed news stories.				
List of Laboratory Tasks: Laboratory Work: to analyzing the web for various functionalities given in the subject and using various tools and technologies to do the experimentation. It also involves installation and working on tools and technologies in this domain.				
Targeted Application & Tools that can be used				
Project work/Assignment:				
Assignment:				
Text Book 1. Gautam Shroff, "Intelligent Web - Search, Smart Algorithms, and Big Data", Oxford University Press, 2016. 2. HaralambosMarmanis, Dmitry Babenko, "Algorithms of the Intelligent Web", Manning publications, 2019.				
References 1. Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, "An Introduction to Information Retrieval", Cambridge University Press, 2019. 4. 2. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012. 5. 3. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013. R3 Web resources:				

http://www.coursetalk.com/coursera/web-intelligence-and-big-data Course code Course Title L T

pu.informatics.global,

https://sm-nitk.vlabs.ac.in/

Topics relevant to "Skill Development": Intelligent Web and Clustering for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: PG COURSE: CSE 2024	Course Title:NoSQL Databases Type of Course:Program Core Theory and Laboratory Integrated	L-T- P- C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	CSE2074-DBMS				
Anti-requisites	NIL				
Course Description	Introduction to non-relational (NoSQL) data models, such as Key-Value, Document, Column, Graph and Object-Oriented database models. Advantages and disadvantages of the different data architecture patterns will be discussed. Hands-on experience with a representative sample of open-source NoSQL databases will be provided. The rapid and efficient processing of data sets with a focus on performance, reliability, and agility will be covered.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of NoSQL Databases and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: 1. Understandhistory, fundamentals,characteristics, and main benefits of NoSQL databases. [Knowledge] 2.Comprehenddifferent types of NoSQL databases through case studies. [Comprehension] 3. Designdifferent types of NoSQL databases, add content, and try queries on them. [Comprehension]				
Course Content:					

Module 1	NoSQL Database Architectures	Assignment	Knowledge	No. of Classes:6
Topics: Transactions: Concurrency and Integration, ACID, NoSQL emergence and its main features, BASE for reliable database transactions, Achieving horizontal scalability with data base sharding, Brewers CAP theorem. Main Data models of NoSQL: Document Data Model, Key-Value Data Model, Columnar Data Model, Graph Data Model.				
Module 2	Document data model	Assignment	Analysis	No. of Classes:6

Topics: Characteristics of Document Data Model, Collection, Naming, CRUD Operation, Querying, Indexing, Replication, Sharding, Consistency, Update Consistency, Read Consistency, Relaxing Consistency, Capped Collection.				
Module 3	Document Data Model Hands on: Mongo DB/Casandra	Assignment	Programming (Embedded Lab)	No. of Classes:7
Topics:Install, Perform CRUD (create, read, update and delete) Operations, Aggregations, Data Models, Transactions, Indexes, Security, Replication and Sharding.				
Module 4	Basics of Columnar and Graph Data Models	Assignment	Comprehend	No. of Classes:7

Topics:

Columnar Data Model: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes, Indexing, Adaptive Indexing and Database Cracking.

Graph Data Model: Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank-Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution.

Learn MongoDB/Casandra by doing the following

Master the art of queries, CRUD, schema design, and data aggregation

Understand scalability using sharding and replication

Write code, build real-world projects and learn hands-on with Cloud Labs

List of Lab Experiments

Lab Experiments are to be conducted on the following topics

Topic 1: Install MongoDB

Topic 2: Do lab experiment to perform CRUD (create, read, update and delete).

Topic 2: Demonstrate Aggregations in NoSQL with a real-life application.

Topic 3: Demonstrate different aspect of transactions in NoSQL by taking suitable problem.

Topic 5: Show making indexes in NoSQL with a suitable application.

Topic 6: Illustrate security features of NoSQL with a suitable problem.

Topic 6: Explain Sharding concept practically through a suitable example.

Targeted Applications(few are as given below):

1.Content Management systems are pretty common. All the comments on posts on social media are contained in a separate database. In MongoDB, a model has been designed to store such comments and is known as "MetaData and Asset Management".

2.MongoDB is widely used for storing product information and details by finance and e-commerce companies. You can even store the product catalogue of your brand in it.

3. MongoDB can also be used to store and model machine-generated data. For this, you can learn the "Storing Log data" document. This is known as operational intelligence.

List of MongoDB Tools

MongoDB Compass.

Mongo Management Studio.

MongoJS Query Analyzer.

Nucleon Database Master.

NoSQLBooster.

Studio 3T.

MongoDB Spark Connector.

MongoDB Charts.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Project Works:

1. Create a database that stores road cars. Cars have a manufacturer, a type. Each car has a maximum performance and a maximum torque value. Do the following: Test Cassandras replication schema and Consistency models.

2. Shopping Mall case study using cassendra, where we have many customers ordering items from the mal land we have suppliers who deliver them their ordered items.

Text Books

Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition,2019

https://bigdata-ir.com/wp-content/uploads/2017/04/NoSQL-Distilled.pdf

Bradshaw &Chodorow. MongoDB: The Definitive Guide: Powerful and Scalable Data Storage, 3rd ed., O'Reilly, 2019

https://www.oreilly.com/library/view/mongodb-the-definitive/9781491954454/

References Pivert. NoSQL Data Models: Trends and Challenges, 1st ed. Wiley, 2018 https://www.perlego.com/book/995563/nosql-data-models-trends-and-challenges-pdf   Amit Phaltankar, Juned Ahsan, Michael Harrison, LiviuNedov, MongoDB Fundamentals A hands-on guide to using MongoDB and Atlas in the real world: 1st edition, Packt publications, 2020 https://www.perlego.com/book/2059687/mongodb-fundamentals-a-handson-guide-to-using-mongodb-and-atlas-in-the-real-world-pdf
More than 25% of changes are made from the earlier version. Changesare highlighted in bold.
Topics relevant to "SKILL DEVELOPMENT": Usage of un-structured data for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2011	Course Title: Data Communications and Computer Networks Type of Course: Program Core - Theory	L-T-P- C	3-0	0	3
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites					
Course Description	This is the first course on data communication and computer networks. This course gives a thorough introduction to all the layers of computer network following the top-down approach. Application, Transport, Network, and data link layer protocols are taught with analysis wherever applicable. All-important concepts required to take up advanced courses and to face placement tests by an undergraduate student will be covered in this course. This course also covers necessary foundational topics pertaining to data communications. This course can be followed up with an advanced computer networks by the student to get a complete understanding of this domain.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques				
Course Outcomes	1. Explain the concepts of Computer Networks and Working Principles of Application Layer and Transport Layer (Comprehension) 2. Apply the Knowledge of IP Addressing and Routing Mechanism in Computer Networks. (Application) 3. Discuss the functionalities of Data Link Layer (Comprehension) 4. Explain the Basic Concepts of Data communication. (Comprehension)				
Course Content:					

Module 1	Overview, Application and Transport Layers.	Assignment	Comprehension	13 Sessions
Introduction: Computer Networks, Topologies, OSI Reference Model, TCP/IP model. Principles of Network Applications, The Web and HTTP, DNS—The Internet's Directory Service, Socket Programming: Creating Network Applications. Introduction and Transport-Layer Services, Connection-less Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.				

Module 2	Network Layer	Assignment	Application	12 Sessions

Overview of Network Layer, Forwarding and Routing, The Data and Control Planes.The Internet Protocol (IP): IPv4, Addressing, IPv6, IPv4 Datagram Format, IPv4 Addressing, Network Address Translation (NAT), IPv6. Introduction Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Intra-AS Routing in the Internet, OSPF Routing Among the ISPs: BGP, Introduction to BGP. ICMP: The Internet Control Message Protocol.

Module 3	Data Link Layer	Assignment	Comprehension	10 Sessions

Introduction to the Link Layer, The Services Provided by the Link Layer, Error-Detection and -Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols. Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs),DHCP,UDP,IP and Ethernet.

Module 4	Physical Layer with Data Communication	Assignment	Comprehension	O7 Sessions

Data communications: Components, Data Representation, Data Flow, Analog and Digital Signals, Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Transmission Impairment, Data Rate Limits: Noiseless Channel, Nyquist Bit Rate, Noisy Channel: Shannon Capacity, Performance: Bandwidth, Throughput, Latency (Delay), Bandwidth-Delay Product, Parallel/Serial Transmission, Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing.

Targeted Application & Tools that can be used:

Instant Messaging

Telnet

File Transfer Protocol

Video Conferencing

Project work/Assignment:

Project Assignment:

Assignment 1: Data Flow Directions

Assignment 2: Types of Topology

Textbooks:

T1. James F. Kurose, Keith W. Ross, "Computer Networking A Top down Approach", 8th Edition, Pearson, 2021.

T2. Behrouz A. Forouzan, "Data Communications and Networking", 6th Edition, Tata McGraw-Hill, 2021.

References:

R1. William Stallings: "Data and Computer Communication", 10th Edition, Pearson Education, 2017.

R2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2012.

Web references:

Digital Learning Resources (Library Resources)

W1. https://puniversity.informaticsglobal.com/login

https://nptel.ac.in/courses/105106053

Topics relevant to "Skill Development":

Virtual Local Area Networks (VLANs), DHCP, UDP, IP and Ethernet for Skill Development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 3028	Course Title:Blockchain security and performances			2-0	2	3
	Type of Course:Program Core Theory and Laboratory Integrated		L-T- P-C			
Version No.	1.0					
Course Pre-requisites	Blockchain Technology and Applications					
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce the students to security and privacy techniques in blockchain based systems. The course provides a comprehensive understanding of blockchain security, risks, methods, and best practices. The course develops critical thinking skills by augmenting the student's ability to tackle security related issues of blockchain The associated laboratory provides an opportunity to validate the concepts taught as well as enhances the ability to visualize the real-world problems in order to provide a solution using various tools and techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1:Comprehend security and performance perspective of blockchain technology. CO2: Apply cryptographic techniques to enhance security in blockchain based systems CO3: Implement secure transaction models. CO4: Apply security techniques to blockchain systems that provide solutions to some real world problems					
Course Outcome	The objective of the course is to familiarize the learners with the concepts of CSE3028_BLOCKCHAIN SECURITY & PERFORMANCE and attain Employability through Experiential Learning techniques.					
Course Content:						
Module 1	Fundamentals of Privacy And Security Techniques In Blockchain	Assignment	Programming			9 Sessions
Introduction to Blockchain Technology, Cyber Security Threats and incidents on blockchain networks, Categorization of blockchain threats and vulnerabilities: Client vulnerabilities,						

Consensus Mechanism vulnerabilities, Mining Pool vulnerabilities, Network vulnerabilities, Smart Contract vulnerabilities; Privacy and security techniques: Mixing, Anonymous Signatures, Homomorphic Encryption, Attribute-Based Encryption, Secure Multi-Party Computation, Non-Interactive Zero-Knowledge (NIZK) Proof, TEE Based Smart Contracts, Game-Based Smart Contracts.

| Module 2 | Cryptography | Assignment | Programming | 12 sessions |

Cryptography, Public Key Cryptography and Cryptocurrency, Private Keys, Generating a Private Key from a Random Number, Public Keys, Elliptic Curve Cryptography, Elliptic Curve Arithmetic Operations, Generating a Public Key, Elliptic Curve Libraries, Cryptographic Hash Functions, Ethereum's Cryptographic Hash Function: Keccak-256, Ethereum Address and Formats, Inter Exchange Client Address Protocol

| Module 3 | Transaction Model | Assignment | Programming | 9 sessions |

Topics: Blockchain Level Transaction Models : UTXO, Account-Based Online Transaction Model, CAP Properties in Blockchain, Security and Privacy Requirements of Online Transactions, Basic Security Properties: Consistency, Tamper-Resistance, Resistance to DDoS attacks, Resistance to Double-Spending attacks, Resistance to the Consensus attacks, Pseudonymity; Additional Security and Privacy Properties of Blockchain: Unlinkability, Confidentiality of Transactions and Data Privacy, Consensus Algorithms, BFT based Consensus Algorithms, Sleepy Consensus, Proof of Elapsed Time, Proof of Authority, Proof of Reputation, Comparison of Consensus Algorithms

List of Laboratory Tasks:

Targeted Application & Tools that can be used:

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

After completion of each module a programming based Assignment/Assessment will be conducted.

On completion of Module 3, student will be asked to develop a Project.

Textbook(s):

T1.Antonopoulos, Andreas M., and Gavin Wood. Mastering ethereum: building smart contracts and dapps. O'reilly Media, 2018.

T2.Howard E. Poston, Blockchain Security from the Bottom Up: Securing and Preventing Attacks on Cryptocurrencies, Decentralized Applications, NFTs, and Smart Contracts, John Wiley & Sons, 2022.

References

R1.Parisi, Alessandro. Securing Blockchain Networks like Ethereum and Hyperledger Fabric: Learn advanced security configurations and design principles to safeguard Blockchain networks. Packt Publishing Ltd, 2020.

Web Based Resources and E-books:

Digital Learning Resources (Library Resources)

W1: NPTEL : https://nptel.ac.in/courses/106/104/106104220/#

W2: UDEMY : https://www.udemy.com/course/build-your-blockchain-az/

W3 : Book
https://www.google.co.in/books/edition/Blockchain_By_Example/ci59DwAAQBAJ?hl=en&gbpv=1

W4 : Book

https://www.insiderintelligence.com/insights/blockchain-technology-applications-use-cases/

W6: https://www.analyticsinsight.net/real-world-applications-of-blockchain-technologies/

W7:PU Library Link : https://puniversity.informaticsglobal.com/login Or : http://182.72.188.193/

Topics relevant to "SKILL DEVELOPMENT": Real time data analysis used for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:CSE3023	CourseTitle:Distributed Ledger Technology		L-T- P-C	2-0	2	3
	TypeofCourse:Discipline Elective					
Version No.	1.0					
Course Pre-requisites	Foundations of Blockchain Technology					
Anti-requisites	NIL					
CourseDescription	The purpose of the course is to provide the fundamental concepts of distributed ledger technologies as well as to explore various aspects of distributed ledger techniques like Ethereum, Hyper ledger and smart contract. With a good knowledge in the fundamental concepts of block chain and distributed ledger technologies, the student can gain practical experience in implementing them, enabling the student to be an effective chain code creator.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Distributed Ledger Technology and attain Skill Development through Experiential Learning techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: Understand and explore the working of distributed ledger technology (Knowledge) Understand the working of Smart Contracts (Knowledge) Apply the learning of solidity and de-centralized apps on Ethereum (Application).					
Course Content:						
Version No.	1.0					
Module 1	Introduction to Distributed Ledger Technologies	Assignment	Data Collection		No. of Sessions: 09	

Topics:

What is Distributed Ledger Technology (DLT) and How Does it work? Key Features of DLT, Distributed Nature of the Ledger, Consensus Mechanism,Open/Permissionless Distributed Ledgers : Bitcoin , Ethereum ; Permissioned Distributed Ledgers :, Ripple, Fabric (Hyperledger Project) , Corda, Key Advantages of DLT, Challenges and Risks related to DLT, Applications of DLT.

Assignment: Permissionless Distributed Ledgers/ Permissioned Distributed Ledgers

Module 2	Introduction to Hyperledger	Assignment	Writing Task	No. of Sessions: 09

Topics:

What is Hyperledger? Hyper ledger frameworks, Hyperledger Fabric- Components design, principles of Hyperledger design, reference architecture, run time architecture, the journey of sample transaction, Hyperledger Composer.

Assignment: Hyperledger Fabric Design

Module 3	Designing a Data and Transaction Model	Assignment	Programming Task	No. of Sessions: 10

Topics:

Starting the chaincode development, Compiling and running chaincode, Installing and instantiating chaincode, Invoking chaincode, Creating a chaincode, The chaincode interface, setting up chaincode file, Access control – ABAC- Registering a user, Enrolling a user, Retrieving user identities and attributes in chaincode, Implementing chaincode functions, Defining chaincode assets, Coding chaincode functions Creating an asset, Testing.

Assignment: Creating Chaincode and interfacing among them.

Module 4	Applications of DLT	Case Study	Discussion	No. of Sessions: 08

Topics:

Applications: Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

Case study: Managing the Metal and Mining Industry's Supply Chain with Hyperledger Fabric

List of Laboratory Tasks:
Level 1: Create a Simple Blockchain in any suitable programming language.
Level 2: Create a complex Blockchain in any suitable programming language
Level 1: Deposit oneEther in your MetaMask accounts.
Level 2: Deposit 10 Ether in your MetaMask accounts
Level 1: Create Single account.
Level 2: Create multiple accounts and make a transaction between these accounts
Level 1: Test any one property of cryptographic hashing
Level 2: Test all the properties of cryptographic hashing
Level 1: Add a transaction to a blockchain
Level 2: Add multiple transaction to a blockchain
Level 1: Create a new file 'WorkingWithVariables.sol' in Solidity
Level 2: Program to write a solidity program with required variables
Level 1: Create a new file 'SendMoney.sol' in solidity
Level 2: Create new transaction with signing
Level 1: Single Error Handling using solidity
Level 2: Complex exception Handling using solidity
Level 1:Use Geth to Implement Private Ethereum Block Chain.
Level 2: Use Geth to Implement public Ethereum Block Chain.
Level 1: Build Hyperledger Fabric Client Application.
Level 2: Build Hyperledger Fabric Server/network Application.
Level 1: Build Hyperledger Fabric with Smart Contract.
Level 2: Case study on Hyperledger Fabric
Level 1: Create Case study of Block Chain being used in illegal activities in real world.
Level 2: Using Golang to develop Block Chain Application
Targeted Application & Tools that can be used: Meta mask, Docker and Docker compose, Go Programming language
Project work/Assignment:
Topics: Permissioned Distributed Ledgers Chaincode- Creation and interface

Textbook(s):
T1. Nitin Gaur, Hands-on blockchain with Hyperledger_ Building decentralized applications with Hyperledger Fabric and Composer, Packt,2020.

References
R1. Andreas M. Antonopoulos, "Mastering Bitcoin- Programming" - The Open Blockchain,Oreilly,2017
R2. hyperledger-fabricdocs Documentation, Release Master, 2021.
R3. D. Drescher, Blockchain Basics. Apress, 2017.
R4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Other Resources
Distributed Ledger Technology (DLT) and Blockchain, Fintech
NPTEL online course : https://nptel.ac.in/courses/106/104/106104220/
Udemy: https://www.udemy.com/course/build-your-blockchain-az/
EDUXLABS Online training :https://eduxlabs.com/courses/blockchain-technologytraining/?tab=tab-curriculum
E-Book Links:
T1. https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EXc_hRKtg1dOu6GuNvv0MZMBQ_Zo0lpNJyXsJ4lANfcJdQ?e=YAvywC
R1. https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EUMg4-zAc3dGgl1RWeDDJR8B4SCqMMeO0IIzun51qbDlTw?e=ObRwKr
R2. https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EWrs6M9zaYpJhvf9RI2jRaUB9PIJhXmQfZC5vdg284oVlg?e=aD9RgX

Topics relevant to "Skill Development": Applications of DLT is used for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3020	Course Title: Smart Contract and Solidity Type of Course: Integrated	L-T- P- C	2-0	2	3
Version No.	1				
Course Pre-requisites	Basics of Mathematics and any Programming Language				
Anti-requisites	NONE				
Course Description	Solidity is an object-oriented, high-level language for implementing smart contracts. Smart contracts are programs which govern the behaviour of accounts within the Ethereum state. Solidity is a curly-bracket language designed to target the Ethereum Virtual Machine (EVM). It is influenced by C++, Python and JavaScript. The Ethereum Virtual Machine (EVM) and assembly (low level language), events and logging blockchain emissions, send vs transfer methods, scoping and more				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Smart Contract and Solidity and attain EMPLOYABILITY through Experiential Learning Techniques..				
Course Out Comes	On successful completion of the course the students shall be able to: CO 1 :Understand the fundamentals of computational Element of the Blockchain Technology C.O 2: Implementuser-defined operations of arbitrary complexity that are not possible through plain cryptocurrency protocols C.O 3: Exhibitbest practices for designing solutions with smart contracts using Solidity and Remix IDE				
Course Content:	Module: 1: Introduction to Smart Contract[14 Hrs - L[14] + T[00]] [Knowledge] A Simple Smart Contract, Blockchain Basics, The Ethereum Virtual Machine, Versioning, Remix, npm / Node.js, Docker, Binary Packages, Building from Source, CMake options. Module: 2: Solidity in Depth [22 Hrs – L[08] + T[02] + P[12]] [Application] Layout of a Solidity Source File, Structure of a Contract, Types, Units and Globally Available Variables, Expressions and Control Structures, Contracts, Solidity Assembly, Miscellaneous, Solidity v0.5.0 Breaking Changes Module 3: Contract Metadata & Contract ABI Specification [22 Hrs – L[08] + T[02] + P[12]] [Comprehension]] Encoding of the Metadata Hash in the Bytecode, Usage for Automatic Interface Generation and NatSpec, Usage for Source Code Verification,				

	Basic Design, Function Selector, Argument Encoding, Types, Design Criteria for the Encoding, Formal Specification of the Encoding, Function Selector and Argument Encoding, Examples, Use of Dynamic Types, Events, JSON, Strict Encoding Mode, Non-standard Packed Mode			
Module 1	Introduction to Smart Contract	TEST-1	Fundaments of Smart Contract and Solidity	12Sessions
Topics:				
Module 2	Solidity in Depth	TEST-1	Case studies / Case let	12 Sessions
Topics:				
Module 3	Contract Metadata & Contract ABI Specification	Endterm lab Exam	Implementing Applications	14 Sessions
Topics:				

List of Laboratory Tasks:

Develop a complex voting application

Build blind auction App

Create safe remote purchase

Develop micropayment channel

Creating Decentralized Apps with Solidity

Store Patient Health Records using Solidity

Implement Supply Chain Management App using Solidity

Targeted Application & Tools that can be used

NetBeans

Project work/Assignment:	
Assignment: Quiz and Group Project	
Text Book T1 Solidity Smart Contracts: Build DApps In Ethereum Blockchain- Rangel Stoilov T2Mastering Blockchain Programming with Solidity- Jitendra Chittoda .	
References R1Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and blockchain R2 Hands-On Smart Contract Development with Solidity and Ethereum: From Fundamentals to Deployment- Book by David H. Hoover, Kevin Solorio, and Randall Kanna E book linkR1:NA E book link R2: NA R3 Web resources: Udemy course –https://www.udemy.com/course/the-complete-solidity-course-blockchain-zero-to-expert/ Co Coursera Course ---- https://www.coursera.org/learn/smarter-contracts/	
Topics relevant to "SKILL DEVELOPMENT": Encoding of the Metadata Hash in the Bytecode, Usage for Automatic Interface Generation and NatSpec, Usage for Source Code Verification, Basic Design, Function Selector, Argument Encoding, Types, Design Criteria for the Encoding, Formal Specification of the Encoding, Function Selector and Argument Encoding for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.	

Course Code: CSE3020	CourseTitle:Blockchain Technology and Applications TypeofCourse:ProgramCore		L-T- P- C	3-0	0	3
Version No.	1.0					
Course Pre- requisites	Fundamentals of Blockchain Technology					
Anti-requisites	NIL					
CourseDescription	The purpose of the course is to provide an introduction to Blockchain technology with specific focus on industrial applicationslike Blockchain in Financial system, trade/supply chain management, agriculture industry, Healthcare sectors and Insurance system. With the knowledge of blockchain technology, Students will learn how these system are built, how to interact with them.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Blockchain Technology and Applications and attain Skill Development through Participative Learning techniques.					
Course OutComes	Onsuccessfulcompletionofthiscoursethestudentsshallbeableto: Understand the concepts of Blockchain technology (Knowledge). Explain the methods for verification and validation of Bitcoin transactions (Comprehension). Explore the use the Ethereum programming (Application). Illustrate the role ofblockchain in various domain (Comprehension).					
CourseContent:						
Module 1	Introduction to Blockchain	Quiz	Knowledge based quiz on Cryptographic Hash Functions	No.of Classes:8		
Topics: Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Online Wallets and Exchanges, Payment Services, Transaction Fees, Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures.						
Module 2	Bitcoin	Assignment	Bitcoin mining pools	No.of Classes:10		
Bitcoin Mechanics: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements.						

Bitcoin mining: The task of Bitcoin miners, Mining Hardware, Energy consumption, Mining pools, Mining incentives and strategies.

Module 3	Ethereum	Create a smart contract using solidity language	Components of Ethereum Ecosystem	No.of Classes:10

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

Module 4	Blockchains in Business	Case Study	Conduct a case study on how BaaS is adopted in industries.	No.of Classes:10

Topics: Blockchain in Supply Chain - Blockchain in Manufacturing - Blockchain in Automobiles - Blockchain in Healthcare- Blockchain in Financial Industry

List of Laboratory Tasks: NA

Targeted Application & Tools that can be used:

Etherum Remix online& Ganache

Solidity programming language

Project work/Assignment:

Calculate the 'number of ethers' for the transaction of gas limit for the scenario in which the sender sets the gas limit to 50,000 and a gas price to 20 gwei.

 Represent the EthereumMerkley Tree for the given list of Transactions.

Create Survey report of various types of Blockchain and its real time use cases.

Textbook(s):

BellajBadr, Richard Horrocks, Xun (Brian) Wu, "BlockchainBy Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.

References:

Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018.

Weblinks:

Udemy: https://www.udemy.com/course/build-your-blockchain-az/

NPTEL online course : https://nptel.ac.in/courses/106/104/106104220/#

Textbook(s):

BellajBadr, Richard Horrocks, Xun (Brian) Wu, "BlockchainBy Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.

https://www.google.co.in/books/edition/Blockchain_By_Example/ci59DwAAQBAJ?hl=en&gbpv=1

Topics relevant to "SKILL DEVELOPMENT": Ethereum, Blockchain in Manufacturing for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:CSE2019	CourseTitle: Foundations of Blockchain Technology	L-T-P- C	3-0	0	3
	TypeofCourse:ProgramCore& Theory only				
Version No.	1.1				
Course Pre-requisites	Networks				
Anti-requisites	NIL				
CourseDescription	The purpose of the course is to provide the fundamental knowledge onBlockchaintechnologyand explore various aspects of Blockchain technology like types of Blockchain, Bitcoin and EthereumBlockchain platform. With a good knowledge of block chain technology, the student can understand the mechanism of Bitcoin and able to write simple smart contracts				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Foundations of Blockchain Technology and attain Skill Development through Participative Learning techniques.				
Course OutComes	Onsuccessfulcompletionofthiscoursethestudentsshallbeableto: Understand the concepts of anemerging blockchain technology(Knowledge). Infer the knowledge about consensus protocols (comprehension). Explore Bitcoin payment methods(comprehension). Develop simple smart contract(comprehension).				
CourseContent:					

Module 1	BlockchainBasics	Quiz	Knowledge based quiz on distributed ledger	10 Sessions

Topics:The history of Blockchain: Blockchain, Generic elements of a blockchain, Benefits and limitations of Blockchain, Tiers of Blockchain technology, Features of Blockchain. Types of Blockchain: Distributed ledgers, Public Blockchain, private Blockchain, shared ledger.

Quiz:Knowledge based quiz on distributed ledger

Module 2	Distributed Consensus	Assignment	PoW	08 Sessions

Topics: Consensus: Consensus mechanism, Types of consensus mechanisms, Consensus in Blockchain.

Assignment: Write an assignment on PoW consensus mechanism

Module 3	Introducing Bitcoin	Case study	Bitcoin network wallets	10 Sessions

Topics: Bitcoin definition, Digital keys and addresses, Transactions, mining, Bitcoin network wallets, Bitcoin payments.

Case Study: Conduct a study about hot bitcoin wallets

Module 4	Smart contracts	Case study	how to execute smart contract	10 Sessions

Topics:History, Definition, Introduction to Ethereum,Ethereum network,Components of Ethereum ecosystem, Smart contracts.

Case Study: Create a simple smart contract for User identity management using Solidity language and show how to execute.

Targeted Application & Tools that can be used:
Ethereum Remix
MetaMask
Truffle
Ganache

Textbook
T1.Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018.
Weblinks:Mastering Blockchain - Google Books

References

R1.Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015.

R2.Blockchain by Melanie Swa, O'Reilly .

Weblinks:

Blockchain A-Z™: Learn How To Build Your First Blockchain | Udemy

https://www.coursera.org/learn/wharton-cryptocurrency-blockchain-introduction-digital-currency

https://www.coursera.org/specializations/introduction-to-blockchain

https://presiuniv.knimbus.com/user

Text book of Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained, 2nd Edition, Packt Publishing Ltd, March 2018.

https://www.google.co.in/books/edition/Mastering_Blockchain/3ZlUDwAAQBAJ?hl=en&gbpv=1

Topics relevant to "SKILL DEVELOPMENT":

Bitcoin and Smart Contracts for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: Machine Learning Techniques						
CSE3008	Type of Course: 1] Discipline Elective 2] Laboratory integrated			L-T- P-C	2-0	2	3
Version No.	1.0						
Course Pre-requisites	CSE3001 Artificial Intelligence and Machine Learning						
Anti-requisites	[List the Anti -requisites of the course]						
Course Description	Machine Learning algorithms are the key to develop intelligent systems such as Apple's Siri, Google's self-driving cars etc. This course introduces the concepts of the core machine learning techniques such as Regression learning, Bayesian learning, Ensemble learning, Perceptron learning, Unsupervised learning, Competitive learning, learning from Gaussian mixture models and learning to detect outliers. Course lectures covers both the theoretical foundations as well as the essential algorithms for the various learning methods. Lab sessions complement the lectures and enable the students in developing intelligent systems for real life problems.						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Machine Learning Techniques and attain Skill Development through experiential Learning techniques.						
Course Out Comes	On successful completion of the course the students shall be able to: 1] Apply advanced supervised machine learning methods for predictive modeling. [Application] 2] Produce machine learning models with better predictive performance using meta learning algorithms [Application] 3] Create predictive models using Perceptron learning algorithms[Application] 4] Employ advanced unsupervised learning algorithms for clustering, competitive learning and outlier detection[Application] 5] Implement machine learning based intelligent models using Python libraries. [Application]						
Course Content:							
Module 1	Supervised Learning	Assignment	Programming using Keras/Sklearn		No. of Classes		

				L – 7 P – 12

Topics: An overview of Machine Learning(ML); ML workflow; types of ML; Types of features, Feature Engineering -Data Imputation Methods; Regression – introduction; simple linear regression, loss functions; Polynomial Regression; Logistic Regression; Softmax Regression with cross entropy as cost function; Bayesian Learning – Bayes Theorem, estimating conditional probabilities for categorical and continuous features, Naïve Bayes for supervised learning; Bayesian Belief networks;   Support Vector Machines – soft margin and kernel tricks.

Module 2	Ensemble Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-3 P-4

Topics: Ensemble Learning – using subset of instances – Bagging, Pasting, using subset of features –random patches and random subspaces method; Voting Classifier, Random Forest; Boosting – AdaBoost, Gradient Boosting, Extremely Randomized Trees, Stacking.

Module 3	Perceptron Learning	Assignment /Quiz	Programming using Keras/Sklearn	No. of Classes L-7 P -2

Topics: Perceptron Learning – from biological to artificial neurons, Perceptrons, Linear Threshold Units, logical computations with Perceptrons, common activation functions – sigmoid, tanh, relu and softmax, common loss functions, multi-layer Perceptrons and the Backpropagation algorithm using Gradient Descent.

Module 4	Unsupervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-6 P -6

Topics: Unsupervised Learning – simple k Means clustering- simple and mini-
batch; updating centroids incrementally; finding the optimal number of clusters using Elbow method ; Silhoutte coefficient, drawbacks of kMeans, kMeans++ ; Divisive hierarchical clustering – bisecting k-means, clustering using Minimum Spanning Tree
(MST) Competitive Learning - Clustering using Kohenen's Self Organising Maps (SOM), Density Based Spatial Clustering – DBSCAN; clustering using Gaussian Mixture Models (GMM) with EM algorithm ; Outlier Detection methods – Isolation Forest, Local Outlier Factor(LOF)

List of Laboratory Tasks:

Experiment N0 1: Methods for handling missing values

Level 1: Given a data set from UCI repository, implement the different ways of handling missing values in it using Scikit-learn library of Python

Level 2: Implement one of these methods using a custom defined function in Python.

Experiment No. 2: Data Visualization

Level 1 Perform Exploratory Data Analysis for a given data set by creating Scatter Plot, Pair Plot, Count Plot using Matplotlib and Seaborn

Level 2 Create Heat Maps, WordCloud

Experiment No. 3: Regression learning

Level 1 Given a data set from UCI repository, implement the simple linear regression algorithm and estimate the models parameters and the performance metrics. Plot the learning curves.

Level 2 Implement the polynomial regression algorithm. Compare the learning curves of Polynomial and Linear Regression.

Experiment No.4: Logistic regression

Level 1 Write custom code for generating the logistic/sigmoid plot for a given input

Level 2 Given a data set from UCI repository, implement the Logistic regression algorithm. Estimate the class probabilities for a given test data set. Plot and analyze the decision boundaries.

Experiment No.5: Bayesian Learning

Level 1 Given a data set from UCI repository, implement a classification model using the Bayesian algorithm

Experiment No.6: Support Vector Machine(SVM)

Level 1 Given data sets from UCI repository, implement a linear SVM and a non-linear SVM based classification model.

Experiment No. 7: Ensemble Learning

Level 1 : Implement Ensemble Learning algorithms such as Bagging, Pasting and Out-of Bag Evaluation

Level 2 : Random Patches and Random Subspace Method

Experiment No. 8: Ensemble Learning

Level 1 : AdaBoost and Gradient Boosting, Stacking

Experiment No. 9: Perceptron Learning

Level 1 : Implement the Perceptron Classifier

Level 2 : – An Image Classifier Using the Sequential API of Keras

Experiment No. 10: Unsupervised Learning

Level 1 : K-means – simple and mini-batch. Finding the optimal number of clusters using Elbow method and Silhoutte Coefficient . Compare the inertia of both as k increases. Tuning the hyperparameter 'k' using GridSearchCV.

Level 2 : – Using clustering for Image segmentation and Preprocessing. Kmeans++

Experiment No. 11: Density Based Clustering

Level 1 Implement DBSCAN – clustering using the local density estimation. Perform hard and soft clustering for new instances.

Experiment No. 12: Outlier Detection

Level 1 Outlier Detection using Isolation Forest and Local Outlier Factor |
| Targeted Application & Tools that can be used :

 Execution of the ML algorithms will be done using the Google's cloud service namely "Colab", available at https://colab.research.google.com/ or Jupyter Notebook.

The data sets will be from the bench marking repositories such as UCI machine learning repository available at : https://archive.ics.uci.edu/ml/index.php

Laboratory tasks will be implemented using the libraries available in Python such as Scikit learn, matplotlib, seaborn, perceptron and the deep learning framework namely Keras. |
| Project work/Assignment: Mention the Type of Project /Assignment proposed for this course |
| Students can be assigned a mini project to develop a machine learning application for real-life problems in various domains such as health care, business intelligence, environmental modeling, etc. |
| Text Book

There are a number of useful textbooks for the course, but each cover only a part of the course syllabus. Following is an indicative list of textbooks. |

Aurélien Géron, "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", Oreilly, Second Edition, 2019.

Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with Python :A Guide for Data Scientists", Oreilly, First Edition, 2018

Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017.

References   In references apart from the books and web links, mention a few standards &Hand books relevant to the Laboratory tasks used by the professionals.

Tan P. N., Steinbach M & Kumar V. "Introduction to Data Mining", Pearson Education, 2016.

https://towardsdatascience.com/machine-learning/home

MITopencourseware:https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/resources/lecture-11-introduction-to-machine-learning/

https://onlinecourses.nptel.ac.in/noc21_cs85/preview

Topics relevant to "Skill Development ": Assignment implementations in software, batch wise presentations are used for developing Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE254	Course Title: Microprocessor and Microcontroller Laboratory Type of Course: Laboratory Only	L-T- P- C	0-0	2	1
Version No.	2.0				
Course Pre- requisites	NIL				
Anti-requisites	NIL				
Course Description	This course introduces the assembly level language programming of 8086. The course introduces the core concept of microprocessor and develops in students the assembly language programming skills along with real time applications of microprocessor. It gives a practical training to students to perform interfacing peripheral devices with 8086 microprocessors. This lab focusses mainly on software and few interfacing programs with microprocessor				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Microprocessor and Microcontroller Laboratory and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Outcome	After successful completion of course, students shall be able to (i) Learn 80x86 instruction sets and gain the knowledge on how assembly language works. (ii) Implement programs written in 80x86 assembly language. (iii) Explore functioning of hardware devices and interfacing them to x86 family. (iv) Implement basic 8051 microcontroller programs.				
Course Content:					
	:	Write an Assembly Language Program (ALP) to perform Arithmetic operations like Addition, subtraction, Multiplication and Division on two numbers			
	:	Write an ALP to add two Binary Coded Decimal (BCD) numbers			
	:	Write an ALP To move 8-bit contents of array from one memory location to another memory location			
	:	Write an ALP to find the sum of N consecutive numbers			

	:	Write an ALP to sort N numbers in ascending/descending order using Bubble sort technique Write an ALP to print N Fibonacci numbers.
	:	Write an ALP to search a key element in a list of numbers using linear search
	:	Write an ALP to read the current time from the system and display on screen Write an ALP to check whether a string is Palindrome or not
	:	Write an ALP to search a key element in a list of numbers using binary search
	:	Write an ALP to read the current date from the system and display on screen
	:	Write an ALP to read two strings from the keyboard and check whether they are equal or not.
8255 Interfacing Experiments		
	:	Design and develop an ALP to drive a Stepper Motor interface and rotate the rotor in specified direction (clockwise or anti-clockwise) by N steps
	:	Design and develop an ALP program using Logic Controller to multiply (X*Y)
8051 Microcontroller Experiments		
	:	Design and develop 8051 ALP program to store values in registers and swap the contents of Registers
	:	Design and develop 8051 ALP program to perform arithmetic operations
	:	Design and develop 8051 ALP program to perform FIBONACCI series
	:	Design and develop an 8051 ALP to drive a Stepper Motor interface and rotate the rotor in specified direction (clockwise or anti-clockwise) by N steps

Targeted Application & Tools that can be used: MASM,   Professionally used software - KEIL software
Text Book Douglas V Hall SSSP Rao, "Microprocessor and Interfacing", 3rd editon, Mc Graw Hill , Higer Education, 2012. Barry B Brey, " The Intel Microprocessors", 8th edition, Pearson , 2014.

References

Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, "The x86 PC Assembly Language Design and Interfacing", 5th Edition, Pearson, 2013.

Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", First Impression, Pearson Education.

https://nptel.ac.in/courses/108105102

https://nptel.ac.in/courses/117104072

Course Code: CSE3016	Course Title:CSE3016 Neural Networks and Fuzzy Logic		L-T- P-C	3-0	0	3
	Type of Course: Discipline Elective in AI & ML Basket					
	Theory Course					
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course aims to introduce the basic concepts of Neural Networks and Fuzzy Logic. Neural networks reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of AI, machine learning, and deep learning. Fuzzy Logic is a method of reasoning that resembles human reasoning. The approach of Fuzzy Logic imitates the way of decision-making in humans that involves all intermediate possibilities between digital values YES and NO. This course introduces fundamental concepts in Neural Networks and Fuzzy Logic Theory.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Neural Networks and Fuzzy Logic and attain Skill Development through Participative Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to:					
	Define the concept of Neural Networks. [Knowledge]					
	Define the ideas behind most common learning algorithms in Neural Network.[Knowledge]					
	Discuss the concepts of Fuzzy Sets and Relations. [Comprehension]					
	Demonstrate the Fuzzy logic concepts and its applications.[Application]					
Course Content:						
Module 1	Introduction to Neural Network	Quiz	Single Layer Perceptron		9Classes	
Topics:						

Introduction to NN: History, Artificial and biological neural networks, Artificial intelligence and neural networks.

Neurons and Neural Networks: Biological neurons, Models of single neurons, Different neural network models.

Single Layer Perceptron: Least mean square algorithm, Learning curves, Learning rates, Perceptron.

Module 2	Multilayer Perceptron	Quiz	Multilayer Perceptron	10 Classes

Topics:

Multilayer Perceptron: The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm, Some examples.

Radial-Basis Function Networks: Interpolation, Regularization, Learning strategies.

Kohonen Self-Organising Maps: Self-organizing map, The SOM algorithm, Learning vector quantization.

Module 3	Fuzzy Sets, Operations and Relations	Quiz	Fuzzy Operations	10Classes

Topics:

Fuzzy Sets: Crisp Sets - an Overview, Fuzzy Sets - Definition and Examples, α - Cuts and its Properties, Representations of Fuzzy Sets, Extension Principles of Fuzzy Sets.

Fuzzy Operations: Operations on Fuzzy Sets - Fuzzy Complements, Fuzzy Intersections, Fuzzy Unions, Combinations of Operations, Aggregation Operations.

Fuzzy Relations: Binary Fuzzy relations, Fuzzy Equivalence Relations, Fuzzy Compatibility Relations.

Module 4	Fuzzy Logic and Fuzzy Logic Controller	Assignment	Developing Fuzzy Logic Controller	10Classes

Fuzzy Logic: Classical Logic, Multivalued Logic, Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inference from Conditional Fuzzy Propositions, Conditional and Qualified Propositions and Quantified Propositions.

Fuzzy Controllers: An Overview, Fuzzification Module, Fuzzy Rule Base, Fuzzy Inference Engine, Defuzzification Module, An Example.

Targeted Application & Tools that can be used:

Python Libraries and Software (Eg.,Tensorflow, Scikit-Learn etc.)

Matlab (Neural Network Toolbox, Fuzzy Logic Toolbox)

Project work/Assignment:

Students will have to do group assignments for Modules 2 & 4. As a part of their assignments, they will have to implement the solution to particular problems.

Textbook(s):

Haykin, Simon. "Neural networks and learning machines", 3/E. Pearson Education India, 2011. https://www.pearson.com/en-us/subject-catalog/p/Haykin-Neural-Networks-and-Learning-Machines-3rd-Edition/P200000003278/9780133002553

George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic- Theory and Applications", Prentice Hall of India, 2015.

https://www.worldcat.org/title/fuzzy-sets-and-fuzzy-logic-theory-and-applications/oclc/505215200

References:

Shivanandam, Deepa S, "Principles of Soft computing", N Wiley India, 3rd Edition, 2018.https://www.wileyindia.com/principles-of-soft-computing-3ed.html

Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley, 2011.

https://onlinelibrary.wiley.com/doi/book/10.1002/9781119994374

Kumar S., "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2nd Edition 2017.https://www.worldcat.org/title/neural-networks-a-classroom-approach/oclc/56955342

Fakhreddine O. Karray, and Clarence W. De Silva. "Soft computing and intelligent systems design: theory, tools, and applications". Pearson Education, 2009.

Weblinks

https://www.pearson.com/en-gb/search.html?q=Karray%20Soft-Computing-and-Intelligent-Systems-Design-Theory-Tools-and-Applications

Topics relevant to "Skill Development ": Assignment implementations in software, batch wise presentations are used for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3005	Course Title: APPLIED ARTIFICIAL INTELLIGENCE Type of Course: Integrated	L-T-P- C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	CSE 3001: Artificial Intelligence and Machine Learning				
Anti-requisites	NIL				
Course Description	This course covers some of the applications in artificial intelligence, such as logic, searching, adversarial search, constraint satisfaction, Bayesian networks, etc. Topic include: AI methodology, Logic in AI, Resolution Principle, Graphical Search techniques, Adversarial Search techniques, Game playing, Uncertainty and Probability, Reasoning in AI, Bayesian Networks and Statistical Learning.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of APPLIED ARTIFICIAL INTELLIGENCE and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Explain different methods of searching, proving, and analysis in AI. [Knowledge] Prove by Resolution, different situations in First-order logic. [Application] Implement various graphical and adversarial search algorithms. [Application] Solvesequence-labeling problems using HMM. [Application]				
Course Content:					
Module 2	Logic in AI			12Sessions
Topics: Propositional Logic,Predicate Logic, First order Logic, Properties of well-formed formulas (Wffs), Conversion to Clausal Form, The Resolution Principle, Inference in First Order Logic (FOL).					
Module 1	Problem Solving by Searching	Case studies / Case let	Case studies / Case let	12 Sessions
Topics: Introduction to Problem space and state space, State space search techniques solving problems by searching:Classical Search, Adversarial Search, Game playing, and Constraint Satisfaction Problems.					

Module 3	Learning and Probabilistic Reasoning	Quiz	Case studies / Case let	14 Sessions

Topics: Introduction to Reasoning, Various types of Reasoning methods, Probabilistic Reasoning in AI, Uncertainty in AI, Bayesian Networks, Hidden Markov Model, Applications of HMM for Part-of-Speech tagging.

List of Laboratory Tasks:

Reading text files in Python (may be needed for some of the later experiments), using IDEs like PyCharm.

Evaluation of well-formedness of formulae in propositional logic.

Evaluation of well-formedness of formulae in first-order logic.

Implementation of graph-based representations - Adjacency List, Adjacency Matrix - Interconversion between Adjacency List and Adjacency Matrix.

Implementation of Uninformed Search Algorithms (1) - Breadth-First Search

Implementation of Uninformed Search Algorithms (2) - Depth-First Search

Implementation of Heuristic Search Algorithms (1) - Greedy Best First Search

Implementation of Heuristic Search Algorithms (2) - A* Search

Implementation of Adversarial Search Algorithms (1) - Minimax Tree Construction

Implementation of Adversarial Search Algorithms (2) - Alpha Beta Pruning and Ideal Ordering Algorithms

Implementation of Constraint Satisfaction Problems (1) - Sudoku

Implementation of Constraint Satisfaction Problems (2) - Map Colouring

Implementation of Constraint Satisfaction Problems (3) - Timetable Scheduling

Implementation of Decision-Making - Minesweeper

Implementation of Probabilistic Decision-Making - Battleship

Implementation of HMM

Building a PoS Tagger using HMM.

Targeted Application & Tools that can be used

Google Colab

Java (any online or desktop IDE)

Project work/Assignment:

Assignment: Students will have to do a course assignment as designed by the Instructor-in-charge. The assignment can be a programming-based assignment, or solving a number of problems, etc.

Text Book
T1. Stuart J. Russell and Peter Norvig.2021. Artificial intelligence: A Modern Approach, 4th Edition. Pearson.
References
R1.Elaine Rich, Kevin Knight and Shivashankar B Nair. 2009. Artificial Intelligence, 3rd Edition. Tata McGraw-Hill.   E book linkT1:https://ia803402.us.archive.org/35/items/artificial-intelligence-a-modern-approach-4th-edition/Artificial%20Intelligence%20A%20Modern%20Approach%20%284th%20Edition%29.pdf   Web resources: W1.http://aima.cs.berkeley.edu/global-index.html   W2. https://presiuniv.knimbus.com/user#/
Topics relevant to "Skill Development": Probabilities for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2053	Course Title: Enterprise Network Design		L-T-P- C	3-0	0	3
Version No.	1.0					
Course Pre-requisites	CSE-2011-Data communication and Computer Networks Computer Networks: OSI Reference Model and TCP/IP Protocol Suite 2. Routing IP Addresses 3. Internetworking Devices					
Anti-requisites	NIL					
Course Description	In Enterprise Network Design, students will investigate and design a variety of enterprise network configurations. They will enhance their consulting skills through the process of customer requirement analysis, network design, product specifications. Methodologies for Analysis of network performance and traffic for established complex networks.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of ENTERPRISE NETWORK DESIGN and attain Skill Development through Problem Solving Methodologies.					
Course Outcomes	On successful completion of the course the students shall be able to: Understand the customer requirements, Structure and Modularize the Network. [KNOWLEDGE] Compare Openflow controllers and switches with other enterprise networks. [COMPREHENSION] Design Basic Campus and Data Center Network, Remote Connectivity, IP Addressing and Select suitable Routing Protocols for the Network. [APPLICATION] Apply a Methodology to Network Design [APPLICATION]					

Course Content:

Module 1	Applying a Methodology to Network Design:	Assignment	Theory	No. of Classes:09

Applying a Methodology to Network Design: The Cisco Service Oriented Network Architecture, Network Design Methodology, Identifying Customer Requirements, Characterizing the Existing Network and Sites, Using the Top Down Approach to Network Design, The Design Implementation Process. Network Design Demonstration through CISCO Packet Tracer.

Module 2	Structuring, Modularizing the Network, and Designing Basic Campus and Data Center Networks	Assignment	Theory	No. of Classes:12

Network Hierarchy, Using a Modular Approach to Network Design, Services Within Modular Networks, Network Management Protocols and Features, Campus Design Considerations, Enterprise Campus Design, Enterprise Data Center Design Considerations.				
Module 3	Remote Connectivity, Designing IP Addressing in the Network & Selecting Routing Protocols	Assignment	Theory	No. of Classes:12
Enterprise Edge WAN Technologies, WAN Design, Using WAN Technologies, Enterprise Edge WAN and MAN Architecture, Selecting Enterprise Edge Components, Designing an IP Addressing Plan, Introduction to IPv6, Routing Protocol Features, Routing Protocols for the Enterprise, Routing Protocol Deployment, Route Redistribution, Route Summarization				
Module 4	Software Defined Network	Assignment	Case Study	No. of Classes:12
Understanding SDN and Open Flow : SDN – SDN Building Blocks, OpenFlow messages – Controller to Switch, Symmetric and Asynchronous messages, Implementing OpenFlow Switch, OpenFlow controllers , POX and NOX, Open Flow in Cloud Computing, Case study: how SDN changed Traditional Enterprise network Design				

Targeted Application & Tools that can be used:

CISCO Packet Tracer.

SDN Open flow

Suggested List of Hands-on Activities self study

Perform a case study on VLSM

Using CISCO Packet Tracer design a LAN with 50 PCV and configure it with suitable IP addressing and routing protocols for an Enterprise Network.

DO a case study on an SDN for an Enterprise.

Text Book

Authorized Self-Study Guide, Designing for Cisco Internetwork Solutions (DESGN), Second Edition, Cisco Press-Diane Teare.

Network Analysis, Architecture, and Design 3rd Edition, Morgan Kaufman, James D.

CCDA Cisco official Guide 4. Software Defined Networking with Open Flow : PACKT Publishing Siamak Azodolmolky

References

Top-Down Network Design (Networking Technology) 3rd Edition, Priscilla Oppenheimer ,Cisco Press Book

Network Planning and Design Guide Paperback – 2000, Shaun Hummel Web Resources and Research Articles links;

Network Planning and Design Guide Paperback – 2000, Shaun Hummel

Weblinks:

https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-live%26ebv%3dEB%26ppid%3dpp_xiii

https://www.youtube.com/watch?v=ITsezBQU_Co

http://www.teraits.com/pitagoras/marcio/gpi/b_POppenheimer_TopDownNetworkDesign_3rd_ed.pdf

https://www.cisco.com/c/dam/en/us/td/docs/solutions/Enterprise/Medium_Enterprise_Design_Profile/chap2sba.pdf

https://nptel.ac.in/courses/106105184

Topics relevant to development of " EMPLOYABILITY SKILLS": Network Design Methodology, Identifying Customer Requirements, Characterizing the Existing Network and Sites.

Course Code: CSE 6001	Course Title:Deep Learning Type of Course:Program Core Theory and Laboratory Integrated		L-T- P- C 2-0	2	3
Version No.	1.0				
Course Pre- requisites	Data Mining and Machine Learning fundamentals Basic working knowledge of Statistics and Probability Familiarity with programming languages and hands on coding				
Anti-requisites	NIL				
Course Description	The course introduces the core intuitions behind Deep Learning, an advanced branch of Machine Learning involved in the development and application of Artificial Neural Networks that function by simulating the working principle of human brain. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. The course includes theory and lab components which emphasizes on understanding the implementation and application of deep neural networks in various prominent problem domains like speech recognition, sentiment analysis, recommendations, and computer vision etc. The course facilitates the students to interpret and appreciate the successful application of deep neural nets in various prediction and classification tasks of ML.				
Course Object	The objective of the course is to familiarize the learners with the concepts of Deep Learning and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Apply basic concepts of Deep Learning to develop feed forward models Apply Supervised and Unsupervised Deep Learning techniques to build effective modelsfor prediction or classification tasks Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains of Machine Learning and Machine vision. Analyze performance of implemented Deep Neural models				
Course Content:					
Module 1	Introduction to Deep Learning	Assignment	Programming	No. of Classes:10	
Topics: Machine Learning in a nutshell, Fundamentals of deep learning and neural networks,Deep Neural Network,Feedforward Neural Network, , Perceptron, MLP Structures, Activation					

Functions, Loss Functions, Gradient Descent, Back-propagation, Training Neural Networks Building your Deep Neural Network: Step by Step, Deep Neural Network for Classification.

| Module 2 | Improving Deep Neural Networks | Assignment | Programming | No. of Classes:09 |

Topics:

Hyperparameter tuning, Initialization, Overfitting and Underfitting, Regularization and Optimization, Dropout, Batch Normalization

| Module 3 | Deep Supervised Learning Models | Assignment | Programming | No. of Classes:10 |

Topics:

Convolutional neural network,Prediction of image using Convolutional Neural Networks,Deep learning in Sequential Data, RNN & LSTM, GRU, Sentiment Analysis

| Module 4 | Deep Unsupervised Learning | Assignment | Programming | No. of Classes:10 |

Topics:

 Basics of Deep unsupervised learning, Auto encoders,Restricted Boltzmann Machine, Recommender systems

Text Book

 Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2017

References

1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Inderscience, 2nd Edition. 2013

2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4, Academic Press, 2015

3. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence, 2013

4. Bishop, C. M. Neural Networks for Pattern Recognition, Oxford University Press, 2008.

https://sm-nitk.vlabs.ac.in/

https://nptel.ac.in/courses/105105157

Topics relevant to "SKILL DEVELOPMENT": Real time Data Analysis, Naming and coding for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3152	Course Title: .NET Full Stack Development				
		L-T- P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	CSE3151 Java Full Stack Development				
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of DotNET FULL STACK Development and attain Employability Skills through Experiential Learning techniques.				
Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of C# for developing a small application [Application] 2] Show web applications using Entity Framework. [Application] 3]Solve simple web applications that use SQL and ASP.NET [Application] 4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]				
Course Content:					

Module 1	C# Programming for Full Stack Development	Project	Programming	10 Sessions

Topics:

.NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions, Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading, Data validation and working

with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework

Assignment: Develop a small application for managing library using C#.

Module 2	Entity Framework Core 2.0	Project	Programming	06 Sessions

Topics:

Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET

Assignment: Develop an application for managing HR policies of a department.

Module 3	ASP.NET	Project	Programming	06 Sessions

Topics:

ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC & Layouts;

Assignment: Develop a web application to mark entry/exit of guests in a building.

Module 4	ASP.NET	Project	Programming	08 Sessions

Topics:

Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application

Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Visual Studio

Project work/Assignment:

Problem Solving: Design of Algorithms and implementation of programs.

Programming: Implementation of given scenario using .NET.

Assignment: Case study on Web sites development

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

T2. Valerio De Sanctis, "ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11", 4th Edition, Packt, 2021.

References

R1. Benjamin Perkins, Jon D. Reid, "Beginning C# and .NET", Wiley, 2021 Reid, 2021.

R2. Piotr Gankiewicz, "Full Stack .NET Web Development", Packt Publishing, 2017.

R3. Tamir Dresher, Amir Zuker, Shay Friedman, "Hands-On Full-Stack Web Development with ASP.NET Core", Packt Publishing, 2018.

R4. Dustin Metzgar, "Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core", Manning, 2017.

Topics relevant to development of "Employability": C#, ASP.NET & SQL for developing Employability Skill Development through Experiential Learning techniques.. This is attained through assessment component mentioned in course handout.

Course Code: CSE391	Course Title: Java Full Stack Development	L-T- P- C	0	4	2
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	CSE392 .NET Full Stack Development				
Course Description	This advanced level course enables students to perform full stack development using Java, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Java Full Stack Development and attain EMPLOYABILITY SKILLS through EXPERIENTIAL LEARNING techniques
Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of Java for full stack development [Application] 2] Show web applications using Java EE. [Application] 3] Solve simple applications using Java Persistence and Hibernate [Application] 4] Apply concepts of Spring to develop a Full Stack application. [Application] 5] Employ automation tools like Maven, Selenium for Full Stack development. [Application]

Course Content:

Module 1	Introduction	Project	Programming	03 Sessions

Topics:

Review of Java; Advanced concepts of Java; Java generics; Java IO; New Features of Java. Unit Testing tools.

Module 2	Java EE Web Applications	Project	Programming	05 Sessions

Topics:

Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App

Assignment: Develop an application for managing HR policies of a department.

Module 3	Java Persistence using JPA and Hibernate	Project	Programming	06 Sessions

Topics:

Fundamentals of Java Persistence with Hibernate; JPA for Object/Relational Mapping, Querying, Caching, Performance and Concurrency; First & Second Level Caching, Batch Fetching, Optimistic Locking & Versioning; Entity Relationships, Inheritance Mapping & Polymorphic Queries; Querying database using JPQL and Criteria API (JPA)

Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society..

Module 4	Spring Core	Project	Programming	10 Sessions

Topics:

Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development

Assignment: Develop a software tool to do inventory management in a warehouse.

Module 5	Automation tools	Project	Programming	06 Sessions

Topics:

Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands

Assignment: Illustrate the use of automation tools in the development of a small software project.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.

Text Book:

   T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

References

      R1. Soni, Ravi Kant. "Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful." , Apress, 2017. in https://presiuniv.knimbus.com/user#/home

       R2. Mardan, Azat. "Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB.", Apress, 2015

    Weblinks:

    https://www.javatpoint.com/java-full-stack

Topics relevant to development of "Employability": Hibernate, Eclipse & Spring for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE390	Course Title: Front-end Full Stack Development	L-T- P- C	0	4	2
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	NIL				
Course Description	This intermediate course enables students to perform front-end full stack development, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts Front end Full Stack Development and attain Employability through experiential Learning techniques.				
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the fundamentals of DevOps and Front-end full stack development. [Comprehension] 2] Illustrate a basic web design using HTML, CSS, Javascript. [Application] 3] Illustrate development of a responsive web. [Application] 4] Apply concepts of Angular.js to develop a web front-end. [Application]				
Course Content:					

Module 1	Fundamentals of DevOps	Project	Programming	04 Sessions

Topics:

Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes.

Review of GIT source control.

Module 2	Web Design & Development	Project	Programming	03 Sessions

Topics:

HTML5 – Syntax, Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform;

Assignment: Develop a website for managing HR policies of a department.

Module 3	Responsive web design	Project	Programming	08 Sessions

Topics:

BootStrap for Responsive Web Design; JavaScript – Core syntax, HTML DOM, objects, classes, Async; Ajax and jQuery Introduction

Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society..

Module 4	Fundamentals of Angular.js	Project	Programming	15 Sessions

Topics:

Setting up Development & Build Environment: Node.js and NPM; Introduction to TypeScript; Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications; Components & Databinding in Depth; Angular Directives; Using Services & Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication & Route Protection; Dynamic Components; Angular Modules & Optimizing Angular Apps; Deploying an Angular App; Angular Animations; Adding Offline Capabilities with Service Workers; Unit Testing in Angular Apps (Jasmine, Karma). Overview of React.js

Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:
Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: GCC compiler.					

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

T2. Northwood, Chris, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", APress, 2018

References:

R1. Flanagan D S, "Javascript : The Definitive Guide" 7th Edition. 7th ed. O'Reilly Media; 2020.

R2. Alex Libby, Gaurav Gupta, and Asoj Talesra. "Responsive Web Design with HTML5 and CSS3 Essentials", Packt Publishing, 2016

R3. Duckett J Ruppert G Moore J. "Javascript & Jquery : Interactive Front-End Web Development."; Wiley; 2014.

R4. Web Reference:

 https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2

R5. Web Reference: https://www.freecodecamp.org/news/frontend-web-developer-bootcamp/

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&site=ehost-live

https://nptel.ac.in/courses/106102064

Topics relevant to development of "Employability": DevOps Tools Overview – Jenkins, Docker, Kubernetes for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: Data Visualization	L-T- P-C	1	4	3
CSE 367	Type of Course: Integrated				
Version No.	1.0				

Course Pre-requisites	Fundamental knowledge of data structures, statistics, database concepts and Python.			
Anti-requisites	Nil			
Course Description	This course provides an introduction to turning data into presentable graphics. Data Visualization is important today as the usage of data is growing in many different fields. Data visualization techniques help people to better understand this data. The goal of this course is to introduce students to data visualization including principles, techniques and algorithms, to create effective visualizations based on principles from graphic design, visual art, perceptual psychology, and cognitive science. Students will learn the value of visualization, specific techniques in data visualization, grammar of graphics and how to leverage visualization tools.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data visualization and attain EMPLOYABILITY SKILLS through EXPERIENTIAL LEARNING techniques			
Course Out Comes	On successful completion of the course the students shall be able to: Understand the visual representation of data (Knowledge). Analyze the one, two and multi-dimensional data for the data visualization process and evaluate the visualization of groups, trees, graphs, clusters, networks and software (Application). Construct the effective model for data visualization by using various techniques (Application).			
Course Content:				
Module 1	A Conceptual Framework for Data Visualization	Quiz / Assignment	Data Collection/Interpretation	L – 2 sessions, P – 4 sessions,
Topics: Data, information, knowledge, and insight; The transformation of data; Data visualization history; How does visualization help decision-making; Visualization plots.				
Module 2	Visualization Techniques for Spatial Data	Quiz / Assignment	Data Collection/Interpretation	L – 5 sessions, Lab – 10 sessions
Topics: One Dimensional Data; Two-Dimensional Data; Three-Dimensional Data; Dynamic Data; Combining Techniques. Visualization Techniques for Time-Oriented Data: Characterizing Time-Oriented Data; Visualizing Time-Oriented Data. Visualization Techniques for Multivariate Data: Point-Based Techniques; Line-Based Techniques; Region-Based Techniques; Combinations of Techniques.				

Module 3	Visualization Techniques for Trees, Graphs and Networks	Group Project	Case studies / Case let	L – 2 sessions, Lab – 8 sessions

Topics: Displaying Hierarchical Structures; Displaying Arbitrary Graphs / Networks,

Text and Document Visualization: Levels of Text Representations; Vector Space Model; Single Document Visualizations; Document Collection Visualizations; Extended Text Visualizations.

Module 4	Visualization Techniques for Geospatial Data	Group Project	Case studies / Case let	L – 4 session, Lab – 8 sessions

Topics: Visualizing Spatial Data; Visualization of Point Data; Visualization of Line Data; Visualization of Area Data.

Interaction Concepts: Interaction Operators; Interaction Operands and Spaces; A Unified Framework.

Designing Effective Visualizations: Steps in Designing Visualizations; Problems in Designing Effective Visualizations.

Comparing and Evaluating Visualization Techniques: User Tasks; User Characteristics; Data Characteristics; Visualization Characteristics; Structures for Evaluating Visualizations; Benchmarking Procedures.

List of Laboratory Tasks: Introduction to Data Visualization, Introduction to Python Packages (pandas), Visualization Tools, Time Series Data Visualization, Advanced Visualizations, Visualization Techniques for Geospatial Data, Interaction Concepts

Targeted Application & Tools that can be used:

Text Book

T1: Ward, Matthew O., Georges Grinstein, and Daniel Keim. Interactive data visualization: foundations, techniques, and applications. CRC Press, 2010.

T2: Madhavan, Samir. Mastering Python for Data Science. Packt Publishing Ltd, 2015.

T3: Wilkinson, Leland, The Grammar of Graphics, Springer-Verlag New York,2015

References

R1: Wilke, Claus O. Fundamentals of data visualization: a primer on making informative and compelling figures. O'Reilly Media, 2019.

R2: Tamara Munzner, Visualization Analysis and Design (VAD), CRC press, 2014

R3: Show Me the Numbers: Designing Tables and Graphs to Enlighten, Few, Stephen. 2nd Edition. Analytics Press.

R4: Interactive Data Visualization for the Web by Scott Murray 2nd Edition (2017)

R5: Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016

R6: Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010.

R7: Semiology of Graphics by Jacques Bertin (2010)

R8: Sosulski, K. (2018). Data Visualization Made Simple: Insights into Becoming Visual. New York: Routledge.

R9: (Information Science and Statistics). Springer-Verlag, Berlin, Heidelberg.

E book link
R1:   https://data.vk.edu.ee/PowerBI/Opikud/Fundamentals_of_Data_Visualization.pdf

E book link
R2:   https://www.cs.ubc.ca/~tmm/vadbook/

E book link
R3: https://courses.washington.edu/info424/2007/readings/Show_Me_the_Numbers_v2.pdf

 R3 Web resources:

https://www.coursera.org/specializations/data-visualization?utm_source=gg&utm_medium=sem&campaignid=18216928764&adgroupid=141296025752&device=c&keyword=coursera%20website&matchtype=b&network=g&devicemodel=&adpostion=&creativeid=619458216881&hide_mobile_promo=

https://www.udemy.com/course/learning-python-for-data-analysis-and-visualization/?gclid=CjwKCAiAvK2bBhB8EiwAZUbP1AMoQv7rzjp8XYIdXw1d5bz2VQs6GvhLcB7z6a3WxnDo_Gwq4NbYlBoCQUgQAvD_BwE&matchtype=b&utm_campaign=LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_medium=udemyads&utm_source=adwords&utm_term=_._ag_84769191288_._ad_533157478534_._kw_%2Bdata+%2Bvisualization+%2Bcourse_._de_c_._dm__._pl__._ti_kwd-143520005604_._li_9062050_._pd__._

https://www.youtube.com/watch?v=iPPGfEA2s2M

https://www.youtube.com/watch?v=PSeRjy7y9yE

http://www.ifs.tuwien.ac.at/~silvia/wien/vu-infovis/articles/Chapter8_VisualizationTechniquesForTreesGraphsAndNetworks_271-290.pdf

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjY-56U5KD7AhUq7TgGHRPxBXYQtwJ6BAgIEAI&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D1k7sryECatk&usg=AOvVaw2ZyMwaMdBZiF4cH2YqXmYc

Topics relevant to development of "Employablity":   Visualization Techniques for Spatial Data, Trees, Graphs, Networks and Geospatial Data for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: Go Programming		3	0	3
CSE 2033	Type of Course: Theory Only Course	L-T- P- C			
Version No.	1.0				
Course Pre-requisites	Computer Programming/ Object Oriented Programming (java)				
Anti-requisites	NIL				
Course Description	Go is an open source programming language created by Google. Go is expressive, concise, clean, and efficient. Its concurrency mechanisms make it easy to write programs that get the most out of multicore and networked machines. Go compiles quickly to machine code yet has the convenience of garbage collection and the power of run-time reflection. It's a fast, statically typed, compiled language that feels like a dynamically typed, interpreted language. It is gaining popularity and it is continuing to grow rapidly in industries such as Dropbox, Uber etc. This course will provide an introduction to the Go programming essentials to students of Engineering through lecture hours with demonstrations. Topics: Topics covered in this course are go program structure; data types and control statements; Composite Types – arrays, slices, strings, runes, bytes, hash maps; functions; methods; garbage collection essentials – pointers, structs, interfaces; error handling; Concurrency – go routines and channels, Packages – import and create custom packages and applications of Go				
Course Objective	The objective of the course is to familiarize the learners with the concepts of GO Programming and attain Employability Skills through Problem Solving techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Identify primitive programming constructs in GO. (Knowledge) CO2: Discuss composite data types with concepts of modular programming. (Comprehension) CO3: Implement garbage collection using pointers, structs, interfaces and modules. (Application) CO4: Apply concurrent programming and test routines with applications. (Application)				
Course Content:					

Module 1	Introduction to Go Programming Language	Assignment	Data Collection/Interpretation	10 Sessions

Topics: [Knowledge]

Feature of Go language, Installing and Configuring the development environment- Go tools and playground. Structure of Go program; Basic types-numbers, boolean, strings, runes. Variables-declaration, zero values, naming, rules, conversions, constants, multiple variables. Introduction to packages, functions from other packages, println, reading input, Control Structures - if, switch, for, programming exercises using control statements.

Module 2	Composite types and functions	Assignment	Data Collection/Interpretation	9 Sessions

Topics: [Comprehension]

Composite types - arrays, slices, slices with overlapping storage, Structs. Functions-declaring, parameters, returning multiple values, variadic functions;   Programming exercises

Module 3	Pointers, Structs, Interfaces and modules	Quiz	Case studies / Case let	9 Sessions

Topics: [Application]

Pointers: *and & operator, types, pointers with functions, garbage collector – history, Methods and Interfaces, Modules,packages – importing and creating custom packages; Programming exercises.

Module 4	Concurrency and Applications	Quiz	Case studies / Case let	7 Sessions

Topics: [Application]

Concurrency using Go routines, multiple go routines, channels – channel operations, Testing-writing test, Go test command, Core Packages for – strings, containers and lists, Writing Web Applications, Basic Statistical Computations, histogram plotting, encryption and decryption.

Targeted Application & Tools that can be used:

https://go.dev/play/

https://go.dev/doc/install

Project work/Assignment:

Text Book
T1 1. John Badner,"Learning Go: An Idiomatic Approach to Real World Go Programming", Oreilly, California,2021.

References
R1. 1. Alan A.A. Donovan and Brian W. Kernighan, "The Go Programming Language", Pearson Education, India,2016. R2. Tsoukalos M. Mastering Go: Create Golang production applications using network libraries, concurrency, machine learning, and advanced data structures. Packt Publishing Ltd; 2019 Aug 29. Web resources: https://www.golangprograms.com/go-language.html EBSCO database of Presidency University:https://puniversity.informaticsglobal.com/login W3. GO document: https://go.dev/doc/ Online tool for program execution: GO Play Ground - https://go.dev/play/ Download and install: https://go.dev/doc/install

Topics relevant to development of "Employability": Go Programming basics for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE2015	Course Title: Data Analysis and Visualization			L-T- P-C	2	4	4
	Type of Course:1] Program core						
	2] Lab Integrated Course						
Version No.	1.0						
Course Pre-requisites	Python Programming						
Anti-requisites	NIL						
Course Description	The purpose of the course is to instill a strong foundation of scientific process orientation that is the cornerstone of effective data handling, and creative design thinking appended with strong programming skills to create meaningful visualizations of data. The student should have prior knowledge of python programming and basic knowledge of data concepts.						
	The associated laboratory provides an opportunity to strengthen student's skillset in the arena of Data Preprocessing and Visualization.						
	With a good knowledge in the fundamental concepts of the various libraries for handling and visualizing data the student can gain a stronghold in Data Science enabling the student to be an effective analyst for prospective employers.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Analysis and Visualization and attain EMPLOYABILITY through Experiential Learning techniques.						
Course Out Comes	On successful completion of this course the students shall be able to:						
	Understand the various types of data, apply and evaluate the principles of data visualization.						
	Acquire skills to apply visualization techniques to a problem and its associated dataset.						
	Create interactive visualization for better insight using various visualization tools.						
	Handle data occurring in large volumes						
	Implement the visualization concepts practically using Python						
Course Content:							
Module 1	Introduction to Data Visualization (Comprehension)	Assignment	Programming activity	10 Hours			
Topics:							

Data collection, Data Preparation Basic Models- Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Interacting with Databases, Data Cleaning and Preparation, Handling Missing Data, Data Transformation.

Python Libraries: NumPy, pandas, matplotlib, GGplot,Introduction to pandas Data Structures

Module 2	Data Visualization Techniques (Application)	Assignment	Programming activity	10 Hours

Topics:

Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data, Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map.

Module 3	Visual Analysis of data from various domain (Application)	Assignment	Programming activity	10 Hours

Topics:

Time-oriented data visualization – Spatial data visualization, Text data visualization – Multivariate data visualization and case studies, Finance- marketing-insurance-healthcare etc.

Module 4	Visualization of Streaming Data (Application)	Assignment	Programming activity	10 Hours

Topics:

Guidelines for designing successful visualizations, Data visualization dos and don'ts, Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.

List of Laboratory Tasks:

Labsheet -1 [4 Practical Sessions]

Working with Numpy Functions and Pandas functions

Acquiring and plotting data.

Labsheet -2 [4 Practical Sessions]

Practicals based on Data Cleaning and Preparation

Practicals based on Data Wrangling

Statistical Analysis – such as Multivariate Analysis, PCA, LDA, Correlation regression and analysis of variance   Labsheet – 3 [4 Practical Sessions] Practicals based on Data Visualization using matplotlib Visualization of various massive dataset - Finance - Healthcare - Census   Labsheet – 4 [4 Practical Sessions] Practical based on Time Series Data Analysis-stock market Market-Basket Data analysis-visualization Text visualization using web analytics   Labsheet -5 [4 Practical Sessions] Financial analysis using Clustering, Histogram and HeatMap Visualization on Streaming dataset (Stock market dataset, weather forecasting)
Targeted Application & Tools that can be used: Anaconda/Google Colab, Google Data Studio, Deep Note
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Problem Solving: Choose an appropriate set of visualization elements and design for a dashboard. Programming: Implementation of the chosen dashboard
Text Book McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media. Tamara Munzer, Visualization Analysis and Design, CRC Press 2014. Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018 Dr. OssamaEmbarak,"Data Analysis andVisualization Using Python", Apress,(2018)

References

R1. Dr.Chun-hauh Chen, W.K.Hardle, A.Unwin, Handbook of Data Visualization, Springer publication, 2016.

R2. Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020 3. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014.

R3. García Salvador, LuengoJulián, & Herrera, F. "Data preprocessing in Data Mining", Springer,(2015)

R4. Stephen Few, "Information Dashboard Design: the effective visual communication of data", Oreilly, 2006

R5. Belorkar, A, "Interactive Data Visualization with Python" - [S.l.]: Packt Publishing, Second Edition. (2018)

Web links

R1. https://pythonprogramming.net/live-graphs-data-visualization-application-dash-python-tutorial/

R2. Google Data Analytics Professional Certificate | Coursera

R3. Learning Python for Data Analysis and Visualization Ver 1 | Udemy

R4. Data Science, Analytics and Visualization (DS) Courses | Chaminade University - PROD [Integrated] Catalog

R5. Data Visualization Training and Certification Courses | Koenig Solutions (koenig-solutions.com)

Topics relevant to "Employability": Visual Analysis and Streaming of Data for Employability through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

Decision	Course Title: Innovation Project-Raspberry Pi Using Python		L-T-P- C	0	4 This includes few lecture sessions	2
Version No.	0.9					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	In this course the students will learn fundamental concepts of 'Python' and Python for Raspberry Pi through problem solving using Python in a systematic way to read and write the Python code and to implement them on Raspberry Pi prototype board. The course will also demonstrate how to assemble various sensory devices and program them using Raspberry platform as a basis. Students will have the opportunity of gaining real-world experience in handling IoT devices involving hardware and software combinations. The course also offers in-depth knowledge of designing, developing, coding and implementing Raspberry Pi projects.					
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: Develop beginner level python code. [Application] Explain the main features of the Raspberry Pi board. [Comprehension] Demonstrate the hardware interfacing of the peripherals to Raspberry Pi system. [Application] Demonstrate the functioning of live various projects carried out using Raspberry Pi system. [Application]					
Course Content:						
Module 1	Basics of Python	Quiz		Problem Solving	4 Sessions	

Topics:				
Introduction, Getting started with Python, Variables and Literals, Print function, input function, Data Types Type Conversions, Operations on Strings, Arithmetic and logical Operators, Boolean expression, Data sequence, lists, tuples, sets, dictionary. Concepts will be taught by solving problems through programs.				
Module 2	Decision Making and Iterations	Quiz	Problem Solving	4 Sessions
Topics:				
Conditional coding and Control statements-if, elif, else, while loop, for loop, nested for loop, range function, break and continue, pass. Concepts will be taught by solving problems through programs.				
Module 3	Functions, Files	Project Development	Problem Solving	4 Sessions
Topics:				
Introduction to functions, syntax, variables scope and lifetime, function parameters and arguments, importing modules. Concepts will be taught by solving problems through programs.				
Module 4	Interaction with API Services	Project Development	Modeling and Simulation task	3 Sessions
Topics:				
Raspberry Pi interact with online API services through the use of public APIs and SDKs using Firebase, Gspread API. Node-RED – a programming tool for wiring together hardware devices, MQTT. Android/Case study.				
Targeted Application & Tools that can be used: Making it a reality (Raspberry Pi Projects) : Projects will include but not limited to : 1) Intelligent home locking system. 2) Intelligent water level management system. 3) Home automation using RFID. 4) Real time clock-based home automation. 5) Intelligent Automatic Irrigation System Professionally Used Software: Raspberry Pi.				
Project work/Python Lab Test:				

Project work	
Python test.	
Text Book(s):	
Ashok Namdev Kamthane, Amit Ashok Kamthane, "Problem Solving and Python Programming", Mc Graw Hill Education, 2018.	
Reference(s):	
https://github.com/thibmaek/awesome-raspberry-pi	
MagPi magazine	
Topics relevant to development of "Skill Development": Basic Concepts of Python-Programming, and Raspberry Pi for Skill Development through Experiential Learning Techniques. This is attained through assessment component mentioned in course handout.	
Evaluation:	Review-1-20%, Review-2-25%, Python test-25%, Project Expo-30%

Course Code: CSE253	Course Title: Database Management Systems Lab Type of Course: Practical	L- T-P-C	0	0	4	2
Version No.	2.0					
Course Pre-requisites	Basic elements of programming language, set theory, Modular approach, Operating system basics					
Anti-requisites	-					
Course Description	Database management lab is designed to have a real feel of database design using structured query languages, which includes use of various data definition, data manipulation commands, functions, joins, sub-queries, views ,set operations, procedures and triggers.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems Lab and attain SKILL DEVELOPMENT through E EXPERIENTIAL LEARNING techniques					
Course Out Comes	On successful completion of the course the students shall be able to: Apply the various data models and ER modeling concepts used in database design. (Application) Demonstrate SQL commands for structured database management. (Application)					

	Develop the solutions for solving database problems through case studies. (Application)
Course Content:	Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model, constraints, SQL Query Language, insert, delete, and update statements in SQL, Schema change statements (alter, drop),in, Exists, not exists clause, Implement different types of aggregate functions (min, max, sum, count etc.),math functions, commit, rollback, Triggers, Views, Functions, Procedure and cursor.

List of Laboratory Tasks

Draw E-R diagram and convert entities and relationships to relation table for a given scenario. a. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)

To study and implement Data Definition Language commands of SQL.

To study and implement Data Manipulation Language of SQL.

To study and implement SQL data retrieval using SELECT, FROM and WHERE clause.

Perform the following: a. Viewing all databases, creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)

To Retrieve Data from Database using different types of special operators.

To study and implement aggregating Data using Group by Clause and HAVING clause and sort data using Order By.

To study and implement different types of Set Operations.

To study and implement different types of Joins in SQL.

Subqueries- With IN clause, With EXISTS and Not Exists clause

To study and implement different types Math Functions

To Retrieve Data from a given Database using Nested queries, Correlated queries.

To study and implement Views, Triggers in SQL.

To study and implement Functions and Procedures.

Write a SQL program using FOR loop to insert ten rows into a database table

To design and implement the DDL, DML and Retrieval for the BANK DATABASE.

Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table

Targeted Application & Tools that can be used:

Data base management applications and Oracle-Mysql

Text Book
Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Education.
References
Silberschatz A, Korth H F and Sudarshan S, "Database System Concepts",McGraw Hill Education.
E-Resources
NPTEL course:
https://onlinecourses.nptel.ac.in/noc22_cs51/preview
https://onlinecourses.swayam2.ac.in/cec22_cs08/preview
Topics relevant to "SKILL DEVELOPMENT": Aggregates, Join, Views and Triggers for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3085	Course Title: Real Time Operating Systems Type of Course : Theory	L-T- P-C	3	0	0
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The Real-time Operating Systems program is an educational and methodological document included in the master's educational program, provides for the acquisition of skills and competencies related to the study of the features of embedded operating systems, as well as real-time systems. Real-time Operating Systems is aimed at the formation of competencies aimed at obtaining theoretical knowledge about embedded operating systems, and the acquisition of practical skills and competencies in installing, configuring and debugging operating systems.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Real Time Operating Systems and attain EMPLOYABILITY SKILL through PARTICIPATIVE LEARNING techniques.				

Course Out Comes	On successful completion of the course the students shall be able to:
	
	Explain the fundamentals of Real time systems and its classifications.
	
	Understand the concepts of computer control and the suitable computer hardware requirements for real-time applications.
	
	   Describe the operating system concepts and techniques required for real time systems.
	
	   Apply deadlock detection and prevention algorithms to solve the given problem				

Course Content:					

Module 1	8 Sessions
Introduction Real Time Operating System Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads, Scheduling	
Module 2	8 Sessions
BASICS OF REAL-TIME CONCEPTS	

Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel

Module 3	8 Sessions

PROCESS MANAGEMENT

Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals

Module 4	8 Sessions

INTER-PROCESS COMMUNICATION: Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion,

PIPES MEMORY MANAGEMENT: - Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection

Text Book

J. J Labrosse, "MicroC/OS-II: The Real –Time Kernel", Newnes, 2002.

Jane W. S. Liu, "Real-time systems", Prentice Hall, 2000.

References

W. Richard Stevens, "Advanced Programming in the UNIX® Environment", 2nd Edition, Pearson Education India, 2011.

Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wley& Sons, 2004

Doug Abbott, "Linux for Embedded and Real-Time Applications", Newnes, 2nd Edition, 2011.

Web resources: http://pu.informatics.global

Topics relevant to development of "Skill Development":   Threads: Multi-threading models, threading issues, thread libraries, synchronization for developing Employability Skills through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3080	Course Title: Quantum Computing Type of Course: Integrated	L -T- P- C	2	2	3
Version No.	1				

Course Pre-requisites	Linear Algebra			
	Probability and Statistics			
Anti-requisites				
Course Description	This course provides an introduction to the theory and practice of quantum computation. Topics covered include: quantum mechanics to understand quantum computation. Quantum algorithms. The Shor's factorization algorithm Grover's search algorithm Mathematical models of quantum computation, Quantum Machine Learning, and to physical systems.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Quantum Computing and attain EMPLOYABILITY SKILLS through EXPERIENTIAL LEARNING techniques			
Course Out Comes	On successful completion of the course the students shall be able to:			
	Understand the basic principles of quantum computation and quantum mechanics.			
	Design quantum circuits using quantum gates.			
	Analyze the behavior of basic quantum algorithms.			
	Understand the difference between classical and quantum machine learning approach.			
Course Content:				
Module 1	INTRODUCTION	Quiz	Quiz	10 sessions (8 T + 2 L)
Topics:				
Introduction to quantum computing. Qubits, Bloch sphere, multiple qubits, quantum states and measurements, Postulates of quantum mechanics, Classical computation vs quantum computation.				
Module 2	QUANTUM MODEL OF COMPUTATION	Quiz	Quiz	12 sessions (8 T + 4 L)
Topics:				
The model of quantum computation, Quantum circuits: single qubit gates, multiple qubit gates, design of quantum circuits.				
Module 3	QUANTUM ALGORITHMS	Assignment	Case Studies	12 sessions (8 T + 4 L)
Topics: Deutsch-Jozsa algorithm and Grover's search algorithm. Shor's algorithm for factoring, Quantum Fourier transform.				

Module 4	QUANTUM INFORMATION THEORY & QUANTUM MACHINE LEARNING	Assignment	Case Studies	11 sessions (9 T + 2 L)

Topics: Comparison between classical and quantum information theory, Applications of quantum information, Bell states, Quantum Machine Learning, no cloning theorem.

List of Laboratory Tasks:

Lab 1: Use Qiskit Tools [Module 1]

Lab 2: Display and Use System Information [Module 1]

Lab 3: Construct Visualizations [Module 1]

Lab 4: Perform Operations on Quantum Circuits [Module 2]

Lab 5: Implement BasicAer: Python-based Simulators [Module 2]

Lab 6: Access Aer Provider [Module 3]

Lab 7: Implement QASM [Module 3]

Lab 8: Executing Experiments [Module 3]

Lab 9: Return the Experiment Results [Module 4]

Lab 10: Compare and Contrast Quantum Information [Module 4]

Targeted Application & Tools that can be used

Framework- Qiskit

Language- Python

Applications:

Quantum Circuits

Quantum Gates

Quantum Machine Learning Algorithms

Project work/Assignment:

Assignment:

Create quantum circuit functions that can compute the XOR, AND, NAND and OR gates using the NOT gate (expressed as x in Qiskit), the CNOT gate (expressed as cx in Qiskit) and the Toffoli gate (expressed as ccx in Qiskit) .

Measure the Bloch sphere coordinates of a qubit using the Aer simulator and plot the vector on the Bloch sphere

Investigate the relationship between the number of qubits required for the desired accuracy of the phase estimation with high probability.

Project Work:

Create a program that builds an oracle for a given string (e.g. given 01101, will return a QuantumCircuit that inverts the phase of the state $|01101\rangle$ and leaves all other states unchanged.

Tackle an open issue in the Qiskit Terra repo.

Create a program that builds an oracle circuit from a problem (like the PhaseOracle class does in the previous page). Assess how the size of your circuits grow with the size of the problem.

Text Book

Nielsen, M., & Chuang, I. (2010). Quantum Computation and Quantum Information: 10th Anniversary Edition. Cambridge: Cambridge University Press.
doi:10.1017/CBO9780511976667

McMahon D. Quantum Computing Explained. Hoboken N.J: Wiley-Interscience : IEEE Computer Society; 2008.

References

Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. (2004)

Pittenger A. O., An Introduction to Quantum Computing Algorithms (2000).

E book link R1:

http://community.qiskit.org/textbook

E book link R2

https://github.com/Qiskit

R3 Web resources:

Abraham Asfaw and Antonio Corcoles & et al. "Learn Quantum Computation Using Qiskit", 2020, http://community.qiskit.org/textbook

IBM Qiskit Global Summer School 2021: Quantum Machine Learning, https://qiskit.org/events/summer-school/

https://quantum-computing.ibm.com/

https://qiskit.org/

https://presiuniv.knimbus.com/u

Topics relevant to development of "Employability Skills"

Designing Quantum circuits

Visualizing Quantum Circuit outputs

Analyzing and Comparing Quantum Algorithm Performance for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3019	Course Title: Stochastic Decision making	L- T- P- C	3	0	0	3
	Type of Course: Theory					
Version No.	1.0					
Course Pre-requisites	A course in Statistics: STAT-UB 1 or STAT-UB 3 or STAT-UB 103. Basic familiarity with Microsoft Excel: developing and copying formulas with relative and absolute cell addresses, and using the function and chart wizards.					
Anti-requisites						
Course Description	This course introduces the basic concepts, principles, and techniques of decision making under uncertainty. Students will learn how to model complex business problems that involve risk and uncertainty with the help of spreadsheet models. The course covers analytical models such as Decision Tree, Stochastic Optimization, Simulation & Optimization, and Dynamic Optimization. The course is hands-on. The emphasis will be on model formulation and interpretation of results, not on mathematical theory. This course emphasizes optimization models with uncertain parameter values. In contrast, the DMA course focuses on various deterministic optimization models and Monte Carlo simulation.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Stochastic Decision making and attain Employability through Participative Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: Gain basic knowledge about stochastic processes in the time domain. The student has acquired more detailed knowledge about Markov processes with a discrete state space, including Markov chains, Poisson processes and birth and death processes. Know about queueing systems and Brownian motion, in addition to mastering the fundamental principles of simulation of stochastic processes and the construction of Markov chain Monte Carlo (MCMC) algorithms. formulate simple stochastic process models in the time domain and provide qualitative and quantitative analyses of such models.					

Course Content:	Use data to model currency exchange rates, stock prices, commodity prices, air travelDemand; Brief introduction to Monte Carlo simulation; Optimal financial hedging strategies; Supply contract selection; Airline booking control. Introduction to decision tree; Value of information; Bayesian updateValue an R&D project: managing technology risk; Value a license agreement; Options to postpone, expand, and contract.			
Module 1	Simple static stochastic optimization models	Assignment	Simulation/Data Analysis	14 Sessions

Use data to model currency exchange rates, stock prices, commodity prices, air travelDemand; Brief introduction to Monte Carlo simulation; Optimal financial hedging strategies; Supply contract selection; Airline booking control. Introduction to decision tree; Value of information; Bayesian updateValue an R&D project: managing technology risk; Value a license agreement; Options to postpone, expand, and contract.

Module 2	sequential decision making: decision tree	Assignment	Simulation/Data Analysis	14 Sessions

 Introduction to dynamic programming; Binomial tree; American option pricing; Targeted marketingInventory management at a retail pharmacy; Optimal timing for market entry; Cash management at a retail bank.Moving average; Trends; Seasonality .Introduction to linear programming; Production planning with forecasted demand; Airline revenue management

Module 3	Real options and decision tree	Term paper/Assignment	Simulation/Data Analysis	14 Sessions

 Capital budgeting: when projects have uncertain NPVs and uncertain capital usage; Production strategy: managing quality risk of raw materials; Value-at-risk Plant location for a multinational firm: hedging currency exchange risk; Process flexibility: hedging demand risk.Inventory transshipment: managing demand risk; Capacity planning for an electric utility.

List of Laboratory Tasks

Targeted Application & Tools that can be used:

The course is theory based and students will get hands on experience in statistical tools.
Assignment:
Text Book   J Medhi, "Stochastic Processes"
References A K Basu, "Introduction to Stochastic process" Ming Liao, "Applied Stochastic Process" Time A Wheeler, Kyle H.Wray, "Algorithms for Decision making" E-Resources   https://presiuniv.knimbus.com/user#/home
Topics relevant to the "EMPLOYABILITY SKILLS": Combing simulation with linear optimazation, for development of Employability skills through Participative Learning Techniques. This is attained through the assessment components mentioned in the course handout.

Course Code: CSE 3076	Course Title: Artificial Intelligence for Robotics	L-T-P- C	3	0	3
	Type of Course: Theory Only Course				
Version No.	1.0				
Course Pre-requisites	Basic Programming Concepts				
Anti-requisites	NIL				
Course Description	The course explores the intelligent system structure, working and various levels of representation. The students learn how to identify, differentiate, and categorize a wide range of intelligent system, as well as to evaluate how AI contribute to the design and development of intelligent system design. Also this course offers comprehensive knowledge and professional-level skills focused on developing and deploying software robots. It starts with the basic concepts of Robotic Process Automation. After successful completion of the qualification the candidates shall be employed in the industries for following occupations: RPA Developer, RPA Engineer, RPA Expert.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Artificial Intelligence for Robotics and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: CO 1: Define the basic of local search algorithms, various optimization techniques for a given AI algorithm. [Remember] CO 2: Identify the smart intelligent way to represent the knowledge Engineering. [Application] CO 3: Describe RPA, where it can be applied and how it's implemented. [Remember] CO 4: Use different types of variables, Control Flow and data manipulation techniques. [Application]				
Course Content:					

Module 1	Introduction to intelligent systems	Quiz		10 Sessions

Topics:

Basic Concepts and definitions of AI. Searching: Searching for solutions, Uniformed Search Strategies, Informed Search Strategies, and Heuristic Functions. Local Search Algorithms and Optimization Problems: Hill climbing, simulated annealing, local beam, Genetic algorithms, Constraint Satisfaction Problems, Backtracking Search for CSPs. searching in solution tree-

case study: water jug problem. Adversial Search: Games, Optimal Decision in Games, Alpha Beta Pruning, Evaluation Functions, Cutting off search, Games that include an Element of chance, Game programs.

Module 2	Knowledge representations	Quiz		10 Sessions

Topics:

First Order Logic: Syntax and Semantics, Using First Order Logic, Knowledge Engineering, Inference in First Order Logic: Propositional vs. First Order Inference, Unification and Lifting, Resolution, Forward and Backward Chaining.

Module 3	Introduction To Robotic Process Automation	Assignment	Design solution to given problem	10 Sessions

Topics:

Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation.

RPA BASICS:

History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

Module 4	Rpa Tool Introduction And Basics	Assignment	Design solution to given problem	08 Sessions

Topics:

The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation

- Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data.

Targeted Application & Tools that can be used:

Targeted application: Web Crawler, Email Crawler, etc.

Tools: UiPath, Power automate, etc.

Project work/Assignment:
Assignment: Create a sequence that asks the user for his first and last name, and give him choices to order from his favorite snacks, and then displays his answers. Design a process to Extract Initial name from full name Design a process to insert integer and decimal value into a string without using + operator. Design a process to read text from multiple word documents

Text Book
 	
  T1 E. Rich and K. Knight," Artificial Intelligence", Tata McGraw Hill, 2013
 	
  T2 Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018

References
 	
   R1 E. Charnaik and D.McDermott," Introduction to artificial Intelligence", Pearson Education, 2012.
 	
   R2 Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate
 	
       Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
 	
E book link R1:
 	
https://s3.amazonaws.com/ebooks.syncfusion.com/downloads/robotic-process-automation-succinctly/robotic-process-automation-succinctly.pdf?AWSAccessKeyId= AKIAWH6GYCX3TD2TTP24&Expires=1668334212&Signature=3ysYmpkfW8xJnT1yiSy%2FqTq1q9w%3D
 	
   Web resources: https://www.uipath.com/rpa/robotic-process-automation
 	
                  https://puniversity.informaticsglobal.com/login
 	
                  https://www.fer.unizg.hr/_download/repository/AI-1-Introduction.pdf

Topics relevant to "EMPLOYABILITY SKILLS": Design of assistant bots, Debugging and Exception Handling, Excel Data Tables & PDF - Data Tables in RPA for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout

Course Code: CSE3098	Course Title: Vulnerability Assessment and Penetration Testing Type of Course: Theory Only Course	L-T-P- C	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				
Course Description	This course explores the tools that can be used to perform information gathering. This course also covers how vulnerability can be carried out by means of tools or manual investigation, and analysis of common attacks in data, mobile applications and wireless networks				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Vulnerability Assessment and Penetration Testing and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the basic principles for information gathering and detecting vulnerabilities in the system. Determine the security threats and vulnerabilities in SDN networks and web applications. Able to use the exploits in mobile applications and wireless networks Understand the metasploit and metrepreter are used to automate the attacks and penetration testing techniques.				
Course Content:					
Module 1	Information Gathering, Host Discovery and Evading Techniques	Assignment	Theory	9 Sessions	
Topics:					

Introduction - Terminologies - Categories of Penetration Testing - Phases of Penetration Test -Penetration Testing Reports - Information Gathering Techniques - Active, Passive and Sources of Information Gathering – Approaches, Host discovery - Scanning for open ports and services- Types of Port, Vulnerability Scanner Function, pros and cons - Vulnerability Assessment with NMAP - Testing, SCADA environment with NMAP

Module 2	Vulnerability Scanner in SDN Networks and Web application	Quiz	Theory	10 Sessions

Topics:

Nessus Vulnerability Scanner - Safe check – Silent dependencies - Port Range Vulnerability Data Resources, SDN Data plane, Control Plane, Application Plane. SDN security attack vectors and SDN Hardering, Authentication Bypass with Insecure Cookie Handling - XSS Vulnerability - File inclusion vulnerability - Remote file Inclusion -Patching file Inclusions - Testing a website for SSI Injection.

Module 3	Mobile Application Security and wireless network Vulnerability analysis	Quiz	Theory	11 Sessions

Topics:

Types of Mobile Application Key challenges in Mobile Application and Mobile application penetration testing methodology, Android and ios Vulnerabilities - OWASP mobile security risk - Exploiting WM - BlackBerry Vulnerabilities - Vulnerability Landscape for Symbian - Exploit Prevention -Handheld Exploitation, WLAN and its inherent insecurities Bypassing WLAN Authentication uncovering hidden SSIDs MAC Filters Bypassing open and shard authentication - Advanced WLAN Attacks Wireless eavesdropping using MITM session hijacking over wireless – WLAN Penetration Test Methodology.

Module 4	Exploits	Quiz	Theory	8 Sessions

Topics:

Architecture and Environment- Leveraging Metasploit on Penetration Tests, Understanding - Metasploit Channels, Metasploit Framework and Advanced Environment configurations – Understanding the Soft Architecture, Configuration and Locking, Advanced payloads and add on modules Global datastore, module datastore, saved environment Meterpreter.

Targeted Application & Tools that can be used:

This course helps the students to understand the threats and vulnerabilities using NMAP.

Project work/Assignment:

Project Assignment:

Text Book

Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015. ISBN : 78-1-4822-3161-8.

Dr. Patrick Engebretson, The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing made easy , Syngress publications, Elsevier, 2013. ISBN :978-0-12-411644-3.

Mayor, K.K.Mookey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, Elsevier, 2007. ISBN : 978-1-59749-074-0

References

Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 PacktPublishing.

SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication

Web resources: https://onlinecourses.nptel.ac.in/noc19_cs68/preview - IIT Kharagpur, Prof. Indranil Sen Gupta

Topics relevant to development of "EMPLOYABILITY SKILLS": Exploitation, Penetration testing techniques, for development of Employability skills through the Participative Learning Techniques. This is attained through the assessment components mentioned in course handout.

Course Code: CSE3137	Course Title: Text Mining And Analytics Type of Course: Theory Only Course	L-T- P-C	3	0	3
Version No.	1				
Course Pre-requisites	No Prerequisites				
Anti-requisites	Nil				
Course Description					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Text Mining And Analytics and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: 1.Interpret the contribution of text mining to generate new knowledge from natural language text 2. Extract useful information from the textual data using various classifiers and Predictors 3. Identify the various components of a web that can be used for mining process 4. Analyse social media data using appropriate web mining techniques 5. Discover interesting patterns from Social Media Networks using linear methods and models				
Course Content:					
Module 1	Text Mining: Overview, Applications and Issues			14 Sessions	

Topics :   Early history, Applications, Introduction to Data Mining, Introduction to text mining, Need for text mining, Challenges in text mining, Areas of text mining, Data Retrieval, Information Retrieval.

| Module 2 | TEXT EXTRACTION, CLASSIFICATION, AND CLUSTERING | | | 14 Sessions | |

Topics: Automatic keyword extraction from individual documents: Introduction, Rapid automatic keyword extraction, Candidate keywords, Keyword scores, Adjoining keywords, Extracted keywords, Benchmark evaluation, Evaluating precision and recall, Evaluating efficiency.

Module 3	Content-based spam email classification using machine-learning algorithms			12 Sessions

Topics: Introduction, Machine-learning algorithms, Naive Bayes, LogitBoost, Support vector machines, Data preprocessing, Feature selection, Message representation.

Targeted Application & Tools that can be used:

Project work/Assignment:

Assignment:

Text Book

  T1   Text Mining Applications and Theory, Michael W. Berry Jacob Kogan, 2010

  T2 Bing Liu, Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data, Springer, Second Edition, 2011.

.

References

  R1   Ronen Feldman and James Sanger, The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data, Cambridge University Press, First Edition, 2009.

   R3 Web resources:

https://www.ibm.com/in-en/topics/text-mining

pu.informatics.global, https://sm-nitk.vlabs.ac.in/

Topics relevant to development of "EMPLOYABILITY SKILLS": Machine learning algorithms, LogitBoost, for development of Employability Skills through Problem solving Techniques. This is attained through the assessment components as mentioned in course handout.

Course Code: CSE 1003	Course Title: Innovation Project-Raspberry Pi Using Python Type of Course: School Core & Practical Only.		L-T- P-C	0	4 This includes few lecture sessions	2
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The Raspberry Pi is an amazing single board computer (SBC) capable of running Linus and a whole host of applications. Python is a beginner-friendly programming language that is used in schools, web development, scientific research, and in many other industries. This course will enable students in writing own programs with Python to blink lights, respond to button pushes, read sensors, log data on the Raspberry Pi and many more. The course also offers in-depth knowledge of designing, developing, coding and implementing projects using Raspberry Pi.					
Course Outcomes	On successful completion of this course the students shall be able to: Write a program in Python. Explain the main features of the Raspberry Pi board Demonstrate the hardware interfacing of the peripherals to Raspberry Pi system. Demonstrate the functioning of live various projects carried out using Raspberry Pi system.					
Course Content:						
Module 1	Basics of Python, functions	Quiz	Problem Solving		4 Lab Sessions	
Topics: Introduction, Structure of Python Program, Data Types and Variables, Input and Output, Operators, Importing libraries, Functions, Development Tool. Concepts will be taught by solving problems through programs.						
Module 2	Python Programming	Quiz	Problem Solving		4 Lab Sessions	
Control statements, Lists and Dictionaries, Problem solving using Python. Concepts will be taught by solving problems through programs.						

Module 3	Overview of Raspberry Pi	Project Development	System Design Task and Analysis	4 Lab Sessions

Topics:

An exploration of GPIO pins, LED and switch control. Installation of libraries, PuTTY SSH. Raspberry Pi to interface with more complicated sensors and actuators like Pi Camera, servo motor ADS51115 through PIP libraries. Arduino with Raspberry-pi

Module 4	Interaction with API Services	Project Development	Modeling and Simulation task	3 Lab Sessions

Topics:

Raspberry Pi interact with online API services through the use of public APIs and SDKs using Firebase, Gspread API.

Node-RED – a programming tool for wiring together hardware devices, MQTT.

Android/Case study.

Targeted Application & Tools that can be used:

Making it a reality (Raspberry Pi Projects) :

Projects will include but not limited to :

1) Intelligent home locking system.

2) Intelligent water level management system.

3) Home automation using RFID.

4) Real time clock-based home automation.

5) Intelligent Automatic Irrigation System

 Professionally Used Software: Raspberry Pi.

Project work/Python Lab Test:

Project work

Python test.

Text Book(s):

1) Ashok Namdev Kamthane, Amit Ashok Kamthane, "Problem Solving and Python Programming", Mc Graw Hill Education, 2018.

Reference(s):

https://github.com/thibmaek/awesome-raspberry-pi

MagPi magazine

Topics relevant to development of "Foundation Skills": Basic Concepts of Python-Programming, and Raspberry Pi.

Topics related to development of "Employability Skills": Problem solving, Creative Thinking, Team work, Prototype Development.	
Topics related to development of "Entrepreneurship": Effective Communication, Strategic Thinking, Creative Thinking.	
Evaluation:	Review-1-20%, Review-2-25%, Python test-25%, Project Expo-30%

Course Code: CSE2029	Course Title: Web Data Analytics Type of Course: Discipline Elective in data Science basket Theory & Integrated Laboratory	L-T- P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	Python programming				
Anti-requisites	NIL				
Course Description	The objective of this course is to provide overview and importance of Web analytics and helps to understand role of Web analytic. This course also explores the effective of Web analytic strategies and implementation. The purpose of this course is to introduce the students to the Web data analytics concept. The course is both conceptual and analytical and is understood with practical knowledge. The course develops critical thinking skills by augmenting the student's ability to develop web data analytical models for various data sets which helps to overcome many problems. The course involves quizzes and assignments.				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by web analytics and improving business.				
Course Outcomes	Upon successful completion of this course the students shall be able to: 1. Understand the concept and importance of Web analytics in an organization and the role of Web analytic in collecting, analyzing and reporting website traffic. [Knowledge level] (2) Identify key tools and diagnostics associated with Web analytics. [Application level] (3) Explore effective Web analytics strategies and implementation and Understand the importance of web analytic as a tool for e-Commerce, business research, and market research. [Application level] (4). Understand web site data optimization.[Application level].				
Course Content:					

Module 1	Introduction to Web Analytics	Quiz	Data Analytics	L-4, P-2

Topics:

Introduction to Web Analytics: Web Analytics Approach – Data collection methods in Web Analytics -A Model of Analysis – Context matters – Data Contradiction – Working of Web Analytics: Log file analysis – Page tagging – Metrics and Dimensions – Interacting with data in Google Analytics.

Module 2	Learning about users Through Web Analytics	Assignment	Data Collection, data analysis	L-5,P-2

Topics: Introduction – Goals and Conversions – Conversion Rate – Goal reports in Google Analytics – Performance Indicators – Analyzing Web Users: Learning about users – Traffic Analysis – Analyzing user content – Click-Path analysis – Segmentation.

Module 3	Web Search Engine Data Analytics	Quizzes and assignments	Google analytics	L-6 ,P-3

Topics: Different analytical tools - Key features and capabilities of Google analytics- How Google analytics works - Implementing Google analytics - Getting up and running with Google analytics -Navigating Google analytics – Using Google analytics reports -Google metrics - Using visitor data to drive website improvement- Focusing on key performance indicators- Integrating Google analytics with third-Party applications

Module 4	Qualitative Analysis	Project-based assignment	Reports and analytics	L-9 , P-4

Topics:

Lab Usability Testing- Heuristic Evaluations- Site Visits- Surveys (Questionnaires) - Testing and Experimentation: A/B Testing and Multivariate Testing-Competitive Intelligence - Analysis Search Analytics: Performing Internal Site Search Analytics, Search Engine Optimization (SEO) and Pay per Click (PPC)-Website Optimization against KPIs- Content optimization- Funnel/Goal optimization - Text Analytics: Natural Language Processing (NLP)- Supervised Machine Learning (ML) Algorithms-API and Web data scarping using R and Python.

List of Laboratory Tasks:

Lab sheet 1[2 Practical Sessions]

Experiment No. 1:

Level 1:

Working concept of web analytics

Level 2:

2. Evaluation with Intermediate metrics, custom metrics, calculated metrics.

3. Collection of web data and other internet data with the help of web analytics

Lab Sheet 2[2 Practical Sessions]

Experiment No. 2:

Level 1:

Delivering reports based on collected data

Level 2:

2. Implement the concept of web analytics ecosystem

3. Creation of segmentation in web analytics

Lab Sheet 3[4 practical Sessions]

Level 1:

1. Visualization, acquisition and conversions of web analytics data

2. Performing site search analytics

Level 2:

3. Analyze the web analytic reports and visualizations

Lab Sheet 4[4 practical Sessions]

Experiment No. 4:

Level 1:

Performing visual web analytics

Assignments and final discussions

Level 2:

   3. Web Analytics case studies .

Targeted Application & Tools that can be used: Google analytics
Project work/Assignment:
Web data analytics for website data
Textbook(s):   1.Beasley M, (2013), Practical web analytics for user experience: How analytics can help you understand your users. Newnes, 1st edition, Morgan Kaufmann.
References   Sponder M, (2013), Social media analytics: Effective tools for building, interpreting, and using metrics, 1st edition, McGraw Hill Professional.   Clifton B, (2012), Advanced Web Metrics with Google Analytics, 3rd edition, John Wiley & Sons.
Topics related to development of "FOUNDATION": Web data Analytics, Google analytics reports.   Topics related to development of "EMPLOYABILITY": performing web data analytics for website data.   Topics related to development of "HUMAN VALUES AND PROFESSIONAL ETHICS":   Data collection

Course Code: CSE502	Course Title: Technical Skills in Java				
	Open Elective	L-T-P-C	0	0	6	3
	Type of Course: Lab Integrated Course				
Version No.	1.0				
Course Pre-requisites	Basic knowledge of programming and data structure concepts.				
Anti-requisites	NIL				
Course Description	This Course is designed for students who have prior programming experience. It provides assistance to prepare for placements and extensive exposure to object-oriented programming features. It helps to develop robust solutions for real world applications.				
Course Objective	The objective of the course is SKILL DEVELOPMENT and EMPLOYABILITY of students by using participative learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: 1. Summarize the Object-oriented concepts with example program. 2. Implement Arrays and Strings to solve real world problems. 3. Apply the concept of polymorphism & inheritance to solve real time problems. 4. Illustrate programs on Interface, Packages 5. Demonstrate runtime errors using Exception handling.				
Course Content:					
Module 1	Introduction to Object-oriented programming	Assignment	Practical Task	14 Hours	

Topics:				
Introduction to object oriented programming, Java Evolution, How Java differs from C++, Features of Java,				
Java Environment: Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions, JDK, JVM, JRE.				
Java Tokens: Datatypes, Variables, Operators, Control Statements, Command Line Arguments.				
Classes, Objects, and Methods: Defining a class, Access Specifiers, instantiating objects, Reference variable, Accessing class members and methods, constructors, method overloading, static members,				
static methods, inner class, Wrapper class, Auto-boxing and Unboxing.				
Module 2	Arrays, Strings	Assignment	Practical Task	11 Hours
Topics:				
Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array				
Strings: Operation on String, Mutable & Immutable String, Creating Strings using String Buffer or StringBuilder.				
Assignment: Test 1,Quiz1				
Module 3	Inheritance and Polymorphism	Assignment	Practical Task	12 Hours
Inheritance and Polymorphism: Defining a subclass, Types of Inheritance, Method overriding, super keyword, Dynamic method invocation, Dynamic polymorphism, Final, Abstract, this keyword. Forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.				
Module 4	Interface and Package	Assignment	Practical task	8 Hours
Topics:				
Defining interfaces, extending interfaces, implementing interfaces.				
Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages Import and Static Import, Naming Convention for Packages.				
Assignment: Test 2				

Module 5	Exception Handling	Assignment	Theory task	6 Hours

Topics:

Exception Handling: Introduction to Exceptions, Difference between Exceptions & Errors, Types of Exception, Handling of Exceptions: Use of try, nested try statements, catch, finally, throw, throws, built in exceptions, User Defined Exceptions, Checked and Un-Checked Exceptions

Text Book

Text Books:

Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson 2016.

Cay S Horstmann and Cary Gornell, "CORE JAVA volume II-Advanced Features", Pearson 2017.

References

Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 10th Edition 2017.

James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers 2000.

Web resources:

1. https://www.udemy.com/course/object-oriented-programming-oops-concepts-in-english/

2. https://archive.nptel.ac.in/courses/106/105/106105191/

Course Code: CSE503	Course Title: Technical Skills in Python			0	0	6	3
	Open Elective	L-T-P- C					
	Type of Course: Lab Integrated Course						
Version No.	1.0						
Course Pre-requisites	Basic knowledge of programming and data structure concepts.						
Anti-requisites	NIL						
Course Description	This Course is designed for students who have prior programming experience. It provides assistance to prepare for placements and extensive exposure to Programming in Python. It helps to develop robust solutions for real world applications.						
Course Objective	The objective of the course is SKILL DEVELOPMENT and EMPLOYABILITY of students by using participative learning techniques.						
Course Out Comes	On successful completion of this course the students shall be able to: 1. Summarize the Object-oriented concepts using Python with example program. 2. Implement Lists, Tuples, Dictionary and Strings to solve real world problems. 3. Apply the concept of polymorphism & inheritance to solve real time problems. 4. Illustrate programs by using Python Library 5. Demonstrate runtime errors using Exception handling.						
Course Content:							
Module 1	Introduction to Python and Basics	Assignment	Practical Task	11 Hours			

Topics:				
Introduction to Python programming, Python Evolution, Features of Python, Python Environment: Installing Python, Python Program Development, Python Source File Structure, Interpretation, Executions. Python Data Structures & Data Types Looping, I/O Formatting, Functions, Lambda Functions				

Module 2	Classes, Files and Exception handling	Assignment	Practical Task	8 Hours

Topics:

New Style Classes ☐ Creating File handling Modes ☐ Reading Files ☐ Writing& Appending to Files

☐ Handling File Exceptions

 Classes ☐ Instance Methods ☐ Inheritance ☐ Polymorphism ☐ Exception Classes & Custom Exceptions

Assignment: Test 1,Quiz1

Module 3	Data Structures, Collections, generators and Iterators	Assignment	Practical Task	11 Hours

List Comprehensions ☐ Nested List Comprehensions ☐ Dictionary Comprehensions

named tuple() ☐ deque ☐ ChainMap ☐ Counter ☐ OrderedDict

Iterators ☐ Generators ☐ The Functions any and all ☐ With Statement

Module 4	GUIs, Date and time, Regular expressions	Assignment	Practical task	11 Hours

Topics:

Components and Events ☐ An Example GUI ☐ The root Component ☐ Adding a Button ☐ Entry Widgets ☐ Text Widgets

sleep ☐ Program execution time ☐ more methods on date/time

Filter ☐ Map ☐ Reduce ☐ Decorators ☐ Frozen set

Split ☐ Working with special characters, date, emails ☐ Quantifiers ☐ Match and find all

Assignment: Test 2				
Module 5	Threads, API, Django	Assignment	Theory task	10 Hours

Topics:

Class and threads □ Multi-threading □ Synchronization □ Treads Life cycle

Introduction □ Facebook Messenger □ Openweather

Django Overview □ Django Installation □ Creating a Project □ Usage of Project in depth Discussion □ Creating an Application □ Understanding Folder Structure

Text Book

Text Books:

Python Programming – A Modular Approach Pearson 2021.

Martin C Brown "The Complete reference Python", McGraw Hill 2021.

References

Mark Lutz, "Learning Python", OReilly 2021.

Web resources:

   1 https://developers.google.com/edu/python/

   2 https://www.educative.io/courses/learn-python-3-from-scratch?affiliate_id=5073518643380224

Course Code: CSE 1004	Course Title: Problem Solving Using C Type of Course: School Core Lab Integrated.		L- T-P-C	1	0	4	3
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.						
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.						
Course Outcomes	On successful completion of this course the students shall be able to: Write algorithms and to draw flowcharts for solving problems Demonstrate knowledge and develop simple applications in C programming constructs Develop and implement applications using arrays and strings Decompose a problem into functions and develop modular reusable code Solve applications in C using structures and Union Design applications using Sequential and Random Access File Processing.						
Course Content:							
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.			
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.							

Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.

Topics:

Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. Strings: Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.

Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.

Topics:

Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.

Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.

Topics:

Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.

Module 5	File handling	Case Study	Problem Solving	9 Hrs.

Topics:

Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files

List of Practical Tasks

Lab Sheet 1 (Module I)

Programs using IO Statements, Conditional Statements and Looping Statements

Lab Sheet 2 (Module II)

Programs using Arrays and Strings

Lab Sheet 3 (Module III)

Programs using Functions and Pointers

Lab Sheet 4 (Module IV)

Programs using Structures and Unions

Lab Sheet 5 (Module V)

Programs using Files

Text Book(s):
E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0. By
Reference Book(s):
Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015
Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.
Web Links and Video Lectures:
https://nptel.ac.in/courses/106/105/106105171/
https://archive.nptel.ac.in/courses/106/104/106104128/

Course Code: CSE2069	Course Title: Cloud Computing Type of Course: Theory and Lab Integrated	L- T-P-C	2	0	2	3
Version No.	2.0					
Course Pre-requisites	[1] Data Communication and Computer Networks (CSE2011)					
Anti-requisites	NIL					
Course Description	This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.					
Course Objective	The course aims to impart knowledge to students that can provide easy, scalable access to computing resources and IT services. This course is designed to improve the learner's EMPLOYABILITY SKILLS using EXPERIENTIAL LEARNING techniques.					

Course Outcomes	Upon successful completion of the course, the students shall be able to:
	Comprehend the significance of Cloud computing technologies
	Describe appropriate Virtualization techniques to virtualize infrastructures
	Apply Cloud mechanisms to optimize the QoS parameters
	Interpret recent technologies on Cloud

Course Content:				
Module 1	Introduction to Cloud Services	Assignment	Theory	No. of Hours:10 (Theory: 6, Lab:4)
Topics: A Facility for Flexible Computing, The Start of Cloud: The Power Wall and Multiple Cores, From Multiple Cores to Multiple Machines, From Clusters to Web Sites and Load Balancing, Racks of Server Computers, The Economic Motivation for a Centralized Data Center, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, and Cloud Computing Environments.				
Module 2	Virtualization Techniques	Lab-based Assignments	Theory	No. of Hours:10 (Theory: 6, Lab:4)
Topics: Basics of Virtualization - Types of Virtualizations, Taxonomy of Virtualization Techniques, Implementation Levels of Virtualization.				
Module 3	QoS and Management	Application Development	Theory	No. of Hours:10 (Theory: 6, Lab:4)
Topics: Quality of Service (QoS) in the Cloud, Cloud Infrastructure Mechanisms, Service Level Agreements (SLAs), Specialized Cloud Mechanisms, Cloud Management Mechanisms, Application development in the Cloud				
Module 4	Security and advancements	Case Study	Case Study	No. of Hours:10 (Theory: 6, Lab:4)
Topics: The Zero Trust Security Model, Identity Management, Privileged Access Management, AI Technologies And Their Effect on Security, Protecting Remote Access, Privacy in a Cloud Environment, Application development in Cloud, Latest trends in Cloud Computing, Fog Computing, Dew Computing, Case Studies, and Recent Advancements				
Targeted Applications & Tools that can be used:				

Targeted Applications:

Developing applications on Cloud Platforms via Virtual machines

Cloud Tools:

VMWare

Amazon EC2

Google Compute Engine

Microsoft Azure

Cloudsim

Project work/Assignment:

Automation of performance analysis of students through the Cloud

Chatbots development using Cloud resources

Blog creation using Cloud computing

Analysis of Case Studies: When deciding to adopt cloud computing architecture, decide if the cloud is right for your requirements (for the application identified).

Suggested List of Hands-on Activities:

Sl. No	Title
1	Install Virtualbox/VMware Workstation with different flavors of Linux or Windows OS on top of windows 11
2	Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.
3	Install Google App Engine (GAE). Create a "hello world" application and other simple web applications using python/java
4	Use GAE launcher to launch the web applications.
5	Simulate a cloud scenario using CloudSim and run a scheduling algorithm
6	Find a procedure to transfer the files from one virtual machine to another virtual machine.
7	Find a procedure to launch a virtual machine using Openstack
8	Demonstrate Migration, Cloning, and Snapshots within and across VMs

9	Demonstrate on the Virtual Environment on hypervisor. a) Communication between the VM's. b) The backup and restore mechanism.
10	Implement and Evaluate the performance of MapReduce program on word count for different file size.

Text Book(s)

Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", Chapman and Hall/CRC; 1st edition, July 2021.

References

Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013 edition.

Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", PHI publisher 2013 edition.

Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw-Hill, 2010 edition.

David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press, 2018 edition.

Manvi, Sunilkumar, and Gopal K. Shyam. "Cloud Computing: Concepts and Technologies". CRC Press, 2021.

Web Resources and Research Articles links:

IEEE Transactions on Cloud Computing-
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519

 International Journal of Cloud Computing-
https://www.inderscience.com/jhome.php?jcode=ijcc

CloudSim Resources- https://javadoc.io/doc/org.cloudsimplus/cloudsim-plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html

Journal of Network and Computer Networking- https://www.journals.elsevier.com/journal-of-network-and-computer-applications

Course Code: CSE3035	Course Title: R Programming for Data Science		L-T- P- C	1	4	3
	Type of Course: Program Core Lab Integrated Course					
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	Nil					
Course Description	R Programming for Data Science is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on Data Analytics to a wide range of applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of R Programming for Data Science and attain Employability through Problem Solving Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe the R programming for Data Analytics.[Knowledge] 2) Generalize the appropriate visualization methods.[Comprehension] 3) Demonstrate the various statistical testing methods.[Application] 4) Apply the probability and complex distribution functions for the analysis of data.[Application]					
Course Content:						
Module 1	Introduction to R Programming	Case studies	Programming	8 Sessions		
R Studio: Base R-R Studio IDE-Introduction to R Projects and R Markdown. Basic R: R as a calculator-Scripts and Comments-R Variables. Data I/O: Working Directories-Importing Data-Exporting Data-More ways to save-Data I/O in Base R. Subsetting Data in R: Selecting specific elements-Renaming Columns-Subsetting Columns - Subsetting Rows – Adding/Removing Columns-Ordering Columns - Ordering Rows						

Module 2	Data Analysis	Case studies	Programming	10 Sessions

Data Summarization: One Quantitative and Categorical Variable. Data Classes: One Dimensional Data Classes-Data Frames and Matrices-Lists. Data Cleaning: Dealing with Missing Data-Strings and Recoding Variables. Manipulating Data in R: Reshaping Data-Merging Datasets. Data Visualizations: Plotting with ggplot2- Plotting with Base R

Module 3	Statistical Analysis in R	Case studies	Programming	8 Sessions

Proportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-Wilcoxon signed rank test- One Way ANOVA- Kruskal Wallis Test-Linear Regression-Logistic Regression and Generalized Linear Models-Poisson Regression.

Module 4	Simulations	Case studies	Programming	10 Sessions

Functions: Writing your own function-Loops. Simulations: Standard Probability Distributions-Sampling from more Complex Distributions-The Accept and Reject Algorithm-The Metropolis Hasting Algorithm. R Markdown: Exploratory Analysis-Multiple Facets-Linear Models-Grabbing coefficients-Pander-Multiple Models-Data Extraction

Targeted Applications & Tools that can be used:

Tools:

R Programming

Lab:

 Exp 1.

Level 1:

create a new variable called my.num that contains 6 numbers

multiply my.num by 4

create a second variable called my.char that contains 5 character strings

combine the two variables my.num and my.char into a variable called both

what is the length of both?

what class is both?

divide both by 3, what happens?

Level 2:

create a vector with elements 1 2 3 4 5 6 and call it x

create another vector with elements 10 20 30 40 50 and call it y

what happens if you try to add x and y together? why?

append the value 60 onto the vector y (hint: you can use the c() function)

add x and y together

multiply x and y together. pay attention to how R performs operations on vectors of the same length.

Exp 2.

Level 1:

Read in the Youth Tobacco study, Youth_Tobacco_Survey_YTS_Data.csv and name it youth.

Install and invoke the readxl package. RStudio > Tools > Install Packages. Type readxl into the Package search and click install. Load the installed library with library(readxl).

Level 2:

Download an Excel version of the Monuments dataset, Monuments.xlsx, from CANVAS. Use the read_excel() function in the readxl package to read in the dataset and call the output mon.

Write out the mon R object as a CSV file using readr::write_csv and call the file "monuments.csv".

Write out the mon R object as an RDS file using readr::write_rds and call it "monuments.rds".

Exp 3:

Level 1:

Check to see if you have the mtcars dataset by entering the command mtcars.

What class is mtcars?

How many observations (rows) and variables (columns) are in the mtcars dataset?

Copy mtcars into an object called cars and rename mpg in cars to MPG. Use rename().

Convert the column names of cars to all upper case. Use rename_all, and the toupper command (or colnames).

Convert the rownames of cars to a column called car using rownames_to_column. Subset the columns from cars that end in "p" and call it pvars using ends_with().

Create a subset cars that only contains the columns: wt, qsec, and hp and assign this object to carsSub. What are the dimensions of carsSub? (Use select() and dim().)

Level 2:

Convert the column names of carsSub to all upper case. Use rename_all(), and toupper() (or colnames()).

Subset the rows of cars that get more than 20 miles per gallon (mpg) of fuel efficiency. How many are there? (Use filter().)

Subset the rows that get less than 16 miles per gallon (mpg) of fuel efficiency and have more than 100 horsepower (hp). How many are there? (Use filter().)

Create a subset of the cars data that only contains the columns: wt, qsec, and hp for cars with 8 cylinders (cyl) and reassign this object to carsSub. What are the dimensions of this dataset?

Re-order the rows of carsSub by weight (wt) in increasing order. (Use arrange().)

Create a new variable in carsSub called wt2, which is equal to wt^2, using mutate() and piping %>%.

Exp 4:

Level 1:

How many bike lanes are currently in Baltimore? You can assume that each observation/row is a different bike lane.

How many (a) feet and (b) miles of total bike lanes are currently in Baltimore? (The length variable provides the length in feet.)

How many types (type) bike lanes are there? Which type (a) occurs the most and (b) has the longest average bike lane length?

Level 2:

How many different projects (project) do the bike lanes fall into? Which project category has the longest average bike lane length?

What was the average bike lane length per year that they were installed? (Be sure to first set dateInstalled to NA if it is equal to zero.)

Numerically and graphically describe the distribution of bike lane lengths (length).

Describe the distribution of bike lane lengths numerically and graphically after stratifying them by (a) type and then by (b) number of lanes (numLanes).

Exp 5:

Level 1:

Get all the different types of bike lanes from the type column. Use sort(unique()). Assign this to an object btypes. Type dput(btypes).

By rearranging vector btypes and using dput, recode type as a factor that has SIDEPATH as the first level. Print head(bike$type). Note what you see. Run table(bike$type) afterwards and note the order.

Make a column called type2, which is a factor of the type column, with the levels: c("SIDEPATH", "BIKE BOULEVARD", "BIKE LANE"). Run table(bike$type2), with the options useNA = "always". Note, we do not have to make type a character again before doing this.

Level 2:

 • Reassign dateInstalled into a character using as.character. Run head(bike$dateInstalled).

Reassign dateInstalled as a factor, using the default levels. Run head(bike$dateInstalled).

Do not reassign dateInstalled, but simply run head(as.numeric(bike$dateInstalled)). We are looking to see what happens when we try to go from factor to numeric.

Do not reassign dateInstalled, but simply run head(as.numeric(as.character(bike$dateInstalled))). This is how you get a "numeric" value back if they were incorrectly converted to factors.

• Convert type back to a character vector. Make a column type2 (replacing the old one), where if the type is one of these categories c("CONTRAFLOW", "SHARED BUS BIKE", "SHARROW", "SIGNED ROUTE") call it "OTHER". Use %in% and ifelse. Make type2 a factor with the levels c("SIDEPATH", "BIKE BOULEVARD", "BIKE LANE", "OTHER").

• Parse the following dates using the correct lubridate functions:

"2014/02-14"

"04/22/14 03:20" assume mdy

"4/5/2016 03:2:22" assume mdy

Exp 6:

Level 1:

Count the number of rows of the bike data and count the number of complete cases of the bike data. Use sum and complete.cases.

Create a data set called namat which is equal to is.na(bike). What is the class of namat? Run rowSums and colSums on namat. These represent the number of missing values in the rows and columns of bike. Don't print rowSums, but do a table of the rowSums.

Filter rows of bike that are NOT missing the route variable, assign this to the object have_route. Do a table of the subType variable using table, including the missing subTypes. Get the same frequency distribution using group_by(subType) and tally() or count().

Filter rows of bike that have the type SIDEPATH or BIKE LANE using %in%. Call it side_bike. Confirm this gives you the same number of results using the | and ==.

Do a cross tabulation of the bike type and the number of lanes (numLanes). Call it tab. Do a prop.table on the rows and columns margins. Try as.data.frame(tab) or broom::tidy(tab).

Read the Property Tax data into R and call it the variable tax.

How many addresses pay property taxes? (Assume each row is a different address.)

What is the total (a) city (CityTax) and (b) state (SateTax) tax paid? You need to remove the $ from the CityTax variable, then you need to make it numeric. Try str_replace, but remember $ is "special" and you need fixed() around it.

Using table() or group_by and summarize(n()) or tally().

How many observations/properties are in each ward (Ward)?

What is the mean state tax per ward? Use group_by and summarize.

What is the maximum amount still due (AmountDue) in each ward? Use group_by and summarize with 'max`.

What is the 75th percentile of city and state tax paid by Ward? (quantile)

Make boxplots showing CityTax (y-variable) by whether the property is a principal residence (x = ResCode) or not. You will need to trim some leading/trailing white space from ResCode.

Level 2:

    Subset the data to only retain those houses that are principal residences. Which command subsets rows? Filter or select?

How many such houses are there?

Describe the distribution of property taxes on these residences. Use hist/qplot with certain breaks or plot(density(variable)).

Make an object called health.sal using the salaries data set, with only agencies (JobTitle) of those with "fire" (anywhere in the job title), if any, in the name remember fixed("string_match", ignore_case = TRUE) will ignore cases.

Make a data set called trans which contains only agencies that contain "TRANS".

What is/are the profession(s) of people who have "abra" in their name for Baltimore's Salaries? Case should be ignored.

What does the distribution of annual salaries look like? (use hist, 20 breaks) What is the IQR? Hint: first convert to numeric. Try str_replace, but remember $ is "special" and you need fixed() around it.

Convert HireDate to the Date class - plot Annual Salary vs Hire Date. Use AnnualSalary ~ HireDate with a data = sal argument in plot or use x, y notation in scatter.smooth. Use the lubridate package. Is it mdy(date) or dmy(date) for this data - look at HireDate.

Create a smaller dataset that only includes the Police Department, Fire Department and Sheriff's Office. Use the Agency variable with string matching. Call this emer. How many employees are in this new dataset?

Create a variable called dept in the emer data set, dept = str_extract(Agency, ".*(ment|ice)").
E.g. we want to extract all characters up until ment or ice (we can group in regex using parentheses) and then discard the rest. Replot annual salary versus hire date and color by dept (not yet - using ggplot). Use the argument col = factor(dept) in plot.

(Bonus). Convert the 'LotSize' variable to a numeric square feet variable in the tax data set. Some tips: a) 1 acre = 43560 square feet b) The hyphens represent a decimals. (This will take a lot of searching to find all the string changes needed before you can convert to numeric.)

Exp 7:

Level 1:

Read in the Bike_Lanes_Wide.csv dataset and call is wide.

Reshape wide using pivot_longer. Call this data long. Make the key lanetype, and the value the_length. Make sure we gather all columns but name, using -name. Note the NAs here.

Read in the roads and crashes .csv files and call them road and crash.

Replace (using str_replace) any hyphens (-) with a space in crash$Road. Call this data crash2. Table the Road variable.

How many observations are in each dataset?

Separate the Road column (using separate) into (type and number) in crash2. Reassign this to crash2. Table crash2$type. Then create a new variable calling it road_hyphen using the unite function. Unite the type and number columns using a hyphen (-) and then table road_hyphen.

Which and how many years were data collected in the crash dataset?

Read in the dataset Bike_Lanes.csv and call it bike.

Level 2:

Keep rows where the record is not missing type and not missing name and re-assign the output to bike.

Summarize and group the data by grouping name and type (i.e for each type within each name) and take the sum of the length (reassign the sum of the lengths to the length variable). Call this data set sub.

Reshape sub using pivot_wider. Spread the data where the key is type and we want the value in the new columns to be length - the bike lane length. Call this wide2. Look at the column names of wide2 - what are they? (they also have spaces).

Join data in the crash and road datasets to retain only complete data, (using an inner join) e.g. those observations with road lengths and districts. Merge without using by argument, then merge using by = "Road". call the output merged. How many observations are there?

Join data using a full_join. Call the output full. How many observations are there?

Do a left join of the road and crash. ORDER matters here! How many observations are there?

Repeat above with a right_join with the same order of the arguments. How many observations are there?

Exp 8

Level 1:

Plot average ridership (avg data set) by date using a scatterplot.

Color the points by route (orange, purple, green, banner)

Add black smoothed curves for each route

Color the points by day of the week

Replot 1a where the colors of the points are the name of the route (with banner –> blue)

pal = c("blue", "darkgreen","orange","purple")

Plot average ridership by date with one panel per route

Level 2:

Plot average ridership by date with separate panels by day of the week, colored by route

Plot average ridership (avg) by date, colored by route (same as 1a). (do not take an average, use the average column for each route). Make the x-label "Year". Make the y-label "Number of People". Use the black and white theme theme_bw(). Change the text_size to (text = element_text(size = 20)) in theme.

Plot average ridership on the orange route versus date as a solid line, and add dashed "error" lines based on the boardings and alightings. The line colors should be orange. (hint linetype is an aesthetic for lines - see also scale_linetype and scale_linetype_manual. Use Alightings = "dashed", Boardings = "dashed", Average = "solid")

Exp 9

Level 1:

Compute the correlation between the 1980, 1990, 2000, and 2010 mortality data. No need to save this in an object. Just display the result to the screen. Note any NAs. Then compute using use = "complete.obs".

Compute the correlation between the Myanmar, China, and United States mortality data. Store this correlation matrix in an object called country_cor

Extract the Myanmar-US correlation from the correlation matrix.

Is there a difference between mortality information from 1990 and 2000? Run a paired t-test and a Wilcoxon signed rank test to assess this. Hint: to extract the column of information for 1990, use mort$"1990"

Level 2:

Using the cars dataset, fit a linear regression model with vehicle cost (VehBCost) as the outcome and vehicle age (VehicleAge) and whether it's an online sale (IsOnlineSale) as predictors as well as their interaction. Save the model fit in an object called lmfit_cars and display the summary table.

Create a variable called expensive in the cars data that indicates if the vehicle cost is over $10,000. Use a chi-squared test to assess if there is a relationship between a car being expensive and it being labeled as a "bad buy" (IsBadBuy).

Fit a logistic regression model where the outcome is "bad buy" status and predictors are the expensive status and vehicle age (VehicleAge). Save the model fit in an object called logfit_cars and display the summary table. Use summary or tidy(logfit_cars, conf.int = TRUE, exponentiate = TRUE) or tidy(logfit_cars, conf.int = TRUE, exponentiate = FALSE) for log odds ratios

Exp 10

Level 1:

• Write a function, sqdif, that does the following:

takes two numbers x and y with default values of 2 and 3.

takes the difference

494

squares this difference

then returns the final value

checks that x and y are numeric and stops with an error message otherwise

Level 2:

- Try to write a function called top() that takes a matrix or data.frame and a number n, and returns the first n rows and columns, with the default value of n=5.

- Write a function that will calculate a 95% one sample t interval. The results will be stored in a list to be returned containing sample mean and the confidence interval. The input to the functions is the numeric vector containing our data. For review, the formula for a 95% one sample t interval is $\bar{x} \pm 1.96 * s/\sqrt{n}$.

Exp 11

Level 1:

Simulate a random sample of size n=100

- from

a normal distribution with mean 0 and variance 1. (see rnorm)

a normal distribution with mean 1 and variance 1. (see rnorm)

a uniform distribution over the interval [-2, 2]. (see runif)

- Run a simulation experiment to see how the type I error rate behaves for a two sided one sample t-test when the true population follows a Uniform distribution over [-10,10]. Modify the function t.test.sim that we wrote to run this simulation by

changing our random samples of size n to come from a uniform distribution over [-10,10] (see runif).

performing a two sided t-test instead of a one sided t-test.

performing the test at the 0.01 significance level.

choosing an appropriate value for the null value in the t-test. Note that the true mean in this case is 0 for a Uniform(-10,10) population. Try this experiment for n=10,30,50,100,500. What happens the estimated type I error rate as n changes? Is the type I error rate maintained for any of these sample sizes?

Level 2:

- From introductory statistics, we know that the sampling distribution of a sample mean will be approximately normal with mean μ and standard error $\sigma/\sqrt{n}$ if we have a random sample

from a population with mean μ and standard deviation σ and the sample size is "large" (usually at least 30). In this problem, we will build a simulation that will show when the sample size is large enough.

Generate N=500 samples of size n=50 from a Uniform[-5,5] distribution.

For each of the N=500 samples, calculate the sample mean, so that you now have a vector of 500 sample means.

Plot a histogram of these 500 sample means. Does it look normally distributed and centered at 0?

Turn this simulation into a function that takes arguments N the number of simulated samples to make and n the sample size of each simulated sample. Run this function for n=10,15,30,50. What do you notice about the histogram of the sample means (the sampling distribution of the sample mean) as the sample size increases.

Text Book

Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020

References

1. Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014.

2. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.

Topics relevant to Development skills

Topics relevant to development of "Employability": Real time application development using R Programming Tools.

Topics relevant to "Human Values & Professional Ethics"

Course Code:	Course Title: Applied Machine Learning					
CSE3087	Type of Course: 1] Program Core 2] Laboratory integrated		L-T- P-C	2	2	3
Version No.	1.0					
Course Pre-requisites	CSE3001 Artificial Intelligence and Machine Learning					
Anti-requisites	NIL					
Course Description	Machine Learning algorithms are the key to develop intelligent systems such as Apple's Siri, Google's self-driving cars etc. This course introduces the concepts of the core machine learning techniques such as Regression learning, Bayesian learning, Ensemble learning, Perceptron learning, Unsupervised learning, Competitive learning, learning from Gaussian mixture models and learning to detect outliers. Course lectures covers both the theoretical foundations as well as the essential algorithms for the various learning methods. Lab sessions complement the lectures and enable the students in developing intelligent systems for real life problems.					
Course Objectives	This course is designed to improve the learners 'EMPLOYABILITY SKILLS' by using EXPERIENTIAL LEARNING techniques. The supervised hands-on laboratory exercises, assessments and the group projects facilitate this learning process.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Apply advanced supervised machine learning methods for predictive modeling. [Application] 2] Produce machine learning models with better predictive performance using meta learning algorithms [Application] 3] Create predictive models using Perceptron learning algorithms[Application] 4] Employ advanced unsupervised learning algorithms for clustering, competitive learning and outlier detection[Application] 5] Implement machine learning based intelligent models using Python libraries. [Application]					
Course Content:						
Module 1	Supervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes		

				L – 7 P – 12

Topics: An overview of Machine Learning(ML); ML workflow; types of ML; Types of features, Feature Engineering -Data Imputation Methods; Regression – introduction; simple linear regression, loss functions; Polynomial Regression; Logistic Regression; Softmax Regression with cross entropy as cost function; Bayesian Learning – Bayes Theorem, estimating conditional probabilities for categorical and continuous features, Naïve Bayes for supervised learning; Bayesian Belief networks;   Support Vector Machines – soft margin and kernel tricks.

Module 2	Ensemble Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-3 P-4

Topics: Ensemble Learning – using subset of instances – Bagging, Pasting, using subset of features –random patches and random subspaces method; Voting Classifier, Random Forest; Boosting – AdaBoost, Gradient Boosting, Extremely Randomized Trees, Stacking.

Module 3	Perceptron Learning	Assignment /Quiz	Programming using Keras/Sklearn	No. of Classes L-7 P -2

Topics: Perceptron Learning – from biological to artificial neurons, Perceptrons, Linear Threshold Units, logical computations with Perceptrons, common activation functions – sigmoid, tanh, relu and softmax, common loss functions, multi-layer Perceptrons and the Backpropagation algorithm using Gradient Descent.

Module 4	Unsupervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-6 P -6

Topics: Unsupervised Learning – simple k Means clustering- simple and mini-batch; updating centroids incrementally; finding the optimal number of clusters using Elbow method ; Silhoutte coefficient, drawbacks of kMeans, kMeans++ ; Divisive hierarchical clustering – bisecting k-means, clustering using Minimum Spanning Tree (MST) Competitive Learning - Clustering using Kohenen's Self Organising Maps (SOM), Density Based Spatial Clustering – DBSCAN; clustering using Gaussian Mixture Models (GMM) with EM algorithm ; Outlier Detection methods – Isolation Forest, Local Outlier Factor(LOF)

List of Laboratory Tasks:

Experiment N0 1: Methods for handling missing values

Level 1: Given a data set from UCI repository, implement the different ways of handling missing values in it using Scikit-learn library of Python

Level 2: Implement one of these methods using a custom defined function in Python.

Experiment No. 2: Data Visualization

Level 1 Perform Exploratory Data Analysis for a given data set by creating Scatter Plot, Pair Plot, Count Plot using Matplotlib and Seaborn

Level 2 Create Heat Maps, WordCloud

Experiment No. 3: Regression learning

Level 1 Given a data set from UCI repository, implement the simple linear regression algorithm and estimate the models parameters and the performance metrics. Plot the learning curves.

Level 2 Implement the polynomial regression algorithm. Compare the learning curves of Polynomial and Linear Regression.

Experiment No.4: Logistic regression

Level 1 Write custom code for generating the logistic/sigmoid plot for a given input

Level 2 Given a data set from UCI repository, implement the Logistic regression algorithm. Estimate the class probabilities for a given test data set. Plot and analyze the decision boundaries.

Experiment No.5: Bayesian Learning

Level 1 Given a data set from UCI repository, implement a classification model using the Bayesian algorithm

Experiment No.6: Support Vector Machine(SVM)

Level 1 Given data sets from UCI repository, implement a linear SVM and a non-linear SVM based classification model.

Experiment No. 7: Ensemble Learning

Level 1 : Implement Ensemble Learning algorithms such as Bagging, Pasting and Out-of Bag Evaluation

Level 2 : Random Patches and Random Subspace Method

Experiment No. 8: Ensemble Learning

Level 1 : AdaBoost and Gradient Boosting, Stacking

Experiment No. 9: Perceptron Learning

Level 1 : Implement the Perceptron Classifier

Level 2 : – An Image Classifier Using the Sequential API of Keras

Experiment No. 10: Unsupervised Learning

Level 1 : K-means – simple and mini-batch. Finding the optimal number of clusters using Elbow method and Silhoutte Coefficient . Compare the inertia of both as k increases. Tuning the hyperparameter 'k' using GridSearchCV.

Level 2 : – Using clustering for Image segmentation and Preprocessing. Kmeans++

Experiment No. 11: Density Based Clustering

Level 1 Implement DBSCAN – clustering using the local density estimation. Perform hard and soft clustering for new instances.

Experiment No. 12: Outlier Detection

Level 1 Outlier Detection using Isolation Forest and Local Outlier Factor

Targeted Application & Tools that can be used :

 Execution of the ML algorithms will be done using the Google's cloud service namely "Colab", available at https://colab.research.google.com/ or Jupyter Notebook.

The data sets will be from the bench marking repositories such as UCI machine learning repository available at : https://archive.ics.uci.edu/ml/index.php

Laboratory tasks will be implemented using the libraries available in Python such as Scikit learn, matplotlib, seaborn, perceptron and the deep learning framework namely Keras.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Students can be assigned a mini project to develop a machine learning application for real-life problems in various domains such as health care, business intelligence, environmental modeling, etc.

Text Book

There are a number of useful textbooks for the course, but each cover only a part of the course syllabus. Following is an indicative list of textbooks.

Aurélien Géron, "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", Oreilly, Second Edition, 2019.

Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with Python :A Guide for Data Scientists", Oreilly, First Edition, 2018

Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017.

References   In references apart from the books and web links, mention a few standards &Hand books relevant to the Laboratory tasks used by the professionals.

Tan P. N., Steinbach M & Kumar V. "Introduction to Data Mining", Pearson Education, 2016.

https://towardsdatascience.com/machine-learning/home

MITopencourseware:https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/resources/lecture-11-introduction-to-machine-learning/

https://onlinecourses.nptel.ac.in/noc21_cs85/preview

Course Code: UG COURSE: CSE3107	Course Title: Robotic Vision			L-T- P-C	2	2	3
	Type of Course: Program Core Theory with embedded lab						
Version No.	1.0						
Course Pre-requisites	MAT1001- Calculus and Linear Algebra, MAT1002 - Transform Techniques, Partial Differential Equations and their Applications						
Anti-requisites	NIL						
Course Description	This Course is an introduction to Robotic vision and image analysis techniques and concepts. Robotic vision has found much wider applications not only in the space program, but also in the areas such as medicine, biology, industrial automation, astronomy, law enforcement, defense, intelligence. With the progress made AI Robotics these days, Robotic vision has become an indispensable part of our digital age. This course includes Fundamentals, Applications, Human Visual Perception, Image Formation, Sampling and Quantization, Binary Image, Three-Dimensional Imaging, Image file formats. Color and Color Imagery: Perception of Colors, Image Transformation: Fourier Transforms, Image Enhancement and Restoration, Image Reconstruction, Image Segmentation, Visual based Servoing, Object detection.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Robotic Vision Employability through Problem Solving Methodologies.						
Course Out Comes	On successful completion of the course the students shall be able to: Explain the fundamentals of Robotic vision and its processing. [Understanding] Utilize image enhancement techniques in spatial and frequency domain. [Application] Apply the mathematical modeling of image degradation and restoration.[Application] Apply the concept of image segmentation. [Application]						
Course Content:							

Module 1	Introduction to Robotic Vision	Assignment	Practical	No. of Classes:8
Overview of computer vision and its applications in robotics, Introduction to robotic perception and the role of vision sensors ,Challenges and limitations of robotic vision systems				

Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Classification of images, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

Module 2	Image Transformation:	Assignment	Practical	No. of Classes:8

Image enhancement in spatial domain: Some basic gray level transformations, Histogram processing, Smoothing and Sharpening spatial filters.

Image enhancement in frequency domain: 1D FFT, 2D FFT, Smoothing and Sharpening frequency domain filters, Homomorphic filtering.

Module 3	Image Restoration	Assignment	Practical	No. of Classes:8

A model of the image restoration and degradation process, Noise models – spatial and frequency properties of noise, some important probability density functions: Gaussian noise, Rayleigh noise, Gamma noise, exponential, uniform, impulse noise, Periodic noise Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering.

Module 4	Image Segmentation and Ethics	Assignment	Practical	No. of Classes:6

Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation,

Color image processing: Color Fundamentals, Color Models, Pseudo color Image Processing.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, Some Basic Morphological Algorithms.

Ethical and Social Implications: Ethical considerations in robotic vision applications, Privacy concerns and data protection, Social impact and implications of robotic vision technologies

Lab Experiments are to be conducted on the following topics:-

Lab Sheet 1:

 1. Simulation and Display of an Image, Negative of an Image (Binary & Gray Scale._____(One Lab Session)

        a) Red Blue and Green and Gray Components _____(Level 1)

         b) Display color Image, find its complement and convert to gray scale _____(Level 1)

        c) Simulation of an Image (Arithmetic & Logic Operation)._____(Level 2)

2. Implementation of Relationships between Pixels._____(One Lab Session)

find Neighbour of a given Pixel _____(Level 1)

4 Point Neighbour _____(Level 1)

8 Point Neighbour _____(Level 2)

Diagonal Neighbour _____(Level 2)

Lab Sheet 2:

 3. Implementation of Transformations of an Image._____(One Lab Session)

Scaling & Rotation _____(Level 1)

Gray level transformations, power law, logarithmic, negative._____(Level 2)

Contrast stretching of a low contrast image, Histogram, and Histogram Equalization.

(One Lab Session)(Level 2)

Display of bit planes of an Image. _____(One Lab Session) (Level 2)

6. Implementation of Image Intensity slicing technique for image enhancement._(One Lab Session) (Level 2)

Lab Sheet 3:

7.   Display of FFT (1-D & 2-D) of an image. _____(One Lab Session)(Level 2)

8. Computation of mean, Standard Deviation, Correlation coefficient of the given Image.

(One Lab Session)(Level 2)

9. Implementation of Image Smoothening Filters(Mean, Median and MinMax filtering of an Image)

(One Lab Session)(Level 2)

10. Implementation of image sharpening filters and Edge Detection using Gradient Filters.

(One Lab Session)(Level 2)

Lab Sheet 4:

11. Canny edge detection Algorithm._____(One Lab Session)(Level 2)

12. Image morphological operations opening closing erosion dilation._____(Two Lab Sessions)(Level 2)

13. Image segmentation by region growing split and merge algorithm._____(Two Lab Sessions)(Level 2)

Tools/Software Required: OpenCV 4 Python 3.7 MATLAB	
Text Books Rafael C. Gonzalez and Richard E. Woods' "Digital Image Processing", Fourth Edition, Global Edition 2018.	
References Perter Corke, "Robotics, Vision and Control: Fundamental Algorithms in MATLAB", 2nd Edition, Springer, 2017 Ravishankar Chityala, Sridevi Pudipeddi, "Image Processing and Acquisition Using Python", Taylor & Francis, 2020. Jason M. Kinser, "Image Operators: Image Processing in Python", CRC Press, 2018. TinkuAcharya and Ajoy K. Ray, "Image Processing Principles and Applications", John Wiley and Sons publishers.	

Course Code: CSE3155	Course Title: Data Communications and Computer Networks Type of Course: Program Core Theory– Laboratory integrated	L-T-P-C 3-0-2-4	3	0	2	4
Version No.	1.0					
Course Pre-requisites	Digital Design					
Anti-requisites	NIL					
Course Description	The objective of this course is to provide knowledge in data communications and computer networks, its organization and its implementation, and gain practical experience in the installation, monitoring, and troubleshooting of LAN systems. .					

	The associated laboratory is designed to implement and simulate various networks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffics.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain Employability through Problem Solving Methodologies.			
Course Out Comes	On successful completion of the course, the students shall be able to: 1] Illustrate the Basic Concepts Of Data Communication and Computer Networks. 2] Analyze the functionalities of the Data Link Layer. 3] Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. 4] Demonstrate the working principles of the Transport layer and Application Layer.			
Course Content:				
Module 1	Introduction and Physical Layer-CO1	Assignment	Problem Solving	07 Classes

Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media –Reference Models -OSI Model – TCP/IP Suite.

Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.

Module 2	Reference Models and Data Link Layer – CO2	Assignment	Problem Solving	7 Classes

Data Link Layer - Error Detection and Correction – Parity, LRC, CRC, Hamming Code, Flow Control and Error Control, Stop and Wait, ARQ, Sliding Window, Multiple Access Protocols, CSMA/CD,CSMA/CA, IEEE 802.3, IEEE 802.11 Ethernet.

Module 3	Network Layer – CO 3	Assignment	Problem Solving	10 Classes

Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing – RIP-BGP-Link State Routing –OSPF-Multi cast Routing-MOSPF- DVMRP – Broad Cast Routing. EVPN-VXLAN, VPLS, ELAN.

Module 4	Transport and Application Layer -CO3	Assignment	Problem Solving	10 Classes

Transport Layers - Connection management – Flow control – Retransmission, UDP, TCP, congestion control, – Congestion avoidance (DECbit, RED)

The Application Layer: Domain Name System (DNS), Domain Name Space, SSH, FTP, Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – – SNMP, Web Services, Virtual Networking.

List of Laboratory Tasks:

Lab sheet -1, M-1, 3 [2 Hours]

Experiment No 1:

Level 1: Study of basic network commands and network configuration commands.

Lab sheet -2, M-1[2 Hours]

Experiment No 1:

Level 1: Identify and explore Network devices, models and cables. Introduction to Cisco packet tracer.

Experiment No. 2:

Level 2 – Create various network topologies using a cisco packet tracer.

Lab sheet -3, M-2,3 [2 Hours]

Experiment No. 1:

Level 2 - Basic Configuration of switch/router using Cisco packet tracer.

Experiment No. 2:

Level 2 -Configure the privilege level password and user authentication in the switch/router.

Lab sheet – 4, M-3 [2 Hours]

Experiment No. 1:

Level 2 - Configure the DHCP server and wireless router and check the connectivity

Lab sheet – 5, M-3 [2 Hours]

Experiment No. 1:

Level 2 - Configure the static routing in the Cisco packet tracer.

Experiment No. 2:

Level 2 - Configure the dynamic routing protocol in the Cisco packet tracer.

Lab sheet – 6, M-4 [2 Hours]

Experiment No. 1: Configuration of DNS Server with Recursive & Integrative approach in Cisco packet tracer.

Lab sheet – 7, M-4 [2 Hours]

Experiment No. 1:

Configure the telnet protocol in the router using the Cisco packet tracer.

Lab sheet – 8, M-4[2 Hours]

Experiment No. 1:

Level1- Introduction to NS2 and basic TCL program.

Lab sheet – 9, M-4 [2 Hours]

Experiment No. 1:

Level 1: Simulate three node Point to point network using UDP in NS2.

Experiment No. 2:

Simulate transmission of Ping message using NS2.

Lab sheet – 10, M-4[2 Hours]

Experiment No. 1:

Simulate Ethernet LAN using N-node in NS2.

Experiment No. 2:

Simulate Ethernet LAN using N-node using multiple traffic in NS2

Lab sheet –11, M-3,4 [2 Hours]

Experiment No. 1:

Level 1- Introduction to Wire Shark.

Experiment No. 2:

Level 2- Demonstration of packet analysis using wire shark.

Lab sheet –12, M-1,2,3 [2 Hours] Experiment No. 1: Level 2- Demonstration of switch and router configuration using real devices
Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.
Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4
Problem Solving: Choose and appropriate devices and implement various network concepts. Programming: Simulation of any network using NS2.
Text Book Behrouz A. Forouzan, "Data Communications and Networking 5E", 5th Edition, Tata McGraw-Hill, 2017. Andrew S Tanenbaum, Nick Feamster & David J Wetherall, "Computer Networks" Sixth Edition, Pearson Publication, 2022
References "Computer Networking: A Top-Down Approach", Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.   William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.   Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007. E-Resources: 1.https://archive.nptel.ac.in/courses/106/105/106105183/ 2. http://www.nptelvideos.com/course.php?id=393 3.https://www.youtube.com/watch?v=3DZLItfbqtQ 4.https://www.youtube.com/watch?v=_fIdQ4yfsfM 5. https://www.digimat.in/keyword/106.html https://puniversity.informaticsglobal.com/login

Course Code: CSE3156	Course Title: Database Management Systems Type of Course: 1) School Core 2) Laboratory Integrated			L-T-P-C	3	0	2	4
Version No.	1.0							
Course Pre-requisites	NIL							
Anti-requisites	NIL							
Course Description	This course introduces the core principles and techniques required in the design and implementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve information efficiently. It helps the students to learn and practice data modeling and database designs. The course also introduces the concept of object oriented and object relational databases. The associated laboratory is designed to implement database design using MySQL DATABASE in information technology applications. All the exercises will focus on the fundamentals for creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain Employability through Problem Solving Methodologies.							
Course Out Comes	On successful completion of the course the students shall be able to: 1] Demonstrate a database system using ER model and relational algebra. [Understanding] 2] Build databases using SQL queries query processing. [Applying] 3] Apply the functional dependencies and design the database using normalization. [Applying] 4] Interpret the concept of object-oriented databases and object-relational databases. [Understanding]							
Course Content:								
Module 1	Introduction to Database Modelling and Relational Algebra (Understanding)	Assignment	Problem Solving	8 Classes				

Topics:

Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.

Relational Algebra with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.

Module 2	Fundamentals of SQL and Query Optimization (Applying)	Assignment	Programming	8 Classes

Topics:

SQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.

Database programming issues and techniques: Embedded SQL, Dynamic SQL; SQL / PSM and NoSQL.

Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.

Module 3	Relational Database Design & Transaction Management (Applying)	Assignment	Problem Solving	12 Classes

Topics:

Relational database design: Problems in schema design, redundancy and anomalies, Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions, Database De-normalization.

Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Module 4	Advanced DBMS Topics (Understanding)	Assignment	Case Study	8 Classes

Topics:

Advanced topics: Object oriented database management systems, Deductive database management systems, Spatial database management systems, Temporal database management systems, Constraint database management systems.

New database applications and architectures such as Data warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, Statistical databases.

List of Laboratory Tasks:

Create Employee, Student, Banking and Library databases and populate them with required data. Do the following experiments of different lab sheets on those databases.

Labsheet-1 [3 Practical Sessions]

Experiment No 1: [1 Session]

To study and implement the different language of Structured Query Language.

Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.

Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]

Experiment No. 2: [2 Sessions]

To study and implement the concept of integrity constraints in SQL.

Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.

Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical Sessions]

Experiment No. 3: [1 Session]

Implement complex queries in SQL.

Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database.

Level 2: Implement MySQL DB queries on library database using appropriate clauses and aggregate functions. Also order the data either in ascending and descending order using corresponding clause. [Library databases].

Experiment No. 4: [2 Session]

To study and implement different types of Set and Join Operations [2 Slots]

Level 1: Demonstrate different types of Set Operations (UNION, UNION ALL, INTERSECT, MINUS) and Join Operations (INNER JOINs, OUTER JOINS, CROSS JOIN, NATURAL JOIN) on two or more tables of Airline Database.

Level 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given scenario. [Airline Database]

Labsheet-3 [2 Practical Sessions]

Experiment No. 5: [2 sessions]

To study and implement Views, and Procedures in MySQL DB.

Level 1: Implement MySQL Views, and Procedures in ORACLE DB on Employee database.

Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database]

Labsheet-4 [2 Practical Sessions]

Experiment No. 6: [2 Sessions]

To study and implement Functions, and Triggers in MySQL DB.

Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database.

Level 2: Analyze the requirement and construct Functions and Triggers. [Supply chain Database]

Labsheet-5 [2 Practical Sessions]

Experiment No. 7: [2 Sessions]

To implement the concept of forms and reports.

Level 1: Implement the concept of forms and reports.

Level 2: Analyze the schema relationship.

Labsheet-6 [2 Practical Sessions]

Experiment No. 8: [2 Sessions]

Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc.

Level 1: Implement the real time database.

Level 2: Analyze the working of database in real time.

Targeted Application & Tools that can be used:

Application Area: Relational database systems for Business, Scientific and Engineering Applications.

Tools/Simulator used: MySQL DB for student practice.

Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

Percentage of changes in this version: 50% of changes from earlier version. New topics are highlighted in italic.

---

1. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.

2. Programming: Implementation of any given scenario using MySQL.

Text Book

1] RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.

2] Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.

3] W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.

References

1] Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018.

2] M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.

Topics relevant to development of "FOUNDATION SKILLS":   S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB.

Topics relevant to development of Employability: Develop, test and implement computer databases, creating sophisticated, interactive and secure database applications

Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Nil

Course Code: CSE3157	Course Title: Artificial Intelligence and Machine Learning Type of Course:1]Program Core 2] Laboratory integrated		L-T-P-C	3	0	2	4
Version No.		1.0					
Course Pre-requisites		Python Programming					
Anti-requisites		NIL					
Course Description		This course introduces the basic concepts of artificial intelligence(AI) and Machine Learning (ML) which is a subset of Artificial Intelligence. AI & ML provides important set of techniques and algorithms for solving several real world business and social problems. The objective of this course is to discuss machine learning model development using Python. Topics include: Working with Collections and Data Frames; History, Application and Agents of AI; Knowledge Representation ; Hill Climbing, A* and SMA* algorithms; Knowledge representation - Approaches and Issues, Knowledge-Based Systems; Knowledge representation using Propositional logic and Predicate Logic, Unification and lifting, Forward chaining, Backward chaining. Introduction to the Machine Learning (ML) - Framework, types of ML, Concept Learning: Concept learning task, Find-S algorithm, Candidate Elimination Algorithm. Neural and Bayesian Belief networks – Perceptron, Multi-layer feed forward networks, Back propagation algorithm. Nearest Neighbor techniques, Support Vector Machines; Supervised Learning – Classification & Regression – Algorithms; Unsupervised Learning - Clustering & Association – Algorithms					
Course Objective		The objective of the course is to familiarize the learners with the concepts of Artificial Intelligence and Machine Learning Employability through Problem Solving Methodologies.					
Course Out Comes		On successful completion of this course the students shall be able to: Describe the basic understanding of the AI and concepts of searching for AI problems. (KNOWLEDGE) Develop knowledge base for representing the given real world data using logic and reasoning methods. (Application) Apply concept learning and Artificial Neural Network techniques for the given problems. (Application) Articulate Machine Learning model using Supervised and Unsupervised learning algorithms. (Application)					

		Develop solutions / mini project on real world problems using AIML domain, either individually or as a part of the team and report the results. (Application)			
Course Content:					
Module 1	Introduction to Artificial Intelligence and Searching	Assignment	Programming Activity	15 Hours	
	Topics: Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agent, Structure of Intelligent agent and its functions, Agents and Environment; Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first; A* - SMA* algorithms.				
Module 2	Knowledge Representation	Assignment	Programming activity	15 Hours	
	Topics: Introduction to Knowledge representation, approaches and issues in knowledge representation, Knowledge-based agent and its Structure, Knowledge-Based Systems; Knowledge representation using Propositional logic and Predicate Logic- First-Order Logic - Syntax and Semantics, Knowledge Engineering - Unification and lifting, Forward chaining, Backward chaining				
Module 3	Introduction to Machine Learning & Neural Network	Assignment	Programming activity	15 Hours	
	Topics: Introduction to the Machine Learning (ML) Framework, types of ML, types of variables/features used in ML algorithms, Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm. Neural and Belief networks - Perceptron - Multi-layer feed forward networks - Bayesian belief networks, Back propagation algorithm.				
Module 4	Supervised & Unsupervised Learning	Mini Project	Programming activity	15 Hours	
	Topics:				

Supervised Learning – Classification & Regression - Decision Tree Learning, Random Forest - Support Vector Machines ; Simple Linear Regression Algorithm, Multivariate Regression Algorithm

Unsupervised Learning – Clustering & Association - K-Means Clustering algorithm , Mean-shift algorithm , Apriori Algorithm, FP-growth algorithm

List of Laboratory Tasks:

Lab sheet -1

A review of Python programming - Anaconda platform and its installation, Executing programs on Jupyter IDE/ Colab.

Programming exercises on Tuples, Nested data structures

Lab sheet -2

Introduction to Numpy, Pandas, Scikit-learn and Visualization techniques.

Dictionaries, dictionary comprehension , Data Frames using Pandas and working with frames

Lab sheet - 3

Search Algorithms – A* & SMA *

Lab sheet -4

Tic-tac-toe game simulation using search and heuristics.

Describe the Sudoku game and represent the actions using First-order / Propositional logic.

Sorting algorithms employing forward chaining.

Lab sheet -5

Find-S Algorithm

Candidate Elimination Algorithm

Back Propagation Algorithm

Lab sheet -6

Support Vector Machines ;

Simple Linear Regression Algorithm

Multivariate Regression Algorithm

Lab sheet -7

	K-Means Clustering algorithm
	Mean-shift algorithm
	Apriori Algorithm
	Mini Project / Case Study – Real Time Project
	Targeted Application & Tools that can be used: Use of PowerPoint software for lecture slides and use of Google's Colab cloud service https://www.tutorialspoint.com/google_colab/index.html for executing and sharing of lab exercises.
	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
	1] Programming: Implementation of given scenario using Python and Colab. 2] Assignment: Learning courses for 4 Hours from the following link https://learn.datacamp.com/courses?topics=Machine%20Learning
	Text Book Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, 3rd edition, Upper Saddle River, Prentice Hall 2021. Tom Mitchell, "Machine Learning", First Edition, Tata McGraw Hill India, 2017.
	References Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python", Wiley, First Edition 2019. Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with Python :A Guide for Data Scientists", Oreilly, First Edition, 2016 Elaine Rich, Kevin K and S B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill Education, 2017. Pattern Classification 2nd Edition by Richard O. Duda , Peter E. Hart , David G. Stork

Course Code:	Course Title: Medical Image Processing			L- T-P- C	2	0	2	3
CSE 5020	Type of Course: Discipline Elective Theory and Lab Integrated							
Version No.	2.0							
Course Pre-requisites	Python programming language OpenCV library Basics of digital image processing							
Anti-requisites	NIL							
Course Description	The course introduces the basics to advance the implementation of biomedical images such as MRI, CT, X-ray, etc. Here we will be studying about complete basics of theical image processing and then moving forward we will be learning about the various filters and feature extraction techniques. This course also teaches the segmentation and restoration techniques in depth along with the practical implementation.							
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques.							
Course Outcomes	On successful completion of the course, the students shall be able to: CO 1: understand digital image processing using OpenCV and Python programming language. CO 2: Demonstrate image enhancements for Filter and feature extraction of statistical measurement. CO 3: Implement deep learning techniques for image restoration and segmentation. CO 4: Experiment with soft computing techniques for content-based medical image retrieval							
Course Content:								
Module 1	Digital image processing	Assignment	Image processing	10 Sessions				
Introduction: What is an image, Digital image, Image resolution, and aspect ratio, components of digital image processing, sampling, and quantization, applications areas, vision fundamentals, CAD systems, research areas of digital image processing. Biomedical image processing: various modalities of medical imaging: breast cancer imaging,								

mammographic imaging, ultrasound imaging, magnetic resonance imaging(MRI), and breast
thermography imaging. Problems with medical images, image enhancement, and other
modalities of medical imaging.

Module 2	Filters and feature extraction	Use case study	Feature extraction	10 Sessions

Noise reduction filters for medical imaging: sources of noise and filters used for noise
reduction, spatial domain filters, frequency domain filters, practical results.
Feature extraction and statistical measurement: selection of features, shape-related
features, Fourier descriptors, text analysis.

Module 3	Image restoration and segmentation	Assignment	Segmentation	8 Sessions

Medical Image restoration: Image resolution, degradation model, estimation of degradation
function, blur model, medical image restoration, blur identification, super-resolution
method.
Biomedical image segmentation: Broad classification and applications, point detection, line
detection, edge detection methods, histogram-based image segmentation, segmentation
using
split and merge method, region growing method, watershed method, k-means clustering
method, self-similar fractal method, topological derivative-based segmentation, comparison
of
segmentation methods.

Module 4	Soft computing techniques and content-based image retrieval	use case study	Content based imge retrieval	10 Sessions

Soft computing techniques: Fuzzy-based techniques, Neural network-based techniques
,genetic algorithm-based techniques. Content-based image retrieval: Content-based image
retrieval (CBIR): Visual connect descriptors, shape similarity measure, relevance feedback,
distance measureand s, challenges,Content-based medical image retrieval (CBMIR):
Challenges in implementation of
CBMIR, Practical approaches of CBMIR.

Targeted Application & Tools that can be used:

Google Collab Pro

Jupyter Notebook with GPU

Project work/Assignment:

Mini project on feature extraction using deep learning algorithm such as CNN.

Text Book					

Text Book

T1. G.R Sinha, Bhagwati Charan Patel," Medical Image Processing Concepts and Applications", Eastern Economy Edition.2020

References

R1. Geoff Dougherty California State University, Channel Islands" Digital Image Processing for Medical Applications", Cambridge University Press.2019

Weblinks

W1. https://onlinecourses.nptel.ac.in/noc22_bt34/preview

W2. https://www.slideshare.net/AboulEllaHassanien/medical-image-analysis-27297012

Topics relevant to development of "SKILL DEVELOPMENT":Design and development of feature extraction and segmentation algorithm using python programming language.

Topic relevant to HUMAN VALUES & PROFESSIONAL ETHICS": Naming and coding convention for Project Development.

Course Code: CSE3068	Course Title:Advanced DBMS Type of Course: Core Theory &Integrated Laboratory	L-T- P- C	2	2	3
Version No.	1.0				
Course Pre-requisites	[1] Database Management System (CSE2074) Basics of DBMS, like, File System and its drawbacks, Database Approach, 3-Schema Architecture and its concepts, Relational Algebra, Normalization, Transactions and its concepts, Backup and Recovery. In laboratory MySQL database skills are learnt.				
Anti-requisites	NIL				
Course Description	The purpose of this course is to make the students revisit RDBMS transactions first. Then introduce them with Distributed, Parallel, and NoSQL database concepts. They include the main characteristics, advantages, and disadvantages of each one of them. Importance and differences among them are noted. Need to transit from RBMS to NoSQL is discussed. The striking features of distributed, parallel and NoSQL are considered and studied. The associated laboratory provides a chance to have hands-on concepts learned during this course.				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by learning the working on Database using MySQL.				

Course Outcomes	On successful completion of this course the students shall be able to: Recall the transactions in RDMS				
	(2) Explain advanced features of distributed, parallel, and NoSQL databases.				
	(3) Illustrate the features in Distributed database				
	(4) Employ Parallel database concepts in real life applications.				
Course Content:					

Module 1	Transactions in RDBMS	Quiz	Comprehension based Quizzes and assignments.	06Classes

Topics:

RDBMS -Transaction control state diagram, ACID properties of transaction, Schedules in transactions - Serial, Non-Serial and Serializable, Serializability-Conflict and View, Conflict Serializability check by Precedency Graph, Concurrency Control – Lock Based and Time Stamp Based.

Module 2	NoSQL Databases	Programming and Mini Project	Laboratory experiments and Mini Projects on NoSQL Topics using MongoDB/ Casandra.	06Classes

Topics:

NoSQL Introduction – Scale Out, Commodity Hardware, Brief History, Features – Non-Relational, Schema Free, Simple API, and Distributed. NoSQL Architectures/Data Models - Document, Columnar, Key-Value, and Graph. Transaction in NoSQL- BASE for reliable database transactions, Achieving Horizontal Scalability with Database Sharding, CAP theorem.

Case Study: MongoDB/Casandra/ AWS/ HBase

Module 3	Distributed Databases	Assignment	Assignment on main topics of Distributed Databases	06Classes

Topics:

Loosely Coupled, Characteristics of Distributed Databases, Local and Global view of applications, Distributed Processing, Types – Homogeneous and Heterogeneous, Distributed Data Storage – Replication and Fragmentation, Fragmentation – Horizontal and Vertical Type, Difference between Centralized and Distributed Databases.

Module 4	Parallel Databases	Assignment	Assignment on main topics of Parallel Databases	06 Classes

Topics:

Tightly Coupled, Features of parallel databases, Shared Memory, Shared Disk, Shared Nothing Systems. Advantages of each of these schemes, Advantages and Disadvantages of Parallel Databases, Differences between Parallel and Distributed Databases.

Install MONGODB

https://www.javatpoint.com/mongodb-create-database

Create any one of the following databases.

Employee, Student, University, Banking, or Online Shopping

Drop database

Create Collection: In MongoDB db.createCollection(name,option) is used to create collection.

Drop Collection

List of Laboratory Tasks:(7 X 2= 14 Sessions)

Level 1: Perform CRUD operations (Insert, Update, Delete and Query Documents) on 'Student' Database.

Level 2: Do MongoDB text search on 'Employee' Database.

Experiment No. 2: Try experiments on MongoDB Operators

Level 1: Perform queries involving MongoDB Query and Projection Operators using 'Student' Database.

Level 2: Do queries involving MongoDB update operator on 'Employee' Database.

Experiment No. 3:Explore different query modifiers.

Level 1: Perform different query modifiers on 'Student' Database.

Level 2: Try various query modifiers on 'Employee' Database.

Experiment No. 4:Explore Aggregation commands.

Level 1: Implement different aggregation commands on 'Student' Database.

Level2: Perform various aggregation commands on 'Employee' Database.

Experiment No. 5:Explore Authentication commands.

Level 1: Try authentication commands on 'Student' Database.

Level 2: NA
Experiment No. 6:Explore Replication Commands
Level 1: Try all replication commands on 'Student' Database.
Level2: Implement replication commands on 'Employee' Database.
Experiment No.7:Try Sharding Commands.
Level1: Explore Sharding Commands on 'Student' Database.
Level 2: Implement Sharding Commands on 'Employee' Database.
Targeted Application & Tools that can be used: MongoDB is to be installed and used.
Project work/Assignment:
Each batch of students (self-selected batch mates) will identify projects, such as, Library, Banking, and Reservation etc.,and do it. Concepts of NoSQL, like, CRUD operations, supporting ad hoc queries, indexing flexibility, assisting replication, creating capped collections, and Retrieving data from multiple documents.   Sample Mini Projects: 1. Content Management System   Clubbing the content assets like text and HTML into a single database helps provide a better user experience. MongoDB has an excellent toolset not only for storing and indexing but also for controlling the structure of a content management system. You can easily design a web-based CMS by using the model proposed by "Metadata and Asset Management" in MongoDB. Additionally, you can use "Storing Comments" to model user comments on blog posts.   2. Gaming Project   Data is an essential part of making video games work. Some typical examples of gaming data include player profiles, matchmaking, telemetry, and leaderboards.   The common thread between all games is that they all have a specific goal. And you have to achieve multiple objectives or pay your way out to reach the end goal. This may involve steps like watering your plants, growing vegetables, serving food in a restaurant, and so on.
Textbook(s):
Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, 1st Edition, 2019(Wiley Publications).

Stefano Ceri, Giuseppe Pelagatti , Distributed Databases: Principles and Systems,, 2017(McGraw Hill Education).
References   Elmasri R and Navathe S B, "Fundamentals of Database System",7th Edition, 2017(Pearson Publication).   Pivert. NoSQL Data Models: Trends and Challenges, 1st edition(Wiley).
Topics related to development of "FOUNDATION":Transaction, CRUD Operations, Replication, and Sharding   Topics related to development of "EMPLOYABILITY": Project implementations in software, batch wise presentations   Topics related to development of "HUMAN VALUES AND PROFESSIONAL ETHICS": Team Dynamics during Mini Project Development.

Course Code: CSE3070	Course Title: Advanced Computer Networks	L-T- P-C	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE-2011-Data communication and Computer Networks- TCP/IP Protocol Suite, IEEE 802.x, VLAN, Ipv4 Addresses, IpV6 address				
Anti-requisites	NIL				
Course Description	This course emphasizes the advanced concepts of computer networks and their design aspects. This course will explore the design aspects of physical and network layers, switching basics, logical design and management aspects, network traffic and scheduling, performance of WIFI AND WIMAX network along with current internet technology like 5G and Software Defined Network.				
Course Objective	This course goal is to provide an advanced background on relevant and recent computer networking topics and to have a comprehensive and deep knowledge in computer networks.				
Course Outcomes	Upon successful completion of the course the students shall be able to: Understand the physical network technology and design of WAN. Understand switching networks, routing in packet switching networks with different routing algorithms. Demonstrate the Modeling of network traffic and networking protocols. Understand the principles of new generation of computer networks, alternative Infrastructures and SDN.				
Course Content:					
Module 1	PHYSICAL NETWORK DESIGN	Assignment	Theory		No. of Classes:10
Topics: Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks					

Module 2	SWITCHING BASICS	Assignment	Theory	No. of Classes:12

Topics: Circuit switching, Message switching and Packet switching – Datagrams and Virtual circuits – Cell switching – Label switching – L2 switching Vs L3 switching – VLANs – Switching and Bridging – Loop resolution, Spanning tree algorithms – Cut through and Store and forward switches – Head of line blocking – Back pressure – Switch design goals

Module 3	LOGICAL DESIGN AND MANAGEMENT	Assignment	Theory	No. of Classes:10

Topics: VLSM, OSPF and BGP – VPN –RMON and SNMP, Modeling 802.11 protocol – Basic DCF modeling, RTS/CTS modeling, Modeling 802.11e, Performance, 802.11e HCCA Performance. Modeling 802.16 protocol – system and user performance.

Module 4	NETWORK TRAFFIC, SCHEDULING and Alternative Infrastructures	Assignment	Case Study	No. of Classes:12

Topics: Modeling network traffic – Flow traffic models – Continuous time modeling, Discrete time modeling, Pareto traffic distribution, Destination traffic. Scheduling algorithms – Analysis Alternative Infrastructures (Active networks, Software defined network. Network Security and wireless and Mobile networks, 5G cloudification.

Targeted Application & Tools that can be used:

CISCO Packet Tracer,

Whireshark

Project work/Assignment:

Design LAN WAN and assign IP Address.

Configure the WAN topology using routing protocols

Design Wireless network in college campus.

Suggested List of Hands-on Activities:

Perform a case study on VLSM
Using CISCO Packet Tracer design a LAN with 50 PCV and configure it with suitable IP addressing and routing protocols
DO a case study on an SDN for an Enterprise.
Perform a case study on 5G Cloudification.
Text Book
Larry L. Peterson & Bruce S. Davie, "Computer Network: A System Approach", Morgan Kaufmann, 5/e, 2012.
Jochen Schiller, "Mobile Communications", Pearson Addison-Wesley, 2/e, 2010.
References
Behrouz A. Forouzan , "TCP/IP Protocol Suite", McGraw- Hill, 4/e, 2015.
James F. Kurose, Keith W. Ross, "Computer Networking", Pearson, 2016.
Charles M. Kozierok, "The TCP/IP Guide", No starch press, 2018.
Computer Networking: A Top-Down Approach, James F. Kuros and Keith W. Ross,Pearson, 6th Edition,2012
A Practical Guide to Advanced Networking , Jeffrey S. Beasley and PiyasatNilkaew,Pearson, 3rd Edition,2012
Computer Networks , Andrew S. Tanenbaum, David J. Wetherall,Prentice, 5th Edition,201
Web Resources and Research Articles links:
Journal of Network and Computer Networking- https://www.journals.elsevier.com/journal-of-network-and-computer-applications

Course Code: CSE 3071	Course Title: Computer Vision Type of Course: Program Core Theory and Lab Integrated Course	L-T- P- C	2	2	3
Version No.	1.0				
Course Pre-requisites	Linear algebra, vector calculus, and probability, Data structures				
Anti-requisites	NIL				
Course Description	This course introduces computer vision, including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification, scene understanding, and deep learning with neural networks. We will develop basic methods for applications that include finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment, tracking, boundary detection, and recognition. We will develop the intuitions and mathematics of the methods in class, and then learn about the difference between theory and practice in HomeWorks.				
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING TECHNIQUES.				
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Apply mathematical modeling methods for low-, intermediate- and high- level image processing tasks. CO2: Perform software experiments on computer vision problems and compare their performance with the state of the art. CO3: Describe the geometric relationships between 2D images and the 3D world.				
Course Content:					
Module 1	Digital Image Processing	Programming Assignment	Data Collection and Analysis		12 sessions
Image Formation, Image Filtering, Edge Detection, Principal Component Analysis, Corner Detection SIFT, Applications: Large Scale Image Search.					

Module 2	Geometric Techniques in Computer Vision	Programming Assignment	Data Collection and Analysis	12 sessions

Image Transformations, Camera Projections, Camera Calibration, Depth from Stereo, Two View Structure from Motion, Object Tracking.

Module 3	Machine Learning for Computer Vision	Programming Assignment	Data analysis	14 sessions

Introduction to Machine Learning, Image Classification, Object Detection, Semantic Segmentation.

List of Laboratory Tasks:

1. Simulation and Display of an Image, Negative of an Image (Binary & Gray Scale)[Text Wrapping Break]2. Implementation of Relationships between Pixels[Text Wrapping Break]3. Implementation of Transformations of an Image[Text Wrapping Break]4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization[Text Wrapping Break]5. Display of bit planes of an Image[Text Wrapping Break]6. Display of FFT (1-D & 2-D) of an image[Text Wrapping Break]7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image[Text Wrapping Break]8. Implementation of Image Smoothening Filters (Mean and Median filtering of an Image)[Text Wrapping Break]9. Implementation of image sharpening filters and Edge Detection using Gradient Filters[Text Wrapping Break]10. Image Compression by DCT, DPCM, HUFFMAN coding[Text Wrapping Break]11. Implementation of image restoring techniques[Text Wrapping Break]12. Implementation of Image Intensity slicing technique for image enhancement

Targeted Application & Tools that can be used: Matlab

Project work/Assignment:

Text Book

T1 Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.

T2 Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, 2ndEdition, Cambridge University Press, March 2004.

References

R1. R. Bishop; Pattern Recognition and Machine Learning, Springer,2006

R2. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

    R3. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

Web references:

https://onlinecourses.swayam2.ac.in/cec20_cs08/preview

.

Library reference: https://presiuniv.knimbus.com/user#/home

Topics relevant to development of "Employability":

Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS"":

Course Code:	Course Title: Applied Artificial Intelligence						
CSE3005	Type of Course: Program Core & Theory Only			L-T- P-C	3	0	3
Version No.	1.0						
Course Pre-requisites	CSE3001: Artificial Intelligence and Machine Learning						
Anti-requisites	Nil						
Course Description	Applied Artificial Intelligence is an advanced-level course designed to build upon the foundational knowledge of artificial intelligence (AI) and its applications in engineering. This course aims to provide engineering students with an in-depth understanding of AI techniques, algorithms, and emerging trends that are shaping the future of AI-driven engineering systems. Through theoretical concepts, practical examples, and case studies, students will explore cutting-edge AI methodologies and their application in solving complex engineering problems.						
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.						
Course Out Comes	On successful completion of the course the students shall be able to: Explain AI techniques and algorithms in engineering domains. [Understand] Solve problems in AI using search methods and constraint satisfaction. [Apply] Apply logic methods for problem-solving using Resolution. [Apply] Describe solutions for problems involving uncertainty in AI. [Apply]						
Course Content:							

Module 1	Search	Quiz Tests	Programming Assignment	L : 12
Introduction: Solving Problems by Searching. Problem-solving agents. Formulating problems. Uninformed Search Algorithms: Breadth-first search. Depth-first search. Uniform cost search. Applications in pathfinding in games. Heuristic Search Algorithms: Heuristics. Greedy best-first search. A* search. Difference between Uniform cost search and A* search. Adversarial Search Algorithms: Game tree. Minimax algorithm. Alpha-beta pruning. Ideal ordering and worst ordering. Extensions of Minimax algorithm for multiplayer games (MaxN) and stochastic games (Expectimax)				

Module 2	Knowledge-Based Logic Representation	Quiz Tests		L: 12

Representation, Reasoning, and Logic. Prepositional Logic. First-Order Logic. Syntax and Semantics. Inference Rules. Propositional and First-Order Resolution. Applications for solving story problems using Resolution.

Module 3	Constraint Satisfaction Problems	Quiz Tests	Programming Assignment	L:7

Constraints. Definition of a CSP. Examples of Constraint Satisfaction Problems. Arc consistency. Problem structure and problem decomposition. Backtracking. Backtracking heuristics. Local search. Timetable scheduling as a real-world example.

Module 4	Uncertainty in AI	Quiz Tests	Programming Assignments	L: 7

Uncertainty in AI. Revision of Probability Basics and Bayes Theorem. Bayesian Networks. Hidden Markov Models. Sub-problems in HMM and their solutions – Forward probability and Viterbi Algorithm. Case study of sequence labeling using HMM for part-of-speech tagging and named entity recognition.

Targeted Application & Tools that can be used :

Applications:

Game playing, knowledge representation, solving story problems, timetable scheduling, sequence labeling in NLP.

Tools:

Google Colab

IDEs (in case they are solving them using C/C++ or Java) like Visual Studio, Netbeans, Eclipse, etc.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Students will be given programming assignments to implement AI algorithms

Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.

Students are also recommended to watch NPTEL videos, register for corresponding NPTEL courses, etc.

Text Book

Stuart J. Russell and Peter Norvig, "Artificial intelligence: A Modern Approach", 4th edition, 2022. Pearson Education.

Lavika Goel, "Artificial Intelligence: Concepts and Applications", 1st Edition. 2021.Wiley.

References

Deepak Khemani, "A First Course in Artificial Intelligence", First Edition Sixth Reprint (2018). Tata McGraw Hill.

NPTEL Courses (and other video links):

Mausam (IIT Delhi), "An Introduction to Artificial Intelligence". – Link: https://nptel.ac.in/courses/106102220. Useful for the full course.

Deepak Khemani (IIT Madras), "Artificial Intelligence: Search Methods for Problem-Solving". – Link: https://nptel.ac.in/courses/106106226. Useful for Module 1.

Deepak Khemani (IIT Madras), "Artificial Intelligence: Knowledge Representation and Reasoning". – Link: https://nptel.ac.in/courses/106106140. Useful for Module 2.

Deepak Khemani (IIT Madras), "AI: Constraint Satisfaction" – Link: https://nptel.ac.in/courses/106106158. Useful for Module 3.

IJCAI 2020 Talk by Eugene Freuder. Link: https://ijcai20.org/excellence-research-award-session/. This will serve as a motivation for the Module 3.

Course Code: CSE3009	Course Title: Optimization Techniques for Machine Learning	L-T- P- C	3	0	3
	Type of Course: Program Core& Theory Only				
Version No.	1.1				
Course Pre-requisites	Fluency with reasoning and analysis using linear algebra and probability is required. Familiarity with Python is preferrable.				
Anti-requisites	NIL				
Course Description	The course aims to equip students with advanced techniques and methods in optimization that are tailored to large-scale statistics and machine learning problems. A number of prominent developments in first-order optimization methods in the convex, nonconvex, stochastic, and distributed settings are explored in this course. Upon completing the course, students are expected to be able to better formulate an optimization problem by exploiting desired structural properties (for example, convexity, smoothness, and sparsity), and to select an efficient optimization method under problem constraints (for example, online, distributed, and memory cost).				
	The course aims to equip students with advanced techniques and methods in optimization that are tailored to large-scale statistics and machine learning problems. A number of prominent developments in first-order optimization methods in the convex, nonconvex, stochastic, and distributed settings are explored in this course. Upon completing the course, students are expected to be able to better formulate an optimization problem by exploiting desired structural properties (for example, convexity, smoothness, and sparsity), and to select an efficient optimization method under problem constraints (for example, online, distributed, and memory cost).				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:				
	1] Understand standard supervised and unsupervised machine learning tasks as optimization problems [Understand]				
	2] Understand key definitions relating to convex functions, convex sets, and convex optimization [Understand]				

	3] Implement first-order and stochastic first-order solvers for convex optimization problems. [Application] 4] Apply machine learning techniques to real world problems. [Application]			
Course Content:				
Module 1	Fundamentals of Convex Analysis	Assignment	Programming Task	8 Sessions

Topics:

Review of basic linear algebra and probability, convex sets and functions – Strong and weak duality, constraint qualifications, Optimality conditions for machine learning problems (regressions, SVM, etc.)

Assignment: Quiz on optimality conditions for machine learning problems.

Module 2	First order and Higher Order Methods	Assignment	Data Collection/Excel	14 Sessions

Topics:

First Order Methods : Gradient descent convergence analysis – Convergence analysis for momentum-based acceleration methods: Heavy-ball, multistep, Nesterov, FISTA, etc. – Convergence speedup with conjugacy – Convergence analysis for sub-gradient methods – Stochastic (sub) gradient descent (convergences in probability and distribution, almost sure convergence, parallelism, applications in deep learning, etc.)

 Higher-Order Methods – Newton's method: convergence analysis (exact/inexact step-sizes, self-concordance), applications in regressions – Quasi-Newton Theory (Secant methods), convergence proofs for BFGS/DFP, L-BFGS in machine learning

Assignment: Different first order methods and their types with examples.

Module 3	Regularized Optimization & Proximal and Operator Splitting	Assignment	Programming/Data analysis Task	10 Sessions

Topics:

I1 -regularized sparse optimization for machine/statistical learning: compressed sensing, LASSO, logistic regression, etc. – Structured sparsity optimization for machine/statistical learning: low-rank matrix completion, nuclear norm regularization, inverse covariance inference, atomic norm regularization, etc.

Dual decomposition and decentralization – Method of multipliers and ADMM methods: convergence analysis and proofs – Proximal operators and proximal methods – Design and analysis of distributed algorithms				
Assignment: Design of distributed algorithms with examples.				
Module 4	Nonconvex Optimization in Machine Learning	Assignment	Programming/Data analysis Task	8 Sessions

Topics:

Coordinate descent methods and convergence analysis – Special structured nonconvex optimization – Optimization landscape – Saddle point escape

Assignment: Design of nonconvex optimization algorithms and their usage.

Targeted Application & Tools that can be used:

Google Colab

Project work/Assignment:

Creating a classification system using Machine Learning methods (Stochastic Gradient Descent, Naïve bayes Classifier, etc.) using standard datasets like Iris Recognition Dataset etc.

Text Book

T1. A. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017.

T2. S. Bubeck, Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization, 2015.

T3. F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective", Foundations and Trends in Machine Learning, Now Publishers Inc., 2013.

References

R1. S. Boyd, N. Parikh, and E. Chu," Distributed optimization and statistical learning via the alternating direction method of multipliers", Foundations and Trends in Machine Learning, Now Publishers Inc.

R2. Y. Nesterov, "Introductory Lectures on Convex Optimization: A Basic Course," Springer, 2004.

R3. M. Bazarra, H.D. Sherali, and C.M. Shetty, "Nonlinear Programming: Theory and Algorithms," John Wiley & Sons, 2006.

http://192.168.1.10/cgi-bin/koha/opac-detail.pl?biblionumber=11708&query_desc=ti%2Cwrdl%3A%20MACHINE%20LEARNING
Topics relevant to development of "SKILL": Gradient descent convergence analysis, Quasi-Newton Theory (Secant methods), LASSO, Logistic Regression, Coordinate descent methods and convergence analysis Topics relevant to development of "ENVIRONMENT AND SUSTAINABILITY SKILLS": NIL

Course Code:	Course Title: Reinforcement Learning				
CSE3011	Type of Course: 1] Program Core 2] Laboratory integrated	L-T- P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	CSE3001: Artificial Intelligence and Machine Learning				
Anti-requisites	NIL				
Course Description	For both engineers and researchers in the field of Computer science, it is common to develop models of real-life situations and develop solutions based on those models. It is of utmost importance to come up with innovative solutions for scenarios that are highly stochastic. The objective of this course, is to introduce different reinforcement learning techniques which is a promising paradigm for stochastic decision making in the forthcoming era. Starting from the basics of stochastic processes, this course introduces several RL techniques that are as per the industry standard. With a good knowledge in RL, the students will be able to develop efficient solutions for complex and challenging real-life problems that are highly stochastic in nature.				
Course Objectives	This course is designed to improve the learners 'EMPLOYABILITY SKILLS' by using EXPERIENTIAL LEARNING techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: 1. Apply dynamic programming concepts to find an optimal policy in a gaming environment [Applying] 2. Implement on-policy and off-policy Monte Carlo methods for finding an optimal policy in a reinforcement learning environment. [Applying] 3. Utilize Temporal Difference learning techniques in the Frozen Lake RL environment [Applying] 4. Solve the Multi-Armed Bandit (MAB) problem using various exploration-exploitation strategies [Applying]				
Course Content:					

Module 1	Introduction to Reinforcement Learning	Assignment	Programming using the OpenAI Gym environment	No. of Classes L – 5 P – 6
Topics : Elements of RL, Agent, environment Interface, Goals and rewards, RL platforms, Applications of RL, Markov decision process (MDP), RL environment as a MDP, Maths essentials of RL, Policy and its types, episodic and continuous tasks, return and discount factor, fundamental functions of RL – value and Q functions, model-based and model-free learning, types of RL environments, Solving MDP using Bellman Equation, Algorithms for optimal policy using Dynamic Programming -Value iteration and policy iteration, Example : Frozen Lake problem, Limitations and Scope				
Module 2	Monte-Carlo(MC) methods	Assignment	Programming using the OpenAI Gym environment	No. of Classes L-5 P-6
Topics: Monte Carlo methods, prediction and control tasks, Monte Carlo prediction : algorithm, types of MC prediction, examples , incremental mean updates, Monte Carlo Control : algorithm, on-policy MC control, MC with epsilon-greedy policy, off-policy MC control. Limitations of MC method.				
Module 3	Temporal Difference(TD) Learning	Assignment /Quiz	Programming using the OpenAI Gym environment	No. of Classes L-7 P -6
Topics: Temporal difference learning: TD Prediction, TD Control : On-policy TD control – SARSA, computing the optimal policy using SARSA, Off-policy TD control – Q learning, computing optimal policy using Q learning, Examples, Difference between SARSA and Q-learning, Comparison of DP, MC and TD methods.				
Module 4	Multi-Armed Bandit (MAB) problem	Assignment	Programming using the OpenAI Gym environment	No. of Classes L-6 P -4
Topics: Understanding the MAB problem, Various exploration strategies – epsilon-greedy, softmax exploration, upper confidence bound and Thompson sampling, Applications of MAB - finding the best advertisement banner for a web site, Contextual bandits, introduction to Deep Reinforcement Learning(DRL) Algorithm – Deep Q Network (DQN)				
List of Laboratory Tasks: 1 .Software Setup : installalling Anaconda, OpenAI Gym and Universe. Basic simulations of some gaming environments in Gym 2. Working with Gym environments to create agents with random policy				

2.1 Create the Frozen Lake GYM environment and explore the states, action, transition probability, reward functions and generating episodes.

2.2 Create an agent for the Cart-Pole environment using a random policy and record the game

3. Finding the optimal policy for the agent using Dynamic Programming

3.1 Compute the optimal policy for the Frozen Lake Environment using value iteration method

3.2 Compute the optimal policy for the Frozen Lake Environment using policy iteration method

4. Implementing Monte Carlo prediction method using blackjack game

4.1 Every-visit MC prediction

4.2 First-visit MC prediction

5. Implementing on-policy MC control method using the epsilon-greedy policy for the blackjack game

6. Implementing Temporal Difference prediction for the Frozen lake environment for a random policy

7. Computing the optimal policy using on-policy TD control – SARSA

8. Computing the optimal policy using off-policy TD control – Q-learning

9. Multi-Armed Bandit problem

9.1 Creating a MAB in Gym

9.2 Compute the best arm using various exploration strategies such as epsilon-greedy and softmax exploration method.

10. Application of MAB – Finding the best advertisement banner for a web site using MAB

Targeted Application & Tools that can be used :

 Execution of the RL algorithms will be done using the environments provided by OpenAI's Gym and Gymnasium of Farama Foundation in "Colab", available at https://colab.research.google.com/ or Jupyter Notebook.

Laboratory tasks will be implemented using the necessary libraries available in Python

---

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

---

Students can be given group assignments to develop different gaming environments and implement the RL algorithms

---

Text Book

Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT press, Second Edition, 2018.

Sudharshan Ravichandiran, "Deep Reinforcement Learning with Python", Packt Publishers, Second Edition, 2020

References

Laurra Graesser and Wan Loon Keng, "Foundations of Deep Reinforcement Learning", Pearson, 2022

https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/

Course Code: CSE 3012	Course Title: Time Series Analysis Type of Course: Laboratory Integrated		L-T-P- C	2	2	3
Version No.	1					
Course Pre-requisites	CSE 3001 Artificial Intelligence and Machine Learning					
Anti-requisites	--					
Course Description	The course will provide a basic introduction to modern time series analysis. This course teaches time-series analysis and the methods used to predict, process, and recognize sequential data. The objective of the course is to give students a better understanding of the concepts and the tools in time series analysis. The course develops a comprehensive set of tools and techniques for analyzing various forms of time series and for understanding the current literature in applied time series econometrics. This course covers time series regression and exploratory data analysis, ARMA/ARIMA models, model identification/estimation/linear operators, Fourier analysis, spectral estimation, and state space models.					
Course Objective	This course is designed to improve the learners "EMPLOYIBILITY SKILLS" by using EXPERIENTIAL LEARNING techniques. Lecturers on the Time Series Analysis facilitates the Peer Learning and group projects on real time applications.					
Course Out Comes	On successful completion of the course the students shall be able to: Understand basic concepts in time series analysis and forecasting. [Understand] Understand the use of time series models for forecasting and the limitations of the methods. [Understand] Develop time series regression models. [Application] Compare with multivariate times series and other applications. [Comprehension]					
Course Content:						
Module 1	INTRODUCTION OF TIMESERIES ANALYSIS	Assignment	Data Collection/Interpretation	L[6] +P[2] Sessions		
Topics: Introduction to Time Series and Forecasting -Different types of data-Internal structures of time series-Models for time series analysis-Autocorrelation and Partial autocorrelation. Examples of Time series Nature and uses of forecasting-Forecasting Process-Data for forecasting – Resources for forecasting.						

Graphical Displays -Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments- General Approach to Time Series Modeling and Forecasting- Evaluating and Monitoring Forecasting Model Performance.

Module 2	TIME SERIES REGRESSION MODEL	Assignment/Quiz	Case studies	L[6] +P[3] Sessions

Topics:

Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression- Prediction of New Observations - Model Adequacy Checking -Variable Selection Methods in Regression - Generalized and Weighted Least Squares- Regression Models for General Time Series Data- Exponential Smoothing-First order and Second order.

Module 3	AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS	Quiz	Case studies	L[10] +P[2] Sessions

Topics:

Autoregressive Moving Average (ARMA) Models - Stationarity and Invertibility of ARMA Models - Checking for Stationarity using Variogram- Detecting Nonstationarity - Autoregressive Integrated Moving Average (ARIMA) Models - Forecasting using ARIMA - Seasonal Data - Seasonal ARIMA Models- Forecasting using Seasonal ARIMA Models Introduction - Finding the "BEST" Model - Example: Internet Users Data- Model Selection Criteria - Impulse Response Function to Study the Differences in Models - Comparing Impulse Response Functions for Competing Models .

Module 4	MULTIVARIATE TIME SERIES MODELS AND FORECASTING	Assignment	Case studies	L[8] +P[1] Sessions

Topics:

Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting.

List of Laboratory Tasks:

Loading, Preprocessing and Handling Time series data.

Fitting and plotting by Modified Exponential Curve.

Estimating and eliminating trend using Aggregation, Smoothing and Polynomial Fitting.

Eliminating Trend and Seasonality via Differencing and Decomposition.

Fitting of Trend using Moving Average Method.
Forecasting by Exponential Smoothing, ARIMA.
Forecasting by Seasonal autoregressive integrated moving average model (SARIMA).
Develop Time series model using Multivariate Analysis models via Canonical Correlation
Develop Time series model using Multivariate Analysis models via Structural Equation Modeling.
Develop Time series model using Inter Dependence Techniques via Factor Analysis.
Develop Time series model using Inter Dependence Techniques via Cluster Analysis.

Targeted Application & Tools that can be used
Target Applications:
HealthCare Industries.
Manufacturing Industries.
Cyber Security.
Smart Intelligent systems.
Tools:
Python
R
MATLAB
XLSTAT
Tableau
Qlik Sense

Project work/Assignment:

Assignment:
Predicting changes in the thickness of Ozone layer based on its time-series data from 1926 – 2016.
Examine the South African GDP on a period from 1960 to 2016. Our data contains 226 observations and has been obtained from OECD Statistics.
Developing an ARIMA model to forecast the monthly Australian gas production level for the next 12 months.

Text Book
T1 Douglas C. Montgomery, Cheryl L. Jen , Introduction To Time Series Analysis And Forecasting,

4th Edition, Wiley Series In Probability And Statistics, 2019.

https://b-ok.cc/book/2542456/2fa941

T2 Dr. Avishek Pal , Dr. Pks Prakash , Master Time Series Data Processing, Visualization, And

Modeling Using Python, 2019.

https://b-ok.cc/book/3413340/2eb247

T3 John Wiley & Sons , Time Series Analysis And Forecasting By Example ,Technical University Of

Denmark, 2021.

https://b-ok.cc/book/1183901/9be7ed

References

R1 Peter J. Brockwell Richard A. Davis Introduction To Time Series And Forecasting Third Edition.(2016).

R2 Multivariate Time Series Analysis and Applications William W.S. Wei Department of Statistical

Science Temple University, Philadelphia, PA, SA This edition first published 2019 John Wiley & Sons

Ltd.

R3 Time Series Analysis by James D Hamilton Copyright © 2020 by prince town university press.

E book link R1: https://b-ok.cc/book/2802612/149485

E book link R2: https://b-ok.cc/book/3704316/872fbf

E book link R3: https://b-ok.cc/book/3685042/275c71

R3 Web resources:

https://www.coursera.org/learn/practical-time-series-analysis

https://ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/download-course-materials/

https://swayam.gov.in/nd1_noc19_mg46/preview

Topics relevant to development of "Skill Development":

Systematic variation in time series data

Autoregressive Models Exponential smoothing models or esms Generating forecasts on time series Topics relevant to development of "Employability Skills" Time series analysis to Monitor and access water resources. Remote Sensing time series analysis for Crop Monitoring. Satellite Image Time series Analysis. Waste Monitoring and Analysis.					

Course Code: CSE3017	Course Title: Autonomous Navigation and Vehicles Type of Course : Theory	L-T- P- C	3	0	3
Version No.	1.1				
Course Pre-requisites	Real-time embedded programming Optimal estimation and control Linear algebra				
Anti-requisites	NIL				
Course Description	Overview of technologies vehicles including sensors, sensing algorithms, machine learning, localization, mapping, object detection, tracking, communication and security. Hands-on implementation of robotic sensing and navigation algorithms on both simulated and physical mobile platforms. This course covers the mathematical foundations and state-of-the-art implementations of algorithms for vision-based navigation of autonomous vehicles (e.g., mobile robots, self-driving cars, drones). It culminates in a critical review of recent advances in the field and a team project aimed at advancing the state-of-the-art. Topics include: Autonomous driving technologies overview, Object Recognition and Tracking, Localization with GNSS, Visual Odometry, Perceptions In Autonomous driving, Deep learning in Autonomous Driving Perception, Prediction and Routing, Decision planning and control				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:				

	Understand the Autonomous system's and its requirements. Explain algorithm, sensing, object recognition and tracking of an Autonomous system. [Understand]
	Do the error analysis of Localization systems and use the tools and techniques,[Analyze]
	Explain, plan and control the traffic behavior, and shall be able to do lane level routing and create simple algorithms. [Application]
	Explain Plan and control motion, choose proper client systems for automotive vehicles and understand the cloud platform.[Application]
Course Content:	

Module 1	12 Sessions
Introduction to autonomous driving: Autonomous driving technologies overview, autonomous driving algorithms: Sensing, Perception. Object Recognition and Tracking: Autonomous driving client system, driving cloud platform, Robot Operating System, HD Map Production, Deep learning Model Training, Localization with GNSS: GNSS overview, GNSS error analysis, satellite based augmentation systems, real time kinematic and differential GPS, precise point positioning, Visual Odometry: Stereo Visual Odometry, Monocular Visual Odometry, Visual Inertial Odometry, Dead Reckoning and Wheel Odometry.	
Module 2	8 Sessions
Perceptions In Autonomous driving: Introduction, Datasets, Detection, Segmentation, Sterio, Optical flow and Scene flow. Deep learning in Autonomous Driving Perception: Convolutional Neural Networks, Detection, Semantic segmentation, Stereo and optical flow.	
Module 3	10 Sessions
Prediction and Routing: Planning and control overview, Traffic prediction: Behaviour prediction as classification, Vehicle trajectory generation, Lane level routing: Constructing a weighted directed graph for routing, typical routing algorithms, routing graph cost.	
Module 4	08 Sessions
Decision planning and control: Behavioral decisions, Motion planning, Feedback control Reinforcement Learning Based Planning and Control, Client systems for Autonomous Driving: Operating systems and computing platform Cloud platform for Autonomous driving: Introduction, infrastructure, simulation.	
Targeted Application & Tools that can be used:	
Applications: Obstacle Avoidance, Path Planning, Autonomous Vehicles.	
Tools: MIDGUARD A Simulation platform for Autonomous Vehicle navigation.	
Project Work/Assignment:	

1. Develop a system that avoids obstacles in the path.

2. To develop a cloud based autonomous navigation, what are the parameters should be considered, draw a framework for the navigation system.

Text Book
T1: Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc, Creating Autonomous Vehicle Systems Morgan & Claypool Publishers 2nd Edition, 2019
T2: Ronald K. Jurgen Autonomous Vehicles for Safer Driving SAE International Edition , 2019

References
R1. Hod Lipson, Melba Kurman Driverless: Intelligent Cars and the Road ahead MIT Press. 1st Edition, 2016
R2. Markus Maurer, J. Christian Gerdes, Barbara Lenz Autonomous Driving: Technical, Legal and Social Aspects 1st Edition, 2016
R3. Hannah YeeFen Lim, Autonomous Vehicles and the Law: Technology, Algorithms and Ethics ,Edward Elgar Publishing. 1st Edition, 2018
Web Resources: http://pu.informatics.global

Topics relevant to development of "Employability":
Deep Learning Models, Convolutional Neural Networks, Vehicle trajectory generation, Decision planning, Reinforcement learning.

Course Code: CSE3018	Course Title: Digital Health and Imaging Type of Course: Program Core& Theory Only	L-T- P-C	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE3008: Machine Learning Techniques				
Anti-requisites	-				
Course Description	This course will give an overview of digital health and its impact on healthcare, Image enhancement techniques, filtering, and restoration. Medical Imaging, health informatics, Health data analytics and predictive modeling.				
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				

Course Out Comes	On successful completion of the course the students shall be able to:
	1.Understand the role of digital health's impact in ethical and legal considerations. [Understand]
	2. Apply Machine learning techniques for medical image analysis. [Application]
	3. Apply Computer-aided detection and diagnosis in medical imaging. [Application]
	4. Apply Health data analytics and predictive modeling. [Application]

Course Content:				
Module 1	Introduction to Digital Health and Digital Image	Assignment	Theory	L : 8

Introduction to Digital Health

Overview of digital health and its impact on healthcare, Introduction to telemedicine, wearables, and health monitoring devices, Ethical and legal considerations in digital health.

Digital Image Processing Fundamentals:

Digital image representation and properties, Image enhancement techniques, Image filtering and restoration, Image segmentation and feature extraction

Module 2	Medical Imaging Modalities	Assignment	Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions	L: 10

Medical Imaging Modalities: Principles and applications of various medical imaging modalities. X-ray imaging, computed tomography (CT), and magnetic resonance imaging (MRI) , Ultrasound imaging and nuclear medicine imaging, Imaging modalities for specific healthcare domains (e.g., radiology, cardiology)

Module 3	Image Analysis in Healthcare	Assignment /Quiz	Researching and reviewing academic papers or industry publications on specific AI applications	L:12

Image registration and fusion techniques, Quantitative image analysis for disease diagnosis and treatment planning, Computer-aided detection and diagnosis in medical imaging, Machine learning in medical image analysis.

Health Informatics and Electronic Health Records, Introduction to health informatics and electronic health records (EHR), EHR systems and interoperability, Data privacy, security, and regulatory considerations in health informatics.

Module 4	Digital Health Applications and Innovations	Assignment	Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.	L: 10

Mobile health (mHealth) applications and remote patient monitoring, Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health. Emerging technologies and trends in digital health.

Targeted Application & Tools that can be used:

Applications: Quantitative image analysis for disease diagnosis, Mobile health (mHealth

Tools: TensorFlow, PyTorch, Computer-aided detection

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assignments can involve researching and reviewing academic papers or industry publications on specific AI applications in engineering / Students may be given programming assignments to implement AI algorithms / Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions / Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.

Text Book

"Digital Health: Scaling Healthcare to the World" by Paul Sonnier-2020

Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods

"Biomedical Signal and Image Processing" by Kayvan Najarian and Robert Splinter

References

Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley , 2021..

"Introduction to Health Informatics" by Mark S. Braunstein

https://talentsprint.com/course/ai-digital-health

https://www.udemy.com/topic/medical-imaging/

Course Code:	Course Title: Stochastic Decision Making					
CSE3019	Type of Course: Program Core& Theory Only		L-T- P- C	3	0	3
Version No.	1.0					
Course Pre- requisites	MAT1003: Applied Statistics					
Anti-requisites	-					
Course Description	Stochastic Decision Making is an advanced-level course designed to build upon the foundational knowledge of artificial intelligence (AI) and its applications in engineering. This course aims to provide engineering students with an in-depth understanding of Stochastic techniques, algorithms, and emerging trends that are shaping the future of Agent-driven engineering systems. Through theoretical concepts, live examples, and case studies, students will explore cutting-edge building intelligent agents methodologies and their application in solving complex partially observable environment.					
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Understand the role of knowledge-based agents and Apply logic in problem-solving [Understanding] 2. Apply dynamic System concepts to find an optimal policy in partially observable environment. [Application] 3. Implementation of various detection techniques and hypothesis for taking the decision in the real time environment [Application] 4. Apply various Project Scheduling strategies to solve the decision problem. [Application]					
Course Content:						
Module 1	Intelligent Agents and Searching Techniques	Assignment	Theory		L : 10	
Introduction - Structure of Intelligent Agents - Agent programs - Simple reflex agents - Goal-based agents - Utility-based agents - Agents and Environments - Properties of task environments - fully observable vs. partially observable - Deterministic vs. stochastic. Static vs, dynamic, Discrete vs. continuous, Single agent vs. multiagent						

Searching Techniques: Solving Problems by Searching - Problem-Solving Agents - Formulating Problems - Real-world problems - Searching for Solutions - Search Strategies - Breadth-first search - Uniform cost search - Depth-first search - Depth-limited search -

Module 2	Dynamic Systems	Assignment	Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions	L: 10

Dynamic Programming -   Decision Trees - Deterministic Decision Trees , Stochastic Decision Trees scenario tree , Stochastic Dynamic Programming, Markowitz' model Comparing the Deterministic and Stochastic Objective values.

Recourse Problems - Outline of Structure - Knowledge Engineering - The Electronic Circuits Domain - General Ontology - The Grocery Shopping World.

Problem Reduction: Finding a Frame, Removing Unnecessary Columns, Removing Unnecessary Rows, Reducing the Complexity of Feasibility Tests

Module 3	Detection and decisions	Assignment /Quiz	Researching and reviewing academic papers or industry publications on specific AI applications	L:10

Detection and decisions : Decision criteria and the maximum a posteriori probability criterion, Binary MAP detection, Binary detection with a minimum-cost criterion, The error curve and the Neyman–Pearson rule, The min–max detection rule

 Hypothesis testing : Sufficient statistics with M ≥ 2 hypotheses, More general minimum-cost tests, Binary hypotheses with IID observations,

Feasibility in Networks: The un-capacitated case, Generating Relatively Complete Recourse, An Investment Example

Module 4	Project Estimation and Scheduling	Assignment	Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.	L: 10

Project Estimation : Introduction - The squared-cost function, Other cost functions. MMSE estimation for Gaussian random vectors- Scalar iterative estimation, The vector space of random variables; orthogonality MAP estimation and sufficient statistics

Project Scheduling : PERT as a Decision Problem , Introduction of Randomness, Bounds on the Expected Project Duration, Series reductions, Parallel reductions, Disregarding path dependences, Arc duplications ,Using Jensen's inequality,

Targeted Application & Tools that can be used:

Applications: Object detection, image classification, Sentiment analysis, language translation, Speech recognition, speaker identification, emotion recognition, Personalized product recommendations etc.

Tools: OpenCV, TensorFlow, PyTorch, NLTK (Natural Language Toolkit), OpenAI Gym

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assignments can involve researching and reviewing academic papers or industry publications on specific AI applications in engineering / Students may be given programming assignments to implement AI algorithms / Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions / Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.

Text Book

Peter Kall, Stein W. Wallace, "Stochastic Programming," Springer 2020

Robert G. Gallager, "Stochastic Processes Theory for Applications", Cambridge University Press 2019

References

Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley , 2021..

Laurra Graesser and Wan Loon Keng, "Foundations of Deep Reinforcement Learning", Pearson, 2022

https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/

Course Code: CSE3088	Course Title: Business Intelligence and Analytics Type of Course:1] Theory	L-T- P-C	3	0	3
Version No.	1.0				

Course Pre-requisites	CSE1002: Programming using Python
	CSE2012: Database Management Systems
Anti-requisites	NIL
Course Description	The purpose of the course is to instill a strong foundation of scientific process orientation that is the cornerstone of effective. Business Intelligence (BI) is a set of architectures, theories, methodologies and technologies that transform structured, semi-structured and unstructured data into meaningful and useful information. Students will analyze enterprise data requirements to develop queries, reports and build OLAP cubes that use business analytics to answer complex business questions.
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Out Comes	On successful completion of this course the students shall be able to:
	Discuss the impact of Business Intelligence (BI) theories, architectures, and methodologies on the organizational decision making process.[Comprehension]
	Analyse the differences between the structured, semi-structured and unstructured data types to leverage the best technologies.[Application]
	Develop Ad hoc queries, reports, spread sheets, dashboards and mobile BI applications.[Application]
	Using business analytics to answer complex business questions using data from a variety of sources, such as data files and relational/NoSQL databases.[Knowledge]
Course Content:	

Module 1	An Overview of Business Intelligence, Analytics (Comprehension)	Assignment		10 Hours

Topics:

A Framework for Business Intelligence (BI). Intelligence Creation Use and BI Governance. Transaction Processing Versus Analytic Processing. Successful BI Implementation. Analytics Overview. Brief introduction to Big Data Analytics.

Module 2	Business Reporting, Visual Analytics and Business Performance (Knowledge)	Assignment		10 Hours

Topics:

Management Business Reporting Definitions and Concepts. Data and Information Visualization. Different Types of Charts and Graphs. The Emergence of Data Visualization and Visual Analytics. Performance Dashboards. Business Performance Management.

Performance Measurement. Balanced Scorecards. Six Sigma as a Performance Measurement System.				
Module 3	Big Data and Analytics (Application)	Assignment		10 Hours
Topics:				
Definition of Big Data. Fundamentals of Big Data Analytics. Big Data Technologies. Data Scientist. Big Data and Data Warehousing. Big Data Vendors. Big Data and Stream Analytics. Applications of Stream Analytics.				
Module 4	Emerging Trends and Future Impacts (Application)	Assignment		10 Hours
Topics:				
Location-Based Analytics for Organizations. Analytics for Consumers. Recommendation Engines. The Web 2.0 Revolution and Online Social Networking. Cloud Computing and BI. Impacts of Analytics in Organizations: An Overview. Issues of Legality, Privacy, and Ethics. The Analytics Ecosystem.				
Targeted Application & Tools that can be used: Anaconda/Google Colab, Google Data Studio, Deep Note				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Gain an immersive understanding of the practices and processes used by a junior or associate data analyst in their day-to-day job				
Learn key analytical skills (data cleaning, analysis, & visualization) and tools (spread sheets, SQL, R programming, Tableau)				
Text Book

C. Albright and W. L. Winston " Business Analytics: Data Analysis & Decision Making ", Cengage Learning India Pvt. Ltd ; Sixth Edition , September 2019

S. Christian, and L.Wayne, "Business Analytics: Data Analysis and Decision Making with MindTap". Second Edition , September 2022 | | | | |

References

R1.   Ramesh Sharda, Dursun Delen, Efraim Turban " Analytics, Data Science, & Artificial Intelligence (10th ed.). Upper Saddle River, NJ: Pearson. ISBN- 9781292341552, Second Edition   6 March 2020

R2.   Jose, J. and Lal, S.P. :Introduction to Computing & problem solving with Python, Khanna Book Publishing First edition 2019

R3.   B. Mt Wan " Data Analytics using Python ", 9th Edition, published by Pearson Education 2020.

R4.   Ramesh Sharda "Business Intelligence Analytics And Data Science A Managerial Perspective" 4Th Edition , Pearson India, April 2019.

Web links

R1. http://owl.english.purdue.edu/owl/resource/560/01/

R2. http://myregisapp.regis.edu/Citrix/StoreWeb/

R3. https://in.coursera.org/courses?query=business%20intelligence

R4. https://www.coursera.org/learn/business-intelligence-data-analytics

R5. https://www.udemy.com/course/business-intelligence-and-data-analytics/

Topics relevant to development of "Employability": Business Intelligence, Big Data Analytics, Data Scientist.

Course Code: CSE3103	Course Title: Cognitive Science & Analytics Type of Course : Theory	L-T- P- C	3	0	3
Version No.	1.1				
Course Pre-requisites	CSE3008: Machine Learning Techniques				
Anti-requisites	NIL				
Course Description	Overview of biological structure and artificial network, sensing algorithms, machine learning, localization. Hands-on implementation of cognitive recognition algorithms on both simulated and physical platforms. This course covers the mathematical foundations and state-of-the-art implementations of algorithms for cognitive analysis. It culminates in a critical review of recent advances in the field and a team project aimed at advancing the Reasoning.				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the different neural network models. [Understand] Understand cognition systems and its requirements. [Understand] Apply dynamic System concepts in Cognitive Science and Neuroeconomics. [Application] Apply Cognitive Science in Learning and Reasoning. [Application]				
Course Content:					

Module 1		8 Sessions

Introduction to Biological Neuron: Structure of Neuron, Action Potential, Process of Action Potential, Process of Synaptic Transmission, Stimulate the synaptic vesicle, Depolarization of the neuron,

Memory (Biological Basis): Theories of Memory Formation, System Consolidation Theory, Multiple-Trace Theory, Reconsolidation Theory,

Artificial Neural Network: Models of single neurons, Different neural network models. Single Layer Perceptron: Least mean square algorithm, Learning curves, Learning rates, Perceptron.

Bayesian Network, Degree of Belief, Conditional Probability, Bayes's Rule

Module 2	12 Sessions

Cognitive Architecture: Fundamental Concepts, Cognitive View, Computers in Cognitive Science, Applied Cognitive Science, Interdisciplinary Nature of Cognitive Science, Nature of Cognitive Psychology, Notion of Cognitive Architecture, Global View of the Cognitive Architecture, Cognitive Processes, Working Memory, and Attention. Neuroscience: Brain and Cognition, Introduction to the Study of the Nervous System, Organization of the Central Nervous System, Neural Representation, Neuropsychology, Computational Neuroscience,	
Module 3	10 Sessions
MO D E L S AN D TOO LS : The Physical Symbol System Hypothesis :Intelligent Action and the Physical Symbol System, Neural based Models of Information Processing. Cognitive Science and Dynamical Systems, Applying Dynamical Systems. Neuroeconomics: Perception as a Bayesian Problem, Neuroeconomics: Bayes in the Brain Strategies for Brain Mapping, Studying Cognitive Functioning: Techniques from Neuroscience	
Module 4	08 Sessions
Application: Models of Language Learning- Language Learning in Neural Networks, Bayesian Language Learning, Language Acquisition, Natural Language Processing, Semantics. Neural Network Models of Children's Physical Reasoning, Cognitive Science and the Law, Autonomous Vehicles: Combining Deep Learning and Intuitive Knowledge,	
Targeted Application & Tools that can be used: Applications: Behavior-Based Robotics Tools: SHAKEY's Software, Logic Programming in STRIPS and PLANEX	
Project Work/Assignment: 1. Develop a Model for Cognition and Knowledge Representation 2.Develop a Model for Biorobotics- Insects and Morphological Computation	
Text Book T2: José Luis Bermúdez, COGNITIVE SCIENCE l Publishers 3rd Edition, Cambridge University Press,2020 T2: Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc, COGNITIVE SCIENCE Publishers 3rd Edition, Cambridge University Press,2020	
References R1. Hod Lipson, Melba Kurman Driverless: Intelligent Cars and the Road ahead MIT Press. 2nd Edition, 2019 R2. Markus Maurer, J. Christian Gerdes, Barbara Lenz Autonomous Driving: Technical, Legal and Social Aspects 12n Edition, 2020 R3. Hannah YeeFen Lim, Autonomous Vehicles and the Law: Technology, Algorithms and Ethics ,Edward Elgar Publishing. 2nd Edition, 2019	

Topics relevant to development of "Employability":

Deep Learning Models, Convolutional Neural Networks, Vehicle trajectory generation, Decision planning, Reinforcement learning.

Course Code: CSE3108	Course Title: Expert Systems	L-T- P-C	3	0	3
	Type of Course: Program Core& Theory Only				
Version No.	1.1				
Course Pre-requisites	CSE3008: Machine Learning Techniques				
Anti-requisites	NIL				
Course Description	This course is an introduction to expert systems, which is an integral part of the computer science curriculum. In this course, we learn how theory and applications complement each other. Both theory and application are presented. Students are provided with the various tools language which they can use to develop systems of their own. By integrating theory with a fully functional means of applying that theory to real-world situations, students will gain an appreciation for the role played by expert systems in today's world.				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: [1] Understand the various AI programming knowledges. [2] Apply the expert system techniques for specific task completion. [3]Design and Develop expert systems using appropriate knowledge-based tools.				
Course Content:					

Module 1	Introduction to AI programming knowledges	Case study	Programming Task	12 Sessions

Introduction to AI programming languages, Blind search strategies, Breadth-first – Depth-first – Heuristic search techniques Hill Climbing – Best first – A Algorithms AO* algorithm – game tress, Min-max algorithms, game playing – Alpha-beta pruning. Knowledge representation issues predicate logic – logic programming Semantic nets- frames and inheritance, constraint propagation; Representing Knowledge using rules, Rules-based deduction systems.

Module 2	Expert System tools	Assignment	Tools	14 Sessions

Introduction to Expert Systems, Architecture of expert system, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems.

Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, system-building aids, support facilities, stages in the development of expert systems.

Module 3	Building an expert systems	Assignment	Programming	16 Sessions

Building an Expert System: Expert system development, Selection of the tool, Acquiring Knowledge, Building process.

Problems with Expert Systems: Difficulties, common pitfalls in planning, dealing with domain experts, difficulties during development.

Targeted Application & Tools that can be used:

AI related tools and knowledge based tools for expert system.

Project work/Assignment:

Assignment 1:Task on FuzzyCLIPS.

Assignment 2: Back-propagation algorithm for training Neural Networks (NN)

Text Book

T1.Elain Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, New Delhi.

T2. Introduction to Expert Systems, Jackson P. , 3rd edition, Addison Wesley, ISBN 0-201-87686-8

T2.Waterman D.A., "A Guide to Expert Systems", Addison Wesley Longman

References

R1. Stuart Russel and other Peter Norvig, "Artificial Intelligence – A Modern Approach", Prentice-Hall,

R2.Patrick Henry Winston, "Artificial Intelligence", Addison Wesley,

R3.Patterson, Artificial Intelligence & Expert System, Prentice Hall India,1999.

R4.Hayes-Roth, Lenat, and Waterman: Building Expert Systems, Addison Wesley,

R5.Weiss S.M. and Kulikowski C.A., "A Practical Guide to Designing Expert Systems", Rowman &Allanheld, New Jersey

.

Weblinks:

https://onlinelibrary.wiley.com/journal/14680394

https://www.youtube.com/watch?v=11nzrNkn9D8

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost- live&ebv=EB&ppid=pp_xiii

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost- live

Course Code: CSE3072	Course Title: Wireless Sensor Networks	L-T- P-C	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE-236 Principles of Data Communications and Computer Networks				
Anti-requisites	NIL				
Course Description	This course examines wireless cellular, ad hoc and sensor networks, covering topics such as wireless communication fundamentals, medium access control, network and transport protocols, uni cast and multicast routing algorithms, mobility and its impact on routing protocols, application performance, quality of service guarantees, and security. Energy efficiency and the role of hardware and software architectures may also be presented for sensor networks.				

Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING TECHNIQUES			
Course Out Comes	On successful completion of the course the students shall be able to: Explain the basics of the Wireless systems. Describe different protocols being used by wireless networks including ABR and MANETS. Illustrate the Fundamental Concepts and applications of ad hoc and wireless sensor networks. Interpret the WSN routing issues by considering related QoS measurements.			
Course Content:				
Module 1	Overview of Wireless Sensor and Adhoc Networks	Assignment	Data Interpretation	08 Sessions
Topics: Introduction, Sensor Network Technology background, Elements of basic Sensor Network Architecture, Survey of Sensor Networks, Network Characteristics and Challenges, Applications of Wireless Sensor Networks, Range of Applications, Category 2 WSN Applications – Home Control, Industrial Automation, Medical Applications, Category 1 WSN Applications – Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Introduction to Cellular and Adhoc Networks, Issues in Adhoc Networks – Routing, Multicasting, QoS, Security, Scalability.				
Module 2	Wireless Transmission Technology and MAC Protocols for Adhoc	Assignment	Basics and Interpretation	13 Sessions
Topics: Introduction, Radio Technology Primer – Propagation and Modulation, Propagation and Modulation impairments, Available Wireless Technologies, Campus Applications, MAN/WAN Applications, Medium Access Control Protocols – Fundamentals, Performance Requirements, MAC Protocols for WSNs -Schedule based Protocols and Random Access based Protocols, Sensor MAC case study, Issues in Designing MAC Protocol for Adhoc Networks - Bandwidth efficiency, QoS support, Synchronization, error-prone broadcast channel, Mobility of nodes.				
Module 3	Routing Protocols for Adhoc and WSN	Quiz	Questions Set	9Sessions
Topics:				

Background, Data Dissemination and gathering, Routing challenges, Network Scale and Time-Varying Characteristics, Routing Strategies, characteristics of an ideal Routing Protocol for Adhoc Networks, WSN Routing Techniques, Classifications of Routing Protocols, Table-driven and on-demand Routing Protocols, Routing Protocols with efficient flooding mechanism.

Module 4	Demonstration of WSN Adhoc Network using Simulators	Quiz	Questions Set	8 Sessions

Topics:

GloMoSim Simulator, TOSSIM, OMNeT++ and other recent available simulation tools (MATLAB wireless module, NS2, etc).

Targeted Application & Tools that can be used:

This course helps the students to understand the concepts related to Wireless Sensor and Adhoc and networks.by using simulation tools in several educational associations and research hubs. For this reason, the study of existing experimental tools for analyzing the behavior of WSNs has become essential, with wireless sensor networks that include NS-2, OMNeT++, Prowler, OPNET, and TOSSIM.

Project work/Assignment:

Project Assignment:

Resource Allocation Robust to Traffic and Channel Variations in Multihop Wireless Networks.

Evaluation Models for the Nearest Closer Routing Protocol in Wireless Sensor Networks

Assignment:

1]Define Wireless Sensor Networks? Explain in brief about the Applications of Wireless SensorNetworks

2] Discuss the advantages and applications of sensor networks?

3] Discuss the design considerations of physical layer and transceiver?

Text Book

T1: Kazem Soharby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley Publication, 2016, ISBN : 978-81-265-2730-4

T2: C. Siva Ram Murthy and B. S. Manoj, Adhoc Wireless Networks – Architecture and Protocols, Pearson Publication, 2013. ISBN: 978-81-317-0688-6

References

R1: Jagannathan Sarangapani, Wireless Adhoc and Sensor Networks – Protocols, Performance and Control, CRC Press 2017, e-book ISBN: 9781315221441

R2: Chai K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall Publisher 2007, ISBN : 0-13-007617-4

R3: https://networksimulationtools.com/glomosim-simulator-projects/

R4 R4 : http://vlabs.iitkgp.ac.in/ant/8/

Ca Case study link:https://www.academia.edu/33109763/A_Case_Study_on_Mobile_Adhoc_Network_Security _for_Hostile_Environment
E book link : http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w03.pdf
E book link : https://referenceglobe.com/CollegeLibrary/library_books/20180301073312adhoc2-ilovepdf-compressed.pdf
R3 Web resources: https://archive.nptel.ac.in/courses/106/105/106105160/- IIT KGP, Prof. SUDIP MISHRA
Web resources: https://www.digimat.in/nptel/courses/video/106105160/L22.html - IIT KGP, Prof. SUDIP MISHRA
Topics relevant to development of "Skill Development":Sustainable development tools, Integrity Availability Concepts Policies, procedures,Guidelines, infrastructure-less wireless network that is deployed in a large number of wireless sensors.

Course Code: CSE3083	Course Title: Advanced Computer Architecture Type of Course: Discipline Elective		L-T- P-C	3	0	3
Version No.	1.0					
Course Pre-requisites	CSE 2009 Computer Organization and Architecture					
Anti-requisites	NIL					
Course Description	This course introduces the principles and classes of parallelism in computation and architectures of different levels of parallel processing from intermediate to advanced level. This theory-based course emphasizes understanding advanced memory optimization techniques. It equips the students with the intuition behind Instruction level parallelism with pipelining and reducing the cost & hazards using dynamic scheduling. It helps the students to appreciate multiprocessing & thread level parallelism using shared, distributed and directory-based memory models for synchronization and consistency. The course also explores SIMD processors like Graphics Processing Units and Vector processors.					
Course Outcomes	On successful completion of the course the students shall be able to: 1] Discuss the concept of parallelism, virtualization, and memory optimization. 2] Interpret the practices to explore Instruction level parallelism with pipe lining and reducing the cost & hazards using dynamic scheduling. 3] Explain the intuition behind multiprocessing & thread level parallelism using shared, distributed and directory-based memory models for synchronization and consistency. 4] Discuss internal architecture of SIMD systems like Vector processors and GPUs.					
Course Content:						
Module 1	Flynn's classification and Memory Hierarchy	Assignment	Data Analysis task		10 Classes	

 Topics:

Defining Computer Architecture, Flynn's Classification of Computers, Metrics for Performance Measurement, Amdahl's Law, Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Virtual Memory and Virtual Machines, The Design of Memory Hierarchy.

Case Study: Memory Hierarchies in Intel Core i7 and ARM Cortex-A8.				
Module 2	Instruction Level Parallelism	Assignment	Analysis, Data Collection	9 Classes

Topics:

Concepts and Challenges, Superscalar architecture, Hazard Resolution and Timing Constraints, Out of Order Execution and Register Renaming, Reducing Branch Costs with Advanced Branch Prediction, Dynamic Scheduling, Advanced Techniques for Instruction Delivery and Speculation, Limitations of ILP.

Case Study: Dynamic Scheduling in Intel Core i7 and ARM Cortex-A8.

Module 3	Thread Level Parallelism	Case Study	Data analysis task	9 Classes

Topics:

Introduction, Shared-Memory Multicore Systems, Performance Metrics for Shared-Memory Multicore Systems, Prefetching, Cache Coherence Protocols, Synchronization, Memory Consistency.

Case Study: Intel Skylake and IBM Power8.

Module 4	Data Level Parallelism	Assignment	Analysis, Data Collection	9 Classes

 Topics:

Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, GPU Memory Hierarchy, Detecting and Enhancing Loop- Level Parallelism

Case Study: Nvidia Maxwell.

Targeted Application & Tools that can be used:

Targeted employment sector is processor manufacturing and memory chip fabrication vendors like Intel, AMD, Motorola, NVidia, Samsung, Micron Technology, western Digital etc. Targeted job profiles include Memory circuit design and verification engineers, Physical system design engineer, System programmer, Fabrication engineer etc.

Tools:
Virtual Lab, IIT KGP
Tejas – Java Based Architectural Simulator, IIT Delhi
Project work/Assignment:
Case Study:
Memory Hierarchies in Intel Core i7 and ARM Cortex-A8
Dynamic Scheduling in Intel Core i7 and ARM Cortex-A8
Term Assignments:
Comparative analysis of instruction set architecture (ISA) of CISC and RISC processors
Carry out a thorough analysis of the internal organization and Instruction set Architecture of state-of the art CISC processors like VAX, PDP-11, Motorola 68k, Intel's x86 and the best in the market RISC architectures including DEC Alpha, ARC, AMD 29k, Atmel AVR, Intel i860, Blackfin, i960, Motorola 88000, MIPS, PA-RISC, Power, SPARC, SuperH, and ARM too.
A short survey of the recent trends in advanced Cache memory optimization
Study and analyze few important present day cache memory optimization techniques the levels used, the mapping technique employed, read and write policies, coherency and consistency scenarios etc.
Text Book
J.L. Hennessy and D.A. Patterson, "Computer Architecture: A Quantitative Approach", 6th Edition, Morgan Kauffmann Publishers, November 2021.
References
J.P. Shen and M.H. Lipasti, "Modern Processor Design: Fundamentals of Superscalar Processors", 2nd Edition paperback imprint, McGraw-Hill Higher Education, 2013.

D.B. Kirk and W.W. Hwu, "Programming Massively Parallel Processors", 3rd Edition, Morgan Kauffmann Publishers, November 2016.

Topics relevant to development of "FOUNDATION SKILLS":   Pipelining, CISC and RISC processors, Static and Dynamic scheduling

 Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Collaboration and Data collection for Term assignments and Case Studies.

Course Code: CSE3085	Course Title: Real Time Operating Systems Type of Course:Theory	L-T- P-C	3	0	3
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The Real-time Operating Systems program is an educational and methodological document included in the master's educational program, provides for the acquisition of skills and competencies related to the study of the features of embedded operating systems, as well as real-time systems. Real-time Operating Systems is aimed at the formation of competencies aimed at obtaining theoretical knowledge about embedded operating systems, and the acquisition of practical skills and competencies in installing, configuring and debugging operating systems.				
Course Objective	This course is designed to develop ENTREPRENEURIAL SKILLS by using EXPERIENTIAL LEARNING Techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Explain the fundamentals of Real time systems and their classifications. Understand the concepts of System control and the suitable computer hardware requirements for real-time applications. Describe the operating system concepts and techniques applicable for real time systems. Apply deadlock detection and prevention algorithms to solve the given problem				
Course Content:					
Module 1		8 Sessions			

Introduction Real Time Operating System	
Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads, Scheduling	
Module 2	8 Sessions
BASICS OF REAL-TIME CONCEPTS	
Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel	
Module 3	8 Sessions
PROCESS MANAGEMENT	
Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals	
Module 4	8 Sessions
INTER-PROCESS COMMUNICATION: Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion, PIPES MEMORY MANAGEMENT: - Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection	
Text Book J. J Labrosse, "MicroC/OS-II: The Real –Time Kernel", Newnes, 2002. Jane W. S. Liu, "Real-time systems", Prentice Hall, 2000.	
References W. Richard Stevens, "Advanced Programming in the UNIX® Environment", 2nd Edition, Pearson Education India, 2011. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wley& Sons, 2004 Doug Abbott, "Linux for Embedded and Real-Time Applications", Newnes, 2nd Edition, 2011. Web resources:http://pu.informatics.global	
Topics relevant to development of "Skill Development":Threads: Multi-threading models, threading issues, thread libraries, synchronization	

Course Code: CSE3089	Course Title: Software Architecture	L-T-P-C	3	0	0	3

	Type of Course: Theory Only						
Version No.	2.0						
Course Pre-requisites	Software Engineering and Object-oriented Analysis and design						
Anti-requisites	NIL						
Course Description	This course deals with basic concepts and principles regarding software architecture and software design. It starts with discussion on importance of Architectures, design issues, followed by coverage on design patterns. It then gives an overview of architectural structures and styles. Practical approaches and methods for creating and analysing software architecture is presented. The emphasis is on the interaction between quality attributes and software architecture. Students will also gain experience with examples in design pattern application and case studies in software architecture.						
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PARTICIPATIVE LEARNING techniques						
Course Out Comes	COURSE OUTCOMES: On successful completion of the course the students shall be able to: CO1. Describe the importance of software architecture in large-scale software systems. CO2.Understand the major software architectural-styles, design-patterns, and frameworks. CO3.Distinguish the quality attributes of a System Architecture. CO4.Identify the appropriate architectural pattern(s) for a given scenario						
Course Content:							

Module 1	Introduction	Quiz	Introduction on S/W A	08 Sessions
Topics: The Architecture Business Cycle: Software processes and the architecture business cycle; What makes a "good" architecture. Influence of software architecture on organization-both business and technical, Architectural patterns, reference models and reference architectures; Architectural structures and views.				
Module 2	Architectural Styles and Case Studies	Quiz	Design	07 Sessions
Topics: Architectural styles; Four Architectural Designs for the KWIC System; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Service oriented architecture, Hypertext style, Repositories; Interpreters; Heterogeneous architectures. Case Studies: Keyword in Context, Mobile Robot system.				
Module 3	Quality: Functionality and architecture	Quiz	Quality Attributes	09 Sessions

Topics: Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Business qualities; Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics, Security tactics. Quality Model, Application of The Customized Quality Model to a Case Study			

Module 4	Architectural patterns and styles	Seminar	Architectural styles	17 Sessions

Topics: Architectural Patterns: Introduction; From Mud to Structure: Layers, Pipes and Filters, Blackboard, Distributed Systems: Broker. Design Patterns: Structural decomposition: Whole – Part; Organization of work: Master – Slave;

   Model View Controller and Reflection patterns. Introduction to Service Oriented Architecture,Three Types of Service-Oriented Architecture

Targeted Application & Tools that can be used:

Multiple integrations with other major architecture software (ArchX, Archisoft, Build software, Astena, Bouwsoft, Teamleader, Total Synergy, etc.) and export opportunities with google drive, dropbox, and CSV formats allow this tool to be widely and comfortably used in the industry.

Professionally used software–Slack, Google calendar, outlook email, and others.

Quiz and Seminar

Quiz on topics from the module 1,2 and 3. Seminar topics will be given to students to present in the class

Text Book

1. T1.Software Architecture in Practice–
LenBass,PaulClements,RickKazman,2ndEdition,Pearson Education, 2019.

T2.Pattern-OrientedSoftwareArchitecture,ASystemofPatterns-Volume1–FrankBuschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, John Wiley and Sons, 2019.

T3.MaryShawandDavidGarlan:SoftwareArchitecture-PerspectivesonanEmergingDiscipline, Prentice-Hall of India, 2007.

References

R1.DesignPatterns-ElementsofReusableObject-OrientedSoftware–
E.Gamma,R.Helm,R.Johnson,J. Vlissides:, Addison- Wesley, 1995.

E-Resources

W1. WebsiteforPatterns:http://www.hillside.net/patterns/

Topics relevant to the development of SKILLS:

CasestudyonArchitecturalstyles

ModelViewPresenter(MVP) Architecture

Course Code: CSE 2028	Course Title: Statistical Foundation of Data Science Type of Course: Integrated	L-T- P- C	2	2	3

Version No.	1
Course Pre-requisites	Basic knowledge about mathematical operations and statistics, Machine learning.
Anti-requisites	
Course Description	This course is intended for those developers who are interested in entering the field of data science and are looking for concise information on the topic of statistics with the help of insightful content based exercises, examples and simple explanation. This course gives in depth introduction to statistics and machine learning theory, methods, and algorithms for data science. It covers multiple regression, kernel learning, sparse regression, sure screening, generalized linear models and quasi-likelihood, covariance learning and factor models, principal component analysis and other related topics.
Course Objective	This course is designed to improve the learner's EMPLOYABILITY SKILLS by using real-world PROBLEM-SOLVING methodologies.
Course Out Comes	On successful completion of the course the students shall be able to: Identify the statistical concepts in the field of data science. (Knowledge) Apply logical thinking, solve the problem in context of High Dimensional Inference. (Application) Classify the relevant topics in statistics and supervised learning & unsupervised learning (Comprehension) Demonstrate different types of data classification real -world problems of data science applications. (Application)
Course Content:	

Module 1	Multiple and Nonparametric Regression	Assignment	Data Collection/Interpretation	10Sessions

Topics: Introduction, Multiple Linear Regression - The Gauss-Markov Theorem, Statistical Tests Weighted Least-Squares, Box-Cox Transformation, Model Building and Basis Expansions - Polynomial Regression, Spline Regression, Multiple Covariates, Ridge Regression - Bias-Variance Tradeoff , Penalized Least Squares, Bayesian Interpretation, Ridge Regression Solution Path, Kernel Ridge Regression,

Module 2	High Dimensional Inference	Case studies	Case studies / Case let	10 Sessions

Topics: Inference in linear regression - Debias of regularized regression estimators, Inference in generalized linear models, Test of linear hypotheses, Numerical comparison - Asymptotic efficiency, Statistical efficiency and Fisher information, Linear regression with random design, Partial linear regression, Gaussian graphical models - Inference via penalized least squares, Sample size in regression and graphical models, General solutions.

Module 3	Mathematics of machine learning	Quiz	Case studies	10 Sessions

Topics: Bayesian modelling and Gaussian processes, randomized methods, Bayesian neural networks: approximate inference, variational autoencoders, generative models, applications. Recurrent neural networks, backpropagation through time, Long short term memory networks, neural Turing machines, machine translation, Restricted Boltzmann Machin

Module 4	Advanced Neural Networks	Quiz	Case studies	10 Sessions

Convolutional neural network, Prediction of data using Convolutional Neural Networks, Generative adversarial networks-Deep learning in Sequential Data, RNN(Recurrent Neural Networks) & LSTM(Long Short Term Memory), GRU(Gated Recurrent Unit), Sentiment Analysis, Recommender systems.

List of Laboratory Tasks:

Experiment No 1:   Working with Numpy arrays

Level 1:   Basic Statistics, Copying, & Subsetting, Indexing, Flattening,

Level 2: Dealing with Missing Values, and filling with missing values

Experiment No. 2: Working with Pandas data frames

Level 1: Descriptive Statistics, Basic statistical functions

Level 2: Statistical functions, Aggregations

Experiment No. 3: Develop python program for Basic plots using Matplotlib

Level 1: Plot, Line, Scatter Plot, Pie Charts, Bars, Histogram, Box Plots

Level 2: Time Series, Categorical Data, and Text Data

Experiment No. 4: Develop python program for Frequency distributions

Level 1: student dataset , pollution dataset

Level 2: stack market dataset

Experiment No. 5: Develop python program for Variability

Level 1: Statistical values

Level 2: Probability Distributions and Pipes

Experiment No. 6: Develop python program for Normal Curves

Experiment No. 7: Develop python program for Correlation and scatter plots

Experiment No. 8: Develop python program for Correlation coefficient

Experiment No. 9 : Develop python program for Simple Linear Regression

Experiment No. 10 : Apply and explore various plotting functions on UCI data sets, Normal curves, Density and contour plots, Correlation and scatter plots

Targeted Applications & Tools that can be used:

Data Analysis

Data classification

Data Exploration

Data Clustering

Tools:

Python with statistical packages

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

After completion of each module a programming-based Assignment/Assessment will be conducted.
A scenario will be given to the students to be developed as a series of Program/ Application.
On completion of Module 2 and Module 4, students will be asked to develop a Mini Project using python.

Text Book
T1 Fan, Jianqing, Runze Li, Cun-Hui Zhang, and Hui Zou. Statistical foundations of data science. CRC press, 2020.
T2 Alan Agresti, Maria Kateri "Foundations of Statistics for Data Scientists With R and Python" 2021

References
Books
R1. James, G., Witten, D., Hastie, T.J., Tibshirani, R. and Friedman, J. (2013). An Introduction to Statistical Learning with Applications in R . Springer, New York.
R2. Hastie, T.J., Tibshirani, R. and Friedman, J. (2009). The elements of Statistical Learning: Data Mining, Inference, and Prediction (2nd ed). Springer, New York.
R3. Buehlmann, P. and van de Geer, S. (2011). Statistics for High-Dimensional Data: Methods, Theory and Applications. Springer, New York.
E book link
1.W. N. Venables, D. M. Smith and the R Core Team, https://www.ebooksdirectory.com/details.php?ebook=1791
Web link:
https://www.udemy.com/course/statistics-for-data-science-and-business-analysis(Udemy)
https://www.coursera.org/learn/foundations-of-data-science(Coursera)

Topics relevant to the development of "Foundation Skills":
Data Exploration using Python and R Programming.
Topics relevant to the development of "Employability Skills":

Statistical Data Analysis and exploration using Python and R Programming.

Course Code: UG COURSE: CSE3013	Course Title: Machine Vision Type of Course: Discipline elective Theory with embedded lab	L-T- P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	MAT1003 Applied Statistics CSE2048 Robotic Vision				
Anti-requisites	NIL				
Course Description	Machine Vision is a field of study that focuses on the design, development, and implementation of computer vision systems and technologies for visual perception and analysis. This course provides an in-depth understanding of the fundamental principles, algorithms, and applications of machine vision. The Machine Vision course covers a wide range of topics related to computer vision, image processing, and pattern recognition. It combines theoretical concepts with hands-on practical exercises to provide students with a comprehensive understanding of machine vision techniques. Introduction to Machine Vision, Image Acquisition and Preprocessing, Image Segmentation and Feature Extraction, Object Detection and Recognition, Machine Vision Systems and Applications.				
Course Object	The objective of the course is to familiarize the learners with the concepts of Machine Vision and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: Gain a solid understanding of the fundamental principles and concepts underlying machine vision systems, including image processing, computer vision algorithms, and pattern recognition techniques. [Knowledge] Acquire knowledge of various machine vision algorithms and techniques used for tasks such as image acquisition, preprocessing, segmentation, feature extraction, object detection, tracking. [Application]				

	Ability to Implement Machine Vision Systems Develop the skills to design, implement, and evaluate machine vision systems using programming languages and libraries commonly used in the field, such as MATLAB, OpenCV, Python, TensorFlow, or PyTorch. [Application] Gain hands-on experience through lab exercises, projects, and assignments that involve implementing and experimenting with machine vision algorithms and systems. [Application] Develop teamwork and communication skills by working on group projects and effectively presenting findings and results related to machine vision tasks. [Application]			
Course Content:				
Module 1	Introduction to Machine Vision	Assignment	Practical	No. of Classes:8
Overview of machine vision and its applications, Basic components of a machine vision system, Challenges and limitations in machine vision				
Module 2	Image Acquisition and Preprocessing	Assignment	Practical	No. of Classes:14
Image formation and acquisition methods, Image enhancement techniques, Noise reduction and image denoising. Image Segmentation and Feature Extraction: Thresholding techniques Edge detection algorithms Region-based segmentation Feature extraction methods				
Module 3	Object Detection and Recognition	Assignment	Practical	No. of Classes:8
Object detection algorithms (e.g., template matching, Haar cascades),Feature-based object recognition, Machine learning-based object detection and recognition				
Module 4	Machine Vision Systems and Application	Assignment	Practical	No. of Classes:8
Industrial machine vision systems Robotics and autonomous systems Medical imaging and healthcare applications Surveillance and security systems				

Augmented reality and virtual reality applications

Lab Experiments are to be conducted on the following topics:-

Lab Sheet 1:

1. Image Loading and Display:

Load an image from a file using the imread function.

Display the loaded image using the imshow function.._____(One Lab Session)

2. Image Arithmetic Operations:

Perform addition, subtraction, and multiplication of images using basic arithmetic operations.

Display the results of each operation using the imshow function ._____(One Lab Session)

3. Implementation of Transformations of an Image._____(One Lab Session)

Scaling & Rotation

Gray level transformations, power law, logarithmic, negative.

Contrast stretching of a low contrast image, Histogram, and Histogram Equalization.___(One Lab Session)

Lab Sheet 2:

Edge Detection:

Apply edge detection algorithms (e.g., Sobel, Canny) to detect edges in the image.

Display the edge-detected images using imshow and compare them with the original. (One Lab Session)

Image Restoration:

Introduce noise (e.g., Gaussian, salt and pepper) to the image using functions like imnoise.

Apply suitable restoration techniques (e.g., median filtering, Wiener filtering) to remove the noise. (One Lab Session)

Image Segmentation:

Convert the image to grayscale using the rgb2gray function.

Perform thresholding using a suitable threshold value to segment the image.

Display the segmented image using imshow and compare it with the original.   (One Lab Session) (Level 2)

Lab Sheet 3:

Feature Extraction:

Texture feature extraction using methods like Gray-Level Co-occurrence Matrix (GLCM) or Local Binary Patterns (LBP).

Shape feature extraction (e.g., area, perimeter, eccentricity) using region properties.

Color feature extraction using color histograms or color moments. (Two Lab Session) (Level 2)

Lab Sheet 4: (Group Project)

Object Detection and Recognition:

Haar cascade object detection (e.g., face detection or object detection using pre-trained classifiers).

Feature-based object detection using techniques like Speeded-Up Robust Features (SURF) or Scale-Invariant Feature Transform (SIFT).

Deep learning-based object detection using Convolutional Neural Networks (CNNs) or You Only Look Once (YOLO) algorithm.

Optical Character Recognition (OCR):

Preprocessing of text images (e.g., binarization, noise removal, or skew correction).

Text localization using techniques like connected component analysis or Stroke Width Transform (SWT).

Character recognition using machine learning algorithms like Support Vector Machines (SVM) or Convolutional Neural Networks (CNNs).

Gesture Recognition:

Hand segmentation using techniques like background subtraction or skin color detection.

Feature extraction from hand regions (e.g., finger counting, hand shape descriptors).

Classification of gestures using machine learning algorithms (e.g., k-Nearest Neighbors or Support Vector Machines).

Tools/Software Required :

OpenCV 4

Python 3.7

MATLAB

Text Books

"Machine Vision: Theory, Algorithms, Practicalities" by E.R. Davies 4th edition 2005

References

"Computer Vision: Algorithms and Applications" by Richard Szeliski 2nd edition 2022.

Ravishankar Chityala, Sridevi Pudipeddi, "Image Processing and Acquisition Using Python", Taylor & Francis, 2020.

Course Code: CSE 3038	Course Title: Applied Data Science Type of Course: Program Core Theory and Laboratory Integrated	L-T- P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	knowledge of statistics and Machine learning				
Anti-requisites	-				
Course Description	This course introduces the core concepts of Data Science followed by programming using R. This course has the theory and lab component which emphasizes on understanding and programming right from Basics to Visualization, and analysis in R. It helps the student to explore data by applying these concepts and also for effective problem solving, visualizing and analyzing.				
Course Objectives	This course is designed to improve the learner's EMPLOYABILITY SKILLS by using real-world PROBLEM-SOLVING methodologies.				
Course Out Comes	On successful completion of the course, the students shall be able to: Discuss the process involved in Data Science (Knowledge) 2. Apply suitable models using machine learning techniques and analyze their performance (Application) 3. Analyze the performance of the model and the quality of the results (Application)				

	4. Demonstrate the different methodologies and evaluation strategies to real-world problems (Application)			
Course Content:				
Module 1	Introduction to Data Science	Assignment	Case Studies	10 Sessions
	Data Science: Basics – Digital Universe – Sources of Data – Information Commons – Data Science Project Life Cycle: OSEMN Framework Data Preprocessing - Data Quality Assessment, Feature Aggregation, Feature Sampling, Dimensionality Reduction, Feature Encoding. Concept Learning: Formulation of Hypothesis – Probabilistic Approximately Correct Learning - VC Dimension – Hypothesis elimination – Candidate Elimination Algorithm			
Module 2	PREPARING MODEL USING R	Assignment	Programming	10 Sessions
Topics:				
	Regression Models- Linear and Logistic Model, Classification Models – Decision Tree, Naïve Bayes, SVM and Random Forest, Clustering Models – K Means and Hierarchical clustering			
Module 3	Performance Evaluation	Assignment	Programming	8 Sessions
	Model Evaluation Techniques: Hold out, cross-validation - Prediction Errors: Type I, Type II - Loss Function and Error: Mean Squared Error, Root Mean Squared Error – Model Selection and Evaluation criteria: Accuracy, F1 score – Sensitivity – Specificity – AUC			
Module 4	Applications of Data Science	Case Study	Programming	8 Sessions
Predictive Modeling: House price prediction, Fraud Detection Clustering: Customer Segmentation Time series forecasting: Weather Forecasting Recommendation engines: Product recommendation.				
List of Laboratory Tasks:				
Experiment No 1: Create an array and perform the following operations on it				

Level 1:   Basic Statistics, Copying, Slicing & Subsetting, Indexing, Flattening,

Reshaping, Resizing,

Level 2: Sorting, Swapping, and Dealing with Missing Values

Experiment No. 2: Create an R Data frame and perform the following operations on it

Level 1: Descriptive Statistics, Indexing & ReIndexing, Renaming, Iteration, Sorting,

Dealing with Missing Data

Level 2: Statistical functions, Window functions, Aggregations

Experiment No. 3: Create an R Data frame and perform the following operations on it

Level 1: Group by Operations, Merging/Joining, Concatenation,

Level 2: Time Series, Categorical Data, and Text Data

Experiment No. 4: Using R graphics perform the following

Level 1: Plot, Line, Scatter Plot, Pie Charts, Bars, Histogram, Box Plots,

Level 2: 3D Pie Charts, 3D Scatter Plot, GG Plot

Experiment No. 5: Using R Statistics perform the following

Level 1: Max & Min, Mean Median Mode, Subgroup Analyses,

Level 2: Probability Distributions and Pipes

Experiment No. 6: House rent prediction using linear regression

Experiment No. 7: Analysis of tweet and retweet data to identify the spread of fake news

Experiment No. 8: Perform analysis of power consumption data to suggest minimizing the usage

Experiment No. 9 : Agricultural data analysis for yield prediction and crop selection on Indian terrain data set

Experiment No. 10 : Behavioural analysis of customers for any online purchase model

Targeted Applications & Tools that can be used:

Data Exploration

Data classification

Data Analysis

Tools:

R Studio

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

After completion of each module a programming-based Assignment/Assessment will be conducted.
A scenario will be given to the students to be developed as a series of Program/ Application.
On completion of Module 2 and Module 4, students will be asked to develop a Mini Project using R.

Text Book
The Essentials of Data Science, Knowledge Discovery Using R, Graham J Williams, CRC Press, 2017
HadleyWickhmen, Garrette Grolemund, R for Data Science: Import, Tidy, Transform, Visualize and Model Data, OReilly, 2017
Build A Career in Data Science, March 2020, by Emily Robinson, Jacqueline Nolis

References
Books
R for Data Science by Hadley Wickham & Garrett Grolemund, Reference, 2017
Practical Data Science CookBook, APRESS Publications, 2018
Web Links:
https://www.coursera.org/learn/introducton-r-programming-data-science (Coursera)
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE
_BASED&unique_id=DOAJ_1_02082022_1773 (E-Library Resource)
https://onlinecourses.nptel.ac.in/noc22_cs32/preview (NPTEL)

Topics relevant to the development of "Foundation Skills":
Data Exploration R Programming.
Topics relevant to the development of "Employability Skills":
Data Analysis and Visualization using R Programming.

Course Code: CSE3076	Course Title: Artificial Intelligence for Robotics Type of Course: Theory Only Course	L-T-P- C	3	0	3
Version No.	1				
Course Pre-requisites	-				

Anti-requisites	-
Course Description	The course "Artificial Intelligence for Robotic Theory" aims to provide students with a deep understanding of the theoretical foundations and advanced concepts in artificial intelligence (AI) as they apply to robotics. The course delves into the theoretical underpinnings of AI algorithms, models, and methodologies used in robotic systems, enabling students to analyze and develop novel AI solutions for complex robotic tasks. Through a combination of lectures, discussions, and theoretical exercises, students will explore key AI theories and their applications in robotics. Students will also critically analyze research papers and gain insights into the current state-of-the-art in AI for robotics.
Course Objective	The objective of the course is skill development of student by using Participative Learning techniques
Course Out Comes	On successful completion of the course the students shall be able to: Summarize the basics of artificial intelligence and its application in the context of robotics. [Understanding] Infer the fundamental concepts and components of robotics, including robot anatomy and the systems engineering approach. [Understanding] Apply the knowledge of image recognition processes and techniques, including image processing, convolution, artificial neurons, and convolutional neural networks. [Appling] Apply the knowledge about how to build a system which detects objects and speech using driftnet techniques. [Appling]
Course Content:	

Module 1	Foundation for Robotics and AI	8 Sessions

Topics:

The basic principle of robotics and AI: Introduction to AI, the example problem – clean up this room, OODA (Observe- Orient-Decide- Act) loop, Artificial intelligence and advanced robotics Techniques, Introducing the robot and development environment, Software components (ROS, Python, and Linux), Robot control systems and a decision-making framework, The robot control system – a control loop with soft real-time control.

Module 2	Robot Design Process	10 Sessions

Topics:

Introduction to what is a robot, Robot anatomy – robots made of A systems engineering-based approach to robotics, Subsumption architecture, Use cases (The Problem Part-1, Problem Part-2), Subsumption architecture: Storyboard – put away the toys, Decomposing hardware needs, Breaking down software needs.

Module 3	Object Recognition Using Neural Networks	10 Sessions

Topics:

The image recognition process, Technical requirements, The image recognition training and deployment process – step by step, Image processing, Convolution, Artificial neurons, The convolution neural network process, Build the toy/not toy detector

Module 4	Robot speech recognition	10 Sessions

Topics:

Introduction to Teaching a Robot to Listen, teaching a Robot to Listen, Robot speech recognition, Robot speech recognition, Intent, Mycroft, Demo of speech recognition.

Targeted Application & Tools that can be used:

Application Area:

Resource Allocation, Finance and Economics (Risk Analysis and Consumption Assessment), Fraud Detection, Image Segmentation, Dimensionality Reduction, Gene Expression Analysis, Recommender System, Image reconstruction, Large Scale Surveillance.

Tools:

Anaconda Navigator

Python Packages

Project work/Assignment:

Assignment:

Train a system to recognize the speech.

Train a system to recognize the object.

Text Book

T1. Artificial Intelligence for Robotics by Francis X. Govers, Released August 2018, Publisher(s): Packt Publishing, ISBN: 9781788835442.

References

R1. Introduction to AI Robotics Robin R. Murph, ISBN 0-262-13383-0 (hc.: alk. paper)

R2. Introduction to AI Robotics, Second Edition by Robin R. Murphy, ISBN 9780262348157

   E book link
R1: https://doc.lagout.org/science/0_Computer%20Science/8_Electronics%20%26%20Robotics/Introduction%20to%20AI%20Robotics%20-%20Murphy%20R.R.pdf

Topics relevant to development of "Skill Development": Object Detection, Speech Recognition

Course Code: CSE3095	Course Title: Cloud Security Type of Course: Discipline Elective in Cloud Computing Basket Theory		L-T- P- C	3	0	3
Version No.	1.0					
Course Pre-requisites	[1] Cloud Computing and Services (CSE322)					
Anti-requisites	NIL					
Course Description	This course provides ground-up coverage on the high-level concepts of cloud landscape, architectural principles, and techniques. It describes the Cloud security architecture and explores the guiding security for Infrastructure and Softwares.					
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: Describe fundamentals of cloud computing [Knowledge]. Explain cloud computing security architecture and associated challenges [Comprehension]. Discuss cloud computing software security essentials [Comprehension]. Apply infrastructure security and data security in cloud computing enviroment. [Application].					
Course Content:						
Module 1:	Fundamentals of Cloud Computing	Quiz	Knowledge based Quiz		10 Sessions	
Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.						
Module 2:	Cloud Security Challenges and Cloud Security Architecture	Quiz	Comprehension based Quiz		10 Sessions	

Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security.				
Module 3	Cloud Computing Software Security Essentials	Assignment	Batch-wise Assignments	9 Sessions
Topics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software Requirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.				
Module 4:	Infrastructure Security and Data Security	Assignment and Presentation	Batch-wise Assignment and Presentations	9 Sessions
Topics: Infrastructure Security: The Network Level, The Host Level, The Application Level. Data Security : Aspects of Data Security, Data Security Mitigation, Provider Data and its Security.				
Targeted Application & Tools that can be used: Use of CloudSim simulator.				
Project work/Assignment: Survey on Cloud Service Providers				
Text Book Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, July 2021. Roland L Krutz and Russell Dean Vines, "Cloud Security - A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, Inc. 2019.				
References Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, "Secure Cloud Computing", Springer, ISBN 978-1-4614-9278-8 (eBook). John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press, 2010. Tim Mather, Subra Kumaraswamy and Shahed Latif", "Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance", Oreily Publication, 2009.				
Topics related to development of "FOUNDATION": Cloud computing architecture, Security policy implementation. Topics related to development of "EMPLOYABILITY": Infrastructure security and Data security.				

Course Code: CSE3102	Course Title: Malware Analysis Type of Course:Discipline Elective in Cyber Security Basket		L-T- P- C	3	0	3
Version No.	1.0					
Course Pre-requisites	Have the knowledge of Cryptography and Network Security					
Anti-requisites	NIL					
Course Description	The purpose of the course is to explore malware analysis tools and techniques in depth. Understanding the capabilities of malware is critical to an organization's ability to derive threat intelligence, respond to information security incidents, and fortify defenses. This course builds a strong foundation for reverse-engineering malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger, and other tools useful for turning malware inside-out.					
Course Objective	To study the fundamentals of malwares. To know about different malicious programs and their behavior To know how to work on linux systems. To learn, analyze and demonstrate network hacking tools					
Course OutComes	On successful completion of this course the students shall be able to: Understanding the nature of malware, its capabilities, and how it is combated through detection and classification. Apply the methodologies and tools to perform static and dynamic analysis on unknown executables. Analyze scientific and logical limitations on society's ability to combat malware.. Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti analysis techniques in future malware samples.					
Course Content:						

Module 1	Introduction to MALWARE ANALYSIS (Application)		Assignment	Programming activity	12 Hours

Topics:

Introduction to malware, OS security concepts, malware threats, evolution of malware, malware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.

Module 2	Static Analysis (Application)		Assignment	Programming activity	11 Hours

Topics:

X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture

Module 3	Dynamic Analysis (Application)		Assignment	Programming activity	11 Hours

Topics:

Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark

Module 4	Malware Functionality and Detection Techniques (Comprehension)		Assignment	Programming activity	12 Hours

Topics:

Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences

Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Problem Solving: Choose an appropriate data structure and implementation of programs.

Programming: Implementation of given scenario using Java

Text Book

Michael Sikorski and Andrew Honig, 2012: " Practical Malware Analysis", No Starch Press.

References

Jamie Butler and Greg Hoglund, 2005: "Rootkits: Subverting the Windows Kernel", Addison-Wesley.

Dang, Gazet and Bachaalany, 2014: "Practical Reverse Engineering",Wiley.

Reverend Bill Blunden, 2012: "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition,Jones& Bartlett.

Course Code: CSE3136	Course Title: E-Business and Marketing Analytics Type of Course: Theory Only Course	L-T-P- C	3	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course describes the basic principles of e-business technologies. Upon the completion of this course, students should have a good working knowledge of e- business concepts, applications, technologies (e.g. e-business infrastructure, technology required for e-business, e-business marketplace, e-Commerce, B2B e- business, E-business strategy, e-procurement, customer relationship management and service implementation and optimization) and ability to understand any kind of marketing analytics.				
Course Objective	This course is designed to improve the learner's EMPLOYABILITY SKILLS by using real-world PROBLEM-SOLVING methodologies.				
Course Out Comes	On successful completion of the course, the students shall be able to: Demonstrate the strategy of E-Business and identify the component parts (Knowledge). Identify records according to management policy by maintaining database and processing software (Knowledge). Identify the ethical, social and security issues of information systems (Knowledge). Apply the basic concepts and technologies used in the field of business management information systems (Application).				
Course Content:					
Module 1: E-BUSINESS – An Introduction			10 Sessions		

Introduction, E-Commerce – definition, History of E-commerce, types of E-Commerce B to B etc. Comparison of traditional commerce and e-commerce. E-Commerce business models – major B to B, B to C model, Consumer-to-Consumer (C2C), Consumer-to-Business (C2B) model, Peer to-Peer (P2P) model – emerging trends. Advantages/ Disadvantages of e-commerce, web auctions, virtual communities, portals, e-business revenue models.

Module 2: MARKETING ANALYTICS	10 Sessions

Introduction to Marketing Analytics-Marketing Budget and Marketing Performance Measure, Marketing Metrics and its application- Financial Implications of various Marketing Strategies-Geographical Mapping, Data Exploration, Market Basket Analysis, History and Evolution of social media-Understanding Science of social media, Web analytics, Search analytics. E-Commerce and marketing B to B and B to C marketing and branding strategies.

Module 3: SECURITY THREATS OF E-BUSINESS	09 Sessions

  Security threats – An area view – implementing E-commerce security – encryption – Decryption, Protecting client computers E-Commerce Communication channels and web servers Encryption, SSL protocol, Firewalls, Cryptography methods, VPNs, protecting, networks, policies and procedures, E-payment systems – An overview. B to C payments, B to B payments. Types of E- payment system, Secure Electronic Transaction (SET) protocol. RFID Concepts.

Module 4: E-BUSNESS MARKETING TECHNOLOGIES	09 Sessions

Introduction to R-Programming, Statistical models in R, Simple programs using R. Algorithms using MAP Reduce, Linear and Logistic Regression modelling, Clustering techniques. Case studies: Social network analysis- Text analysis-marketing analysis.

Text Book

Beginner's Guide for Data Analysis using R Programming, Jeeva Jose Khanna Book Publishing; 1st edition, 2018.

K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013

References

Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014

Bittu Kumar, Social Networking, V & S Publishers, 2013

Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007

TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

Web resources: https://onlinecourses.nptel.ac.in/noc19_mg54/preview

                https://onlinecourses.nptel.ac.in/noc20_mg30/preview

	https://www.coursera.org/learn/foundations-of-digital-marketing-and-e-commerce

Topics relevant to development of "Employability skill Development": Web auctions, E-Business revenue model, RFID concept, CRM system. Web analytics and search analytics

Course Code: CSE3137	Course Title: Text Mining and Analytics Type of Course: Discipline Elective	L-T- P-C	3	0	3
Version No.	1.0				
Course Pre-requisites	Basic knowledge of Python and machine learning				
Anti-requisites	Nil				
Course Description	This course covers the major techniques for mining and analyzing text data to discover interesting patterns, extract useful knowledge, and support decision-making, with an emphasis on statistical approaches and Machine Learning Methods				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Apply various pre-processing techniques to clean and prepare text data for analysis. [Application] Demonstrate the fundamental concepts and techniques of natural language processing (NLP) and text mining. [Application]				

	Develop the techniques for document summarization to extract key information from text data. [Application] Apply sentiment analysis to identify and understand the sentiment expressed in the text. [Application] Interpret text mining techniques in interdisciplinary contexts, such as social sciences, healthcare, finance, and marketing. [Application]

Course Content:				

Module 1	Introduction to Text mining	Assignment	Knowledge, Quizzes	07 Hours

Topics:

Text mining techniques and their applications

Fundamental of text mining and analytics, Introduction to preprocessing techniques, Text normalization including tokenization and lemmatization, Text and character N-grams, Stopword removal, and stemming, Hand-on practice: Text preprocessing, text classification, sentiment analysis, information retrieval.

Module 2	Natural Language Processing	Assignment	Knowledge, Quizzes	08 Hours

Topics:

Introduction to NLP:

Tokenization, part-of-speech tagging, syntactic parsing, named entity recognition, and semantic analysis

Module 3	Text Classification and Sentiment Analysis	Case study	Application, Quizzes	09 Hours

Topics: Text classification techniques and sentiment analysis: feature extraction, feature selection, and various classification algorithms using different Machine learning and Deep Learning techniques such as SVM, Decision tree, Random Forest, CNN, LSTM.				
Module 4	Information Retrieval and Search Engines	Case study	Application, Quizzes	09 Hours
Topics: Information retrieval techniques for text-based search engines: Basic concepts, components of an information retrieval system, retrieval models. Query formulation, query optimization, query expansion techniques. Web Search Engines: Crawling and indexing techniques, web ranking algorithms (e.g., PageRank), search engine architectures. Multimedia Retrieval: Image and video retrieval, content-based and metadata-based approaches. Evaluation Metrics.				
Module 5	Text Analytics for Social Media and Web Data	Case study	Application, Quizzes	07 Hours
Topics: Text analytics techniques for social media and web data: Mining and analyzing text data from platforms like Twitter, Facebook, and web pages [Blooms 'level selected: Application]				
Targeted Application & Tools that can be used: Natural Language Processing (NLP) Libraries: NLTK, SpaCy, Stanford NLP Text Classification Tools: Scikit-learn, TensorFlow, Keras Social Media Analytics Tools: Twitter API, Facebook Graph API, YouTube Data API				

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Develop a project where they collect social media data from platforms like Twitter or Facebook and perform sentiment analysis to determine the overall sentiment (positive, negative, or neutral) of the collected data   Develop a text classification model that can automatically categorize news articles into different topics or classes such as sports, politics, entertainment, etc   Develop a project where they build a system that can identify named entities (such as person names, locations, organizations) in a given text and extract relations between them
Text Book   C. D. Manning, H. Schütze, and P. Raghavan, "Text Mining and Analytics: From Text Data to Knowledge Graphs," Cambridge University Press, 2021.   G. Chakraborty, M. Pagolu, and S. Garla, "Text Mining and Analysis: Practical Methods, Examples, and Case Studies Using SAS," CRC Press, 2014.   "Speech and Language Processing" by Daniel Jurafsky and James H. Martin, published by Pearson. The latest edition is the 3rd edition, published in 2020.
References   S. Weiss, N. Indurkhya, T. Zhang, and F. Zhang, "Text Mining: Predictive Methods for Analyzing   Unstructured Information," Springer, 2015.   G. Sholomitsky and Y. Reiter, "Introduction to Text Analytics: Language Technology for Information   Access and Management," Morgan & Claypool Publishers, 2019.   S. M. Weiss, N. Indurkhya, T. Zhang, and F. Damerau, "Text Mining: Predictive Methods for Analyzing Unstructured Information," Springer, 2004.   S. Bird, E. Klein, and E. Loper, "Natural Language Processing with Python," O'Reilly Media, 2009   D. Sarkar, "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from Your Data," Apress, 2020
Web Resources and Research Articles: 1. https://www.datacamp.com/courses/text-mining-with-r   2. https://www.nltk.org/book/   3. https://libguides.wellesley.edu/c.php?g=992506&p=7181108   4. http://www.acadmix.com/eBooks_Download

Course Code: CSE3106	Course Title: Robotic Process Automation Systems Type of Course: Theory / Practical	L-T-P- C	2	4	4
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The Step into Robotic Process Automation (RPA) course is intended to introduce RPA to students. The course assumes no prior knowledge of RPA. The course takes a use-case approach. It begins by defining a real-world, generic problem and how it's solved in a non-RPA environment. The course goes on to teach skills that enable the students to create a robot using free UiPath software (Academic Alliance Edition) to automate the solution.				
Course Objective	The objective of the course is to provide a knowledge and applications of Robotic Process Automation.				
Course Outcomes	Upon successful completion of the course the students shall be able to: Illustrate the intuition about Robotic Process Automation Technology and the underlying logic/structure related to RPA [Remember]. Demonstrate the RPA Methodologies for Control Flow and data manipulation techniques [Apply]. Apply appropriate RPA Tools for the automation Process [Apply]. Utilize of various automated tools and its modern workflow automations [Apply].				

Course Content:

Module 1	RPA Foundations	Remember		8 Sessions

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Future of RPA, Differentiating RPA from Automation, Defining Robotic Process Automation & its benefits, What RPA is Not, Types of Bots, Application areas of RPA, How Robotic Process Automation works, RPA development methodology and key considerations.

Introduction to Robotic Process Automation Tools, Basic components in an RPA platform, Installation details of RPA tools, Types of Templates, User Interface, Domains in Activities, Workflow Files in the RPA platform.

Module 2	RPA Methodologies	Apply		7 Sessions

Process Components and Activities: User Interface Automation Activities, System Activities, Variables, Arguments, Imports Panel and User Events. App Integration, Recording, Scraping, Selector, Workflow Activities. Example of Automate login to your (web)Email account, recording mouse and keyboard actions to perform an operation, scraping data from website and writing to CSV.

Module 3	Intelligent Automation	Apply		7 Sessions

Data Manipulation, Automation of Virtual Machines, Introduction to Native Citrix Automation, Text and Image Automation, PDF Automation, Computer Vision, Programming, Debugging, Error Handling, Logging, Extensions, Project Organization

Module 4	DEPLOYING AND MAINTAINING THE BOT	Apply		8 Sessions

Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages - Meta Bot Designer – Meta Bot with AI Sense - Bot Insight -

Transactional Analytics - Operational Analytics

List Of Laboratory Tasks (30 Hours)

Lab Sheet 1: (6 Hrs)

Setup and Configure a RPA tool and understand the user interface of the tool:

Create a Sequence to obtain user inputs display them using a message box.

Create a Flowchart to navigate to a desired page based on a condition.

Create a State Machine workflow to compare user input with a random number.

Lab Sheet 2: (6 Hrs)

Build a process in RPA platform using Automation Activities.

Create an automation process using key System Activities, Variables and Arguments.

Also implement Automation using System Trigger

Lab Sheet 3: (6 Hrs)

Automate login to (web)Email account.

Lab Sheet 4: (6 Hrs)

Recording mouse and keyboard actions to perform an operation Scraping data from website and writing to CSV

Lab Sheet 5: (6 Hrs)

Different ways of Error Handling in RPA platform

Browse through the log files related to a RPA Project

Suggested List of Hands-on Activities:

Scrape the number of GitHub repositories for the top technologies in today's market.

Extract data from an excel file, according to a specific condition and store it in another excel file.

Segregate emails based on the email ID in respective folders present in the Outlook folder
Text Book(s)
Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, Mumbai, 2018 Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9787788470940 Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.
References:
Richard Murdoch, "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant" (1st Edition), Independently published, 2018. ISBN 978-1983036835. A Gerardus Blokdyk, "Robotic Process Automation Rpa A Complete Guide ", 2020. Frank Casale, Rebecca Dilla, Heidi Jaynes and Lauren Livingston, "Introduction to Robotic Process Automation: A Primer. EMC education services. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, Wiley, 2012. Web Resources and Research Articles links: IEEE Transactions on Robotic Process Automation- https://ieeexplore.ieee.org/abstract/document/9114349 NPTEL Course on " Robotics, IIT Bombay by Prof. B. Seth, Prof. C. Amarnath, Prof. K. Kurien Issac, Prof. P.S. Gandhi, Prof. P. Seshu   https://nptel.ac.in/courses/112101098 https://www.uipath.com/rpa/robotic-process-automation https://www.uipath.com/rpa/robotic-process-automation

Course Code: CSA2003	Course Title: Software Metrics and Quality Management Type of Course: Integrated	L-T-P- C	2	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course will focus on the processes, principles, and techniques of software testing and analysis. It covers a full spectrum of topics from basic principles and underlying theory of testing to organizational and process issues in real-world applications. The emphasis is on selecting practical techniques to achieve an acceptable level of quality at an acceptable cost. This course will provide software engineering professionals with realistic strategies for reliable and cost-effective software testing.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Software Metrics and Quality Management and attain Employability through Experiential Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: To understand software testing and quality assurance as a fundamental component of software life cycle [Knowledge] To efficiently perform T & QA activities using modern software tools [Comprehension] To prepare test plans and schedules for a T&QA project [Application]				
Course Content:					
Module 1	Introduction to Quality			12 Hours	
Topics:					
Introduction to Quality: Historical Perspective of Quality, what is Quality? (Is it a fact or perception?), Definitions of Quality, Core Components of Quality, Quality View, Financial Aspect of Quality, Customers, Suppliers and Processes, Total Quality Management (TQM), Quality Principles of Total Quality Management, Quality Management Through Statistical Process Control, Quality Management Through Cultural Changes, Continual (Continuous) Improvement Cycle, Quality in Different Areas, Benchmarking and Metrics, Problem Solving Techniques, Problem Solving Software Tools.					
Module 2	Software Quality			12 Hours	
Topics:					
Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship, Requirements of a Product, Organisation Culture, Characteristics					

of Software, Software Development Process, Types of Products, Schemes of Criticality Definitions, Problematic Areas of Software Development Life Cycle, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management System, Important Aspects of Quality Management.

Module 3	Software Verification and Validation			14 Hours

Topics:

Introduction, Verification, Verification Workbench, Methods of Verification, Type, Entities involved in verification, Reviews in testing lifecycle, Coverage in Verification, Concerns of Verification, Validation, Validation Workbench, Levels of Validation, Coverage in Validation, Acceptance Testing, Management of Verification and Validation, Software development verification and validation activities. V-test Model: Introduction, V-model for software, Testing during Proposal stage, Testing during requirement stage, Testing during test planning phase, Testing during design phase, Testing during coding, VV Model, Critical Roles and Responsibilities.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Case study on real time software applications like MSTeam

Implementation of verification and validation for any realtime software application.

Text Book

T1 Software Testing and Continuous Quality Improvement, William E. Lewis, CRC Press, 3rd,2016.

T2 Software Testing: A Craftsman's Approach, Paul C. Jorgenson, CRC Press, 4th, 2017.

References

R1. P. Ammann and J. Offutt. Introduction to Software Testing. Cambridge University Press, 2008.

R2.
https://www.tutorialspoint.com/software_quality_management/software_quality_management_metrics.htm

 https://nptel.ac.in/courses/106105150

https://nptel.ac.in/courses/106101163

Topics relevant to "EMPLOYABILITY SKILLS": Total quality management, software quality management, for development of Employability Skills through Experiential Learning Techniques. This is attained through assessment components mentioned in the course handout.

Course Code: 2054	Course Title: Storage Area Networks	L-T-P- C	3	0	3
	Type of Course: Program Core				
Version No.	1.0				
Course Pre-requisites	Basics of Computer Networks				
Anti-requisites	NIL				
Course Description	The objective of this course is to help students understand the knowledge gap in understanding varied components of modern information storage infrastructure, including virtual environments. It provides comprehensive learning of storage technology, which will enable you to make more informed decisions in an increasingly complex IT environment. ISM builds a strong understanding of underlying storage technologies and prepares you to learn advanced concepts, technologies, and products. You will learn about the architectures, features, and benefits of Intelligent Storage Systems; storage networking technologies such as FC-SAN,IP-SAN, NAS, Object-based and unified storage; business continuity solutions such as backup, replication, and archive; the increasingly critical area of information security; and the emerging field of cloud computing. This unique, open course focuses on concepts and principles which are further illustrated and reinforced with EMC examples.				
Course Out Comes	On successful completion of the course the students shall be able to: Identify key challenges in managing information and analyze different storage networking technologies and virtualization Knowledge Illustrate the storage infrastructure, Storage network Technologies and management activities Comprehension Define backup, recovery, disaster recovery, business continuity, and replication. Knowledge Define information security and identify different storage virtualization technologies. Knowledge				
Course Content:					
Version No.	1.0				

Module 1	Introduction to Storage System	Assignment	Comprehension, Quizzes	No. of Classes: 8

Topics:

Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host (Compute), Connectivity, Storage. Data Protection: RAID: RAID Implementation Methods, RAID Techniques, RAID Levels, RAID Impact on Disk Performance. Intelligent Storage Systems: Components of Intelligent Storage System, Storage Provisioning

Module 2	Storage Networking Technologies	Assignment	Comprehension, Quizzes	No. of Classes: 8

Topics:

Fibre Channel Storage Area Networks: Components of FC SAN, FC connectivity, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN.IP SAN and FCoE: iSCSI, FCIP, FCoE. Network Attached Storage: Components of NAS, NAS I/O Operation, NAS File-Sharing Protocols, File-Level Virtualization

Module 3	Backup, Archive and Replication	Assignment	Application, Quizzes	No. of Classes: 8

Topics:

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive. Local Replication: Replication Terminology, Uses of Local Replicas, Local Replication Technologies, Local Replication in a Virtualized Environment. Remote Replication: Remote Replication Technologies, Three-Site Replication, Remote Replication and Migration in a Virtualized Environment.

Module 4	Cloud Computing	Assignment	Comprehension, Quizzes	No. of Classes: 8

Topics:

Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Outof-Band Virtualization Appliances, High Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation

Module 5	Securing and Managing Storage Infrastructure	Assignment	Knowledge, Quizzes	No. of Classes: 8

Topics:

Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. Managing the Storage Infrastructure : Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering

List of Laboratory Tasks:

Targeted Application & Tools that can be used:

SID Tool(Cisco SAN Insights Discovery Tool)

SAN Congestion Innovation with Cisco DIRL(Dynamic Ingress Rate Limiting)

Project work/Assignment:

1.Cloud storage for accessing file over internet though SAN

2.Creating and storing daily backup of multiple machine over SAN. Or creating disk-less clients and use one server for processing and one server for storage and access all over network

Textbook(s):

Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839

Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516

References

Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.

Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.

Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Udemy: https://www.udemy.com/course/storageintro/ c;

SANFOUNDRY Online training : https://www.sanfoundry.com/san-storage-area-networks-training/

Course Code: CSE3016	Course Title: CSE3016 Neural Networks and Fuzzy Logic Type of Course: Discipline Elective in AI & ML Basket Theory Course	L-T- P-C	3	0	3
Version No.	1.2				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course aims to introduce the basic concepts of Neural Networks and Fuzzy Logic. Neural networks reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of AI, machine learning, and deep learning. Fuzzy Logic is a method of reasoning that resembles human reasoning. The approach of Fuzzy Logic imitates the way of decision-making in humans that involves all intermediate possibilities between digital values YES and NO. This course introduces fundamental concepts in Neural Networks and Fuzzy Logic Theory.				
Course Objective	This course is designed to improve the student's EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.				
Course Outcomes	On successful completion of this course the students shall be able to: Define the concept of Neural Networks. [Knowledge] Define the ideas behind most common learning algorithms in Neural Network. [Knowledge] Discuss the concepts of Fuzzy Sets and Relations. [Comprehension] Demonstrate the Fuzzy logic concepts and its applications. [Application]				
Course Content:					

Module 1	Introduction to Neural Network	Quiz	Single Layer Perceptron	9 Classes

Topics:

Introduction to NN: History, Artificial and biological neural networks, Artificial intelligence and neural networks.

Neurons and Neural Networks: Biological neurons, Models of single neurons, Different neural network models.

Single Layer Perceptron: Least mean square algorithm, Learning curves, Learning rates, Perceptron.

Module 2	Multilayer Perceptron	Quiz	Multilayer Perceptron	10 Classes

Topics:

Multilayer Perceptron: The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm, Some examples.

Radial-Basis Function Networks: Interpolation, Regularization, Learning strategies.

Kohonen Self-Organising Maps: Self-organizing map, The SOM algorithm, Learning vector quantization.

Module 3	Fuzzy Sets, Operations and Relations	Quiz	Fuzzy Operations	10 Classes

Topics:

Fuzzy Sets: Crisp Sets - an Overview, Fuzzy Sets - Definition and Examples, α - Cuts and its Properties, Representations of Fuzzy Sets, Extension Principles of Fuzzy Sets.

Fuzzy Operations: Operations on Fuzzy Sets - Fuzzy Complements, Fuzzy Intersections, Fuzzy Unions, Combinations of Operations, Aggregation Operations.

Fuzzy Relations: Binary Fuzzy relations, Fuzzy Equivalence Relations, Fuzzy Compatibility Relations.

Module 4	Fuzzy Logic and Fuzzy Logic Controller	Assignment	Developing Fuzzy Logic Controller	10 Classes

Fuzzy Logic: Classical Logic, Multivalued Logic, Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inference from Conditional Fuzzy Propositions, Conditional and Qualified Propositions and Quantified Propositions.

Fuzzy Controllers: An Overview, Fuzzification Module, Fuzzy Rule Base, Fuzzy Inference Engine, Defuzzification Module, An Example.

Targeted Application & Tools that can be used:

Python Libraries and Software (Eg., Tensorflow , Scikit-Learn etc.)

Matlab (Neural Network Toolbox, Fuzzy Logic Toolbox)

Project work/Assignment:
Students will have to do group assignments for Modules 2 & 4. As a part of their assignments, they will have to implement the solution to particular problems.

Textbook(s):
Haykin, Simon. "Neural networks and learning machines", 3/E. Pearson Education India, 2011. https://www.pearson.com/en-us/subject-catalog/p/Haykin-Neural-Networks-and-Learning-Machines-3rd-Edition/P200000003278/9780133002553
George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic- Theory and Applications", Prentice Hall of India, 2015.
https://www.worldcat.org/title/fuzzy-sets-and-fuzzy-logic-theory-and-applications/oclc/505215200

References:
Shivanandam, Deepa S, "Principles of Soft computing", N Wiley India, 3rd Edition, 2018. https://www.wileyindia.com/principles-of-soft-computing-3ed.html
Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley, 2011.
https://onlinelibrary.wiley.com/doi/book/10.1002/9781119994374
Kumar S., "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2nd Edition 2017. https://www.worldcat.org/title/neural-networks-a-classroom-approach/oclc/56955342
Fakhreddine O. Karray, and Clarence W. De Silva. "Soft computing and intelligent systems design: theory, tools, and applications". Pearson Education, 2009.
Weblinks
https://www.pearson.com/en-gb/search.html?q=Karray%20Soft-Computing-and-Intelligent-Systems-Design-Theory-Tools-and-Applications

Topics related to development of "EMPLOYABILITY": Assignment implementations in software, batch wise presentations.

Catalogue prepared by	Dr. S. Thiruselvan
Recommended by the Board of Studies on	(BOS NO: SOCSE1. BOS held on 22 / 12 / 2022)
Date of Approval by the Academic Council	(Academic Council Meeting No.20.3 , Dated 15 /02 /23)

Course Code: CSE 3050	Course Title: Software Project Management Type of Course: School Core	L-T- P-C	3	0	3
Version No.	2.0				
Course Pre-requisites	Software Engineering				
Anti-requisites	NIL				
Course Description	The objective of this course is to provide the fundamentals concepts of Software Project planning approaches and methodologies. The objective of this course is to provide the fundamentals standards of software development and management. This course covers the roles and functions of project management and the process of project life cycle. The objective of the course is to understand the need and techniques for managing users and user.				
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Project Management, Software Project Effort and Cost Estimation. (Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand People management (Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)				
Course Objectives	The objective of this course are the successful development of the project's procedures of initiation, planning, execution, regulation and closure as well as the guidance of the project team's operations towards achieving all the agreed upon goals within the set scope, time, quality and budget standards.				

Module 1	Project Management Fundamentals	Assignment	Identification of Cost Estimation	12 Sessions

Introduction to Software Project Management – all life cycle activities, Project Initiation Management – scope, objective, size and factors. Software Project Effort and Cost Estimation – cocomo, artifacts. Risk Management : Perform The risk analysis for the given case study. Configuration Management – techniques. Project Monitoring and Control – measuring task, status report, evm. Project Closure – closure steps

Module 2	Software Life Cycle Management	Assignment	Apply the testing concepts using Programing	10 Sessions

Introduction to Software Life-Cycle Management – life cycle process. Software Requirement Management – requirement and management. Software Design Management – standards, techniques. Software Construction – reviews, walkthrough, inspections. Software Testing – Verification, validation, strategy, automation and monitoring. Product Release and Maintenance – types and techniques				
Module 3	People Management		Comparison of CMO, ISO, IEEE standards	08 Sessions
Introduction to People Management – people, team and supplier management. Team Management – organizational structure, team effectiveness. Customer Management – expectation and negotiation. Supplier Management – agreement and communication.				
Module 4	Software Engineering Management and Tools	Assignment	Apply the testing concepts using Programing	10 Sessions
Introduction to Software Process Standards and Process Improvement – CMM, ISO, IEEE. Software Project Management Tools Introduction – tools application, cost and effectiveness. Project Management and Software Life-Cycle Tools – life cycle and project management templates. Software Project Templates – WBS and monitoring tools. Software configuration management- SCM process, SCM Tools (GitHub).				
Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Identification of Cost Estimation Apply the testing concepts using Programing Comparison of CMO, ISO, IEEE standards Installing Selenium/GitHub software and exploring the functionality				
Text Book 1] Bob Hughes, Mike Cottere, Rajib Mall, "Software Project Management", 5th Ed, Tata McGraw Hill,				
References 1] Ashfaque Ahmed, "Software Project Management: a process-driven approach",Boca Raton, Fla. : CRC Press, 2012 2] Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2005.				
Foundation Skills: Students can able to learn the fundamental foundation skills in this course such as initiation, planning, execution, regulation and closure as well as the guidance of the project team's operations.				

Course Code: CSE 3051	Course Title: System Monitoring Type of Course: Theory only	L-T- P-C	3	0	3
Version No.	1				
Course Pre-requisites	Agile Structures and Frameworks				
Anti-requisites	NA				
Course Description	This course is intended for understanding the principles of automation and the application of tools for the analysis and testing of software. The automated analysis encompasses both approaches to automatically generate a very large number of tests to check whether programs meet requirements, and also means by which it is possible to prove that software meets requirements and that it is free from certain commonly-occurring defects, such as divide-by-zero, overflow/underflow, deadlock, race-condition freedom, buffer/array overflow, uncaught exceptions, and several other commonly-occurring bugs that can lead to program failures or security problems. The learner will become familiar with the fundamental theory and applications of such approaches, and apply a variety of automated analysis techniques on example programs.				
Course Objective	The objective of the course is skill development of students by using Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand testing in DevOps. Learn its approaches to testing. Understand to design test cases.				
Course Content:					
Module 1	NEED OF SYSTEM MONITORING	Assignment			8 Sessions
Topics: Predicting system load - Failure prevention – Anomalies					
Module 2	TENETS OF SYSTEM	Assignment			8 Sessions
Topics: Identifying as many problems as possible - Identifying problems as early as possible - Generating as few false alarms as possible – Automation					

Module 3	CORE COMPONENTS OF MONITORING TOOLS	Assignment		8 Sessions
Topics: Alerts – Graphs - Logs				
Module 4	INTELLIGENTLY MONITORING THE RIGHT METRICS IN EACH	Assignment		8essions
Topics : Layer 0: The Application - Layer 1: The Process - Layer 2: The Server - Layer 3: The Hosting Provider - Layer 4: External Dependencies - Layer 5: The User				
Module 5	MONITORING STRATEGIES	Quiz		8 Sessions
Topics : Monitor potential faulty entities - Monitor existing faulty entities - Tuning and Continuous Improvement				
Targeted Application & Tools that can be used Jenkins, Docker				
Project work/Assignment:				
Assignment:				
Text Book Building a Monitoring Infrastructure with Nagios - by David Josephsen. 2016 Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation - by Jez Humble (Author), David Farley (Author), Martin Fowler (Foreword). 2017				
References 1. Instant Nagios Starter - by Michael Guthrie, Packt Publishing Limited (23 May 2016) Web resources: W1. https://presiuniv.knimbus.com/user#/home				

Course Code: CSE3073	Course Title: Game Design and Development				
	Type of Course: Discipline Elective	L-T- P- C	2	2	3
Version No.	1.0				
Course Pre-requisites	CSE 2001- Data Structures and Algorithms & C# Programming Specific Topics to be included				
Anti-requisites	NIL				
Course Description	The course helps learners to build the necessary skills to design and development games. The Specialization focuses on both the theory and practice of game making. From a technical standpoint, learners will learn about basic operation using latest Unity 2021 game engine. In Game Design process, learners will write a complete game script and proposal of their own design from initial concept up to the first playable prototype.				
Course Object	The course will give a well-rounded knowledge in the Game Development with an emphasis on understanding and applying techniques in video game production. And this course will cover with a solid grasp of the fundamental game art principles, including knowledge of game engine technology and pre-production and production environments.				
Course Out Comes	On successful completion of the course the students shall be able to: Recognize Game Preproduction and Design Process. Identify the UI of Unity Game Engine and its Work Flow. Illustrate GameObject Behaviour using C# Script. Produce Game using Unity Game Engine.				
Course Content:					
Module 1	Essentials of Game Design	Assignment	Memory recall quiz from Introduction to Game and its basics		No. of Classes:8

			and Practical components for Preproduction	

Topics: Introduction to Game - Basic Elements of Play- Basic elements of games- Basic Game Design Tools- Constraint- Direct and indirect actions- Goals-Challenge- Skill, strategy, chance, and uncertainty- Decision-making and Feedback-Abstraction-Theme-Context of Play-Preproduction-Logo - background

Module 2	The Kinds of Play & Working with Unity API	Assignment	Quiz based on Play Categories and Lab Experiments on Unity Engine API	No. of Classes: 12

Topics: The Kinds of Play- Competitive play, Cooperative play, Skill-based play, Experience-based play, Games of chance and uncertainty, Whimsical play, Role-playing, Player Experience -Introduction to fundamentals of game, Storytelling - basic programming using C#, Game Theory, Unity Interface- Tools- Windows – Game Objects, Components, Camera – Lightning -Building Platform and Project Preferences. Unity Editor Interface: Main Menu-Tool bar- Scene View-Game View-Hierarchy Window-Project Window-Inspector Window-Console Window-Status Bar -Game Objects.

Module 3	Game Design Process and Working with Game Object in Unity	Assignment	Experiments based on Unity API and basic Operation	No. of Classes:12

Topics: Iterative Game Design Process – Conceptualize- Prototype- Playtest and Evaluate Game Design Values: Experience – Theme - Point of view – Challenge - Skill, strategy, chance, and uncertainty - Introduction to Vectors, Game design- The structure of games, Unity Tools Materials and Textures, Game Objects, Components- Scripting: Unity Mono Behavior Class-Mono Behavior Methods / Messages - Rotations, Translations - Layers, Tags- Colliders, Collisions, Triggers- Physics, Physic Material, Texture, Shader – Lighting.

Module 4	Game Prototyping, Evaluation and Game Development	Assignment	Game prototyping and Unity Programming	No. of Classes:12

Topics: Game Prototyping: Paper prototypes - Physical Prototypes Playable prototypes - Art and sound prototypes - Core game prototypes - Complete game prototypes, Evaluation – UI: Working with UI & Menus- - Game development, Asset Management, Advanced Unity Programming

Lab Experiments are to be conducted on the following topics: -

Introduction to Preproduction

Introduction to Unity Game Engine API

Unity Game Objects its properties

Grouping Object in Environment
Multiple Game Objects
Object Mono Behavior
Object Transform
Get Component Method
Prefabs
Translating Game Objects
Textures
Unity Physics
Player Movement
Camera Movement
Player Control
Character Controller
UI
Game Development
Mini Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Building a 2D/3D Game
Text Books
Colleen Macklin, John Sharp, Games, Design and Play A Detailed Approach to Iterative Game Design, Pearson Education, Inc. 2016
Ernest Adams, "Fundamentals of Game Design", Pearson Education, 2012
Ethan Ham, Tabletop Game Design for Video Game Designers, 2016 Taylor & Francis
References
Jeff W Murray, "2D Unity", William Pollock 2015,
Alan Thorn, "Learn Unity for 2D Game Development", Tia 2017.
Unity API, Documentation 2021.

Course Code:	Course Title: E-Commerce		2	2	3

CSE3126	Type of Course: Program Core	L-T- P-C			
Version No.	1.0				
Course Pre-requisites	Web Technology				
Anti-requisites	NIL				
Course Description	This course caters the knowledge of real time ecommerce platforms, their architecture, structure and workflow. It also provides sufficient hands on to build a own e commerce platform and host.				
Course objectives	The objective of the course is skill development of student by using Participative Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: Understand the concepts of an E-commerce (Knowledge). Acquire the knowledge about existing e-commerce applications (comprehension). Build own e-commerce application (Application) Deploy e-commerce application (Application).				
Course content:					

Module 1	Introduction to E-Commerce	Assignment	Survey	8 Sessions

Topics: Introduction to Electronic Commerce: Meaning, nature and scope; Business application of ecommerce; Global trading environment and adopting of e -commerce, evolution of World Wide Web, future of Web.

Assignment: Perform a survey of state-of-art e-commerce platforms

Module 2	Website design	Assignment	Case Study	9 Sessions

Topics: Web sites as market place; Role of web site in B2C e -commerce; Web site strategies; Web site design principles; push and pull approaches; Alternative methods of customer communication such as e -mail, BBA; E-mail etiquette and e-mail security.

Assignment: Write a case study of any B2C business application

Module 3	Business Models of E-Commerce	Assignment	Case Study	10 Sessions

Topics: B2B, B2C, B2G and other models of e - commerce; Applications of e-commerce to supply chain management; Product and service digitisation; Remote servicing, procurement and online marketing and advertising; Applications to Customer Relationship Management. Business to Consumer E-Commerce Applications: Cataloging, Order planning and order generation; Cost estimation ad pricing; Order receipt and accounting; Order selection and prioritization; Order scheduling, fulfilling and delivery, Order billing, Post sales services.

Assignment: Write a case study of any B2B and B2G business application

Module 4	E-Payment System	case study	Programming Task	9 Sessions

Topics: Types of payment systems –e-cash and currency servers, e-cheques, credit cards, smart cards; electronic purses and debit cards; Operational, credit and legal risk of e - payment, Risk management options for e-payment systems, Set standards.

Assignment: Develop one online e-commerce platform for online tutorial

List of Laboratory Tasks:

Level 1: Understand the work flow of various e-commerce applications (Amazon, flipkart, myntra, etc.)

Level 2: create a web page of your college.

Level 1: Develop a web page for user login

Level 2: Develop a web page for registration

Level 1: Develop a home page of website consisting of navigation menus.

Level 2: Develop a home page of website consisting of navigation menus as links.

Level 1: Develop a home page of website consisting of vertical navigation panel.

Level 2: Develop a page to navigate a page with user credentials and verify.

Level 1: Build multiple web pages and link them to home page.

Level 2: Embed relevant videos of recommended in home page.

Level 1: Create a small website for online grocery.

Level 2: Create a cart of products and navigate to pay portal.

Level 1: Build a small B2B website (Shopify)

Level 2: Build a small B2B website (eBay)

Level 1: Build a small B2C business transaction (Amazon).

Level 2: Build a small B2C business transaction (Flipkart).

Level 1: Create simple customer to customer (eBay like e-commerce application).
Level 2: Create simple customer to customer (big Basket like e-commerce application).
Level 1: Write a case study on security issues in e-commerce.
Level 2: Write a case study on risk management in e-commerce.

Targeted Application & Tools that can be used:
Xamp server, Notepad, Visual studio, MySQL

Project work/Assignment:
Design a website to showcase working of 4 types of e-commerce (B2B, B2C, C2B and C2C business transactions.

Textbook(s):
Sushila Madan (2022), E-Commerce, Scholar Tech Press
S.J. P.T. Joseph (2019), E-COMMERCE : An Indian Perspective, PHI
Laudon, Kenneth C. and Carol Guercio Traver (2002) E -commerce: business, technology, society. (New Delhi: Pearson Educatin).
Awad, Elias M. (2007), Electronic Commerce: From Vision to Fulfillment (New Delhi: Pearson Education).

References
Kalakota, Ravi and Marcia Robinson (2001). Business 2.0: Roadmap for Success (New Delhi: Pearson Education).
Smith, P.R. and Dave Chaffey (2005), eMarketingeXcellence; The Heart ofeBusiness (UK: Elsevier Ltd.)

https://onlinecourses.nptel.ac.in
https://onlinecourses.swayam2.ac.in
http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=4125&query_desc=kw%2Cwrdl%3A%20e%20commerce
http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14338&query_desc=kw%2Cwrdl%3A%20e%20commerce

Course Code: CSE3146	Course Title: Advanced Java Programming Type of Course:1] School Core 2] Laboratory integrated	L-T- P-C	1	4	3
Version No.	1.0				

Course Pre-requisites	[1] Problem Solving Using Java (CSE1001) [2] Database Management System (CSE2074) [3] Web Technology (CSE2006) Basic Knowledge about DBMS, Knowledge on Core Java (OOPs Principles), Client-server Architecture, HTML
Anti-requisites	NIL
Course Description	The purpose of this course is to introduce the students to Java Advanced API enhanced by Design Patterns and SOLID Principles. The course is both conceptual and analytical and is understood with JDK 8 software & IntelliJ IDE. This course develops critical thinking skills by augmenting the student's ability to develop distributed model for control of various modern management systems like banking management system, student information management system, , Library Management System etc. with the necessary API for communication with database enhanced by the current industrial approach of Java's SOLID principle and design patterns. This course also involves essential core java concepts like multithreading, file handling, event handling etc.
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques. Please add as per what the course covers in the criteria1 NAAC Template.
Course Outcomes	On successful completion of this course the students shall be able to: Explain the benefits of Design-Pattern & SOLID principle in java based applications. Understand Concurrent Programming using Java Multi-Threading. Apply Communication mechanisms of Java with DBMS. Implement Web MVC application using Servlet and JSP Technology. Test JPA Implementation using Hibernate.
Course Content:	

Module 1	Multi-Threading (Comprehension)	Assignment	Knowledge Ability	11 Hours

Topics:

Multi-Threading in Java: Understanding Threads , Needs of Multi-Threaded Programming ,Thread Life-Cycle, Thread Priorities ,Synchronizing Threads, Inter Communication of Threads ,Critical Factor in Thread –DeadLock, The Executor Framework.

Module 2	Input & Output Operation in Java (Comprehension)	Assignment	File Operations	11 Hours

Topics:

Java I/O Operations : Input/Output Operation in Java(java.io Package),Streams and the new I/O Capabilities ,Understanding Streams, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.

Module 3	Collection and Database programming using JDBC (Comprehension)	Assignment	Data Storage	12 Hours

Topics:

Collection - The Collection Framework : Collections of Objects , Collection Types, Sets , Sequence, Map, Understanding Hashing, Uses of ArrayList & Vector , Comparable and Comparator Interfaces.

Database Programming using JDBC- Introduction to JDBC, JDBC Drivers & Architecture, CRUD operation Using JDBC, Connecting to non-conventional Databases.

Module 4	Distributed Programming with Servlet (Application)	Assignment	Distributed Programming	11 Hours

Topics:

Servlet -   Web Application Basics, Architecture and challenges of Web Application, Introduction to servlet, Servlet life cycle, Developing and Deploying Servlets, Create and compile servlet source code, start tomcat, start a web browser and request the servlet, servlet API, Handling HTTP Requests and Responses: Handling HTTP GET requests and POST request, Session Tracking, Simple Servlet Program to fetch database records

Module 5	Distributed Programming with JSP (Application), Introduction to Spring Framework (Application)	Assignment	Distributed Programming	11 Hours

Topics:

JSP - Introduction to JSP, Creating simple JSP Programs, How JSP is processed, JSP Scripting Constructs, Predefined Variables, JSP Directives, Simple JSP Program to fetch database records.

Spring CORE, Overview of Spring, Spring Architecture, bean life cycle, Java and XML Configuration on Spring, Spring Different Modules.

Spring JPA, JPA Specification, Classes and Interfaces, Object Relational Mapping using JPA, JPA implementation with Hibernate, Simple JPA-Hibernate program to Create Database schemas.

List of Laboratory Tasks:

Labsheet -1 [4 + 1 Practical Sessions]

Experiment No 1:

Level 1: Demonstration of Thread Class and Runnable Interface.

Level 2 – Implementation of Producer-Consumer Problem.

Labsheet -2 [3 +1 Practical Sessions]

Experiment No. 1:

Level 1 – Usages of Java.io.* package.

Level 2 – File operations with a case study.

Labsheet – 3 [3 +1 Practical Sessions]

Experiment No. 1:

Level 1 – Practicing classes and methods in java.util.collection.

Level 2 – Scenario based questions to apply all collections. [Group wise]

Labsheet – 4 [3 + 1 Practical Sessions]

Experiment No. 1:

Level 1 – JDBC complete Demonstration with Student Database

Level 2 – Implementation of Student Information Management (Standalone). [Group wise]

Labsheet – 5 [3 + 1 Practical Sessions]

Experiment No. 1:

Level 1 – Web page creation using HTML, Dynamic web page using java.servlet and JDBC

Level 2 – Implementation of Student Information Management (WEB based). [Group wise]

Labsheet – 6 [3 + 1 Practical Sessions]

Experiment No. 1:

Level 1 – Web page creation using HTML, Dynamic web page using java.servlet , JSP and JDBC

Level 2 – Implementation of Student Database using JPA Hibernate

Targeted Application & Tools that can be used: Java 8 / MYSQL 8 / Eclipse /IntelliJ (IDE)
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Build a Standalone database application using Java Swing as Front End. Indicative areas include; TimeTable Management, Student Expense Tracker, Important Mail Fetcher, etc. Build a real time database application using J2EE as Front End. Indicative areas include; health care, education, industry, Library, Transport and supply chain, etc.
Text Books Cay S Horstmann and Gary Cornell, "CORE JAVA volume II-Advanced Features, 9th Edition.
References Herbert Schildt, "Java 2: The Complete Reference", Tata McGraw-Hill Education,6th Edition. Y.Daniel Liang, "Introduction to Java programming Comprehensive Version", Pearson Education, 10th Edition. Core and Advanced Java Black Book, Dream Tech Press. Spring in Action , Graig Walls, 5th Edition Java Persistence with Hibernate , Christian Bauer & Gavin King, 2nd Edition https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2

Course Code: CSE3150	Course Title: Front-end Full Stack Development			L-T- P-C	2	2	3
Version No.	1.0						
Course Pre-requisites	Nil						
Anti-requisites	NIL						
Course Description	This intermediate course enables students to perform front-end full stack development, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.						
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.						
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the fundamentals of DevOps and Front-end full stack development. [Comprehension] 2] Illustrate development of a responsive web. [Application] 3] Apply concepts of Angular.js to develop a web front-end. [Application] 4] Apply concepts of Angular.js to develop a web front-end. [Application]						
Course Content:							
Module 1	Fundamentals of DevOps and Web Development	Project	Programming				04 Sessions
Topics: Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes. Review of GIT source control. HTML5 – Syntax, Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform Assignment: Develop a website for managing HR policies of a department.							
Module 2	Responsive web design	Project	Programming				03 Sessions

Topics:

BootStrap for Responsive Web Design; JavaScript – Core syntax, HTML DOM, objects, classes, Async; Ajax and jQuery Introduction

Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society.

Module 3	Fundamentals of Angular.js	Project	Programming	08 Sessions

Topics:

Setting up Development & Build Environment: Node.js and NPM; Introduction to TypeScript; Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications; Components & Databinding in Depth; Angular Directives; Using Services & Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication & Route Protection; Dynamic Components; Angular Modules & Optimizing Angular Apps; Deploying an Angular App; Angular Animations; Adding Offline Capabilities with Service Workers; Unit Testing in Angular Apps (Jasmine, Karma).

Assignment: Develop a software tool to do inventory management in a warehouse.

Module 4	Fundamentals of React.js	Project	Programming	15 Sessions

Topics:

Overview of React.js.; Reactive Programming; React Components; Render Method; Virtual DOM and Bandwidth Salvation; Two Distinct Ways of Initializing a React Class; States & Life Cycles; Component Mounting; Node.js & NPM; JSX Walkthrough; React Testing.

Assignment: Develop a web-based application to book movies/events (like bookmyshow).

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: GCC compiler.

Project work/Assignment:

Problem Solving: Design of Algorithms and implementation of programs.

Programming: Implementation of given scenario using Java.

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

T2. Northwood, Chris, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", APress, 2018

References:

R1. Flanagan D S, "Javascript : The Definitive Guide" 7th Edition. 7th ed. O'Reilly Media; 2020.

R2. Alex Libby, Gaurav Gupta, and Asoj Talesra. "Responsive Web Design with HTML5 and CSS3 Essentials", Packt Publishing, 2016

R3. Duckett J Ruppert G Moore J. "Javascript & Jquery : Interactive Front-End Web Development."; Wiley; 2014.

R4. Greg Sidelnikov, "React.js Book_ Learning React JavaScript Library", 1 edition, Scratch-River Tigris LLC 2016

R5. Web Reference: https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2

Course Code: CSE3151	Course Title: Java Full Stack Development		L-T- P-C	2	2	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	CSE3152 .NET Full Stack Development					
Course Description	This advanced level course enables students to perform full stack development using Java, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.					
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.					
Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of Java for full stack development [Application] 2] Show web applications using Java EE. [Application] 3] Solve simple applications using Java Persistence and Hibernate [Application] 4] Apply concepts of Spring to develop a Full Stack application. [Application] 5] Employ automation tools like Maven, Selenium for Full Stack development. [Application]					
Course Content:						
Module 1	Introduction	Project	Programming		03 Sessions	
Topics: Review of Java; Advanced concepts of Java; Java generics; Java IO; New Features of Java. Unit Testing tools.						
Module 2	Java EE Web Applications	Project	Programming		05 Sessions	

	Topics:
	Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App

Assignment: Develop an application for managing HR policies of a department.

Module 3	Java Persistence using JPA and Hibernate	Project	Programming	06 Sessions

Topics:

Fundamentals of Java Persistence with Hibernate; JPA for Object/Relational Mapping, Querying, Caching, Performance and Concurrency; First & Second Level Caching, Batch Fetching, Optimistic Locking & Versioning; Entity Relationships, Inheritance Mapping & Polymorphic Queries; Querying database using JPQL and Criteria API (JPA)

Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society..

Module 4	Spring Core	Project	Programming	10 Sessions

Topics:

Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development

Assignment: Develop a software tool to do inventory management in a warehouse.

Module 5	Automation tools	Project	Programming	06 Sessions

Topics:

Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands

Assignment: Illustrate the use of automation tools in the development of a small software project.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.					

Project work/Assignment:
Problem Solving: Design of Algorithms and implementation of programs. Programming: Implementation of given scenario using Java.
Text Book: T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

References
 	
   R1. Soni, Ravi Kant. "Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful." , Apress, 2017.
 	
    R2. Mardan, Azat. "Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB.", Apress, 2015

Course Code: CSE3152	Course Title: .NET Full Stack Development	L-T- P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	CSE3151 Java Full Stack Development				
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				

Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of C# for developing a small application [Application] 2] Show web applications using Entity Framework. [Application] 3]Solve simple web applications that use SQL and ASP.NET [Application] 4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]			
Course Content:				
Module 1	C# Programming for Full Stack Development	Project	Programming	10 Sessions

Topics:

.NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions, Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading, Data validation and working with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework

Assignment: Develop a small application for managing library using C#.

Module 2	Entity Framework Core 2.0	Project	Programming	06 Sessions

Topics:

Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET

Assignment: Develop an application for managing HR policies of a department.

Module 3	ASP.NET	Project	Programming	06 Sessions

Topics:

ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC & Layouts;

Assignment: Develop a web application to mark entry/exit of guests in a building.				
Module 4	ASP.NET	Project	Programming	08 Sessions

Topics:

Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application

Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Visual Studio

Project work/Assignment:

Problem Solving: Design of Algorithms and implementation of programs.

Programming: Implementation of given scenario using .NET.

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

T2. Valerio De Sanctis, "ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11", 4th Edition, Packt, 2021.

References

R1. Benjamin Perkins, Jon D. Reid, "Beginning C# and .NET", Wiley, 2021 Reid, 2021.

R2. Piotr Gankiewicz, "Full Stack .NET Web Development", Packt Publishing, 2017.

R3. Tamir Dresher, Amir Zuker, Shay Friedman, "Hands-On Full-Stack Web Development with ASP.NET Core", Packt Publishing, 2018.

R4. Dustin Metzgar, "Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core", Manning, 2017.

Course Code: CSE391	Course Title: Java Full Stack Development			L-T- P-C	0-0-4-2

Version No.	1.0

Course Pre-requisites	Nil

Anti-requisites	CSE392 .NET Full Stack Development

Course Description	This advanced level course enables students to perform full stack development using Java, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.

Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.

Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of Java for full stack development [Application] 2] Show web applications using Java EE. [Application] 3] Solve simple applications using Java Persistence and Hibernate [Application] 4] Apply concepts of Spring to develop a Full Stack application. [Application] 5] Employ automation tools like Maven, Selenium for Full Stack development. [Application]

Course Content:	

Module 1	Introduction	Project	Programming	03 Sessions

Topics:

Review of Java; Advanced concepts of Java; Java generics; Java IO; New Features of Java. Unit Testing tools.

Module 2	Java EE Web Applications	Project	Programming	05 Sessions

Topics:

Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App

Assignment: Develop an application for managing HR policies of a department.

Module 3	Java Persistence using JPA and Hibernate	Project	Programming	06 Sessions

Topics:

Fundamentals of Java Persistence with Hibernate; JPA for Object/Relational Mapping, Querying, Caching, Performance and Concurrency; First & Second Level Caching, Batch Fetching, Optimistic Locking & Versioning; Entity Relationships, Inheritance Mapping & Polymorphic Queries; Querying database using JPQL and Criteria API (JPA)

Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society..

Module 4	Spring Core	Project	Programming	10 Sessions

Topics:

Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development

Assignment: Develop a software tool to do inventory management in a warehouse.

Module 5	Automation tools	Project	Programming	06 Sessions

Topics:

Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands

Assignment: Illustrate the use of automation tools in the development of a small software project.

Targeted Application & Tools that can be used:
Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.

Project work/Assignment:

Problem Solving: Design of Algorithms and implementation of programs.

Programming: Implementation of given scenario using Java.

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

References

R1. Soni, Ravi Kant. "Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful." , Apress, 2017.

R2. Mardan, Azat. "Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB.", Apress, 2015

Course Code: CSE392	Course Title: .NET Full Stack Development	L-T- P-C	0-0-4-2
Version No.	1.0		
Course Pre-requisites	Nil		
Anti-requisites	CSE391 Java Full Stack Development		
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.		
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.		
Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of C# for developing a small application [Application] 2] Show web applications using Entity Framework. [Application] 3]Solve simple web applications that use SQL and ASP.NET [Application] 4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]		
Course Content:			

Module 1	C# Programming for Full Stack Development	Project	Programming	10 Sessions

Topics:

.NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions, Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading, Data validation and working with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework

Assignment: Develop a small application for managing library using C#.				
Module 2	Entity Framework Core 2.0	Project	Programming	06 Sessions

Topics:

Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET

Assignment: Develop an application for managing HR policies of a department.

Module 3	ASP.NET	Project	Programming	06 Sessions

Topics:

ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC & Layouts;

Assignment: Develop a web application to mark entry/exit of guests in a building.

Module 4	ASP.NET	Project	Programming	08 Sessions

Topics:

Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application

Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Visual Studio

Project work/Assignment:

Problem Solving: Design of Algorithms and implementation of programs.

Programming: Implementation of given scenario using .NET.

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

T2. Valerio De Sanctis, "ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11", 4th Edition, Packt, 2021.

References

R1. Benjamin Perkins, Jon D. Reid, "Beginning C# and .NET", Wiley, 2021 Reid, 2021.

R2. Piotr Gankiewicz, "Full Stack .NET Web Development", Packt Publishing, 2017.

R3. Tamir Dresher, Amir Zuker, Shay Friedman, "Hands-On Full-Stack Web Development with ASP.NET Core", Packt Publishing, 2018.

R4. Dustin Metzgar, "Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core", Manning, 2017.

Course Code: CSE3342	Course Title: Ethical Hacking Type of Course: Core Subject	L-T-P- C	1	0	4	3
Version No.	1.3					
Course Pre-requisites	Basic networking tools knowledge and Cryptography & Network Security					
Anti-requisites	NIL					
Course Description	This course introduces students to a wide range of topics related to ethical hacking. It also provides an in-depth understanding of how to effectively protect computer networks. These topics cover some of the tools and penetration testing methodologies used by ethical hackers and provide a thorough discussion of what and who an ethical hacker is and how important they are in protecting corporate and government data from cyber-attacks					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Ethical Hacking and attain to improve the learners' Employability Skills by using Experiential Learning techniques.					

Course Out Comes	On successful completion of this course the students shall be able to:				
	1] Extrapolate the importance of ethical hacking.				
	2] Determine the various techniques for performing reconnaissance				
	3] Categorize various types of system scanners and their functions.				
	4] Identify the function of sniff on a network.				
Course Content:					
Module 1	**Introduction to Hacking**	Assignment		Programming activity	**12 Hours**

Topics:
Introduction to Hacking-Important Terminologies - Asset - Vulnerability - Penetration Test - Vulnerability Assessments versus Penetration Test - Penetration Testing Methodologies - Categories of Penetration Test.
Assignment: Different phase methodologies on penetration testing

Module 2	**Linux Basics**	Assignment		Programming activity	**10 Hours**

Topics:
Major Linux Operating Systems - File Structure inside of Linux - BackTrack - Changing the Default Screen Resolution - Some Unforgettable Basics.
Assignment: Penetration testing distribution

Module 3	**Information Gathering Techniques**	Assignment		Programming activity	**11 Hours**

Topics:
Sources of Information Gathering - Copying Websites Locally - NeoTrace - Xcode Exploit Scanner - Interacting with DNS Servers - DNS Cache Snooping - DNS Lookup with Fierce - SNMP - SMTP.
Assignment: Domain internet groper

Module 4	**Target Enumeration and Port Scanning Techniques**	Assignment		Programming activity	**13 Hours**

Topics:
Target Enumeration and Port Scanning Techniques - Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - Vulnerability Assessment.
Assignment: Demonstrations for port scanning

List of Laboratory Tasks:
Experiments:
1. Command Prompt
2. Wireshark
3. Netscantool
4. OWZAP
5. Neotrace
6. NMAP
7. AngryIPScanner
8. Maltigo
9. Readnotify
10. HTTRACK

11. Yougetsignal
12. CAPSA Portable Network Analyzer
13. Samspade
14. Shodan
15. Oputils
16. Brupsuit
17. Zenmap
18. OSINT
19. John the ripper

Targeted Application & Tools that can be used: Application Software and open source tools like SQL Injection and NIDS,HIDS.

Text Book
1.Rafay Baloch, 2014: "Ethical Hacking and Penetration Testing Guide" Apple Academic Press Inc**.**

References
1.Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security Testing,Penetration Testing, and Basic Security".
2.James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and Network Defense", 2nd Edition, Cengage Learning.

E-Resources:
(1) Ethical Hacking in 12 Hours - Full Course - Learn to Hack! - YouTube

Topics relevant to "EMPLOYABILITY SKILLS": CEH Certification

Ethical hacking techniques for **Employability skills** through **Experiential Learning techniques**. This is attained through the assessment component mentioned in course handout.

Ittagalpura, Rajanukunte, Yelahanka, Bengaluru 560 119