PRESIDENCY UNIVERSITY
GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

PROGRAMME REGULATIONS & CURRICULUM

2024-28

PRESIDENCY SCHOOL OF COMPUTER SCIENCE & ENGINEERING

BACHELOR OF TECHNOLOGY (B.TECH.)

INFORMATION SCIENCE AND TECHNOLOGY - IST

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PRESIDENCY UNIVERSITY

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956

Approved by AICTE, New Delhi

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum 2024-2028

BACHELOR OF TECHNOLOGY (B.Tech.) in INFORMATION SCIENCE AND TECHNOLOGY - IST

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

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

Regulations No.: PU/AC-24.05/SOCSE04/IST/2024-2028

Resolution No.5of 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

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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 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 2024-2028.

b. These Regulations are subject to, and pursuant to the Academic Regulation.

c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2024-2028 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 2024-2025.

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

u. "Degree Program" includes all Degree Programs;

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

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

x. "HOD" means the Head of the concerned Department;

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

z. "MOOC" means Massive Open Online Courses;

aa. "MOU" means the Memorandum of Understanding;

bb. "NPTEL" means National Program on Technology Enhanced Learning;

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

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

ee. "Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028;

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

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

hh. "Registrar" means the Registrar of the University;

ii. "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;

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

kk. "SGPA" means the Semester Grade Point Average as defined in the Academic Regulations;

ll. "Statutes" means the Statutes of Presidency University;

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

nn. "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;

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

pp. "UGC" means University Grant Commission;

qq. "University" means Presidency University, Bengaluru; and

rr. "Vice Chancellor" means the Vice Chancellor of the University.

5. Program Description

The Bachelor of Technology Degree Program Regulations and Curriculum 2024-2028 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 2024-2028 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 (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 able to:

PEO01. Demonstrate as a Computer Engineering Professional with innovative skills and moral and ethical values

PEO02. Engage in lifelong learning through research and professional development

PEO03. Serve as a leader in the profession through consultancy, extension activities and/ 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:

PSO01: Use and develop cloud software, administrative features Infrastructure services and architectural patterns: ethical hacking and forensic security technologies

PSO02: Gain knowledge on design and control strategy; techniques to secure information and adapt to the fast-changing world of information

PSO03: Gain working Knowledge on emerging software tools and technologies and apply the knowledge of secure computing tools and techniques in the field of Information science and technology for solving real world problems.

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, 2023-2027, 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. (Information Science and Technology) 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 Information Science and Technology 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 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.

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

10.2.3 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.

10.2.4 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 of Academic Regulations) 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.** of Academic Regulations) 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	
3	1-0-4-3	Percentage	-	25%	10%	40%	5%	20%	-	100%	Mid-Term & End Term by School
		Marks	-	25	10	40	5	25	-	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 Sub-Clauses 12.6.1 and 12.6.2 of Academic Regulations) 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.** of Academic Regulations) 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 (as per Academic Regulations) 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 (as per Academic Regulations) 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.**. in the Academic Regulations.

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 (13.**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. (Information Science and Technology) Program Structure (2024-2028) 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. (Information Science and Technology) 2024-2028: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	Humanities and Social Sciences including Management Courses (HSMC)	10
2	Basic Science Courses (BSC)	19
3	Engineering Science Courses (ESC)	23
4	Professional Core Courses (PCC)	68
5	Professional Elective Courses (PEC)	18
6	Open Elective Courses (OEC)	06
7	Project Work (PRW)	16
8	Mandatory Courses (MAC)	0
	Total Credits	**160 (Minimum)**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 58% out of the total credits of 160 for B.Tech. (Information Science and Technology) 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 Humanities and Social Sciences including Management Courses (HSMC)					
S.No	Course Name	L	T	P	C
1	Technical English	1	0	2	2
2	Introduction to soft skills	0	0	2	1
3	Introduction to Design Thinking	1	0	0	1
4	Advanced English / Foreign Language courses	1	0	2	2
5	Enhancing Personality Through Soft Skills	0	0	2	1
6	Managerial Economics and Financial Analysis	3	0	0	3
	Total No. of Credits				**10**

Table 3.2 : List of Basic Science Courses (BSC)					
S.No	Course Name				
1	Calculus and Linear Algebra	3	0	2	4
2	Optoelectronics and Device Physics	2	0	2	3
3	Applied Statistics	2	0	0	2
4	Integral Transforms and Partial Differential Equations	3	0	0	3
5	Discrete Mathematics	4	0	0	4
6	Numerical Computations	3	0	0	3
	Total No. of Credits				**19**

Table 3.3 : List of Engineering Science Courses (ESC)					
S.No	Course Name	L	T	P	C
1	Engineering Graphics	2	0	0	2
2	Problem Solving Using C	1	0	4	3
3	Digital Design	2	0	2	3
4	Basic Engineering Sciences	2	0	0	2
5	Problem Solving using JAVA	1	0	4	3
6	Basics of Electrical and Electronics Engineering	3	0	2	4
7	Innovative Projects Using Arduino	-	-	-	1
8	Computational Thinking using Python	2	0	2	3
9	Competitive Programming and Problem Solving	0	0	4	2
Total No. of Credits					**23**

Table 3.4 : List of Professional Core Courses (PCC)					
S. No	Course Name	L	T	P	C
1	Data Structures	3	0	0	3
2	Data Structures Lab	0	0	4	2
3	Web Technologies	2	0	0	2
4	Web Technologies Lab	0	0	2	1
5	Data Communication and Computer Networks	3	0	0	3
6	Data Communication and Computer Networks Lab	0	0	2	1
7	Theory of Computation	3	0	0	3
8	Operating Systems	3	0	0	3
9	Operating Systems Lab	0	0	2	1
10	Computer Organization and Architecture	3	0	0	3
11	Database Management Systems	3	0	0	3
12	Database Management Systems Lab	0	0	2	1
13	Analysis of Algorithms	3	1	0	4
14	Analysis of Algorithms Lab	0	0	2	1
15	Essentials of AI	3	0	0	3
16	Essentials of AI Lab	0	0	4	2
17	Mobile Application Development	2	0	0	2
18	Mobile Application Development Lab	0	0	4	2
19	Software Design and Development	3	0	0	3
20	Cryptography and Network Security	3	0	0	3
21	Fundamentals of Natural Language Processing	3	0	0	3
22	Fundamentals of Data Analytics	3	0	0	3
23	Business continuity and risk analysis	3	0	0	3
24	Applied Data Science	2	0	0	2
25	Applied Data Science Lab	0	0	2	1
26	Cloud Computing	2	0	0	2
27	Deep Learning Techniques	3	0	0	3
28	Reinforcement Learning	2	0	0	2
29	Information Retrieval	3	0	0	3
				Total No. of Credits	**68**

Table 3.5 : List of course in Project Work basket (PRW)					
S.No	Course Name	L	T	P	C
1	Capstone Project	0	0	0	10
2	Internship	0	0	0	02
3	Mini Project	0	0	0	04
Total No. of Credits					**16**

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, 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). The same shall be prescribed in the Course Handout.

18.1 Internship

A student may undergo an Internship for a period of 4-6 weeks in an industry / company or academic / research institution during the Semester Break between 4^{th} and 5^{th} Semesters or 6^{th} and 7^{th} Semesters, 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.

18.1.5 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 Mini Project Work

A student may opt to do a Mini Project Work for a period of 08-10 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the Semester Break between 4^{th} and 5^{th} Semesters or 6^{th} and 7^{th} Semesters or during the 5^{th} / 6^{th} / 7^{th} Semester as applicable, subject to the following conditions:

18.2.1 The Mini Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

18.2.2 The student may do the mini project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.2.1). Provided further, that the Industry / Company or academic / research institution offering such mini project work confirms to the University that the mini project work will be conducted in accordance with the Program Regulations and requirements of the University.

18.3 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 7^{th} / 8^{th} Semester as applicable, subject to the following conditions:

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

18.3.2 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;

18.3.3 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 18.3.2 above.

18.3.4 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 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 Capstone Project Policy of the University.

18.3.5 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.

18.4 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:

18.4.1 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 18.4.1). 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 3.6: Professional Electives Courses/Specialization Tracks – Minimum of 12 credits is to be earned by the student in a particular track and overall 18 credits.

Track 1 – Artificial Intelligence and Machine Learning					
1	Applied Machine Learning	2	0	2	3
2	Optimization Techniques for Machine Learning	3	0	0	3
3	Business Intelligence and Analytics	3	0	0	3
4	Generative AI	2	0	2	3
Track 2 – Big Data and Data Science					
S.No	Course Name	L	T	P	C
1	Big Data Technologies	2	0	2	3
2	Statistical Foundations of Data Science	2	0	2	3
3	Web Data Analytics	2	0	2	3
4	Predictive Analytics	2	0	2	3
5	E-Business and Marketing Analytics	3	0	0	3
6	Data Handling and Visualization	2	0	2	3
Track 3 – Block Chain and Cyber Security					
S.No	Course Name	L	T	P	C
1	Cyber Forensics	2	0	2	3
2	Privacy and Security in Online Social Media	3	0	0	3
3	Ethical Hacking	2	0	2	3
4	Cyber Threats for IoT and Cloud	3	0	0	3
5	Intrusion Detection and Prevention System	3	0	0	3
6	Cyber Security	3	0	0	3

7	Vulnerability Assessment and Penetration Testing	3	0	0	3
8	Digital and Mobile Forensics	2	0	2	3
9	Security Assessment and Testing	2	0	2	3
10	Malware Analysis	3	0	0	3

Track 4 – Cloud Computing and Networks

S.No	Course Name	L	T	P	C
1	Edge and Fog Computing	3	0	0	3
2	Cloud Security and Governance	3	0	0	3
3	Firewall and Internet Security	2	0	2	3
4	5G Networking	3	0	0	3
5	Network Management Systems	3	0	0	3
6	Mobile Networking	2	0	2	3
7	Network Security and Auditing	2	0	2	3

Track 5 – Information Science & Technology

S.No	Course Name	L	T	P	C
1	Operating System with Linux Internals	2	0	2	3
2	Search Engine Optimization	3	0	0	3
3	Service Oriented Architecture	3	0	0	3
4	Information System Audit	3	0	0	3
5	Information Security and Management	3	0	0	3
6	Human Computer Interaction	3	0	0	3
7	Infrastructure Management	3	0	0	3
8	UI UX Design	3	0	0	3

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

Table 3.7 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 06

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 Computer Science and Engineering 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/E N	-	-	-	-
5	CSE3111	Artificial Intelligence : Search Methods For Problem Solving	3	0	0	3	S/ EM/E N	-	-	-	-
6	CSE3112	Privacy And Security In Online Social Media	3	0	0	3	S/ EM/E N	-	-	-	-
7	CSE3113	Computational Complexity	3	0	0	3	S/ EM/E N	-	-	-	-
8	CSE3114	Deep Learning for Computer Vision	3	0	0	3	S/ EM/E N	-	-	-	-
9	CSE3115	Learning Analytics Tools	3	0	0	3	S/ EM/E N	-	-	-	-
Design Basket											
1	DES1001	Sketching and Painting	0	0	2	1	S	-	-	-	-
2	DES1002	Innovation and Creativity	2	0	0	2	F	-	-	-	-
3	DES1121	Introduction to UX design	1	0	2	2	S	-	-	-	-
4	DES1122	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
5	DES1124	Spatial Stories	1	0	2	2	S	-	-	-	-
6	DES1125	Polymer Clay	1	0	2	2	S	-	-	-	-
7	DES2001	Design Thinking	3	0	0	3	S	-	-	-	-
8	DES1003	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
9	DES1004	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
10	DES1005	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
11	DES1006	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
12	DES2080	Art of Design Language	3	0	0	3	S	-	-	-	-
13	DES2081	Brand Building in Design	3	0	0	3	S	-	-	-	-
14	DES2085	Web Design Techniques	3	0	0	3	S	-	-	-	-
15	DES2089	3D Modeling for Professionals	1	0	4	3	S	-	-	-	-
16	DES2090	Creative Thinking for Professionals	3	0	0	3	S	-	-	-	-
17	DES2091	Idea Formulation	3	0	0	3	S	-	-	-	-
Electrical and Electronics Basket											
1	EEE1002	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-
2	EEE1003	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-
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	-	-	-
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	-	-	-
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	-	-	-
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	MGT2021	Finance for Engineers	3	0	0	3	S/EM / EN	HP	-	-	-
25	MGT2022	Customer Relationship Management	3	0	0	3	S/EM / EN	HP	-	-	-
Media Studies Basket											
1	BAJ3050	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-
2	BAJ3051	Digital Photography	2	0	2	3	EM	HP	-	-	-
3	BAJ3055	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-

21. List of MOOC (NPTEL) Courses for Information Science and Technology Program of 12 weeks

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 Wise Course Grids/ Tables: First year - CYCLE 1

Sl. No.	Course Code	Course Name	L	T	P	re dits	ype of Skill/ Focus	Course aters to	Basket
Semester 1 - Physics Cycle						**19**			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4			BSC
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3			BSC
3	MEC1006	Engineering Graphics	2	0	0	2			ESC
4	ENG1002	Technical English	1	0	2	2			HSMC
5	PPS1001	Introduction to soft skills	0	0	2	1			HSMC
6	CSE1004	Problem Solving Using C	1	0	4	3			ESC
7	ECE2007	Digital Design	2	0	2	3			ESC
8	DES1146	Introduction to Design Thinking	1	0	0	1			HSMC
Semester 2 – Basic Engineering Science Cycle						**15**			
1	MAT1003	Applied Statistics	2	0	0	2			BSC
2	CHE1018	Environmental Science	1	0	2	0			MAC

3	CIV1008	Basic Engineering Sciences	2	0	0	2			ESC
4	CSE1006	Problem Solving using JAVA	1	0	4	3			ESC
5	ENG2001	Advanced English	1	0	2	2			HSMC
6	PPS1012	Enhancing Personality Through Soft Skills	0	0	2	1			HSMC
7	EEE1007	Basics of Electrical and Electronics Engineering	3	0	2	4			ESC
8	LAW1007	Indian Constitution and Professional Ethics for Engineers	1	0	0	0			MAC
9	ECE2010	Innovative Projects Using Arduino	-	-	-	1			ESC

First year - CYCLE 2

Sl. No.	Course Code	Course Name	L	T	P	Cre di	Type Skill/ Focu	Cours Caters to	Basket
Semester 1 – Basic Engineering Science Cycle						**15**			
1	MAT1003	Applied Statistics	2	0	0	2			BSC
2	CHE1018	Environmental Science	1	0	2	0			MAC
3	CIV1008	Basic Engineering Sciences	2	0	0	2			ESC
4	CSE1006	Problem Solving using JAVA	1	0	4	3			ESC
5	ENG2001	Advanced English	1	0	2	2			HSMC
6	PPS1012	Enhancing Personality Through Soft Skills	0	0	2	1			HSMC
7	EEE1007	Basics of Electrical and Electronics Engineering	3	0	2	4			ESC
8	LAW1007	Indian Constitution and Professional Ethics for Engineers	1	0	0	0			MAC
	ECE2010	Innovative Projects Using Arduino	-	-	-	1			ESC
Semester 2 – Physics Cycle						**19**			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4			BSC
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3			BSC
3	MEC1006	Engineering Graphics	2	0	0	2			ESC
4	ENG1002	Technical English	1	0	2	2			HSMC
5	PPS1001	Introduction to soft skills	0	0	2	1			HSMC
6	CSE1004	Problem Solving Using C	1	0	4	3			ESC
7	ECE2007	Digital Design	2	0	2	3			ESC
8	DES1146	Introduction to Design Thinking	1	0	0	1			HSMC

Sl. No.	Course Cod	Course Name	L	T	P	Cre di	Type o Skill/ Focus	Course Caters t	Basket
Semester 3						**25**			
1	MAT2501	Integral Transforms and Partial Differential Equations	3	0	0	3			BSC
2	MAT2605	Discrete Mathematics	4	0	0	4			BSC
3	CSE1508	Data Structures	3	0	0	3			PCC
4	CSE1509	Data Structures Lab	0	0	4	2			PCC
5	CSE1504	Web Technologies	2	0	0	2			PCC
6	CSE1505	Web Technologies Lab	0	0	2	1			PCC

7	CSE1506	Data Communication and Computer Networks	3	0	0	3			PCC
8	CSE1507	Data Communication and Computer Networks Lab	0	0	2	1			PCC
9	CSE1500	Computational Thinking using Python	2	0	2	3			ESC
10	MGTXXXX	Managerial Economics and Financial Analysis	3	0	0	3			HSMC
Semester 4						**27**			
1	MAT2602	Numerical Computations	3	0	0	3			BSC
2	CSE2500	Theory of Computation	3	0	0	3			PCC
3	CSE2502	Operating Systems	3	0	0	3			PCC
4	CSE2514	Operating Systems Lab	0	0	2	1			PCC
5	CSE2501	Computer Organization and Architectu	3	0	0	3			PCC
6	CSE1510	Database Management Systems	3	0	0	3			PCC
7	CSE1511	Database Management Systems Lab	0	0	2	1			PCC
8	CSE1512	Analysis of Algorithms	3	1	0	4			PCC
	CSE1513	Analysis of Algorithms Lab	0	0	2	1			PCC
9	CSE1700	Essentials of AI	3	0	0	3			PCC
10	CSE1701	Essentials of AI Lab	0	0	4	2			PCC
Semester 5						**24**			
1	CSE2508	Mobile Application Development	2	0	0	2			PCC
2	CSE2509	Mobile Application Development Lab	0	0	4	2			PCC
3	CSE2000	Software Design and Development	3	0	0	3			PCC
4	XXXXXXX	Open Elective – II	3	0	0	3			OEC
5	CSEXXXX	Professional Elective – I	3	0	0	3			PEC
6	CSE2503	Cryptography and Network Security	3	0	0	3			PCC
7	CSE7000	Internship	-	-	-	2			PRW
8	IST2502	Fundamentals of Natural Language Processing	3	0	0	3			PCC
9	CSD1716	Fundamentals of Data Analytics	3	0	0	3			PCC
Semester 6						**24**			
1	IST2000	Business continuity and risk analysis	3	0	0	3			PCC
2	CSD2001	Applied Data Science	2	0	0	2			PCC
3	CSD2002	Applied Data Science Lab	0	0	2	1			PCC
4	CSE2506	Cloud Computing	2	0	0	2			PCC
5	CSE2510	Competitive Programming and Problen Solving	0	0	4	2			ESC
6	PPSXXXX	Industry Preparedness Program	2	0	0	0			MAC
7	IST2503	Deep Learning Techniques	3	0	0	3			PCC
8	IST2504	Reinforcement Learning	2	0	0	2			PCC
10	XXXXXXX	Open Elective – III	3	0	0	3			OEC
11	CSEXXXX	Professional Elective – II	3	0	0	3			PEC
12	ISE2502	Information Retrieval	3	0	0	3			PCC
Semester 7						**16**			

1	CSEXXXX	Professional Elective – III	3	0	0	3		PEC
2	CSEXXXX	Professional Elective – IV	3	0	0	3		PEC
3	CSEXXXX	Professional Elective – V	2	0	2	3		PEC
4	CSEXXXX	Professional Elective – VI	3	0	0	3		PEC
5	CSE7100	Mini Project	-	-	-	4		PRW
Semester 8						**10**		
1	CSE7300	Capstone Project	-	-	-	10	S/ EM/	PRW

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.

BCC

Course Code: **MAT1001**	**Course Title: Calculus and Linear Algebra** **Type of Course:1] School Core Lab Integrated**	**T- P- C**	**3**	**1**	**0**	**4**
Version No.		2.0				
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.				
Course Objective		The objective of the course is to **familiarize the learners with the concepts of** “CALCULUS AND LINEAR ALGEBRA” **and attain <u>Skill Development</u> through 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.				
Course Content:						
Module 1	**Linear Algebra**					**Classes**
	Review: Types of matrices, elementary transformations, **Linear Algebra:** Echelon form, rank of a matrix, consistency and solution of system of linear equations - Gauss elimination method, Gauss-Jordan method.					

<table>
<tr><td></td><td colspan="5">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.</td></tr>
<tr><td>Module 2</td><td>Partial Derivatives</td><td></td><td></td><td></td><td>14 CLASSES</td></tr>
<tr><td></td><td colspan="5">Review: Differential calculus with single variable.

Differential Calculus:
Partial differentiation, 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.</td></tr>
<tr><td>Module 3</td><td>Integral calculus</td><td></td><td></td><td></td><td>12 Classes</td></tr>
<tr><td></td><td colspan="5">Review: Integral calculus for single integrals.

Integral calculus:
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.

Beta and Gamma functions–inter-relation-evaluation of integrals using gamma and beta functions. Evaluate double & triple integrals.</td></tr>
<tr><td>Module 4</td><td>Differential Equations</td><td>Assignment</td><td></td><td>ogramming</td><td>16 Classes</td></tr>
<tr><td></td><td colspan="5">Definition, types of differential equations, order and degree, 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 eax, sinax, cosax, eaxf(x), xnf(x) etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange’s Equation, Method of Variation of Parameters.
Engineering applications of differential equations.</td></tr>
<tr><td></td><td colspan="5">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: Python.</td></tr>
<tr><td></td><td colspan="5">Assignment:</td></tr>
<tr><td></td><td colspan="5">1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using C Programming/Python.
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>
</table>

	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.
	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/
	Topics relevant to SKILL DEVELOPMENT: 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. for **Skill Development through** Experiential Learning **methodologies.** This is attained through assessment component mentioned in course handout.

Course Code: **PHY1002**	**Course Title: Optoelectronics and Device Physics** **Type of Course: 1] School Core & Laboratory integrated**	-P-C	2-0-2-3
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	successful completion of the course the students shall be able to: 1: Describe the concepts of semiconductors, magnetic materials and superconductors. 2: Apply the concept of materials in the working of optoelectronic and magnetic devices. 3: Discuss the quantum concepts used in advanced microscopy and quantum computers. 4: Explain the applications of lasers and optical fibers in various technological fields. 5: Interpret the results of various experiments to verify the concepts used in optoelectronics d advanced devices. **[Lab oriented].**		
Course Objective	e objective of the course is to familiarize the learners with the concepts of "Optoelectronics d device physics "and attain **Skill Development** through **Experiential Learning** techniques		
Course Content:			
Module 1	**ndamentals of Materials.**	signment	tting of magnetization) v/s Magnetic field for diamagnetic, ramagnetic and romagnetic materials ng excel/ origin ftware.
Topics: Concept of energy bands, charge carriers, carrier concentration, concept of Fermi level, Hall effect, Magnetic materials, Superconductors:			
Module 2	**vanced Devices and applications**	signment	ta collection on iciency of solar cells.
Topics: p-n junctions, Zener diode, transistor characteristics, Optoelectronic devices:, Solar cells, I-V characteristics, and LEDs			
Module 3	**antum concepts and Applications**	m paper	minar on quantum mputers.
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	**sers and Optical ers**	rm paper	se study on medical plications of Lasers.

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.

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

s:
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.

urse Code: **AT1003**	**urse Title: Applied Statistics** **pe of Course:** School Core	**L T P C**	1	0	2	2
rsion No.	)					
urse Pre-requisites	ne					
ti-requisites	ne					
urse Description	e goal of this course is to provide a firm understanding of probability and tistics by means of a thorough treatment of descriptive statistics, probability d probability distributions keeping in mind the future courses having statistical, antitative and probabilistic components. The course covers topics such as scriptive statistics, probability, rules for probability, random variables and obability distributions, standard discrete and continuous probability tributions.					
urse Objective	e objective of the course is to **familiarize the learners with the concepts** "Applied Statistics" and attain **Skill Development Through Problem lving techniques**.					
pected Outcome:	the end of this course, students will be in a position to apply the techniques of descriptive statistics effectively interpret the ideas of probability and conditional probability demonstrate the knowledge of probability distributions Compute statistical parameters, correlation and regression, obability and sampling distributions using R software.					

odule 1	**scriptive Statistics**	signment	ding needed	**10 classes**
roduction to Statistics, Data and statistical thinking, review of basic statistical parameters, variance, Correlation, Types of Measures of Correlation - Karl Pearson's Correlation Coefficient, earman Rank Correlation, linear regression, Multi linear regression **.**				
odule 2	**obability**			**6 classes**
roduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional obability, Total Probability and Baye's theorem with examples				

odule 3	**ndom Variables and obability stributions**		ding needed	**14 classes**
roduction to Random variables, Discrete Random Variables and Continuous Random Variables, obability Distributions, Probability Mass Function and Probability Density Function, Various obability distributions, Binomial, **Negative Binominal (Self Study)**, Poisson, Normal and Exponential tributions				
odule 4	**mpling Theory**		ding needed	**15 classes**
roduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard or. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between rametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and **Difference of eans (Self Study)**, Small Sample Tests: Student's t-Test for Single Mean and **Difference of Means,** F-st, Chi-Square Test.				

rgeted Application & Tools that can be used:

e objective of the course is to familiarize students with the theoretical concepts of probability and tistics and to equip them with basic statistical tools to tackle engineering and real-life problems.
ols used: R Software / MS-Excel

xt Book

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

ferences

James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 18.

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

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

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

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

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

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

Course Code: EEE1007	**Course Title: Basics of Electrical and Electronics Engineering.** **Type of Course: Engineering Science - Theory & Integrated Laboratory**		**L-T-P-C**	3	0	2	4
Version No.	1.0						
Course Pre-requisites	**NIL**						
Anti-requisites	**NIL**						
Course Description	This is a fundamental Course which is designed to know the use of basics of electrical and electronics engineering principles occurs in various fields of Engineering. The course emphasis on the characteristics and applications of Electrical and Electronics devices, working, analysis and design of electrical circuits using both active & passive components, fundamentals of electrical machines and basics of transistors and its application. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to visualize the real system performance, using both hardware and simulation tools.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain **Skill Development** through **Experiential Learning** techniques.						
Course Outcomes	**On successful completion of this course the students shall be able to:** **Explain** basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits. **Discus**s various fundamental parameters appearing in the characteristics of semiconductor devices and their applications. **Summarize** the operations of different biasing configurations of BJTs and amplifiers. **Summarize**the performance characteristics and applications of various electrical Machines. **Demonstrate** the working of electrical machines to observe performance characteristics **Demonstrate** the working of electronic circuits to obtain the V-I Characteristics of various semiconductor devices.						
Course Content:							
Module 1	**Introduction to Electrical Circuits**	Assignment/ Quiz	Numerical solving Task	**10 Sessions**			
DC Circuits: Concept of Circuit and Network, Types of elements, Network Reduction Techniques-Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, Numerical examples. **AC Circuits:** Fundamentals of single phase circuits - Series RL, RC and R-L-C Circuits, Concept of active power, reactive power and Power factor, Numerical examples. Introduction to three phase system and relation between line and phase values in Star & Delta connection, Numerical examples.							
Module 2	**Semiconductor and Diode applications**	Assignment/ Quiz	Memory Recall based Quizzes	**11 Sessions**			
Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal and practical behaviour, Modelling the Diode Characteristic, and Diode applications like rectifiers, Clipping and clamping circuits. Zener diode, characteristics and its applications like voltage regulator.							
Module 3	**Fundamentals of Electrical Machines**	Assignment/ Quiz	Memory Recall-based Quizzes	**12 Sessions**			

Electrical Machines: Single phase transformers: principle of operation and EMF equation, Numerical examples. DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation of Induction Motors and its Applications. **Special Machines:** Introduction to special electrical machines and its applications.				
Module 4	**Transistors and its Applications**	Assignment/ Quiz	Numerical solving Task	**12 Sessions**
Transistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing & stabilization techniques: Fixed Bias, Voltage divider bias and its stability factor and load line analysis. Single and multistage amplifier, Darlington pair. JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes.				

List of Laboratory Tasks:

Experiment No 1: Verification of KVL and KCL for a given DC circuit.
Level 1: Study and Verify KVL and KCL for the given electrical Circuit.
Level 2: For the same circuit considered in level 1, perform the simulation using NI LabVIEW/Multisim/MATLAB.

Experiment No 2: Analyse AC series circuits – RL, RC and RLC .
Level 1: Conduct an experiment to perform and verify the impedance, current and power of Series RL and RC circuits
Level 2:

Experiment No 3: Calculation of power and power factor of the given AC Circuit.
Level 1: Conduct an experiment to measure the power and power factor for given resistive load.
Level 2: Conduct an experiment to measure the power and power factor for given inductive load.

Experiment No 4: Perform the experiments on given Transformer.
Level 1: Verify the EMF equation of a transformer and compute the voltage transformation ratio.
Level 2: Study the effect of load on the secondary side of the transformer and verify the EMF equation under load conditions.

Experiment 5: Load test on DC shunt motor
Level 1: Conduct load test on DC shunt motor and find its efficiency at different loads
Level 2: Conduct load test on DC shunt motor and plot the performance characteristics.

Experiment 6: Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions.
Level 1: Carry out an experiment to plot VI Characteristics and hence find the cut-in voltage on forward characteristics for the Silicon P-N Junction diode.
Level 2: Carry out an experiment to plot VI Characteristics of Zener diode and hence find the zener voltage on reverse characteristics for the Silicon P-N Junction zener diode.

Experiment 7: To observe the output waveform of half wave and full wave rectifier circuit and compute ripple factor and efficiency
Level 1: Identify the components required for a rectifier circuit, rig up the circuit, and sketch the output waveforms without filter.
Level 2: Rig up the rectifier circuit with RC filter, observe the output waveforms, determine the efficiency and ripple factor.

Experiment 8: To construct clipping and clamping circuits for different reference voltages and to verify the responses.
Level 1: Identify the components required for building a Clipper / Clamper circuit. Rig up the circuit according to the circuit diagram given and sketch the output waveform.

Level 2: Given a sinusoidal input of 10 V p-p, implement a positive / negative clipper with output clipped at 2 V.

Experiment 9: To calculate various parameters of emitter follower circuit using BJT
Level 1: Identify the components required to implement an emitter follower circuit. Rig up the circuit and observe the variations in output waveform with respect to the variations in input waveform.
Level 2: Determine the values of Z_{in} input impedance and Z_{out} output impedance for Emitter Follower.

Experiment 10: To Implement RC Coupled amplifier using a BJT and sketch the frequency response.
Level 1: Identify the components required to implement an RC coupled amplifier circuit. Rig up the circuit and sketch the frequency response.
Level 2: From the frequency response curve determine the value of the mid band gain and the bandwidth.

Targeted Application & Tools that can be used:
Targeted Applications: Application Area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.
Professionally Used Software: Matlab/Multisim/ PSpice
Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis..

Text Book(s):
Kothari D. P. &Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-HillEducation.
Theraja B.L. and Theraja A.K., "A Textbook of Electrical Technology: Basic Electrical Engineering" in S.I. System of Units, 23rd ed., New Delhi: S. Chand, 2002.
A.P.Malvino, Electronic Principles,7thEdition, Tata McGraw Hill,2007
J. Millman, C. C. Halkias and C. D. Parikh, "Millman's Integrated Electronics", McGraw Hill Education, 2nd Edition.
Basics of Electrical & Electronics Laboratory Manual.

Reference Book (s):
John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd
R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

Online Resources (e-books, notes, ppts, video lectures etc.):
https://presiuniv.knimbus.com/user#home
https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
Seminar Topic: https://nptel.ac.in/courses/108/105/108105153/ "Electrical Measurements"
Video lectures on "Electronic Devices" by Prof.Dr. A. N. Chandorkar, IIT Bombay
http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html
Video lectures on "Analog Electronics" by Prof. S.C. Dutta Roy, IIT Delhi
https://nptel.ac.in/courses/108/102/108102095/
Video lectures on "Diodes", by Prof.ChitralekhaMahanta, IIT Guwahati,
https://nptel.ac.in/courses/117/103/117103063/

“Introduction to Electrical Machines https://nptel.ac.in/courses/108/102/108102146/” M. -Y. Kao, H. Kam and C. Hu, "Deep-Learning-Assisted Physics-Driven MOSFET CurrentVoltageModeling," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 974-977, June 2022, doi: 10.1109/LED.2022.3168243 https://ieeexplore-ieee-org-resiuniv.knimbus.com/document/9758727 F. Bonet, O. Aviñó-Salvadó, M. Vellvehi, X. Jordà, P. Godignon and X. Perpiñà, "Carrier Concentration Analysis in 1.2 kV SiCSchottky Diodes Under Current Crowding," in IEEE Electron DeviceLetters, vol. 43, no. 6, pp. 938-941, June 2022, doi: 10.1109/LED.2022.3171112. https://ieeexplore-ieeeorg- presiuniv.knimbus.com/document/9764749 M. Chanda, S. Jain, S. De and C. K. Sarkar, "Implementation of Subthreshold Adiabatic Logic for Ultralow-Power Application," in IEEE Transactions on Very Large Scale Integration (VLSI) Systems, vol. .23, no. 12, pp. 2782-2790, Dec. 2015. https://ieeexplore.ieee.org/document/7018053 R. Raut and O. Ghasemi, "A power efficient wide band trans-impedance amplifier in submicron CMOS integrated circuit technology," 2008 Joint 6th International IEEE Northeast Workshop on Circuits and Systems and TAISA Conference, 2008, pp. 113-116, doi: 0.1109/NEWCAS.2008.4606334. https://ieeexplore.ieee.org/document/4606334
Topics relevant to “SKILL DEVELOPMENT”: Performing suitable experiments to compute the Electrical and electronics circuit parameters, performance operation of Machines, and semiconductor devices for **Skill Development**through **Experiential Learning techniques**. This is attained through assessment component mentioned in course plan.

ESC

urse Code: E2007	urse Title: Digital Design pe of Course: Theory &Integrated Laboratory	L- T-P- C	2	0	2	3
rsion No.	)					
urse Pre-requisites	Elements of Electronics/Electrical Engineering, 2] Basic concepts of number presentation, Boolean Algebra					
ti-requisites	-					
urse Description	**e purpose of this course is to enable the students to appreciate the fundamentals of gital logic circuits and Boolean algebra focusing on both combinational and sequential ic circuits. The course emphasizes on minimization techniques for making canonical d low-cost digital circuit implementations. This course deals with analysis and design digital electronic circuits. The course also creates a foundation for future courses which ludes Computer Architecture, Microprocessors, Microcontrollers, and Embedded stems etc.** e course enhances the Design, Implementation and Programming abilities through oratory tasks. The associated laboratory provides an opportunity to verify the theoretical owledge.					
urse Objective	**e objective of the course is to familiarize the learners with the concepts of Digital sign and attain the SKILL DEVELOPMENT through** EXPERIENTIAL **LEARNING.**					
urse Outcomes	**successful completion of this course the students shall be able to:** **Describe** the concepts of number systems, Boolean algebra and logic gates. **Apply** minimization techniques to simplify Boolean expressions. **Demonstrate** the Combinational circuits for a given logic Demonstrate the Sequential and programmable logic circuits **Implement** various combinational and sequential logic circuits using gates.					
urse Content:						

odule 1	**ndamentals of Number systems- olean algebra and digital logic**	plication signment	ta Analysis task	**06 classes**
pics: view of Number systems and logic gates, Number base conversions, Overview of Boolean functions and nplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates AND & NOR) Implementations. Introduction to HDL.				
odule 2	**olean function simplification**	plication signment	ta Analysis task	**08 Classes**
pics: roduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude nparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority coders, HDL Models of combinational circuits.				
odule 3	**mbinational Logic circuits:**	plication signment	ogramming Task Data Analysis task	**08 Classes**
pics: roduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, citation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers Counters. HDL Models of Sequential circuits.				

t of Laboratory Tasks:

periment N0 1: Verify the Logic Gates truth table
vel 1: By using Digital Logic Trainer kit
vel 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

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

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

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

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

periment No. 6: Study of Flip flops

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

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

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

rgeted Application & Tools that can be used:

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

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

xt Book(s):

Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education, 6th edition

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

ference(s):

ference Book(s):

. Jain, R. P., *"Modern Digital Electronics",* McGraw Hill Education (India), 4th Edition

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

line Resources (e-books, notes, ppts, video lectures etc.): Book Free Download udymaterialz.in)

eBook1: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education. {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download

eBook2: Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC SIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.

NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits

Digital Logic Design PPT Slide 1 (iare.ac.in)

Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video

rcuitVerse - Digital Circuit Simulator online

arn Logisim ➠ Beginners Tutorial | Easy Explanation! - Bing video

gital Design 5: LOGISIM Tutorial & Demo

https://presiuniv.knimbus.com/user#/home

content:

Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 16 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, 684-687, doi: 10.1109/ICMTMA.2016.168.

An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir med Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on mputer and Information Technology (ICCIT)

A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit neration," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: .1109/EWDTS52692.2021.9581029.

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

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

urse Code: /1008	urse Title: **Basic Engineering Sciences** pe of Course: **Theory Only**	L-T-P-C	2	0	0
rsion No.	)				
urse Pre-requisites	-				
ti-requisites	-				

urse Description

is basic course on engineering science is designed to introduce students to the fielc
chanical and petroleum engineering. Student will be exposed to various fields in civil e
d different manufacturing techniques in addition to machinery for power produ
nsumption. Additionally, students will be getting an overview of various sectors of oil & gas
is course acquaints students to basics of Industry 4.0 and Construction 4.0. The course aims
dents to appreciate the multidisciplinary nature of engineering design and operations in t
with mechanization and digitization transforming every aspect of engineering.

urse Objective

e objective of the course is skill development of student by using Participative Learning te

urse Outcomes

successful completion of this course the students shall be able to:
cognize the significance of various disciplines in Civil Engineering
scuss the recent evolutions in Civil Engineering
plain various energies, energy generating machineries and energy consumption machineri
scribe the fundamental concept and terminology associated with the Petroleum Industry
tinguish between conventional and modern manufacturing techniques.

urse Content:

odule 1	**roduction to various fields in il Engineering**	signment	se studies on different il Engineering Projects	**essions**

pics: Introduction to Civil Engineering: Definition, scope and branches of Civil Engineering, Role of Civil Engineer, Ov
rastructure.

odule 2	**rrent Trends and Evolution in il Engineering**	signment	ticle Review	**essions**

pics: Mechanization in Construction, Application of Digital Technologies in Planning, Design, execution, monitoring
intenance of Construction. Overview of Smart Cities.

odule 3	**wer Production and nsumption Machinery**	signment & Quiz	ta Collection	**essions**

pics: Energy and its types, Engines and their applications, Pumps-Compressors and their applications.

odule 4	**erview of Petroleum gineering**	signment & Quiz	ticle Review	**essions**

erview of the Petroleum Industry, Importance of Petroleum Engineering, lifecycle of Petroleum products, Classifica
P activities: Key difference between Offshore and Onshore, Onshore facilities, offshore platforms, Digitization of pe
gineering

odule 5	**lustry 4.0**	signment & Quiz	ta Collection	**essions**

pics: Conventional manufacturing process: Metal forming, metal removal and metal joining process.
odern Manufacturing process: 3D Printing / Additive Manufacturing.

rgeted Application & Tools that can be used:

plication Areas include design and implementation of Smart City projects, Infrastructure maintenance, Power prodı
gines, Electric vehicles, onshore and offshore exploration and production activities

oject work/Assignment:

signment 1: Collect data and prepare report on various Mega Projects in Civil Engineering
signment 2: Review Articles on current evolutions in Civil Engineering.
signment 3: Collect data related to renewable energy generation (Wind, Solar)
signment 4: Prepare an energy consumption chart for a compressor or pumps.
signment 5: Prepare a report on role of 3D printing across various industries.
signment 6: Prepare an assignment on geopolitical influence on oil and gas industries.

xt Book:

ments of Civil and Mechanical Engineering, L.S. Jayagopal & R Rudramoorthy, Vikas Publishers

. Elements of Mechanical Engineering, by VK Manglik

ndamentals of Oil & Gas Industry for Beginners by Samir Dalvi, Notion Press; 1st edition

ferences

K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and P
t Ltd, Mumbai.

Nontechnical Guide to Petroleum Geology, Exploration, Drilling & Production by Norman J. Hyne, PennWel
d Revised edition

eb-resources:

Basic Civil Engineering
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site=ehost-live

Post-parametric Automation in Design and Construction
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live

Smart Cities : Introducing Digital Innovation to Cities
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live

Innovation Energy: Trends and Perspectives or Challenges of Energy Innovation
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2323766&site=ehost-live

Mechanical Engineering
ps://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_RE

Additive Manufacturing: Opportunities, Challenges, Implications
ps://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live

Society of Petroleum Engineers (SPE)
ps://www.spe.org/en/

PetroWiki: A comprehensive online resource created by the Society of Petroleum Engineers that provides in
various aspects of petroleum engineering.
ps://petrowiki.spe.org/PetroWiki

Rigzone: A resource for news and information about the oil and gas industry, including job postings an
nds.
https://www.rigzone.com/

pics relevant to the development of SKILLS:

gines-Turbines and their applications.

echanization in Construction.

gitization in Petroleum Industries

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	**e objective of the course is to familiarize the learners with the concepts "Engineering Graphics" and attain SKILL DEVELOPMENT through Problem ving methodologies.**			
Course Outcomes	**successful completion of this course the students shall be able to:** 1. **Demonstrate competency of Engineering Graphics as per BIS nventions and standards.** 2. **Comprehend the theory of projection for drawing projections of Points, es and Planes under different conditions.** 3. **Prepare multiview orthographic projections of Solids by visualizing them different positions.** 4. **Prepare pictorial drawings using the principles of isometric projections visualize objects in three dimensions.**			
Course Content:				
Module 1	roduction Drawing	signment	ndard technical drawing	**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	thographic ojections of	signment	ojection methods Analysis	**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	signment	lti-view drawing Analysis	**10 ssions**
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)	signment	atial Visualization	

				8 ssions

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.

ourse Code: CSE1006	**urse Title:** Problem Solving using JAVA **pe of Course:** Integrated	**P- C**	1		3
Version No.	)				
Course Pre-requisites	E1004 – Problem Solving Using C				
nti-requisites					
Course Description	is course introduces the core concepts of object-oriented programming. This course has ory and lab component which emphasizes on understanding the implementation and plication of object-oriented programming paradigm. It helps the student to build real time ure applications by applying these concepts and also for effective problem solving. The dents interpret and understand the need for object oriented programming to build plications.				
Course Objective	e objective of the course is to familiarize the learners with the concepts of Problem-ving using JAVA and attain **SKILL DEVELOPMENT** through **EXPERIENTIAL LEARNING** hniques				
Course Out Comes	**successful completion of the course the students shall be able to:** **O. 1:** Describe the basic programming concepts. [Knowledge] **O. 2:** Apply the concept of classes, objects and methods to solve problems. pplication] **O. 3:** Apply the concept of arrays and strings. [Application] **O. 4:** Implement inheritance and polymorphism building secure applications. pplication] **O. 5:** Apply the concepts of interface and error handling mechanism. [Application]				
urse Content:					

Module 1	**sic Concepts of Programming d Java**	ignment	ta Collection/Interpretation	**12 essions**
pics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, wnload Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: anching and Looping.				
Module 2	**sses, objects, methods and nstructors**	e studies / Case	Case studies / Case let	**12 essions**
pics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding a members and methods to the class, access specifiers, instantiating objects, reference variable, accessing ss members and methods. tic Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static yword, Nested classes, Accessing members in nested classes.				
Module 3	**rays, String and String buffer**	iz	Case studies / Case let	**14 essions**
pics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of jects. String: Creation & Operation. String builder class, methods in String Buffer.				
dule 4	**eritance and Polymorphism**	iz	se studies / Case let	**Sessions**
pics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: thod overriding. Final keyword: with data members, with member functions and with class. Abstract yword: with data members, with member functions and with class, Exception handling.				
dule 5	**ut & Output Operation in a**	iz	se studies / Case let	**Sessions**
ut/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding eams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer nagement, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable erfaces.				

t of Laboratory Tasks:

\- Problem Solving using Basic Concepts.
\- Problem Solving using Basic Concepts and Command Line Arguments.
\- Programming assignment with class, objects, methods and Constructors.
\- Programming assignment with method overloading.
\- Programming assignment with constructor overloading.
\- Programming assignment with Static members and static methods.
\- Programming assignment with Nested classes.
\- Programming assignment using Arrays.
\- Programming assignment using Strings.
0 - Programming assignment using String Builder.
1 - Programming assignment using Inheritance and super keyword.
2 - Programming assignment using Method overriding and Dynamic method invocation.
3 - Programming assignment using Final keywords.
4 - Programming assignment using Abstract keywords.
5 - Programming assignment using Interface.
6 - Programming assignment using Interface.
7 - Programming assignment CharacterStream Classes
8 - Programming assignment Read/Write Operations with File Channel

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

xt Book

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

ferences

: Cay S Horstmann and Cary Gornell, “CORE JAVA volume I-Fundamentals”, Pearson
: James W. Cooper, “Java TM Design Patterns – A Tutorial”, Addison-Wesley Publishers.

ɔook link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-
ɔdf

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

eb **resources**
//youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q
//puniversity.informaticsglobal.com:2229/login.aspx

ɔics 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.

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

ɔurse Code: ɛE2010	ɔurse Title: Innovative Projects using ɛduino	T-P- C	-	-	-	1
ɛrsion No.	)					
ɔurse Pre-ɋuisites	L					
ɪti-requisites	L					
ɔurse ɛscription	is course is designed to provide an in-depth understanding of Arduino crocontrollers and their application in various real time projects involving nsors. Throughout the course, students will learn the fundamentals of ɛduino programming and gain hands-on experience with a wide range of nsors. Students will explore how to connect and interface sensors with ɛduino boards, read sensor data, and use it to control various output devices is course is suitable for beginners who are interested in exploring the world electronics and developing practical applications using Arduino and nsors.					
ɔurse Objective	e objective of the course is **Employability Skills** of student by using **PARTICIPATIVE ARNING** techniques.					
ɔurse ɪtcomes	**ɪ successful completion of the course the students shall be able to** Explain the main features of the Arduino prototype board Demonstrate the hardware interfacing of the peripherals to Arduino stem. Understand the types of sensors and its functions Demonstrate the functioning of live projects carried out using ɛduino system.					
ɔurse Content:						

odule 1	sic concepts of duino	nds-on	erfacing Task and alysis	Sessions

pics:
troduction to Arduino, Pin configuration and architecture, Device and platform features, ncept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , roduction to Embedded C and Arduino platform, Arduino Datatypes and variables, duino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.

odule 2	nsory Devices	nds-on	erfacing Task and alysis	Sessions

duino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, trasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino.
roduction to 3D Printer: 3D Printer technology and its working Principles, Applications.
roduction to online Simulators: Working with Tinkercad Simulator.

pics: Types of Arduino boards, sensors, 3D Printer

rgeted Application & Tools that can be used:

pplication Area:

me Automation, Environmental Monitoring, Agriculture and Farming, Industrial tomation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education d Learning. These are just a few examples of the many application areas where Arduino and nsors can be applied. The flexibility and affordability of Arduino, combined with the wide nge of sensors available, allow for endless possibilities in creating innovative projects.

ofessionally Used Software: students can use open SOURCE Softwares Arduino IDE and ncker CAD

oject work/Assignment:

Projects: At the end of the course students will be completing the project work on solving ny real time issues.

Book/Article review: At the end of each module a book reference or an article topic will given to an individual or a group of students. They need to refer the library resources and ite a report on their understanding about the assigned article in appropriate format. esidency University Library Link .

Presentation: There will be a presentation from interdisciplinary students group, where students will be given a project on they have to demonstrate the working and discuss the plications for the same

xtbook(s):
onk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill blications Second Edition

ferences
ference Book(s)
Neerparaj Rai "Arduino Projects for Engineers" BPB publishers,first edition, 2016.

Ryan Turner ”Arduino Programming ” Nelly B.L. International Consulting Ltd. first ition,2019.

nline Resources (e-books, notes, ppts, video lectures etc.):

Arduino trending Projects < https://www. https://projecthub.arduino.cc/>

Introduction to Arduino < ps://onlinecourses.swayam2.ac.in/aic20_sp04/preview>

Case studies on Wearable technology< https://www.hticiitm.org/wearables>

content:

Cattle Health Monitoring System Using Arduino and IOT (April 2021 | IJIRT | lume 7 Issue 11 | ISSN: 2349-6002)

M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh” IOT SED SMART SECURITY SYSTEM USING ARDUINO” 2021 JETIR August 2021, Volume 8, ue 8.

R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. niri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer anagement Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. **ps://ieeexplore.ieee.org/document/8494144**.

Yaser S Shaheen,Hussam., " Arduino Mega Based Smart Traffic Control System ," cember 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): -52, 2021):15(12): 43-52, 2021.

pics relevant to development of “SKILL”: System design for achieving Sustainable velopment Goals.

urse Code: E2001	**urse Title: Data Structures and Algorithms** **pe of Course: School Core** **eory-Integrated Laboratory**	**T-P- C**	3-0-2-4	
rsion No.	**)**			
urse Pre- quisites	**/a or Python**			
ti-requisites	**-**			
urse scription	**e purpose of the course is to provide the fundamental concepts of data uctures and algorithm, to emphasize the importance of choosing an propriate data structure and algorithm for program development.** **e student should have basic programming skills, to solve gineering/computational problems.** **e associated laboratory provides an opportunity to implement the concepts d enhance critical thinking and analytical skills.** **th a good knowledge in the fundamental concepts of data structures and orithm the student can gain practical experience in implementing them, abling the student to be an effective designer, developer for new software plications.**			
urse Outcomes	**successful completion of this course the students shall be able to:** 1. **Implement modularized solutions for given problem using ndamental data structures.** **Apply an appropriate linear data structure for a given computation.** **Apply an appropriate non-linear data structure for a given computation** **Analyze complexity of given searching and sorting algorithms.**			
urse Content:				
odule 1	ndamentals of Data ucture omprehension)	signment	ogramming Task	**06 Classes**
pics: ta Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear & Non ear Data Structures. Recursion: Recursive Definition and Processes, Programming examples. ndamentals of Algorithmic problem solving, Important Problem types.				
odule 2	ear Data Structure ck, Queues & Linked t oplication)	se Study	ogramming Task	**Classes**
pics: ck- Concepts and representation, Stack operations, stack implementation using array. plications of Stack. eues- Representation of queue, Queue Operations, Queue implementation using array, Types of eue, Applications of Queue.				

ked List- Singly Linked List, Operation on linear list using singly linked storage structures, Doubly ked List, Circular List, Applications of Linked list.				
odule 3	n-linear Data uctures – ees (Application)	signment	ogramming Task	**Classes**
pics: roduction to Trees, Binary tree: Terminology and Properties, Binary tree traversals: Pre-Order versal, In-Order traversal, Post-Order traversal.				
odule-4	n-linear Data uctures –Graphs omprehension)	signment	ogramming Task	**Classes**
pics: aph – Basic Concept of Graph Theory and its Properties, Representation Of Graphs.				
odule-5	arching & Sorting rformance Analysis and anagement omprehension)	signment	ogramming Task	**Classes**
pics: rting & Searching: Performance Analysis and Management - Time and space analysis of algorithms verage, best and worst case analysis. Searching – Sequential Search and Binary Search, Sorting – bble Sort, Selection Sort.				

t of Laboratory Tasks:

b sheet

[02 Classes]

implement the Programs on User define functions

vel 1: Implement a program to compute factorial using functions.
vel 2: Implement a program to pass array to a function and manipulate the data in array.

b sheet

[02 Classes]

implement the Programs on User define functions

vel 1: Implement a program to compute factorial using recursion.
vel 2: Implement a program to solve towers of Hanoi using recursion.

b sheet

[04 Classes]

implement the Programs on Stack.

vel 1: Implement the operations of the Stack.
vel 2: Implement the evaluation of postfix expression

b sheet

[04 Classes]

implement the programs on Queue.

vel 1: Implement all the operations of the Queue
vel 2: Issuing token for doctor appointment.

b sheet

[06 Classes]

implement the Programs on Linked List.

vel 1: Implement all the operations of the Singly Linked List
vel 2: Implement Stack and Queue with Linked List.

b sheet

[04 Classes]

implement the Programs on Trees and Traversals

vel 1: Implement construction of the Binary tree.
vel 2: Implement tree traversals.

b sheet 7: **[2**
sses]
study and implement the Programs on Graphs.
vel 1: Program to implement graph

b **sheet**
[6 Classes]
analyze time complexity and implement the Programs on searching and sorting.
vel 1: Program on searching and sorting.
vel 2: To analyze the time complexity.

rgeted Application & Tools that can be used:

stem software and Application software Programming
ofessionally Used Software : Eclipse / Jupyter notebook IDE

oject work/Assignment:

Problem Solving: Choose an appropriate data structure and implementation of ograms.
Programming: Implementation of given scenario using Java or python

FERENCE MATERIALS: Text Book(s):

R. Venkatesan, S. Lovelyn Rose, ”Data Structures” Wiley, Second edition, January 2019.

Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson ucation.

ferences

Kurt Mehlhorn, and Peter Sanders – Algorithms and Data Sturctures The Basic Toolbox, ringer-Verlag Berlin Heidelberg, 2008.

Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to gorithms”, PHI Learning Private Limited.

pics relevant to development of **“Foundation Skills”:** Fundamentals of Data structure, **“Skill velopment” –** Implementation Linear and nonlinear data structure, **“Employability”**-Linear & nlinear Data Structure

ourse Code: CSE3216	se Title: Mastering Object- Oriented Concepts in ython of Course: Lab		P- C	3-0-2-4
ersion No.				
ourse Pre-requisites	SE1005 – Programming in Python			
ti-requisites				
Course Description	his course covers mastering object-oriented concepts in Python, including asses, inheritance, polymorphism, and encapsulation. Students will learn to esign and implement robust, reusable code using real-world examples. Ideal for ose with basic Python knowledge, it enhances problem-solving skills and oftware development proficiency.			
rse Objective	**he objective of the course is to familiarize the learners with the concepts f Mastering Object Oriented Concepts in Python and attain Skill evelopment through Experiential Learning.**			
rse Out Comes	**O1:** Explain features of Oops along with creation of Python classes and objects represent real world Objects. **[Understand]** **O2:** Demonstrate inheritance, polymorphism, and abstraction in Python to build aintainable and extendable software systems.**[Apply]** **O3:** Demonstrate exception handling in Python to build robust error-handling echanisms and debugging tool and Assess various file handling techniques in ython. **[Apply]**			
se Content:				

Module 1	**duction to OOPS, lasses and Objects**		nment	**0 Sessions**

opics:
troduction to OOPs: Problems in Procedure Oriented Approach, Specialty of Python Language, eatures of OOPS - Classes and Objects, Encapsulation, Abstraction, Inheritance and olymorphism.
lasses and Objects: Creating a Class, The Self Variable, Constructor, Destructors, Types of ariables, Namespaces, Types of Methods - Instance Methods, Class Methods, Static Methods, assing Members of One Class to Another Class, Inner Classes.

Module 2	**ritance and olymorphism**		nment	**0 Sessions**

onstructors in Inheritance, Overriding Super Class Constructors and Methods, The Super() Method, Types Inheritance – Single Inheritance, Multiple Inheritance, Method Resolution Order(MRO), Polymorphism, uck Typing Philosophy of Python, Operator Overloading, Method Overloading, Method Overriding.
bstract Classes and Interfaces: Abstract Method and Abstract Class, Interfaces in Python, Abstract asses vs. Interfaces.

Module 3	**ptions and Files in ython**		gnment	**0 Sessions**

ptions: Errors in a Python Program – Compile-Time Errors, Runtime Errors, Logical Errors. xceptions, Exception Handling, Types of Exceptions, The Except Block, The assert Statement, ser-Defined Exceptions, Logging the Exceptions.

in Python: Files, Types of Files in Python, Opening a File, Closing a File, Working with Text Files ontaining Strings, Knowing whether a File Exists or Not, Working with Binary Files, The with atement, Pickle in Python, The seek() and tell() Methods.
eted Application & Tools that can be used: on, PyCharm
Project work/Assignment:
nment: odule 1 Assignment: Design and implement a Python application that simulates a banking system using asses and methods for customers and accounts. odule 2 Assignment: Develop a Python application that simulates Library management system that emonstrates inheritance, polymorphism and abstraction concepts. odule 3 Assignment: Develop a Python program that handles different types of exceptions while rocessing user input for a movie ticket booking system showcasing exception handling and File handling oncepts.
ext Book r. R Nageshwara Rao, "Core Python Programming", Dreamtech Press, 3rd Edition, 2021.
rences lex Martelli, Anna Ravenscroft & Steve Holden, "Python in a Nutshell The Definitive Reference", 'Reilly Media, 3rd edition, 2017. uciano Ramalho, "Fluent Python Clear, Concise, and Effective Programming", O'Reilly Media, 2nd dition, 2022. ark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th edition, 013. avid Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media, rd edition, 2013. **links:** ww.learnpython.org tps://realpython.com/python3-object-oriented tps://www.tutorialspoint.com/python/python_oops_concepts.htm
opics relevant to "SKILL DEVELOPMENT": uilding Real-World Applications Using OOPS Concepts, Error Handling and Debugging echniques, Concurrency in Python, Advanced File Handling Techniques, Creating and Managing ython Packages and Modules, Designing and Implementing Python Interfaces **his is attained through assessment component mentioned in course handout.**

HSMC

urse Code: ENG1002	**urse Title: Technical English** **pe of Course: 1] School Core** **2] Laboratory integrated**	**L-T-P-C**	1-0-2-2
rsion No.	V. 3		
urse Pre-requisites	ermediate Level English		
urse ti-requisites	L		

urse Description	chnical English course is designed to equip students with the language skills cessary for effective communication in technical and scientific contexts. The course uses on the specialized vocabulary, writing styles, and communication techniques ed in various technical fields, including engineering and information technology.			
urse Objectives	e objective of this course is to develop the learners' **EMPLOYABILITY SKILLS** using **EXPERIENTIAL LEARNING** and **PARTICIPATIVE LEARNING CHNIQUES.**			
urse tcomes	**successful completion of the course, the students shall be able to:** Develop proficiency in using technical vocabulary and terminology. Apply language skills for better speaking skills in technical fields. Write technical descriptions Demonstrate writing skills in writing technical documents such as reports, nuals, and articles.			
urse Content:				
odule 1	**ndamentals of Technical mmunication**	**orksheets& Quiz**	**ocabulary ilding**	**Classes**
roduction to Technical English fferences between Technical English and General English chnical Writing Basics chnical Vocabulary				
odule 2	**chnical Presentation**	**esentations**	**eaking Skills**	**Classes**
troduction nning the Presentation eating the Presentation ving the Presentation				
odule 3	**chnical Description**	**signment**	**oup Presentation**	**Classes**
oduct Description ocess Description er Manuals anscoding: Diagrams, charts and images				
odule 4	**chnical Writing**	**signment**	**riting Skills**	**Classes**
il Writing uasive and Descriptive Language essional Email Etiquette ting clear and concise technical emails mmunicating technical information effectively **hnical Report Writing** es of technical reports (Lab reports, research reports, etc.) mponents of technical reports ting an abstract and executive summary				

cture and content organization

ıscoding: diagrams, charts and images

st of Laboratory Tasks:

Module-1

vel 1: Worksheets

vel 2: Worksheets

Module 2

vel 1: Preparing Presentation

vel 2: Giving Presentation (Individual)

Module-3

vel 1: Product Description & User Manual

vel 2: Process Description & Transcoding

Module 4

vel 1: Email Writing

vel 2: Report Writing

rgeted Applications & Tools that can be used:

Flipgrid

Quizzes

Youtube Videos

Podcast

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

Bring out the essence of technical communication with reference to the conventions of technical mmunication, with examples

Prepare a technical presentation on the importance of Technical Communication and its evance in a technical field, with real-life examples.

ıe following individual, as well as group Assignments, will be given to the students.

Presentation

Describing a product/process

Individual Reports

xt Books

Kumar, Sanjay; Pushpalatha. *English Language and Communication Skills for Engineers.* Oxford ıiversity Press. 2018.

Brieger, Nick and Alison Paul. *Technical English Vocabulary and Grammar*. ps://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf

ference Book:

Chauhan, Gajendra Singh, and Kashmiramka, Smita, ***Technical Communication.*** Cengage Publication. 18.

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

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

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

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

eb Resources:

ttps://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=JST 1_3307. ttps://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=5&sid=3a77d69b-abe5-4681-b39d-dfdcb8f4a5%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=154223466&db=iih Last,Suzan, et. al. ***Technical Writing Essentials.*** University of Victoria, British Columbia, 2019 (E- Book) Vambui, Tabita Wangare, et al. ***Communication Skills- Volume 1***, LAP LAMBRET, USA, 2012 (E Book)
pics Relevant to the Development of Employability Skills: **eaking Skills, Writing Skills, Critical Thinking and Critical Analysis, and Group Communication.**

urse Code: **S1012**	**urse Title: Enhancing Personality rough Soft Skills** pe of Course: Practical Only Course	T - P- C	0	0	2	
rsion No.						
urse Pre- uisites	idents are expected to understand Basic English. idents should have the desire and enthusiasm to be involved, participate and learn.					
ti-requisites	L					
urse Description	is course is designed to enable students to understand soft skills concepts and prove confidence, communication, and professional skills to give the students a mpetitive advantage and increase chances of success in the professional world. The urse will benefit learners in presenting themselves effectively through various ivities and learning methodologies.					
urse Objective	e objective of the course is to **familiarize the learners with the concepts of nhancing Personality through Soft Skills" and attain SKILL EVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
urse Out Comes	**successful completion of this course, the students shall be able to:**) 1 **Identify the stages of** team formation (Remember) CO 2 **Demonstrate** ective presentation skills (Apply) CO3 **Prepare** professional social media profile pply)					
urse Content:						
odule 1	ofessional Brand Building	nd Framework Activity	**Hours**			

pics: Personal brand definition, Crafting a compelling LinkedIn profile, Networking strategies, veraging AI tools for developing content for brand visibility. **tivity:** Create a post and enhancing LinkedIn profile			
odule 2	t of Questioning	le plays	**Iours**
pics: Framing Questions, 5W1H Technique, Open-ended and Close-ended questions, Funnel hnique, Probing questions, Leading questions			
odule 3	esentation Skills	actice and evaluation of lividual/group presentation	**Hours**
pics: Content development, Delivery techniques, Audience Analysis, Timing and Pacing, ndling questions and challenges. **tivity:** Individual presentations or team presentation			
odule 4	am Building	am building activities	**Iours**
pics: Importance of team, stages of Team Formation, Trust and collaboration. **tivity: Team Building Activity**			
odule 5	cap / Revision /Feedback ssion	scussion, Quiz	**Iours**
rgeted Applications & Tools that can be used: D Talks u Tube Links tivities			
oject work/Assignment: Mention the Type of Project /Assignment proposed for this course			
esentation Evaluation nkedIn assessment			

rgeted Applications & Tools that can be used:

D Talks
uTube Links
deos by L&D Team shared on Edhitch/YouTube.com
IS

signments proposed for this course
aluation on Presentation
signment on LinkedIn Post

uTube Links: https://youtu.be/z jxoczNWc (Steve Jobs Introducing the iPhone 4 in June 10)

ferences

alk Like TED - The 9 Public-Speaking Secrets of the World's Top Minds" By Carmine Gallo St. rtin's Press Copyright © 2014 Carmine Gallo All rights reserved. ISBN: 978-1- 250-04112-8
he Presentation Secrets of Steve Jobs: How to Be Insanely Great in Front of Any dience" MP3 CD – Import, 22 April 2014
he Definitive Book of Body Language: The Hidden Meaning Behind People's Gestures d Expressions" Hardcover – Illustrated, 25 July 2006
rucial Conversations: Tools for Talking When Stakes Are High" Paperback – Import, 1 July 2002

eb links:

1. https://www.wordstream.com/blog/ws/2014/11/19/how-to-improve-presentation-skills

ps://www.cbs.de/en/blog/15-effective-presentation-tips-to-improve-presentation-skills/

ps://hbr.org/2022/05/the-art-of-asking-great-questions

pics relevant to the development of "SKILL": Art of Presentation, Team building, Art of estioning, and Personal Branding for Skill Development through Participative Learning Techniques. is is attained through the assessment component mentioned in the course handout.

urse Code: S1001	**urse Title:** **Introduction to Soft Skills** **pe of Course:** **Practical Only Course**	- P- C	0-1-0-0
rsion No.	)		
urse Pre- uisites	ıdents are expected to understand Basic English. ıdents should have desire and enthusiasm to involve, participate and learn.		
ti-requisites	-		
urse Description	is course is designed to enable students understand soft skills concepts and prove confidence, communication and professional skills to give the students a mpetitive advantage and increase chances of success in the professional world. e course will benefit learners in presenting themselves effectively through ious activities and learning methodologies.		
urse Objective	The objective of the course is to **familiarize the learners with the concepts of "Soft Skills" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**		
urse Out Comes	**successful completion of this course the students shall be able to:** 1: **Recognize** significance of soft skills 2: **Illustrate** effective communication while introducing oneself and others 3: **List** techniques of forming healthy habits 4: **Apply** SMART technique to achieve goals and increase productivity		
urse Content:			
odule 1	TRODUCTION TO SOFT SKILLS	**ssroom activity**	**Hours**
pics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality			
odule 2	FECTIVE COMMUNICATION	**lividual Assessment**	**Hours**
pics: Different styles of communication, Difference between hearing and listening, Effective mmunication for success, Email etiquette, Self-introduction framework, Video introduction, ıail- writing, Resume Building- Digital, Video, Traditional.			
odule 3	BIT FORMATION	**orksheets & Assignment**	**Hours**
pics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit op, Unlearning, standing up for what is right			
odule 4	al setting & Time ınagement	**al sheet**	**Hours**
ession where students will be introduced to Time management, setting SMART als, Introduction to OKR Techniques, Time Management Matrix, steps to managing time ough outbound group activity, making a schedule, Daily Plan and calendars (To Do List), onitoring/charting daily activity			
rgeted Application & Tools that can be used: LMS			

oject work/Assignment: Mention the Type of Project /Assignment proposed for this course
Individual Assessment LMS MCQ
e topics related to Skill Development: Communication and professional grooming, Goal setting d presentation for skill development through participative learning techniques. This is attained rough assessment component mentioned in course handout.

G2001	**vanced English**	**T- P- C**				2
rsion No.	;					
urse Pre-quisites	G1002 Technical English					
ti-requisites	-					
urse Description	e course emphasizes on technical communication at advanced level by ploring critical reading, technical presentation and review writing. The rpose of the course is to enable learners to review literature in any form or y technical article and deliver technical presentations. Extensive activities in actical sessions equip to express themselves in various forms of technical mmunications. Technical presentations and the module on career setting cus on learners' area of interests and enhance their English language writing lls to communicate effectively.					
urse Out Come	successful completion of the course the students shall be able to: Develop a critical and informed response reflectively, analytically, cursively, and creatively to their reading. Communicate effectively, creatively, accurately and appropriately in eir writing. Deliver technical presentations Design resume and create professional portfolio to find a suitable reer					

urse Content: Theory				
odule 1	**tical Reasoning d Writing**	**iting Essays**	**tical Reading**	**4 Classes**
pics: 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)				
odule 2	**chnical esentation**	**esentation**	**al Skills**	**3 Classes**
pics: Planning the presentation Creating the presentation Giving the presentation				
odule 3	**iting Reviews**	**ezi**	**view Writing**	**4 Classes**
pics:				

Review Writing Short film reviews Advanced English Grammar (Self Study)				
odule 4	**ırting your reer**	**line Writing Lab**	**iting Skills**	**lasses**
pics: Preparing a Resume Writing Effective Application Letter Creating a Professional Portfolio				
urse Content: Practical Sessions				
odule 1	**tical Reasoning and Writing**			**lasses**
Reading and Analyzing vel 1 – Annotation vel 2 - Assumptions Writing Narrative Essays vel 1 – Draft 1 vel 2 – Draft 2				
odule 2	**chnical Presentation**			**Classes**
Fishbowl Fishbowl, students form concentric circles with a small group inside and a larger group outside. idents in the inner circle engage in an in-depth discussion, while students in the outer circle en and critique content, logic, and group interaction. vel 1 – within group vel 2 – Among 2 group Technical Group Presentation				
odule 3	**iting Reviews**			**Classes**
Practice Worksheets vel 1 – Eliminating the Passive Voice vel 2 – Simple, compound and complex sentences Writing Short Film Reviews				
odule 4	**ırting your Career**			**Classes**
Collaborative Project search and writing report iting Resume				
odule 1-4	**ademic Journal**			**lasses**
Academic Journal Writing vel 1- Mid Term vel 2 – End Term				
rgeted Application & Tools that can be used: Writing reports, Review writing, Group cussion, Dyadic interviews, Grammarly.com				
oject work/Assignment:				
ademic Journal – Assignment Academic Journal (CIJ), students compile task and activities completed in each module and omit to the instructor at the middle and end of the semester.				

ferences   Hering, Heik. *How to Write Technical Reports: Understanding Structure, Good Design, nvincing Presentation*. Springer.   Johnson, Richard. (2010) *Technical Communication Today.* Pearson, 2015   Rice B. Adelrod, Charles R. Cooper and Ellen C. Carillo. (2020) *Reading Critically Writing ell: A Reader and Guide*. Beford/St. Martin's Macmillan Learning, New York.   The Princeton Review. (2010) *MCAT Verbal Reasoning & Writing.* The Princeton Review, .   https://www.hitbullseye.com/Strong-and-Weak-Arguments.php Accessed on 10 Dec 21   https://www.inc.com/guides/how-to-improve-your-presentation-skills.html Accessed 10 Dec 2021
pics Relevant to "employability": Critical Reasoning, Presentation, Review Writing and Starting reer   **pics Relevant to "Human Values and Professional Ethics":** Critical reasoning

PCC

urse Code: E3155	**urse Title: Data Communications and mputer Networks** **pe of Course: Program Core Theory– boratory integrated**	**T-P-C)-2-4**	3	)	2	4
rsion No.	)					
urse Pre-quisites	gital Design					
ti-requisites	L					
urse scription	e objective of this course is to provide knowledge in data communications d computer networks, its organization and its implementation, and gain ctical experience in the installation, monitoring, and troubleshooting of LAN tems. . e associated laboratory is designed to implement and simulate various works using Cisco packet tracer, NS2. All the lab exercises will focus on the ndamentals of creating multiple networks, topologies and analyzing the work traffics.					
urse Objective	e objective of the course is to familiarize the learners with the concepts of ta Communications and Computer Networks and attain **Employability** ough **Problem Solving** Methodologies.					
urse Out mes	successful completion of the course, the students shall be able to: I strate the Basic Concepts Of Data Communication and Computer Networks. Analyze the functionalities of the Data Link Layer. Apply the Knowledge of IP Addressing and Routing Mechanisms in mputer Networks. Demonstrate the working principles of the Transport layer and Application yer.					

urse Content:				
Module 1	Introduction and ysical Layer- CO1	Assignment	'roblem Solving	07 Classes

roduction to Computer Networks and Data communications, Network Components – pologies, Transmission Media –Reference Models -OSI Model – TCP/IP Suite.
ysical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - ıltiplexing and Spread Spectrum.

Module 2	̣eference Models d Data Link Layer – CO2	Assignment	roblem Solving	**7 Classes**

ta Link Layer - Error Detection and Correction – Parity, LRC, CRC, Hamming Code, Flow ntrol and Error Control, Stop and Wait, ARQ, Sliding Window, Multiple Access Protocols, ;MA/CD,CSMA/CA, IEEE 802.3, IEEE 802.11 Ethernet.

Module 3	twork Layer – CO 3	Assignment	roblem Solving	**10 Classes**

twork Layer Services - Network Layer Services, Switching Techniques, IP Addressing ethods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing – RIP-BGP-Link State uting –OSPF-Multi cast Routing-MOSPF- DVMRP – Broad Cast Routing. EVPN-VXLAN, 'LS, ELAN.

Module 4	Transport and pplication Layer - CO3	Assignment	roblem Solving	**10 Classes**

ansport Layers - Connection management – Flow control – Retransmission, UDP, TCP, ngestion control, – Congestion avoidance (DECbit, RED)
e Application Layer: Domain Name System (DNS), Domain Name Space, SSH, FTP, ectronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – – SNMP, Web Services, Virtual tworking.

st of Laboratory Tasks:

b sheet -1, M-1, 3 [2 Hours]
periment No 1:
vel 1: Study of basic network commands and network configuration commands.

b sheet -2, M-1[2 Hours]
periment No 1:
vel 1: Identify and explore Network devices, models and cables. Introduction to Cisco packet cer.

periment No. 2:
vel 2 – Create various network topologies using a cisco packet tracer.

b sheet -3, M-2,3 [2 Hours]
periment No. 1:
vel 2 - Basic Configuration of switch/router using Cisco packet tracer.
periment No. 2:
vel 2 -Configure the privilege level password and user authentication in the switch/router.

b sheet – 4, M-3 [2 Hours]
periment No. 1:
vel 2 - Configure the DHCP server and wireless router and check the connectivity

b sheet – 5, M-3 [2 Hours]
periment No. 1:
vel 2 - Configure the static routing in the Cisco packet tracer.
periment No. 2:
vel 2 - Configure the dynamic routing protocol in the Cisco packet tracer.

b sheet – 6, M-4 [2 Hours]
periment No. 1: Configuration of DNS Server with Recursive & Integrative approach in
sco packet tracer.

b sheet – 7, M-4 [2 Hours]
periment No. 1:
nfigure the telnet protocol in the router using the Cisco packet tracer.
b sheet – 8, M-4[2 Hours]
periment No. 1:
vel1- Introduction to NS2 and basic TCL program.
b sheet – 9, M-4 [2 Hours]
periment No. 1:
vel 1: Simulate three node Point to point network using UDP in NS2.
periment No. 2:
nulate transmission of Ping message using NS2.
b sheet – 10, M-4[2 Hours]
periment No. 1:
nulate Ethernet LAN using N-node in NS2.
periment No. 2:
nulate Ethernet LAN using N-node using multiple traffic in NS2
b sheet –11, M-3,4 [2 Hours]
periment No. 1:
vel 1- Introduction to Wire Shark.
periment No. 2:
vel 2- Demonstration of packet analysis using wire shark.

b sheet –12, M-1,2,3 [2 Hours]
periment No. 1:
vel 2- Demonstration of switch and router configuration using real devices

rgeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.
ıse Study/Assignment: Choose and analyze a network from any ganization/Assignment proposed for this course in CO1-CO4
Problem Solving: Choose and appropriate devices and implement various twork concepts. **Programming: Simulation of any network using NS2.**
xt Book **Behrouz A. Forouzan, "Data Communications and Networking 5E", 5th Edition, ta McGraw-Hill, 2017.** **Andrew S Tanenbaum, Nick Feamster & David J Wetherall, "Computer tworks" Sixth Edition, Pearson Publication, 2022**
ferences **"Computer Networking: A Top-Down Approach", Eighth Edition, James F. ırose, Keith W. Ross, Pearson publication, 2021.** **William Stallings, Data and Computer Communication, 8th Edition, Pearson lucation, 2007.** **Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems ›proach, 4th Edition, Elsevier, 2007.** **Resources:** **ıttps://archive.nptel.ac.in/courses/106/105/106105183/** **http://www.nptelvideos.com/course.php?id=393** **ıttps://www.youtube.com/watch?v=3DZLItfbqtQ** **ıttps://www.youtube.com/watch?v=_fIdQ4yfsfM** **https://www.digimat.in/keyword/106.html** **:ps://puniversity.informaticsglobal.com/login**

urse Code: E2502	**urse Title:** **Operating Systems** **pe of Course:** **Program Core and Theory ly**	**[- P- C**	3	)		3
rsion No.	)					
urse Pre-quisites	E2009- Computer Organization, Problem solving using C ıdents should have basic knowledge on computers, computer software & rdware, and Computer Organization. Prior programming experience in C is commended.					
ti-requisites	-					

urse scription	is course introduces the concepts of operating system operations, operating tem structure and its design and implementation. It covers the classical erating systems internal algorithms such as process scheduling, nchronization, deadlocks detection and recovery and memory management. e course also enhances the problem solving, systems programming ability d case studies.			
urse Object	e objective of the course is to familiarize the learners with the concepts of erating Systems and attain **Employability** through **Problem Solving** ethodologies.			
urse Out mes	successful completion of the course the students shall be able to: Describe the fundamental concepts of operating Systems and case studies. **owledge**] Demonstrate various CPU scheduling algorithms. .[**Application**] Apply various tools to handle synchronization problems.[**Application**] Demonstrate deadlock detection and recovery methods **[Application]** Illustrate various memory management techniques.[**Application**]			
urse Content:				
odule 1	roduction to erating System	signment	ogramming	**9 Hours**
pics: roduction to OS , Operating-System Operations, Operating System Services, , System Calls d its types, Operating System Structure, System Program and its types, Linkers and Loaders, erview of OS design and implementation, Open-source operating system				
odule 2	ocess anagement	signment/Case udy	ogramming/Simulation	**11 Hours**
pics: ocess Concept, Operations on Processes, Inter Process Communication, Communication in ent-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, read Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, heduling Algorithms: FCFS, SJF, SRTF, RR and Priority.				
odule 3	ocess nchronization d Deadlocks	signment	ogramming	**Hours**
pics: e Critical-Section Problem- Peterson’s Solution, Synchronization hardware, Semaphores, ssic Problems of Synchronization with Semaphore Solution- Producer-Consumer Problem, ader-Writer problems, Dining Philosopher’s Problem, . Introduction to Deadlocks, Necessary nditions for deadlock, Resource allocation Graph, Methods for handling deadlock: Deadlock evention and Implementation, Deadlock Avoidance and Implementation, Deadlock detection Recovery from Deadlock.				

odule 4	emory anagement	signment	ogramming/Simulation	**10 Hours**

pics:

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

roduction to File system management: File System Interface (access methods, directory uctures), File system implementation.

rgeted Application:

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

ftware Tools:

Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. ed 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-e processors. It helps to identify the specifications of your Intel processor, like no of cores, ipset information, technologies supported by the processor etc.

oject 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].

xt Book

Silberschatz A, Galvin P B and Gagne G , “Silberschatz's Operating System Concepts”, perback, Global Edition Wiley, 2019

ferences

Silberschatz A, Galvin P B and Gagne G, “Operating System Concepts”, 10th edition ley, 2018.

William Stallings, “Operating Systems”,Ninth Edition, By Pearson Paperback ,1 March 18.

Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, “ Cracking the Operating stem skills”, Dreamtech, paperback, 2020

Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , "Operating Systems: Three Easy ces, Amazon digital Services", September 2018. **esources/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: **CSE2511**	**Course Title**: **Data Analytics** **Type of Course: Theory**		**L-T-P- C**	2	0	0	2
Version No.	**1.0**						
Course Pre-requisites	MAT1003 Applied Statistics						
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 this course, the students shall be able to:** **CO1**:Describe different types of data and variables. **CO2**: Explain data using appropriate statistical methods. **CO3**: Demonstrate the collection, processing and analysis of data for any given application and illustrate various charts using visualization methods. **CO4**: Apply the Data Analysis techniques by R Programming						
Course Content:							

Module 1	**Introduction to Data Analysis- CO1**	Assignment	Data Collection, data analysis, Programming	**06 classes**
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. **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.				
Module 2	**Data Analysis and**	Case studies	Programming	**10 classes**

	Visualization-CO2			
Topics: 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 - CO3**	Case studies	R programming	**7 classes**
Topics: Proportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-Wilcoxon signed rank test- one-way ANOVA test- Kruskal Wallis test				
Module 4	Predictive Analysis-CO4	Case studies	Programming	**7 classes**
Topics: Linear least-squares – implementation – the goodness of fit – testing a linear model – weighted resampling. Regression using Stats models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy. Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis				

Targeted Application & Tools that can be used:

Application Area are Decision making in business, health care, financial sector, Medical diagnosis etc.

Text Books

1. 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.
2. Introduction to statistics and Data analytics, Christian H, Michael S, Springer,2016
3. Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020 (E-resource)
4. Introduction to Time Series and Forecasting (Springer Texts in Statistics), Peter Brockwell, Richard A. Davis, Springer, 2016.

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.

Online resources:

http://www.modernstatisticswithr.com/solutions.html#solutionsch3
https://johnmuschelli.com/intro_to_r/
https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/

Topics relevant to development of "FOUNDATION SKILLS":

1. Statistical Concepts for data, visualization techniques.
2. Data collection for project based assignments.
3. Inferential Statistics (T test, Z test)
4. Probability Calculation

for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: **CSE2512**	**Course Title**: **Fundamentals of Data Analytics** **Type of Course:** **Lab**	**L-P- C**	0	0	2	1

Version No.	**1.0**					
Course Pre-requisites	MAT1003 Applied Statistics					
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 this course, the students shall be able to:** **CO1**:Describe different types of data and variables. **CO2**: Explain data using appropriate statistical methods. **CO3**: Demonstrate the collection, processing and analysis of data for any given application and illustrate various charts using visualization methods. **CO4**: Apply the Data Analysis techniques by R Programming					
Course Content:						
Module 1	**Introduction to Data Analysis-CO1**	Assignment	Programming	**09 classes**		

List of Laboratory Tasks:

Experiment No. 1: Introduction to R and RStudio

Level 1: Getting Started with R and RStudio

- Installing R and RStudio.
- Basic R syntax and commands.

Level 2: Working with RStudio

- Understanding the RStudio interface.
- Creating and managing R scripts.

Experiment No. 2: Basic Data Handling in R

Level 1: Data Types and Structures in R

- Vectors, matrices, and data frames.
- Lists and factors.

Level 2: Data Import and Export

- Reading data from CSV, Excel, and text files.
- Exporting data to different formats.

Level 3: Exploring Datasets

- Using functions like head(), summary(), and str().

Experiment No. 3: Basic Data structure in R

Level 1: a. Demonstrate a program to join columns and rows in a data frame using cbind() and rbind() in R. b. Implement different data structures in R (Vectors, Lists, Data Frames) **Level 2:** R AS CALCULATOR APPLICATION a. Using with and without R objects on console a. Using mathematical functions on console b. Write an R script, to create R objects for the calculator application				
Module 2	**Data Analysis and Visualization-CO2**	Assignment	Programming	**13 classes**

Experiment No. 1: Data Cleaning and Preprocessing

Level 1: Handling Missing Data in R

- Identifying missing values.
- Imputing missing values using mean, median, or other methods.

Level 2: Data Transformation in R

- Standardizing and normalizing data.
- Log-transformations and scaling.

Experiment No. 2: Exploratory Data Analysis (EDA) with R

Level 1: Descriptive Statistics

- Calculating mean, median, and standard deviation.
- Visualizing data using histograms, box plots, and scatter plots.

Experiment No. 3: Data Visualization with ggplot2

Level 1: Demonstrate various graphs that can be made and altered using the ggplot2 package.

Level 2: Create 500 random temperature readings for six cities over a season and then plot the generated data using ggplot2 packages in R

Module 3	**Statistical Analysis - CO3**	Assignment	programming	**10 classes**

Experiment No. 1: Perform Tests of Hypotheses hypothesis test (parametric)

Level 1: How to perform tests of hypotheses about the mean when the variance is known. How to compute the p-value. Explore the connection between the critical region, the test statistic, and the p-value.

Level 2: A teacher claims that people who work for only five hours per week will score significantly lower than people who work for ten hours per week on a quantitative abilities test. He brings twenty people and randomly assigned them to one or two groups. In one group he has participants who work for ten hours and in another group, he has participants who work for five hours. He conducts the test for all participants. Scores on the test range from one to ten with higher scores representing better performance. Test if there is any significant difference between those who work for five hours per week versus those who work for ten hours per week based on the test performance.

Experiment No 2: Hypothesis – Non-Parametric Test

Level 1: A car manufacturing company like to find the sales of three types of cars produced by them in three regions and is given. Test if there is an association between the regions and types of cars purchased.

Experiment No 3: Correlation and Covariance

Level 1: Using the iris data set in R

a. Find the correlation matrix.

b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.

c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Level 2 : Ramesh is doing a statistics paper in his post-graduation course. He met his friend Amal who is a textile engineer. Ramesh, who is doing his internship at ABC Researchers, is interested in a question. He poses this question to Amal and tries to find if he can answer. The question is as follows: The data regarding sales of soft- drinks and sales of cotton clothes in a place during the last 12 months are given. Find if there is any association between sales of soft drinks and sales of cotton clothes. Also explain the reason if there is any relationship.

Module 4	Predictive Analysis-CO4	Assignment	Programming	**10 classes**

Experiment No 1: Regression Model

Level 1: Import data from web storage (http://www.ats.ucla.edu/stat/data/binary.csv). Name the dataset and now do Logistic Regression to find out the relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained, and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).

Level 2: Demonstrate multiple regressions, if data have a continuous Independent variable. Apply on the above dataset

Experiment No. 2: Time Series Analysis in R

Level 1: Demonstrate Timeseries analysis using Time Series Data Library at http://robjhyndman.com/TSDL/.

Targeted Application & Tools that can be used:

Application Area are Decision making in business, health care, financial sector, Medical diagnosis etc.

Text Books

1. 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.
2. Introduction to statistics and Data analytics, Christian H, Michael S, Springer,2016
3. Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020 (E-resource)
4. Introduction to Time Series and Forecasting (Springer Texts in Statistics), Peter Brockwell, Richard A. Davis, Springer, 2016.

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. Online resources: http://www.modernstatisticswithr.com/solutions.html#solutionsch3 https://johnmuschelli.com/intro_to_r/ https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/
Topics relevant to development of "FOUNDATION SKILLS": 1. Statistical Concepts for data, visualization techniques. 2. Data collection for project based assignments. 3. Inferential Statistics (T test, Z test) 4. Probability Calculation **for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**

urse Code: E1005	**urse Title:** Programming in Python **pe of Course:** School Core Lab Integrated	**T-P- C**	1	0		3
rsion No.	)					
urse Pre-requisites	sic knowledge of Computers and Mathematics					
ti-requisites	-					
urse Description	e purpose of this course is to enable the students to develop python ipts using its basic programming features and also to familiarize the thon IDLE and other software's. This course develops analytical skills to hance the programming abilities. e associated laboratory provides an opportunity to validate the concepts ught and enhances the ability to build real time applications.					
urse Object	e objective of the course is to familiarize the learners with the concepts Programming in Python and attain **Employability** through **Problem lving** Methodologies.					
urse Outcomes	**successful completion of this course the students shall be able to:** 1. Summarize the basic Concepts of python. Demonstrate proficiency in using data structures. Illustrate user-defined functions and exception handling. Identify the various python libraries.					
urse Content:						
odule 1	sics of Python ogramming	signment	ogramming	**14 Classes**		
pics: Data types, operators and Expressions, Input and Output Statements. Control Structures – ective and Repetitive structures						

odule 2	lexed and sociative Data uctures	nple applications	ogramming	**20 Classes**
pics: Strings, Lists, Sets, Tuples, Dictionaries				
odule 3	nctions, Exception ndling and raries	se study	ogramming	**Classes**
pics: User defined functions, exception handling, Introduction to python built-in libraries				

t of Laboratory Tasks:

No.	periment Name
	OGRAMS ON OPERATORS AND EXPRESSIONS vel - 1 : Basic programs on Operators and Expressions vel - 2 : Develop applications to solve mathematical equations
	OGRAMS ON CONTROL STRUCTURES vel - 1 : Basic programs on Control structures vel - 2 : Create applications to solve the real time problems
	OGRAMS ON SELECTIVE AND REPETITIVE STRUCTURES vel - 1 : Basic programs on Selective and Repetitive structures vel - 2 : Create applications to solve the real time problems
	OGRAMS ON STRINGS vel - 1 : Basic programs on Strings and its manipulation vel - 2 : Develop Real world applications that involves string matching
	OGRAMS ON LISTS, TUPLES and SETS vel - 1 : Basic programs on lists, Tuples and Sets vel - 2 : Create applications that involves sequential and Random access of data
	OGRAMS ON DICTIONARIES vel - 1 : Basic programs on dictionaries vel - 2 : Create applications that involves structuring of data.
	OGRAMS ON FUNCTIONS vel - 1 : Basic programs on Functions vel - 2 : Develop Real world applications using functions
	OGRAMS ON EXCEPTION HANDLING vel - 1 : Basic programs on exception handling

	vel - 2 : Develop applications that involves exception handling
	SIC PROGRAMS ON BUILT-IN LIBRARIES vel - 1 : Basic programs on python modules vel – 2: Develop applications using python libraries

rgeted Application & Tools that can be used:

rgeted Application : Web application development, AI, Operating systems

ols: 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

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

oject work/Assignment:

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

xt Books:

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

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

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

ferences:

E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", Tata cGraw-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 eek (Programming Languages for Beginners)", August 25, 2021. Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code ecution https://practice.geeksforgeeks.org/courses/Python-Foundation
pics relevant to development of "FOUNDATIONS SKILLS"- Solve the real time problems by alyzing and visualizing the data. **pics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS"- Data collection and its angement**

Course Code: CSE2007	**urse Title:** Data Structures and Algorithms **pe of Course: Integrated**			**T-P- C**	3-0-2-4
Version No.	)				
Course Pre-requisites	blem Solving Using Java				
Anti-requisites	-				
Course Description	is course introduces the fundamental concepts of data structures and to emphasize importance of choosing an appropriate data structure and technique for program velopment. This course has theory and lab component which emphasizes on derstanding the implementation and applications of data structures using Java ogramming language. With a good knowledge in the fundamental concepts of data uctures and practical experience in implementing them, the student can be an ective designer, developer for new software applications.				
ourse Objective	e objective of the course is to familiarize the learners with the concepts of Data uctures and Algorithms and attain Skill Development through periential Learning techniques.				
Course Out C omes	**successful completion of the course the students shall be able to:** **)1:** Implement program for given problems using fundamentals of data uctures. [Application] **)2:** Apply an appropriate linear data structure for a given scenarios. pplication] **)3:** Apply an appropriate non-linear data structure for a given scenarios. pplication] **)4:** Explain the performance analysis of given searching and sorting algorithms.				
urse Content:					
Module 1	**troduction to Data ucture and Linear ta Structure – Stacks d Queues**	signment	ogram activity	**18 Sessions**	
troduction – Introduction to Data Structures, Types and concept of Arrays.					

ack - Concepts and representation, Stack operations, stack implementation using array and plications of Stack. **ueues -** Representation of queue, Queue Operations, Queue implementation using array, Types of eue and Applications of Queue.				
Module 2	**near Data Structure- nked List**	signment	Program activity	**17 Sessions**
pics: Linked List - Singly Linked List, Operation on linear list using singly linked storage uctures, Circular List, Applications of Linked list. **cursion** - Recursive Definition and Processes, Programming examples.				
Module 3	**n-linear Data uctures - Trees and aph**	signment	Program activity	**15 Sessions**
pics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly nked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal. **aph** - Basic Concept of Graph Theory and its Properties, Representation of Graphs.				
odule 4	**arching & Sorting rformance alysis**	signment	ogram activity	**sessions**
pic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort. **rformance Analysis** - Time and space analysis of algorithms – Average, best and worst case alysis.				
t of Laboratory Tasks: **o sheet -1** **vel 1:** Prompt the user, read input and print messages.Programs using class, methods and jects **vel 2:** Programming Exercises on fundamental Data structure - Arrays based on Scenario. **o sheet -2** **vel 1:** Programming Exercises on Stack and its operations **vel 2:** Programming Exercises on Stack and its operations with condition **o sheet -3** **vel 1:** Programming on Stack application infix to postfix Conversion **vel 2:** - **o sheet -4** **vel 1:** Programming Exercises on Queues and its operations with conditions **vel 2:** - **o sheet -5** **vel 1:** Programming Exercises on Linked list and its operations. **vel 2:** Programming Exercises on Linked list and its operations with various positions **o sheet -6** **vel 1:** - **vel 2:** Programming scenario based application using Linked List **o sheet -7** **vel 1:** Programming Exercises on factorial of a number **vel 2:** Programming the tower of Hanoi using recursion				

b sheet -8

vel 1: -

vel 2: Programming the tower of Hanoi using recursion

b sheet -9

vel 1: Programming Exercise on Doubly linked list and its operations

vel 2: -

b sheet -10

vel 1: Program to Construct Binary Search Tree and Graph

vel 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-der) and implement BFS and DFS

b sheet -11

vel 1: Program to Implement the Linear Search & Binary Search

vel 2: Program to Estimate the Time complexity of Linear Search

b sheet -12

vel 1: Program to Implement and Estimate the Time complexity of Insertion Sort

vel 2: Program to Implement and Estimate the Time complexity of Insertion Sort

b sheet -13

vel 1: Program to Implement and Estimate the Time complexity of Selection Sort

vel 2: Program to Implement and Estimate the Time complexity of Selection Sort

rgeted Application & Tools that can be used

e of PowerPoint software for lecture slides and use of Ubuntu for lab programs to execute. Tool Codetantra tool.

Project work/Assignment:

signment: Students should complete the lab programs by end of each practical session and odule wise assignments before the deadline.

xt Book

Narasimha Karumanchi: *"Data Structures and Algorithms Made Easy in Java"*, 5th Edition, reerMonk Publications, 2017.

ferences

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

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

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

eb resources:

For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview

For Lab : codetantra tool

https://puniversity.informaticsglobal.com/login

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

urse Code: **E3156**	**urse Title: Database Management Systems** **pe of Course: 1) School Core** **2) Laboratory Integrated**	**T-P-C**		)	2	4
rsion No.	)					
urse Pre-quisites	L					
ti-requisites	L					
urse scription	is course introduces the core principles and techniques required in the design d implementation of database systems. It covers concepts of relational database tems (RDBMS). More emphasis is set on how to design, develop, organize, intain and retrieve information efficiently. It helps the students to learn and ctice data modeling and database designs. The course also introduces the ncept of object oriented and object relational databases. e associated laboratory is designed to implement database design using SQL DATABASE in information technology applications. All the exercises ll focus on the fundamentals for creating, populating, sophisticated, interactive y of querying, and simultaneous execution of the transactions of database.					
urse Objective	e objective of the course is to familiarize the learners with the concepts of tabase Management Systems and attain **Employability** through **Problem lving** Methodologies.					
urse Out mes	successful completion of the course the students shall be able to: Demonstrate a database system using ER model and relational algebra. nderstanding] Build databases using SQL queries query processing. [Applying] Apply the functional dependencies and design the database using rmalization. [Applying] Interpret the concept of object-oriented databases and object-relational abases. [Understanding]					
urse Content:						

odule 1	**troduction to tabase Modelling d Relational gebra nderstanding)**	Assignment	**roblem Solving**	**8 Classes**

pics:

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

ditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, amples on ER model.
lational Algebra with selection, projection, rename, set operations, Cartesian product, joins ner and outer joins), and division operator. Examples on Relational Algebra Operations.

odule 2	**ndamentals of SQL d Query Optimization pplying)**	Assignment	**Programming**	**8 Classes**

pics:
L Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate nctions, Joins, Views, Procedures, Functions and Triggers.
tabase programming issues and techniques: Embedded SQL, Dynamic SQL; SQL / PSM l NoSQL.
ery Optimization: Purpose, transformation of relational expressions, estimating cost and tistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming orithms.

odule 3	**lational Database sign & Transaction anagement (Applying)**	Assignment	**roblem Solving**	**12 Classes**

pics:
lational database design: Problems in schema design, redundancy and anomalies, Normal rms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued pendency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless compositions, Database De-normalization.
ansaction Management: The ACID Properties; Transactions and Schedules; Concurrent ecution of Transactions; Lock- Based Concurrency Control; Performance of locking; nsaction support in SQL; Introduction to crash recovery; 2PL, Serializability and coverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering m a System Crash; Media Recovery; Other approaches and interaction with concurrency ntrol.

odule 4	**vanced DBMS Topics nderstanding)**	Assignment	**Case Study**	**8 Classes**

pics:
vanced topics: Object oriented database management systems, Deductive database nagement systems, Spatial database management systems, Temporal database management tems, Constraint database management systems.
w database applications and architectures such as Data warehousing, ltimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, tistical databases.

t of Laboratory Tasks:
eate Employee, Student, Banking and Library databases and populate them with quired data. Do the following experiments of different lab sheets on those databases.

bsheet-1 [3 Practical Sessions]
periment No 1: [1 Session]

To study and implement the different language of Structured Query Language.

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

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

periment No. 2: [2 Sessions]

To study and implement the concept of integrity constraints in SQL.

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

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

bsheet-2 [3 Practical Sessions]
periment No. 3: [1 Session]

Implement complex queries in SQL.

vel 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on nking Database**.**

vel 2: Implement MySQL DB queries on library database using appropriate clauses and gregate functions**.** Also order the data either in ascending and descending order using rresponding clause. [Library databases].

periment No. 4: [2 Session]

To study and implement different types of Set and Join Operations [2 Slots]

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

vel 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as r the given scenario. [Airline Database]

bsheet-3 [2 Practical Sessions]
periment No. 5: [2 sessions]

To study and implement Views, and Procedures in MySQL DB.

vel 1: Implement MySQL Views, and Procedures in ORACLE DB on Employee database.

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

bsheet-4 [2 Practical Sessions]
periment No. 6: [2 Sessions]

To study and implement Functions, and Triggers in MySQL DB.

vel 1: Implement Oracle Functions and Triggers in Oracle on Employee database.

vel 2: Analyze the requirement and construct Functions and Triggers. [Supply chain tabase]

bsheet-5 [2 Practical Sessions]

periment No. 7: [2 Sessions]

implement the concept of forms and reports.

vel 1: Implement the concept of forms and reports.

vel 2: Analyze the schema relationship.

bsheet-6 [2 Practical Sessions]

periment No. 8: [2 Sessions]

sign a mini project based on the databases such as Inventory Management System, iiversity Management System, Hospital Management System, etc.

vel 1: Implement the real time database.

vel 2: Analyze the working of database in real time.

rgeted Application & Tools that can be used:

plication Area: Relational database systems for Business, Scientific and Engineering plications.

ols/Simulator used: MySQL DB for student practice.

so demonstration of ORACLE DB on object-relational database creation and JDBC nnection.

rcentage of changes in this version: 50% of changes from earlier version. New topics are ghlighted in italic.

Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing databases, querying the databases using relational algebra.

Programming: Implementation of any given scenario using MySQL.

xt Book

RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill ucation.

Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill h Edition, 2019.

W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: actical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University ess, 2018.

ferences

Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th ition, 2018.

M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, alable, and Maintainable Systems", O'Reilly, 2017.

pics relevant to development of "FOUNDATION SKILLS": S - Skill velopment: Relational database design using ER- Relational mapping, Implementation of ven database scenario using MYSQLDB.

pics relevant to development of Employability: Develop, test and implement computer tabases, creating sophisticated, interactive and secure database applications

pics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Nil

talogue prepared	Dr. Madhura K Dr. Nagaraja S R

commended by e Board of Studies	)S NO: SOCSE 2nd BOS held on 10/07/23					
te of Approval by e Academic uncil	ademic Council Meeting No 21, Dated 06/09/2023					
urse Code: E3157	urse Title: **Artificial Intelligence and Machine arning** pe of Course:1]Program Core 2] Laboratory integrated	[-P-C	3	0	2	4
rsion No.	)					
urse Pre- quisites	thon Programming					
ti-requisites	-					
urse scription	is course introduces the basic concepts of artificial intelligence(AI) and achine Learning (ML) which is a subset of Artificial Intelligence. AI & ML ovides important set of techniques and algorithms for solving several al world business and social problems. The objective of this course is to cuss machine learning model development using Python. pics include: Working with Collections and Data Frames; History, plication and Agents of AI; Knowledge Representation ; Hill Climbing, A* d SMA* algorithms; Knowledge representation - Approaches and Issues, owledge-Based Systems; Knowledge representation ng Propositional logic and Predicate Logic, Unification and lifting, rward chaining, Backward chaining. roduction to the Machine Learning (ML) - Framework, types of ML, ncept Learning: Concept learning task, Find-S algorithm, Candidate mination Algorithm. Neural and Bayesian Belief networks – Perceptron, ılti-layer feed forward networks, Back propagation algorithm. Nearest ighbor techniques, Support Vector Machines; Supervised Learning – ssification & Regression – Algorithms; Unsupervised Learning - stering & Association – Algorithms					
urse Objective	e objective of the course is to familiarize the learners with the concepts Artificial Intelligence and Machine Learning **Employability** through **oblem Solving** Methodologies.					
urse Out mes	successful completion of this course the students shall be able to: Describe the basic understanding of the AI and concepts of arching for AI problems. (KNOWLEDGE) Develop knowledge base for representing the given real world ta using logic and reasoning methods. (Application) Apply concept learning and Artificial Neural Network chniques for the given problems. (Application)					

		Articulate Machine Learning model using Supervised and supervised learning algorithms. (Application) Develop solutions / mini project on real world problems using ML domain, either individually or as a part of the team and report the sults. (Application)
urse Content:		

odule 1	**roduction to Artificial elligence and arching**	signment	ogramming Activity	**15 Hours**

pics:

roduction to Artificial Intelligence, Definitions, foundation, History and Applications; ents: Types of Agent, Structure of Intelligent agent and its functions, Agents and vironment; Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first; A* MA* algorithms.

odule 2	**owledge Representation**	signment	ogramming activity	**15 Hours**

pics:

roduction to Knowledge representation, approaches and issues in knowledge presentation, Knowledge-based agent and its Structure, Knowledge-Based Systems; owledge representation using Propositional logic and Predicate Logic- First-Order Logic yntax and Semantics, Knowledge Engineering - Unification and lifting, Forward chaining, ckward chaining

odule 3	**roduction to Machine rning & Neural Network**	signment	ogramming activity	**15 Hours**

pics:

roduction to the Machine Learning (ML) Framework, types of ML, types of riables/features used in ML algorithms, Concept Learning: Concept learning task, Concept rning as search, Find-S algorithm, Candidate Elimination Algorithm.

ural and Belief networks - Perceptron - Multi-layer feed forward networks - Bayesian lief networks, Back propagation algorithm.

odule 4	**pervised & Unsupervised rning**	ni Project	ogramming activity	**Hours**

pics:

pervised Learning – Classification & Regression - Decision Tree Learning, Random Forest - pport Vector Machines ; Simple Linear Regression Algorithm, Multivariate Regression gorithm

supervised Learning – Clustering & Association - K-Means Clustering algorithm , Mean-ft algorithm , Apriori Algorithm, FP-growth algorithm

t of Laboratory Tasks:

b sheet -1

	eview of Python programming - Anaconda platform and its installation, Executing ograms on Jupyter IDE/ Colab. ogramming exercises on Tuples, Nested data structures **o sheet -2** roduction to Numpy, Pandas, Scikit-learn and Visualization techniques. ctionaries, dictionary comprehension , Data Frames using Pandas and working with mes **o sheet - 3** **arch Algorithms** – A* & SMA * **o sheet -4** -tac-toe game simulation using search and heuristics. scribe the Sudoku game and represent the actions using First-order / Propositional logic. rting algorithms employing forward chaining. **o sheet -5** d-S Algorithm ndidate Elimination Algorithm ck Propagation Algorithm **o sheet -6** pport Vector Machines ; nple Linear Regression Algorithm ultivariate Regression Algorithm **o sheet -7** Means Clustering algorithm ean-shift algorithm riori Algorithm **ni Project / Case Study –** Real Time Project
	rgeted Application & Tools that can be used: Use of PowerPoint software for lecture des and use of Google's Colab cloud service ps://www.tutorialspoint.com/google_colab/index.html for executing and sharing of exercises.
	oject work/Assignment: Mention the Type of Project /Assignment proposed for this urse
	Programming: Implementation of given scenario using Python and Colab. **Assignment: Learning courses for 4 Hours from the following link** ps://learn.datacamp.com/courses?topics=Machine%20Learning
	xt Book Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, 3rd ition, Upper Saddle River, Prentice Hall 2021. Tom Mitchell, "Machine Learning", First Edition, Tata McGraw Hill India, 2017.

	ferences Giuseppe Bonaccorso, “Machine Learning Algorithms: A reference guide to pular algorithms from data science and machine learning”, Packt Publishing, 2017. Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning Using Python”, Wiley, st Edition 2019. Andreas C Muller, Sarah Guido, “Introduction to Machine Learning with Python Guide for Data Scientists”, Oreilly, First Edition, 2016 Elaine Rich, Kevin K and S B Nair, “Artificial Intelligence”, 3rd Edition, McGraw l Education, 2017. Pattern Classification 2nd Edition by Richard O. Duda , Peter E. Hart , David G. ork

Course Code: **CSE2060**	**urse Title:** Information Security and Management **pe of Course:** **Theory Only Course**			**T-P- C**	3-0-0-3
Version No.					
Course Pre-requisites	ta Communication and Computer Networks, Information Security, Database nagement Systems and Concepts of cryptography.				
Anti-requisites					
urse Description	e course explores information security through some introductory material and helps n an appreciation of the scope and context of information security. It includes a brief roduction to cryptography, security management, network and computer security. It ows a student to begin a fascinating journey into the study of information security d develop an appreciation of some key security concepts. The course concludes with iscussion of a simple model of the information security in industry and explores skills, owledge and roles required for employability. A student will be able to determine d analyze potential career opportunities in this profession.				
ourse Objective	e objective of the course is to familiarize the learners with the concepts of ormation Security and Management and attain **Employability** through **Participative arning** techniques.				
urse Out Comes	**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)				
urse Content:					
Module 1	**ormation Security nagement:**	signment	ta Collection/Interpretation	**10 Sessions**	

pics: Information Security Overview, Threat and Attack Vectors, Types of Attacks, Common Vulnerabilities d Exposure (CVE), Security Attacks, Fundamentals of Information Security, Computer Security Concerns, ormation Security Measures.				
Module 2	**ndamentals of ormation Security and ta Leakage**	se studies / se let	Case studies / Case let	**13 Sessions**
pics: Key Elements of Networks, Logical Elements of Networks, Critical Information Characteristics, ormation States. What is Data Leakage and Statistics, Data Leakage Threats, Reducing the Risk of Data Loss, y Performance Indicators (KPI), Database Security.				
Module 3	**ormation Security Policies d Management**	se studies / se let	Case studies / Case let	**14 Sessions**
pics: Information Security Policies-Necessity-Key Elements and Characteristics, Security Policy plementation, Configuration, Security Standards-Guidelines and Frameworks, Security Roles and sponsibilities, Accountability, Roles and Responsibilities of Information Security Management, Team sponding to Emergency Situation- Risk Analysis Process.				

rgeted Application & Tools that can be used:

ISMS is a systematic approach to managing sensitive information so that it remains secure. ncludes people, processes and IT systems by applying a risk management process.

can help small, medium and large businesses in any sector keep information assets secure. e ISO 27000 family of standards helps organizations keep information assets secure.

ing this family of standards will help your organization manage the security of assets such as ancial information, intellectual property, employee details or information entrusted to you by third rties.

)/IEC 27001 is the best-known standard in the family providing requirements for an information curity management system (ISMS).

Project work/Assignment:

signment:

xt Book

1 Management of Information Security by Michael E.Whilman and Herbert J.Mattord
2 Information Security: The Complete Reference, Second Edition, 2nd Edition. by Mark Rhodes-sley. Released April 2013. Publisher(s): McGraw-Hill.

ferences

1 Title, Cryptography & Network Security (Sie) 2E. Author, Forouzan. Publisher, McGraw-Hill ucation (India) Pvt Limited.
2 Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best actices. Nina Godbole.

ook link R1: http://www.iso.org/iso/home/standards/management- standards/iso27001.html
book link R2: http://csrc.nist.gov/publications/nistpubs/800-55-Rev1/SP800-55-rev1.pdf
EBLINKS: pu.informatics.global , https://sm-nitk.vlabs.ac.in.

pics relevant to development of “SKILL DEVELOPMENT”: Security Policy Implementation, Security les, for development of Skill Development through Participative Learning Techniques. This is attained ough assessment component mentioned in course handout.

urse Code: **E2019**	**urse Title: Foundations of Blockchain Technology** **pe of Course: Program Core**		**-P-C**	3-0-0-3
rsion No.	)			
urse Pre-quisites	tworks			
ti-requisites	-			
urse Description	e purpose of the course is to provide the fundamental knowledge on Blockchain hnology and explore various aspects of Blockchain technology like types of ckchain, Bitcoin and Ethereum Blockchain platform. th a good knowledge basic concepts of block chain, the student can gain the perience in implementing them, enabling the student to be an effective smart ntracts creator.			
urse Objectives	is course is designed to improve the learners employability skills by using periential learning techniques			
urse Out Comes	successful completion of this course the students shall be able to: **Understand** the concepts of an emerging blockchain technology owledge). **Infer** the knowledge about consensus protocols (comprehension). **Construct** a Bitcoin payment (Application) **Apply** smart contracts on Ethereum (Application).			
urse Content:				
rsion No.	)			

odule 1	**ckchain Basics**	**iz**	**owledge based quiz on tributed ledger**	**No. of lasses:09**

pics: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, rmissions, Privacy. Blockchain Architecture and Design, Basic crypto primitives: Hash, Signature, shchain to Blockchain

odule 2	**tributed nsensus**	**signment**	**mprehension, signment**	**No. of Classes:09**

pics: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of ckchain consensus protocols Permissioned Blockchains: Design goals, Consensus protocols for rmissioned Blockchains.

odule 3	Bitcoin mechanics	case study	pplication, Programing	No. of Classes:10
pics: Bitcoin definition, Digital keys and addresses, Transactions, mining, Bitcoin network wallets, coin payments.				
odule 4	art contracts and herum	se study	plication, Programming	No. of Classes:8
pics: History, Purpose and types of smart contracts, Introduction to Ethereum, Bitcoin vs Ethereum stack. P network in Ethereum, consensus in Ethereum, scripts in Ethereum, Smart contracts (Ethereum Virtual chine). Developing and executing smart contracts in Ethereum.				

t of Laboratory Tasks: NA

rgeted Application & Tools that can be used:

Ethereum Remix
Meta Mask
Truffle
Ganache

se study/Assignment/Project:

Do a survey on the various real-time applications in crypto-currencies (Bitcoin and hereum)
Create simple smart contract for User identity management using Solidity language.
Study of Blockchain development frame works (Truffle/ Ganache)
Use the Meta Mask plugin to conduct transactions with Ether, a crypto-currency

sign Private Ethereum Network and Deploying Smart Contract & Security.

xtbook(s):

Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, d smart contracts explained”, 2nd Edition, Packt Publishing Ltd, March 2018.
Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, “Blockchain By Example: A developer's ide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger”, Packt blishing Limited, 2018

ferences

Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, Reilly Media Inc, 2015.
Blockchain by Melanie Swa, O’Reilly .
Udemy: Blockchain A-Z™: Learn How To Build Your First Blockchain | Udemy
https://www.coursera.org/learn/wharton-cryptocurrency-blockchain-introduction-ital-currency
https://www.coursera.org/specializations/introduction-to-blockchain

urse Code: E3035	urse Title: R Programming for Data Science pe of Course: Program Core		T-P- C	)-0-1
rsion No.	)			
urse Pre-quisites	l			
ti-requisites	l			
urse scription	Programming for Data Science is designed for inspecting, cleansing, nsforming, and modeling data with the goal of discovering useful ormation, and supports in decision-making. The course begins by covering ta extraction, pre-processing, and transformation. It delivers the basic tistics and taught in an intuitive way to analysis the data. This course will p the students to apply the knowledge on Data Analytics to a wide range of plications.			
urse Objective	e objective of the course is to familiarize the learners with the concepts of Programming for Data Science and attain **Employability** through **Problem lving** Methodologies.			
urse Out mes	successful completion of the course the students shall be able to: **Describe the R programming for Data Analytics.[Knowledge]** **Generalize the appropriate visualization methods.[Comprehension]** **Demonstrate the various statistical testing methods.[Application]** **Apply the probability and complex distribution functions for the alysis of data.[Application]**			
urse Content:				
dule 1	roduction to R ogramming	se studies	ogramming	**essions**
Studio: Base R-R Studio IDE-Introduction to R Projects and R Markdown. Basic R: R as a culator-Scripts and Comments-R Variables. Data I/O: Working Directories-Importing Data-porting Data-More ways to save-Data I/O in Base R. Subsetting Data in R: Selecting specific ments-Renaming Columns-Subsetting Columns - Subsetting Rows – Adding/Removing lumns-Ordering Columns - Ordering Rows				
dule 2	ta Analysis	se studies	ogramming	**Sessions**
ta Summarization: One Quantitative and Categorical Variable. Data Classes: One Dimensional ta Classes-Data Frames and Matrices-Lists. Data Cleaning: Dealing with Missing Data-Strings d Recoding Variables. Manipulating Data in R: Reshaping Data-Merging Datasets. Data sualizations: Plotting with ggplot2- Plotting with Base R				
dule 3	tistical Analysis R	se studies	ogramming	**essions**
oportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-lcoxon signed rank test- One Way ANOVA- Kruskal Wallis Test-Linear Regression-Logistic gression and Generalized Linear Models-Poisson Regression.				
dule 4	nulations	se studies	ogramming	**Sessions**

nctions: Writing your own function-Loops. Simulations: Standard Probability Distributions-mpling from more Complex Distributions-The Accept and Reject Algorithm-The Metropolis sting Algorithm. R Markdown: Exploratory Analysis-Multiple Facets-Linear Models-abbing coefficients-Pander-Multiple Models-Data Extraction			
rgeted Applications & Tools that can be used: **ols**: Programming			
xt Book Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins iversity, 2020			
ferences Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data ning Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de cheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.			
pics relevant to Development skills **pics relevant to development of "Employability": Real time application development ing R Programming Tools.** **pics relevant to "Human Values & Professional Ethics"**			
urse Code: **E3035** & E3035_P	**urse Title: R Programming for Data Science** **pe of Course: Program Core**	**T-P- C**	)-4-2
rsion No.	)		
urse Pre-quisites	l		
ti-requisites	l		
urse scription	Programming for Data Science is designed for inspecting, cleansing, nsforming, and modeling data with the goal of discovering useful ormation, and supports in decision-making. The course begins by covering ta extraction, pre-processing, and transformation. It delivers the basic tistics and taught in an intuitive way to analysis the data. This course will p the students to apply the knowledge on Data Analytics to a wide range of plications.		
urse Objective	e objective of the course is to familiarize the learners with the concepts of Programming for Data Science and attain **Employability** through **Problem lving** Methodologies.		
urse Out mes	successful completion of the course the students shall be able to: **Describe the R programming for Data Analytics.[Knowledge]** **Generalize the appropriate visualization methods.[Comprehension]** **Demonstrate the various statistical testing methods.[Application]**		

	Apply the probability and complex distribution functions for the alysis of data.[Application]

b:

xp 1.

vel 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?

vel 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 ne length.

p 2.

vel 1:

Read in the Youth Tobacco study, Youth_Tobacco_Survey_YTS_Data.csv and name outh.

Install and invoke the readxl package. RStudio > Tools > Install Packages. Type readxl o the Package search and click install. Load the installed library with library(readxl).

vel 2:

Download an Excel version of the Monuments dataset, Monuments.xlsx, from ANVAS. Use the read_excel() function in the readxl package to read in the dataset and call the tput mon.

Write out the mon R object as a CSV file using readr::write_csv and call the file onuments.csv”.

Write out the mon R object as an RDS file using readr::write_rds and call it onuments.rds”.

p 3:

vel 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 nmand (or colnames).

Convert the rownames of cars to a column called car using rownames_to_column. bset 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 ject to carsSub. What are the dimensions of carsSub? (Use select() and dim().)

vel 2:

Convert the column names of carsSub to all upper case. Use rename_all(), and ıpper() (or colnames()).

Subset the rows of cars that get more than 20 miles per gallon (mpg) of fuel efficiency. ıw many are there? (Use filter().)

Subset the rows that get less than 16 miles per gallon (mpg) of fuel efficiency and have ore 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 s with 8 cylinders (cyl) and reassign this object to carsSub. What are the dimensions of this aset?

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 ping %>%.

p 4:

vel 1:

How many bike lanes are currently in Baltimore? You can assume that each servation/row is a different bike lane.

How many (a) feet and (b) miles of total bike lanes are currently in Baltimore? (The `ngth` variable provides the length in feet.)

How many types (`type`) bike lanes are there? Which type (a) occurs the most and (b) s the longest average bike lane length?

vel 2:

How many different projects (`project`) do the bike lanes fall into? Which `project` egory has the longest average bike lane length?

What was the average bike lane length per year that they were installed? (Be sure to st 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 atifying them by (a) type and then by (b) number of lanes (`numLanes`).

p 5:

vel 1:

Get all the different types of bike lanes from the `type` column. Use `sort(unique())`. sign this to an object `btypes`. Type `dput(btypes)`.

By rearranging vector `btypes` and using `dput`, recode `type` as a factor that has `DEPATH` as the first level. Print `head(bike$type)`. Note what you see. Run `table(bike$type)` erwards and note the order.

Make a column called `type2`, which is a factor of the `type` column, with the levels: "SIDEPATH", "BIKE BOULEVARD", "BIKE LANE"). Run `table(bike$type2)`, with the tions `useNA = "always"`. Note, we do not have to make type a character again before doing s.

vel 2:

- Reassign `dateInstalled` into a character using `as.character`. Run ad(bike$dateInstalled).

Reassign `dateInstalled` as a factor, using the default levels. Run ad(bike$dateInstalled).

Do not reassign `dateInstalled`, but simply run ad(as.numeric(bike$dateInstalled)). We are looking to see what happens when we try go from factor to numeric.

Do not reassign `dateInstalled`, but simply run ad(as.numeric(as.character(bike$dateInstalled))). This is how you get a "numeric" ue back if they were incorrectly converted to factors.

Convert `type` back to a character vector. Make a column `type2` (replacing the old one), ere if the type is one of these categories `c("CONTRAFLOW", "SHARED BUS BIKE", HARROW", "SIGNED ROUTE")` call it `"OTHER"`. Use `%in%` and `ifelse`. Make `type2` a factor h 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`

p 6:

vel 1:

Count the number of rows of the bike data and count the number of complete cases of 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 mat? Run `rowSums` and `colSums` on `namat`. These represent the number of missing values in 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 ve_route. Do a table of the `subType` variable using table, including the missing `subType`s. t 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 de_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 b. Do a `prop.table` on the rows and columns margins. Try `as.data.frame(tab)` or oom::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 nove the `$` from the `CityTax` variable, then you need to make it numeric. Try `str_replace`, t remember `$` 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` d `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 idence (`x = ResCode`) or not. You will need to trim some leading/trailing white space from `sCode`.

vel 2:

Subset the data to only retain those houses that are principal residences. Which nmand subsets rows? Filter or select?

How many such houses are there?

Describe the distribution of property taxes on these residences. Use `hist/qplot` with tain breaks or `plot(density(variable))`.

Make an object called `health.sal` using the salaries data set, with only agencies `bTitle`) of those with "fire" (anywhere in the job title), if any, in the name remember `xed("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 laries? Case should be ignored.

What does the distribution of annual salaries look like? (use `hist`, 20 breaks) What is IQR? Hint: first convert to numeric. Try `str_replace`, but remember `$` is "special" and you ed `fixed()` around it.

Convert `HireDate` to the `Date` class - plot Annual Salary vs Hire Date. Use `nualSalary ~ HireDate` with a `data = sal` argument in plot or use `x, y` notation in `atter.smooth`. Use the `lubridate` package. Is it `mdy(date)` or `dmy(date)` for this data - k at `HireDate`.

Create a smaller dataset that only includes the Police Department, Fire Department l Sheriff's Office. Use the `Agency` variable with string matching. Call this `emer`. How many ployees 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 ex using parentheses) and then discard the rest. Replot annual salary versus hire date and or 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` a set. Some tips: a) 1 acre = 43560 square feet b) The hyphens represent a decimals. (This l take a lot of searching to find all the string changes needed before you can convert to meric.)

p 7:

vel 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 value `the_length`. Make sure we gather all columns but `name`, using `-name`. Note the `NAs` e.

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 a `crash2`. Table the `Road` variable.

How many observations are in each dataset?

Separate the `Road` column (using `separate`) into (`type` and `number`) in `crash2`. assign this to `crash2`. Table `crash2$type`. Then create a new variable calling it `ad_hyphen` using the `unite` function. Unite the `type` and `number` columns using a hyphen (-) l 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`.

vel 2:

Keep rows where the record is not missing `type` and not missing `name` and re-assign output to `bike`.

Summarize and group the data by grouping `name` and `type` (i.e for each type within h name) and take the `sum` of the `length` (reassign the sum of the lengths to the `length` iable). Call this data set `sub`.

Reshape `sub` using `pivot_wider`. Spread the data where the key is `type` and we want value in the new columns to be `length` - the bike lane length. Call this `wide2`. Look at the umn 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 n) e.g. those observations with road lengths and districts. Merge without using `by` argument, n 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 re?

Do a left join of the `road` and `crash`. ORDER matters here! How many observations there?

Repeat above with a `right_join` with the same order of the arguments. How many servations are there?

p 8

vel 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` –> ue)

```
pal = c("blue", "darkgreen","orange","purple")
```

Plot average ridership by date with one panel per `route`

vel 2:

Plot average ridership by date with separate panels by `day` of the week, colored by `ute`

Plot average ridership (`avg`) by date, colored by `route` (same as 1a). (do not take an erage, use the average column for each route). Make the x-label `"Year"`. Make the y-label `umber of People"`. Use the black and white theme `theme_bw()`. Change the `text_size` to `xt = element_text(size = 20))` in `theme`.

Plot average ridership on the `orange` route versus date as a solid line, and add `dashed` rror" lines based on the `boardings` and `alightings`. The line colors should be `orange`. nt `linetype` is an aesthetic for lines - see also `scale_linetype` and `ale_linetype_manual`. Use `Alightings = "dashed", Boardings = "dashed", erage = "solid"`)

p 9

vel 1:

Compute the correlation between the `1980`, `1990`, `2000`, and `2010` mortality data. No ed to save this in an object. Just display the result to the screen. Note any `NA`s. Then compute ng `use = "complete.obs"`.

Compute the correlation between the `Myanmar`, `China`, and `United States` mortality a. 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 red t-test and a Wilcoxon signed rank test to assess this. Hint: to extract the column of ormation for `1990`, use `mort$"1990"`

vel 2:

Using the cars dataset, fit a linear regression model with vehicle cost (`VehBCost`) as outcome and vehicle age (`VehicleAge`) and whether it's an online sale (`IsOnlineSale`) as dictors as well as their interaction. Save the model fit in an object called `lmfit_cars` and play the summary table.

Create a variable called `expensive` in the `cars` data that indicates if the vehicle cost over `$10,000`. Use a chi-squared test to assess if there is a relationship between a car being pensive and it being labeled as a "bad buy" (`IsBadBuy`).

Fit a logistic regression model where the outcome is "bad buy" status and predictors the `expensive` status and vehicle age (`VehicleAge`). Save the model fit in an object called `gfit_cars` and display the summary table. Use summary or `tidy(logfit_cars, conf.int TRUE, exponentiate = TRUE)` or `tidy(logfit_cars, conf.int = TRUE, ponentiate = FALSE)` for log odds ratios

p 10

vel 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

squares this difference

then returns the final value

checks that x and y are numeric and stops with an error message otherwise

vel 2:

Try to write a function called top() that takes a matrix or data.frame and a number n, and urns 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 t to be returned containing sample mean and the confidence interval. The input to the nctions is the numeric vector containing our data. For review, the formula for a 95% one nple t interval is $\bar{x} \pm 1.96 * s/\sqrt{n}$.

p 11

vel 1:

nulate 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 nple t-test when the true population follows a Uniform distribution over [-10,10]. Modify the nction `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] (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 this case is 0 for a Uniform(-10,10) population. Try this experiment for `10,30,50,100,500`. What happens the estimated type I error rate as `n` changes? Is the type I or rate maintained for any of these sample sizes?

vel 2:

From introductory statistics, we know that the sampling distribution of a sample mean will be proximately normal with mean μ and standard error $\sigma/\sqrt{n}$ if we have a random sample from a pulation with mean μ and standard deviation σ and the sample size is "large" (usually at least). In this problem, we will build a simulation that will show when the sample size is large ough.

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 ctor of 500 sample means.

Plot a histogram of these 500 sample means. Does it look normally distributed and ntered at 0?

Turn this simulation into a function that takes arguments `N` the number of simulated nples to make and `n` the sample size of each simulated sample. Run this function for `10,15,30,50`. What do you notice about the histogram of the sample means (the sampling tribution of the sample mean) as the sample size increases.
xt Book Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins iversity, 2020
ferences Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data ning Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de cheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.
pics relevant to Development skills **pics relevant to development of "Employability": Real time application development ing R Programming Tools.** **pics relevant to "Human Values & Professional Ethics"**

urse Code: **E2067**	**urse Title: Web Technology** **pe of Course: Program core** **Theory Only**	**- P- C**	3-0-0-3
rsion No.	)		
urse Pre-quisites	-		
ti-requisites	-		
urse scription	is course highlights the basic web design using Hypertext Markup Language and scading Style Sheets. Students will be trained in planning and designing effective b pages by writing code using current leading trends in the web domain, hancing web pages with the use of page layout techniques, text formatting, phics, images, and multimedia. The focus is on popular key technologies that will lp students to build Internet- and web-based applications that interact with other plications and with databases.		
urse Objective	**e objective of the course is to familiarize the learners with the concepts of Web chnology and attain Skill Development through Experiential Learning chniques.**		
urse tcomes	**successful completion of this course the students shall be able to:** **1:** Implement web-based application using client-side scripting languages. **pplication level)** **2**: Apply various constructs to enhance the appearance of a website. **pplication level)** **3**: Illustrate java-script concepts to demonstration dynamic web site**(Application el)**		

	4: Apply server-side scripting languages to develop a web page linked to a tabase. **(Application level)**			
urse Content:				
odule 1	**roduction to XHTML**	uizzes and signments	izzes on various features XHTML, simple plications	**Sessions**

pics:
sics: Web, WWW, Web browsers, Web servers, Internet.
TML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document ucture, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic ferences between HTML and XHTML.

odule 2	**vanced CSS**	izzes and signments	mprehension based izzes and assignments; plication of CSS in signing webpages	**Sessions**

pics:
S: Introduction to CSS, Defining & Applying a style, Creating style sheets, types of style sheet, ectors, CSS font properties, border properties, Box model, opacity, CSS pseudo class and pseudo-ments.
vanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Responsive Design, S Frameworks **XML:** Basics, demonstration of applications using XML

odule 3	**ndamentals of aScript**	izzes and signments	plication of JavaScript dynamic web page signing	**Sessions**

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

odule 4	**P – Application Level**	izzes and signments	plication of PHP in web signing	**Sessions**

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

rgeted Application & Tools that can be used:

mpp web server to be used to demonstrate PHP.

oject work/Assignment:

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

xtbook(s):

Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 8th Edition, 2015.
CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ trieved on Jan. 20, 2022)

Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson ucation, 2021.

ferences

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

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

pics related to development of "FOUNDATION":

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

CSS, PHP.

Designing for healthcare.

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

eferences

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

urse Code: E2500	urse Title: **Theory of Computation** pe of Course: **Theory Only**	T-P- C	3	0	0	3

rsion No.	)
urse Pre-quisites	e students should have the Knowledge on Set Theory
ti-requisites	
urse Description	e course deals with introduction of formal languages and the correspondence tween language classes and the automata that recognize them. pics include: Formal definitions of grammars and acceptors, Deterministic and ndeterministic systems, Grammar ambiguity, finite state and push-down tomata; normal forms; Turing machines and its relations with algorithms.
urse Objective	e objective of the course is to familiarize the learners with the concepts of **eory of Computation as mentioned above** and attain **Skill Development** ough **Problem Solving** Methodologies.
urse Out Comes	successful completion of the course the students shall be able to: Describe various components of Automata. (Knowledge) Illustrate Finite Automata for the given Language. (Application) Distinguish between Regular grammar and Context free grammar. omprehension) Construct Push down Automata. (Application) Construct Turing machine for a Language. (Application)
urse Content:	

odule 1	**roduction to automata eory**	signment	blems on Strings and nguage operations	**06 Sessions**

pics:

roduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages operations on languages, Representation of automata, Language recognizers, Finite State achines (FSM): Deterministic FSM, gular languages, Designing FSM, Nondeterministic FSMs

odule 2	**ite Automata**	signment	oblems on DFA, NFA’s	**13 Sessions**

pics:
sic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition aphs and Languages and DFA's, Regular Languages, NFA- Definition of a Nondeterministic cepter, Languages and NFA’s Why Non-determinism? Equivalence of Deterministic and ndeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.

odule 3	**gular Expressions & ntext Free Grammar**	signment	oblems on RE, CFG, PT, and Ambiguity	**12 Sessions**

pics:
rmal Definition of a Regular Expression, Languages Associated with Regular Expressions, nguages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show me languages are t RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, ftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and rivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing nbiguity, Chomsky Normal Form, Gribiche Normal Form.

odule 4	**sh down Automata**	signment	oblems on pushdown tomaton	**08 Sessions**

pics:
finition of a Pushdown Automaton, Language Accepted by a Pushdown tomaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final ite, From Final State to Empty Stack Equivalence of PDA’s and CFG’s: From Grammars to shdown Automata.

odule 5	**ring Machine**	signment	oblems on Turning achine	**07 Sessions**

pics:
finition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to nstruct Turing machine, Turing Machines as Transducers, Halting Programming Techniques for ring Machines

rgeted Application & Tools that can be used:

rgeted Application:

- Text Processing
- Compilers
- Text Editors
- Robotics Applications
- Artificial Intelligence

ols:

JFLAP (Java Formal Language and Automata Package) Software simulation tool. It’s eractive educational software written in Java to experiment topics in automata theory.

Turing machine Online simulators.

xt Book

Peter Linz, “An introduction to Formal Languages and Automata”, Jones and Bartlett blications 6th Ed, 2018.

ferences Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008. Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014. **Resources** TEL course – https://onlinecourses.nptel.ac.in/noc21_cs83/preview
pics relevant to "SKILL DEVELOPMENT": Deterministic and Non-Deterministic Automaton, gular Expressions, CFGs, Turning Machine and Pushdown automaton for Skill Development ough Problem Solving methodologies. This is attained through assessment component ntioned in course handout.

urse Code: **E3075**	bile Applications and Development	**T-P- C**	2	0	0	2
rsion No.	)					
urse Pre-quisites	e student needs to have fundamental understanding of object-oriented gramming concepts with Java/C#, XML, usage of any integrated development vironment.					
ti-requisites						
urse scription	e course deals with the basics of android platform and application life cycle. The al of the course is to develop mobile applications with Android containing at least e of the following phone material components: GPS, accelerometer or phone nera, use simple GUI applications and work with database to store data locally or a server. pics include user interface design; user interface building; input methods; data ndling; network techniques and URL loading; GPS and motion sensing. Android plication framework and deployment. Power management, Screen resolution, uch interface, Store data on the device.					
urse Objective	is course is designed to improve the learners' EMPLOYABILITY SKILLS by ng EXPERIENTIAL LEARNING techniques					
urse Out mes	successful completion of the course the students shall be able to: s the fundamentals of mobile application development and its architecture. omprehension) e mobile applications with appropriate android view. (Application) nstrate the use of services, broadcast receiver, Notifications and content vider.(Application) Apply data persistence techniques, to perform CRUD operations. (Application) Use multimedia and internet services for mobile applications. (Application)					
urse Content:						

odule 1	**roduction and chitecture of droid**	signment	nulation/Data Analysis	**.0 Sessions**
History and features, Architecture, Development Tools, Android Debug Bridge (ADB), and Life cle.				

odule 2	**er Interfaces, Intent d Fragments**	signment	merical from E-sources	**.5 Sessions**

yout, Menu, Intent and Fragments.

odule 3	**mponents of droid**	rm per/Assignment	nulation/Data Analysis	**.1 Sessions**

Services, Broadcast receivers, Content providers and Hosting the App in Playstore.

odule 4	**tifications and Data rsistence**	rm per/Assignment	nulation/Data Analysis	**9 Sessions**

on, Shared Preferences, SQLite database, Third party library integration (cloud).

odule 5	**vance App velopment**	rm per/Assignment	nulation/Data Analysis	**9 Sessions**

and Animation, Multimedia, Telephony, email, Managing Network and Wi-Fi, Location Services d Android with IoT.

xt Book

T1. Pradeep kothari "Android Application Development - Black Book", dreamtechpress

T2. Barry Burd (Author), "Android Application Development" ALL – IN – ONE FOR mmies

T3. Jeff Mcherter (Author),Scott Gowell (Author), "Professional mobile Application Development" paperback, Wrox - Wiley India Private Limited

T4. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – ley India Private Limited

ferences

Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) "Android Programming" 3rd tion, 2017.The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, "

Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India t Ltd, 2014.

Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, Reilly SPD Publishers, 2015.

J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, ley India Pvt Ltd, 2016. ISBN-13: 978-8126565580

Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, ley 2014, ISBN: 978-81-265-4660-2

Reto Meier "Professional Android Application Development"

Resources

TEL course – https://nptel.ac.in/courses/106106156

urse Code: E3075_P	obile Applications and Development Lab	**T-P- C**	0	0	4	2

rsion No.	)
urse Pre-quisites	e student needs to have fundamental understanding of object-oriented ogramming concepts with Java/C#, XML, usage of any integrated development vironment.
ti-requisites	
urse scription	e course deals with the basics of android platform and application life cycle. The al of the course is to develop mobile applications with Android containing at least e of the following phone material components: GPS, accelerometer or phone nera, use simple GUI applications and work with database to store data locally or a server. pics include user interface design; user interface building; input methods; data ndling; network techniques and URL loading; GPS and motion sensing. Android plication framework and deployment. Power management, Screen resolution, uch interface, Store data on the device.
urse Objective	is course is designed to improve the learners' EMPLOYABILITY SKILLS by ng EXPERIENTIAL LEARNING techniques
urse Out mes	successful completion of the course the students shall be able to: s the fundamentals of mobile application development and its architecture. omprehension) e mobile applications with appropriate android view. (Application) nstrate the use of services, broadcast receiver, Notifications and content ovider.(Application) Apply data persistence techniques, to perform CRUD operations. (Application) Use multimedia and internet services for mobile applications. (Application)

t of Laboratory Tasks

). Design an app to read user inputs using edit text and display the result of arithmetic erations using toast message.

). Create an android app to calculate the current age of yourself, select your DOB using date ker.

). Design an app to input your personal information. Use autocomplete text view to select your ce of birth.

). Design an app to select elective course using spinner view and on click of the display button, ast your ID and selected elective course.

Design a restaurant menu app to print the total amount of orders.

Develop an android app that uses intent to maintain the following scenario.

eck the eligibility criteria for voting. Input the Aadhar no., Name & age in the first activity. If the e is above 18, display the voter's detail in the second activity. Else, display, “You are not eligible vote” in the second Activity.

Demonstrate the use of fragment with list of buttons representing various colors, and on click of ese buttons, the appropriate color is filled in the next fragment.

eate an Android application to input the vitals of a person (temperature, BP). If the vitals are normal, give proper notification to the user.

Create an android app to for movie ticket booking. Save the user name of the customer using ared preferences. After completion of booking, retrieve the username from the shared eferences and print the ticket details.

Create an android application to manage the details of students' database using SQLite.Use cessary UI components, which perform the operations such as insertion, modification, removal d view.Presidency University needs an APP for Admission eligibility checking for students, for at you need to take the following information from the Student: registration ID, physics, emistry and mathematics marks (PCM), fees is allotted as below criteria.

M (Total marks %)	Fee concession
above	80 %
to 89	60 %
low 69 %	no concession

click on the button "Registration" details should be stored in the database using SQLite. Create tton DISPLAY ALL (full students list) on click on the button it should display the students list per e fee concession.

A company need to design an app that plays soft music automatically in the background. Create app to achieve this functionality.

Create an android application such that your view object in the Activity can be Animated with le-in effect. Create an appropriate XML file named fade-in and write the application to perform e property animation.

. Demonstrate how to send SMS and email.

11. Create an android application to transfer a file using WiFi. Create an android plication "Where am I" with an Activity that uses the GPS Location provider to find the device's t known location.

xt Book

T1. Pradeep kothari "Android Application Development - Black Book", dreamtechpress

T2. Barry Burd (Author), "Android Application Development" ALL – IN – ONE FOR mmies

T3. Jeff Mcherter (Author),Scott Gowell (Author), "Professional mobile Application Development" paperback, Wrox - Wiley India Private Limited

T4. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – ley India Private Limited

ferences

Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) "Android Programming" 3rd tion, 2017.The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, "

Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India t Ltd, 2014.

Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, Reilly SPD Publishers, 2015.

J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, ley India Pvt Ltd, 2016. ISBN-13: 978-8126565580

Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, ley 2014, ISBN: 978-81-265-4660-2 Reto Meier "Professional Android Application Development" **esources** TEL course – https://nptel.ac.in/courses/106106156
pics relevant to the development of SKILLS: Skill Development through Experiential Learning hniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3080	**urse Title: Quantum Computing**			**T-P- C**	2-0-0-2
Version No.					
ourse Pre-requisites	ear Algebra bability and Statistics				
Anti-requisites					
Course Description	is course provides an introduction to the theory and practice of quantum nputation. Topics covered include: quantum mechanics to understand quantum nputation. Quantum algorithms. The Shor's factorization algorithm Grover's rch algorithm Mathematical models of quantum computation, Quantum Machine rning, and to physical systems.				
Course Objective	e objective of the course is to familiarize the learners with the concepts of **antum Computing** and attain EMPLOYABILITY SKILLS through PERIENTIAL LEARNING techniques				
Course Out Comes	**successful completion of the course the students shall be able to:** Understand the basic principles of quantum computation and quantum chanics. Design quantum circuits using quantum gates. Analyze the behavior of basic quantum algorithms. Understand the difference between classical and quantum machine rning approach.				
urse Content:					
Module 1	**INTRODUCTION**	**Quiz**	**Quiz**	**10 sessions (8 T + 2 L)**	
pics: roduction to quantum computing. Qubits, Bloch sphere, multiple qubits, quantum states and asurements, Postulates of quantum mechanics, Classical computation vs quantum computation.					
Module 2	**QUANTUM MODEL OF COMPUTATION**	**Quiz**	**Quiz**	**12 sessions (8 T + 4 L)**	

pics:
he model of quantum computation, Quantum circuits: single qubit gates, multiple qubit gates, design of antum circuits.

Module 3	**QUANTUM ALGORITHMS**	**Assignment**	**Case Studies**	**12 sessions (8 T + 4 L)**

pics: Deutsch-Jozsa algorithm and Grover's search algorithm. Shor's algorithm for factoring, Quantum urier transform.

Module 4	**QUANTUM INFORMATION THEORY & QUANTUM MACHINE LEARNING**	**Assignment**	**Case Studies**	**11 sessions (9 T + 2 L)**

pics: Comparison between classical and quantum information theory, Applications of quantum ormation, Bell states, Quantum Machine Learning, no cloning theorem.

rgeted Application & Tools that can be used

Framework- Qiskit
Language- Python
Applications:
Quantum Circuits
Quantum Gates
Quantum Machine Learning Algorithms

Project work/Assignment:

signment:

Create quantum circuit functions that can compute the XOR, AND, NAND and OR gates using NOT gate (expressed as x in Qiskit), the CNOT gate (expressed as cx in Qiskit) and the Toffoli gate pressed as ccx in Qiskit) .

Measure the Bloch sphere coordinates of a qubit using the Aer simulator and plot the vector on Bloch sphere

Investigate the relationship between the number of qubits required for the desired accuracy of the ase estimation with high probability.

oject Work:

Create a program that builds an oracle for a given string (e.g. given 01101, will return a antumCircuit 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 previous page). Assess how the size of your circuits grow with the size of the problem.

xt Book

Nielsen, M., & Chuang, I. (2010). Quantum Computation and Quantum Information: 10th niversary Edition. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511976667

McMahon D. Quantum Computing Explained. Hoboken N.J: Wiley-Interscience : IEEE mputer Society; 2008.

ferences

Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: sic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. (2004)

Pittenger A. O., An Introduction to Quantum Computing Algorithms (2000).

book link R1:
ttp://community.qiskit.org/textbook

ook link R2
ps://github.com/Qiskit
eb resources:

Abraham Asfaw and Antonio Corcoles & et al. "Learn Quantum Computation Using Qiskit", 20, http://community.qiskit.org/textbook

IBM Qiskit Global Summer School 2021: Quantum Machine Learning, ps://qiskit.org/events/summer-school/

https://quantum-computing.ibm.com/

https://qiskit.org/

https://presiuniv.knimbus.com/u

pics relevant to development of "Employability Skills"

Designing Quantum circuits

Visualizing Quantum Circuit outputs

Analyzing and Comparing Quantum Algorithm Performance for developing Employability Skills ough Experiential Learning techniques. This is attained through assessment component mentioned in urse handout.

Course Code: CSE3080_P	**urse Title: Quantum Computing**	**T-P- C**	0-0-2-1
Version No.			
ourse Pre-requisites	ear Algebra bability and Statistics		
Anti-requisites			
Course Description	is course provides an introduction to the theory and practice of quantum mputation. Topics covered include: quantum mechanics to understand quantum mputation. Quantum algorithms. The Shor's factorization algorithm Grover's rch algorithm Mathematical models of quantum computation, Quantum chine Learning, and to physical systems.		
Course Objective	e objective of the course is to familiarize the learners with the concepts of **antum Computing** and attain EMPLOYABILITY SKILLS through PERIENTIAL LEARNING techniques		
Course Out Comes	**successful completion of the course the students shall be able to:** Understand the basic principles of quantum computation and quantum chanics. Design quantum circuits using quantum gates. Analyze the behavior of basic quantum algorithms. Understand the difference between classical and quantum machine rning approach.		

t of Laboratory Tasks:

1: Use Qiskit Tools [Module 1]

2: Display and Use System Information [Module 1]

þ 3: Construct Visualizations [Module 1]
þ 4: Perform Operations on Quantum Circuits [Module 2]
þ 5: Implement BasicAer: Python-based Simulators [Module 2]
þ 6: Access Aer Provider [Module 3]
þ 7: Implement QASM [Module 3]
þ 8: Executing Experiments [Module 3]
þ 9: Return the Experiment Results [Module 4]
þ 10: Compare and Contrast Quantum Information [Module 4]

rgeted Application & Tools that can be used

Framework- Qiskit
Language- Python
Applications:
Quantum Circuits
Quantum Gates
Quantum Machine Learning Algorithms

Project work/Assignment:

signment:

Create quantum circuit functions that can compute the XOR, AND, NAND and OR gates using NOT gate (expressed as x in Qiskit), the CNOT gate (expressed as cx in Qiskit) and the Toffoli gate pressed as ccx in Qiskit) .

Measure the Bloch sphere coordinates of a qubit using the Aer simulator and plot the vector on Bloch sphere

Investigate the relationship between the number of qubits required for the desired accuracy of phase estimation with high probability.

oject Work:

Create a program that builds an oracle for a given string (e.g. given 01101, will return a antumCircuit 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 the previous page). Assess how the size of your circuits grow with the size of the problem.

xt Book

Nielsen, M., & Chuang, I. (2010). Quantum Computation and Quantum Information: 10th niversary Edition. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511976667

McMahon D. Quantum Computing Explained. Hoboken N.J: Wiley-Interscience : IEEE mputer Society; 2008.

ferences

Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. (2004)

Pittenger A. O., An Introduction to Quantum Computing Algorithms (2000).

book link R1:

ttp://community.qiskit.org/textbook

book link R2

ps://github.com/Qiskit

eb resources:

Abraham Asfaw and Antonio Corcoles & et al. "Learn Quantum Computation Using Qiskit", 20, http://community.qiskit.org/textbook IBM Qiskit Global Summer School 2021: Quantum Machine Learning, ps://qiskit.org/events/summer-school/ https://quantum-computing.ibm.com/ https://qiskit.org/ https://presiuniv.knimbus.com/u
pics relevant to development of "Employability Skills" Designing Quantum circuits Visualizing Quantum Circuit outputs Analyzing and Comparing Quantum Algorithm Performance for developing Employability Skills ough Experiential Learning techniques. This is attained through assessment component mentioned in urse handout.

se Code: 4010	**se Title: Soft Computing**	**T-P- C**	2-0-0-2
on No.			
se Pre-equisites	**ılus, Probability, Linear Algebra and Basic Programming Skills**		
requisites			
se Description	oft computing is an emerging approach in computing that mimics the human ind's remarkable ability to reason and learn in an environment of uncertainty and precision. Soft computing is based on biologically inspired methodologies such genetics, evolution, ant behaviors, particle swarming, human nervous systems, c. Soft computing is the only solution when we don't have any mathematical odeling of problem-solving (i.e., algorithm), needs a solution to a complex oblem in real-time, and easily adapts with changing scenarios and is implemented ith parallel computing. It has enormous applications in many application areas ich as medical diagnosis, computer vision, handwritten character reconditions, ttern recognition, machine intelligence, weather forecasting, network otimization, VLSI design, etc.		
se Objective	he objective of the course is to familiarize the learners with the concepts of **Soft omputing** and attain **SKILL DEVELOPMENT** through **Problem Solving lethodologies**.		
se omes	n successful completion of the course the students shall be able to: O1: Define the concept and applications of Soft Computing. O2: Discuss Fuzzy logic concepts and its applications. O3: Demonstrate Artificial Neural Networks concepts and its applications. O4: Apply Evolutionary algorithms and hybrid soft computing techniques.		
se Content:			

ıle 1	luction Soft omputing	nment	ısis	**9 Sessions**

:s: ıtroduction to Soft Computing: Concept of computing systems, "Soft" computing versus "Hard" omputing, Characteristics of Soft computing, Applications of Soft computing techniques, Elements of oft Computing.

ule 2	y Logic	nment	ysis, Data Collection	**2 Sessions**
:s: uzzy Logic: Introduction to Fuzzy logic. Fuzzy sets and membership functions. Operations on Fuzzy ets. Fuzzy relations, rules, propositions, implications and inferences. Defuzzification techniques. uzzy logic controller design, Predicate logic, Fuzzy decision making.				
ule 3	ıl Networks	Study	ysis, Data Collection	**0 Sessions**
:s: eural Network: Neural Networks, Supervised and Unsupervised Learning. Single Layer Perceptron, Iultilayer Perceptron, Backpropagation Learning, Network rules and various learning activation ınctions, Introduction to Associative memory, Adaptive resonance theory and self-organizing map, ecent Applications. eural Networks as Associative Memories: Hopfield Networks, Bidirectional Associative Memory. opologically Organized Neural Networks: Competitive Learning, Kohonen Maps.				
ule 4	ıtionary Computing	nment	ysis, Data Collection	**0 Sessions**
:s: volutionary Computing: "History of Genetic Algorithm and Optimization working principle, The chema Theorem, GA operators: Encoding, Crossover, Selection, Mutation, bit wise operation in GA c. Introduction to ant colony optimization and particle swarm optimization. Integration of genetic gorithm with neural network and fuzzy logic.				

eted Application & Tools that can be used: ent times, engineers have very well accepted soft computing tools such as Fuzzy Computing, ANN, eeuro-Computing and Evolutionary Computing, etc., for carrying out various numerical simulation udies. In the last two decades, these tools independently and in hybrid forms have been successfully pplied to varieties of problems. The main objective is to introduce students to the latest soft computing ools. The training of these tools will be helpful to develop rigorous applications in the engineering omain. **:** IATLAB YTHON
ct work/Assignment:
Project:

raining of known/classified datasets representing some objects/pattern using various ANN learning ethods including Perceptron, BPN, Adaline, Associative memory networks, Hopfield, kohenen etworks. lassification of new input feature set/pattern based on training & learning pplying GA search to optimize the solutions. Implementation of the GA procedure.
Book 1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, 3rd Edition 2019 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley.
ences 1. Kumar S., "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2nd Edition 2017. 2. Eiben A. E. and Smith J. E., "Introduction to Evolutionary Computing", Second Edition, Springer, atural Computing Series, 2nd Edition, 2015. 3. Fakhreddine O. Karray, and Clarence W. De Silva. Soft computing and intelligent systems esign: theory, tools, and applications. Pearson Education, 2009. **inks** /1.https://presiuniv.knimbus.com/user#/home /2.https://www.geeksforgeeks.org/fuzzy-logic-introduction/
:s relevant to development of "SKILL DEVELOPMENT": Solving real world problems with ncertainty using Nature Inspired Algorithms for developing SKILL DEVELOPMENT through **roblem Solving Methodologies** . This is attained through assessment component mentioned in course andout

Course Code: CSE3188	**urse Title: NATURAL LANGUAGE PROCESSING** **pe of Course: Theory Only Course**	**- P- C**	3-0-0-3
Version No.	)		
Course Pre-requisites	CSE 3001 – Artificial Intelligence and Machine Learning		
Anti-requisites	-		
urse Description	e purpose of this course is to introduce students to the science of natural language ocessing (NLP). NLP is the science of extracting information from unstructured text. It basically how we can teach machines to understand human languages and extract eaning from text. In addition to regular theory, the course also involves: Programming Assignments Regular Quiz Tests (once a week and once after every module)		
ourse Objective	e objective of the course is to familiarize the learners with the concepts of ndamentals of Natural language Processing and attain **Skill Development** rough **Participative Learning** techniques.		

urse Out Comes	successful completion of the course the students shall be able to: **Understand** the fundamental concepts of Natural Language Processing. owledge] **Read** corpora and **train** models for different NLP tasks. [Application] **Use** word embeddings for solving an NLP Application. [Application] **Understand** sequence to sequence modeling as used in machine translation. plication]			
urse Content:				
Module 1	**roduction**	izzes		**7 Sessions**
pics: roduction. History. Text Analytics. Various tasks in NLP. Sentence boundary Detection. Edit tance. Introduction to word embeddings, PoS tagging, chunking, parsing, machine translation.				
Module 2	**ord and Text presentations**	izzes	Assignments	**8 Sessions**
pics: gistic Regression and Naïve Bayes classification. Vector semantics and embeddings. Neural Networks d Neural Language Models. Text representations and classification. Deep learning architectures for quence processing (CNN and LSTM).				
Module 3	**S Tagging, NER Tagging d Parsing**	izzes	Assignments	**12 Sessions**
pics: rt-of-Speech Tagging – using NLTK and spacy. Building a PoS Tagger using existing data and Hidden arkov Model. Named Entity Recognition. Relationship between NER tagging and PoS tagging. nstituency Parsing.				
Module 4	**P Applications**	izzes		**9 Sessions**
pics: xical Resource Creation. Sentiment Analysis. Machine Translation. Word Sense Disambiguation and ordNet. Question Answering.				
rgeted Application & Tools that can be used: **Python Libraries (Eg. NLTK, Spacy, etc.)** **Java (Stanford CoreNLP)** **Google Colab**				
Project work/Assignment:				
signment: udents will have to do group assignments for Modules 2 & 3. As a part of their assignments, they will ve to implement the solution to particular problems.				
xt Book **1**Daniel Jurafsky, and James Martin.“*Speech and Language Processing*” (3rd edition draft, 2022)				
ferences hris Manning and HinrichSchutze, “*Foundations of Statistical Natural Language Processing*”, 1st ition, MIT Press. 1999.				

awanGoyal, "*Natural Language Processing*". NPTEL. **Book Link for R2: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view** **eb resources:https://web.stanford.edu/~jurafsky/slp3/** **TEL Course: https://onlinecourses.nptel.ac.in/noc22_cs98/course**
pics relevant to "SKILL DEVELOPMENT": Assignment implementations in software, batch wise esentations for developing Skill Development through Participative Learning techniques. This is ained through assessment component mentioned in course handout.

Course Code: IST2000	**urse Title: Business Continuity and Risk alysis** **pe of Course: Theory**	**T-P- C**	3-0-0-3
Version No.	)		
Course Pre-requisites	L		
Anti-requisites	L		
Course Description	rough the study of incident response and contingency planning, including ident response plans, disaster recovery plans, and business continuity plans, this urse aims to help students comprehend the principles of risk management.		
ourse Objective	e objective of the course is to familiarize the learners with the concepts **Business Continuity and Risk Analysis** and attain **Employability** through **rticipative Learning** techniques.		
Course Out Comes	**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 omprehension] Design an incident response plan for sustained organizational erations [Comprehension] Discuss and recommend contingency strategies, including data backup d recovery and alternate site selection for business resumption planning. nowledge]		
urse Content:			

odule 1 Sources of disaster and types of disasters	**Sessions**
saster Recovery Operational cycle of disaster recovery, disaster recovery cost, incidents that uires disaster recovery plans, **evaluating disaster recovery** - methods, team, phases, objectives, ecklist. Best practices for disaster recovery - **Business continuity** - Business continuity vs. disaster overy	
odule 2 Business continuity management:	**Sessions**

roduction - Elements of business continuity management. **Business continuity plan** – **Business ntinuity planning and strategies - BCP standards and guidelines - BCP Project Organization risis communication plan - Emergency response plan - Contingency planning**

odule 3 Managing, assessing and evaluating risks:	**Sessions**
portance of risk management - Risk management methodology - Attack methods and untermeasures - **Cost benefits analysis of risk management** - Risk assessment responsibilities - sponsibilities of security professional - Information system auditing and monitoring – **Verification ols and techniques.**	
odule 4 Risk control policies and Counter measures	**Sessions**
roduction - Counter measures - Risk control policy development factors-Development of ormation assurance principles and practices - Laws and procedures in information assurance policy plementation, Security test and evaluation, Automated security tools, Cost benefit analysis, veloping a risk assessment methodology, Security requirements, Information categorization, Risk nagement methodologies to develop life cycle management policies and procedures, Education, ining and awareness. Policy development Information security policy, change control policies, stem acquisition policies and procedures, Risk analysis policies and General risk control policies.	
xt Book John W. Rittinghouse and James F. Ransome, Business Continuity and Disaster covery 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: 978-1-558-339-2)	
ferences ISO 27001:2013 A specification for an information security management system David Alexander, Amanda Finch, David Sutton, Andy Taylor. Information Security nagement Principles, 2nd Ed. BCS Shop, 2013. (ISBN: 9781780171753) Mark Talabis, Jason Martin. Information Security Risk Assessment Toolkit Practical sessments through Data Collection and Data Analysis. Syngress Imprint, 2013. (ISBN: 978-1-59-9735-0). **eb resources:** http://pu.informatics.global	
pics relevant to "EMPLOYABILITY SKILLS": Business continuity vs. disaster recovery , risk nagement, Storage disaster recovery services tools, Verification tools and techniques **for veloping Employability Skills through Participative Learning techniques. This is attained rough assessment component mentioned in course handout.**	

urse Code: **E2018**	**urse Title: Theory of Computation** **pe of Course: Theory Only**	**T-P- C**	3	0	0	3
rsion No.	)					
urse Pre-quisites	e students should have the Knowledge on Set Theory					
ti-requisites						

urse Description	e course deals with introduction of formal languages and the correspondence tween language classes and the automata that recognize them. pics include: Formal definitions of grammars and acceptors, Deterministic and ndeterministic systems, Grammar ambiguity, finite state and push-down tomata; normal forms; Turing machines and its relations with algorithms.			
urse Objective	e objective of the course is to familiarize the learners with the concepts of **eory of Computation as mentioned above** and attain **Skill Development** ough **Problem Solving** Methodologies.			
urse Out Comes	successful completion of the course the students shall be able to: Describe various components of Automata. (Knowledge) Illustrate Finite Automata for the given Language. (Application) Distinguish between Regular grammar and Context free grammar. mprehension) Construct Push down Automata. (Application) Construct Turing machine for a Language. (Application)			
urse Content:				
odule 1	**roduction to automata eory**	signment	oblems on Strings and nguage operations	**06 Sessions**
pics: roduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages operations on languages, Representation of automata, Language recognizers, Finite State chines (FSM): Deterministic FSM, gular languages, Designing FSM, Nondeterministic FSMs				
odule 2	**ite Automata**	signment	oblems on DFA, NFA's	**13 Sessions**
pics: sic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition aphs and Languages and DFA's, Regular Languages, NFA- Definition of a Nondeterministic cepter, Languages and NFA's Why Non-determinism? Equivalence of Deterministic and ndeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.				
odule 3	**gular Expressions & ntext Free Grammar**	signment	oblems on RE, CFG, PT, and Ambiguity	**12 Sessions**
pics: rmal Definition of a Regular Expression, Languages Associated with Regular Expressions, nguages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show me languages are t RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, ftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and rivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing nbiguity, Chomsky Normal Form, Gribiche Normal Form.				
odule 4	**sh down Automata**	signment	oblems on pushdown tomaton	**08 Sessions**
pics: finition of a Pushdown Automaton, Language Accepted by a Pushdown tomaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final				

ıte, From Final State to Empty Stack Equivalence of PDA's and CFG's: From Grammars to shdown Automata.

odule 5	**ring Machine**	signment	oblems on Turning achine	**07 Sessions**

pics: finition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to nstruct Turing machine, Turing Machines as Transducers, Halting Programming Techniques for ring Machines
rgeted Application & Tools that can be used: rgeted Application: Text Processing Compilers Text Editors Robotics Applications Artificial Intelligence ols: JFLAP (Java Formal Language and Automata Package) Software simulation tool. It's eractive educational software written in Java to experiment topics in automata theory. Turing machine Online simulators.
xt Book Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett blications 6th Ed, 2018.
ferences Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008. Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014. **Resources** TEL course – https://onlinecourses.nptel.ac.in/noc21_cs83/preview
pics relevant to "SKILL DEVELOPMENT": Deterministic and Non-Deterministic Automaton, gular Expressions, CFGs, Turning Machine and Pushdown automaton for Skill Development ough Problem Solving methodologies. This is attained through assessment component entioned in course handout.

urse Code: **E3016**	**urse Title:CSE3016 Neural Networks and zzy Logic** **pe of Course: Discipline Elective in AI & ML sket** **Theory Course**	**T-P-C**	3-0-0-3
rsion No.	)		
urse Pre-quisites	L		
ti-requisites	L		
urse scription	is course aims to introduce the basic concepts of Neural Networks and Fuzzy gic. Neural networks reflect the behavior of the human brain, allowing mputer programs to recognize patterns and solve common problems in the lds of AI, machine learning, and deep learning. Fuzzy Logic is a method of		

	asoning that resembles human reasoning. The approach of Fuzzy Logic itates the way of decision-making in humans that involves all intermediate ssibilities between digital values YES and NO. This course introduces ndamental concepts in Neural Networks and Fuzzy Logic Theory.			
urse Objective	e objective of the course is to familiarize the learners with the concepts of **ural Networks and Fuzzy Logic** and attain **Skill Development** through **rticipative Learning** techniques.			
urse tcomes	**n 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 ural Network.[Knowledge] Discuss the concepts of Fuzzy Sets and Relations. [Comprehension Demonstrate the Fuzzy logic concepts and its applications.[plication]			
urse Content:				
odule 1	**troduction to ural Network**	iz	ngle Layer Perceptron	**9Classes**

pics:
troduction to NN: History, Artificial and biological neural networks, Artificial intelligence and ural networks.
urons and Neural Networks: Biological neurons, Models of single neurons, Different neural twork models.
ngle Layer Perceptron: Least mean square algorithm, Learning curves, Learning rates, rceptron.

odule 2	**ultilayer rceptron**	iz	ultilayer Perceptron	**10 Classes**

pics:
ultilayer Perceptron: The XOR problem, Back-propagation algorithm, Heuristic for improving e back-propagation algorithm, Some examples.
dial-Basis Function Networks: Interpolation, Regularization, Learning strategies.
honen Self-Organising Maps: Self-organizing map, The SOM algorithm, Learning vector antization.

odule 3	**zzy Sets, erations and lations**	iz	zzy Operations	**10Classes**

pics:
zzy Sets: Crisp Sets - an Overview, Fuzzy Sets - Definition and Examples, α - Cuts and its operties, Representations of Fuzzy Sets, Extension Principles of Fuzzy Sets.
zzy Operations: Operations on Fuzzy Sets - Fuzzy Complements, Fuzzy Intersections, Fuzzy ions, Combinations of Operations, Aggregation Operations.
zzy Relations: Binary Fuzzy relations, Fuzzy Equivalence Relations, Fuzzy Compatibility lations.

odule 4	zzy Logic and zzy Logic ntroller	signment	veloping Fuzzy Logic ntroller	Classes

zzy Logic: Classical Logic, Multivalued Logic, Fuzzy Propositions, Fuzzy Quantifiers, nguistic Hedges, Inference from Conditional Fuzzy Propositions, Conditional and Qualified opositions and Quantified Propositions.
zzy Controllers: An Overview, Fuzzification Module, Fuzzy Rule Base, Fuzzy Inference gine, Defuzzification Module, An Example.

rgeted Application & Tools that can be used:

Python Libraries and Software (Eg.,Tensorflow, Scikit-Learn etc.)
Matlab (Neural Network Toolbox, Fuzzy Logic Toolbox)

oject work/Assignment:

udents will have to do group assignments for Modules 2 & 4. As a part of their assignments, ey will have to implement the solution to particular problems.

xtbook(s):

Haykin, Simon. "*Neural networks and learning machines"*, 3/E. Pearson Education dia, 2011. https://www.pearson.com/en-us/subject-catalog/p/Haykin-Neural-Networks-d-Learning-Machines-3rd-Edition/P200000003278/9780133002553
George J. Klir and Bo Yuan, "*Fuzzy Sets and Fuzzy Logic- Theory and Applications*", entice Hall of India, 2015.
tps://www.worldcat.org/title/fuzzy-sets-and-fuzzy-logic-theory-and-plications/oclc/505215200

ferences:

Shivanandam, Deepa S, "*Principles of Soft computing*", N Wiley India, 3rd Edition, 18.https://www.wileyindia.com/principles-of-soft-computing-3ed.html
Timothy J. Ross, "*Fuzzy Logic with Engineering Applications*", Third Edition, Wiley, 11.
tps://onlinelibrary.wiley.com/doi/book/10.1002/9781119994374
Kumar S., "*Neural Networks - A Classroom Approach*", Tata McGraw Hill, 2nd Edition 17.https://www.worldcat.org/title/neural-networks-a-classroom-proach/oclc/56955342
Fakhreddine O. Karray, and Clarence W. De Silva. "*Soft computing and intelligent stems design: theory, tools, and applications*". Pearson Education, 2009.

eblinks

tps://www.pearson.com/en-gb/search.html?q=Karray%20Soft-Computing-and-Intelligent-stems-Design-Theory-Tools-and-Applications

pics relevant to "Skill Development ": Assignment implementations in software, batch wise esentations are used for Skill Development through Participative Learning techniques. This attained through assessment component mentioned in course handout.

ourse Code: CSE3036 & CSE3036_P	**se Title:** Predictive Analytics **of Course: Integrated**		**P- C**	2-0-0-2 0-0-2-1
Version No.				
Course Pre-requisites	amentals of Data Analytics			
nti-requisites				
rse Description	redictive Analytics subject is conceptual in nature. The students will be benefited in is course to know about modern data analytic concepts and develop the skills for nalysing and synthesizing data sets for decision making in the firms.			
urse Objective	he objective of the course is skill development of student by using earning techniques			
rse Out Comes	**n successful completion of the course the students shall be able to:** O 1: Define the nature of analytics and its applications (Knowledge) O 2: Discuss the concepts of predictive analytics and data mining (Comprehension) O 3: Compute the analytical tools in business scenarios to achieve competitive lvantage (Application) O 4: Relate the real-world insights in decision trees and time series analysis methods dynamic business environment (Application) O 5: Outline the importance of big data in predictive analytics (Comprehension)			
se Content:				

Module 1	luction to Predictive nalytics	Learning	cations of analytics	**8 Sessions**
opics: Analytics- Definition, importance, Analytics in decision making, Applications, Challenges, Experts erception on analytics; Popularity in Analytics; Predictive analytics in business Scenarios- case studies				
Module 2	ctive Analytics & Data Iining	analysis	ictive Analytics – Employee Attrition Case center.CO2. https://www.thecase centre.org/products/ view?id=143229	**8 Sessions**
opics: Predictive Analytics- Definition, Importance and application; Predictive Analytics – Marketing, Health re & other industries; Skills and roles in Predictive Analytics; Tools & Software; Data Mining-Definition, oplications, kinds of pattern data mining can discover, data mining tools & dark side of data mining				
Module 3	Methods & Algorithms r Predictive Analytics	ipative earning & ase Analysis	redictive analytics in HR	**8 Sessions**
s: Nature; Pre-processing of data for analytics; Data Mining methods; Prediction; Classification- ecision tress; Algorithms - Naïve Bays, nearest neighbour; Cluster analysis, K means clustering, ssociation; Predictive analytics misconception; Regression - Simple linear regression (SLR) using OLS ethod, Multiple linear regression (MLR); applications of multiple regression for numeric prediction iolation of Ordinary least squares (OLS) method - Auto correlation, Heteroscedasticity , ulticollinearity				
Module 4	ess Forecasting & ecisions Trees	ssion & esentation	Business Forecasting	10 Sessions

cs **Module 4:** Business Forecasting; Time Series Data and Time Series Analysis- based Forecasting, orecasting Accuracy, Auto-regressive and Moving average model-Unstructured data				
Module 5	Data in Predictive nalytics	ssion & resentation	Darkside of data mining, Challenges and problems in data analytics	06 Sessions
undamental concepts of Big data; Challenges and problems in data analytics; Big data technologies; Big data & ream analytics; Expert views on analytics; mulation – A/B Testing Data preparation, cleaning, and exploratory analysis using data visualization and escriptive statistics;				

of Laboratory Tasks:

Predicting buying behavior
alytics to identify buying habits based on previous purchase history.
edict customer purchase patterns.

Fraud detection
identify anomalies in the system and detect unusual behavior to determine threats.
perts can feed historical data of cyberattacks and threats to the system. When the predictive analytics gorithm identifies something similar, it will send a notification to the respective personnel.

Healthcare diagnosis
nderstanding the disease by providing an accurate diagnosis based on past data.
edictive analytics help doctors reach the root cause of diseases.

Card abandonment
edict how likely a customer is to abandon the cart.
will also provide companies with details about each customer about whether they will purchase or abandon e cart based on the previous visits to the store.

Content recommendation
tertainment companies can predict what users want to watch based on their history.
e analytics for predicting the user's behavior.

Equipment maintenance
achinery would alert the personnel and the maintenance can be done to avoid unscheduled and accidental eakdowns.

eted Application & Tools that can be used

tical tools, documentary review, case analysis and Simulation help students to understand the data iven decisions for firms

Project work/Assignment:

ct:
eveloping the questionnaire for specific objective of the brands, primary data collection and do the sales orecasting by using predictive analysis using SPSS software and develop report on data storytelling om the data analysis.
nment:
eview the article on Organisational capabilities in PA using PU link https://wwwemerald-com-esiuniv.knimbus.com/insight/content/doi/10.1108/MD-03-2018-0324/full/html
velop a podcast of 5 mins of each group discussions on Darkside of data mining. Each group consist of members in the team

ext Book

T1 : Predictive Analytics Delen, D. (2020). Predictive Analytics: Data Mining, Machine earning and Data Science for Practitioners. Upper Saddle River, NJ, USA: FT Press. (Pearson ublication)
ences **1** Dinesh Kumar, U. (2021). Business Analytics: The Science of data-Driven Decision Making. **2** Business Analytics - Data Analysis & Decision Making", S. Christian Albright and Wayne L. inston, Cengage Publication, 5th Edition, 2012 **book link R1:** Raman, R., Bhattacharya, S., & Pramod, D. (2018). Predict employee attrition by sing predictive analytics. Benchmarking: An International Journal. https://www-emerald-com-esiuniv.knimbus.com/insight/content/doi/10.1108/BIJ-03-2018- 0083/full/html **book link R2:** Jing, Z., Luo, Y., Li, X., & Xu, X. (2022). A multi-dimensional city data embedding odel for improving predictive analytics and urban operations. Industrial Management & Data ystems, (ahead-of-print). https://www-emerald-com-esiuniv.knimbus.com/insight/content/doi/10.1108/IMDS-01-2022- 0020/full/html **book link R3:** Singh, R., Sharma, P., Foropon, C., & Belal, H. M. (2022). The role of big data and edictive analytics in the employee retention: a resource-based view. International Journal of anpower. https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/IJM-03-21- 0197/full/html **book link R4:** Mishra, D., Luo, Z., Hazen, B., Hassini, E., & Foropon, C. (2018). Organizational pabilities that enable big data and predictive analytics diffusion and organizational performance: A source-based perspective. Management Decision. https://www-emerald-com-esiuniv.knimbus.com/insight/content/doi/10.1108/MD-03-2018- 0324/full/html **eb resources:** W1.https://www.sas.com/en_in/insights/analytics/predictive-analytics.html W2. https://www.techtarget.com/searchbusinessanalytics/definition/predictive-analytics 3. https://www.cio.com/article/228901/what-is-predictive-analytics-transforming-data- intofuture-sights.html W4. https://www.simplilearn.com/what-is-predictive-analytics-article 5. https://www.northeastern.edu/graduate/blog/predictive-analytics/ 6.https://www.marketingevolution.com/knowledge-center/the-role-of-predictive-analyticsin-data-iven-marketing Swayam & NPTEL Video Lecture Sessions on Predictive Analytics 1. https://onlinecourses.swayam2.ac.in/imb20_mg19/preview 2. https://onlinecourses.nptel.ac.in/noc19_mg42/preview ase References edictive Analytics Industry Use cases. ttps://www.rapidinsight.com/blog/11-examples-ofpredictive-analytics/ inivasan Maheswaran (2017). Predictive Analytics – Employee Attrition Case center.
opics relevant to development of "Skill Development": ": Application of Business Analytics to hances customer satisfaction and firms' success **opics relevant to development of "Environment and sustainability:** Focus on Predictive analytics minimize the errors in decision making

PEC

urse Code: **E3087**	**urse Title: Applied Machine Learning** **pe of Course: 1] Program Core** **2] Laboratory integrated**	**T- P-**	2-0-2-3

rsion No.	)		
urse Pre-quisites	E3001 Artificial Intelligence and Machine Learning		
ti-requisites	L		
urse scription	achine Learning algorithms are the key to develop intelligent systems ch as Apple's Siri, Google's self-driving cars etc. This course roduces the concepts of the core machine learning techniques such as gression learning, Bayesian learning, Ensemble learning, Perceptron rning, Unsupervised learning, Competitive learning, learning from ussian mixture models and learning to detect outliers. Course tures covers both the theoretical foundations as well as the essential orithms for the various learning methods. Lab sessions complement lectures and enable the students in developing intelligent systems real life problems.		
urse jectives	is course is designed to improve the learners 'EMPLOYABILITY ILLS' by using EXPERIENTIAL LEARNING techniques. The pervised hands-on laboratory exercises, assessments and the group jects facilitate this learning process.		
urse Out mes	successful completion of the course the students shall be able to: Apply advanced supervised machine learning methods for edictive modeling. [Application] Produce machine learning models with better predictive rformance using meta learning algorithms [Application] Create predictive models using Perceptron learning orithms[Application] Employ advanced unsupervised learning algorithms for clustering, mpetitive learning and outlier detection[Application] Implement machine learning based intelligent models using Python raries. [Application]		
urse Content:			

odule 1	pervised arning	signment	ogramming using ras/Sklearn	No. f Classes – 7 P – 12

pics: An overview of Machine Learning(ML); ML workflow; types of ML; Types of tures, Feature Engineering -Data Imputation Methods; Regression – introduction; nple linear regression, loss functions; Polynomial Regression; Logistic Regression; ftmax Regression with cross entropy as cost function**; Bayesian Learning** – Bayes eorem, estimating conditional probabilities for categorical and continuous

ıtures, Naïve Bayes for supervised learning; Bayesian Belief networks; Support ctor Machines – soft margin and kernel tricks.				
odule 2	semble Learning	signment	ogramming using ras/Sklearn	**No. f Classes L-3 P-4**
pics: **Ensemble Learning** – using subset of instances – Bagging, Pasting, using subset features –random patches and random subspaces method; Voting Classifier, Random rest; Boosting – AdaBoost, Gradient Boosting, Extremely Randomized Trees, ıcking.				
odule 3	rceptron arning	signment /Quiz	ogramming using ras/Sklearn	**No. f Classes L-7 P -2**
pics: **Perceptron Learning** – from biological to artificial neurons, Perceptrons, Linear reshold Units, logical computations with Perceptrons, common activation functions igmoid, tanh, relu and softmax, common loss functions, multi-layer Perceptrons and Backpropagation algorithm using Gradient Descent.				
odule 4	ısupervised arning	signment	ogramming using ras/Sklearn	**No. f Classes L-6 P -6**
pics: **Unsupervised Learning** – simple k Means clustering- simple and mini- tch**;** updating centroids incrementally; finding the optimal number of clusters using bow method ; Silhoutte coefficient, drawbacks of kMeans, kMeans++ **;** Divisive erarchical clustering – bisecting k-means, clustering using Minimum Spanning Tree ST) **Competitive Learning** - Clustering using Kohenen's Self Organising Maps OM), **Density Based Spatial Clustering – DBSCAN**; clustering using Gaussian ixture Models (GMM) with EM algorithm ; Outlier Detection methods – **Isolation rest, Local Outlier Factor(LOF)**				
st of Laboratory Tasks: **periment N0 1: Methods for handling missing values** **vel 1:** Given a data set from UCI repository, implement the different ways of ndling missing values in it using Scikit-learn library of Python **vel 2:** Implement one of these methods using a custom defined function in Python. **periment No. 2: Data Visualization** **vel 1** Perform Exploratory Data Analysis for a given data set by creating Scatter ot, Pair Plot, Count Plot using Matplotlib and Seaborn **vel 2** Create Heat Maps, WordCloud **periment No. 3: Regression learning**				

vel 1 Given a data set from UCI repository, implement the simple linear regression gorithm and estimate the models parameters and the performance metrics. Plot the rning curves.
vel 2 Implement the polynomial regression algorithm. Compare the learning rves of Polynomial and Linear Regression.

periment No.4: Logistic regression
vel 1 Write custom code for generating the logistic/sigmoid plot for a given input
vel 2 Given a data set from UCI repository, implement the Logistic regression gorithm. Estimate the class probabilities for a given test data set. Plot and analyze the cision boundaries.

periment No.5: Bayesian Learning
vel 1 Given a data set from UCI repository, implement a classification model using e Bayesian algorithm

periment No.6: Support Vector Machine(SVM)
vel 1 Given data sets from UCI repository, implement a linear SVM and a non-linear M based classification model.

periment No. 7: Ensemble Learning
vel 1 : Implement Ensemble Learning algorithms such as Bagging, Pasting and Out-Bag Evaluation
vel 2 : Random Patches and Random Subspace Method

periment No. 8: Ensemble Learning
vel 1 : AdaBoost and Gradient Boosting, Stacking

periment No. 9: Perceptron Learning
vel 1 : Implement the Perceptron Classifier
vel 2 : – An Image Classifier Using the Sequential API of Keras

periment No. 10: Unsupervised Learning
vel 1 : K-means – simple and mini-batch. Finding the optimal number of clusters ing Elbow method and Silhoutte Coefficient . Compare the inertia of both as k reases. Tuning the hyperparameter 'k' using GridSearchCV.
vel 2 : – Using clustering for Image segmentation and Preprocessing. Kmeans++
periment No. 11: Density Based Clustering
vel 1 Implement DBSCAN – clustering using the local density estimation. Perform rd and soft clustering for new instances.
periment No. 12: Outlier Detection
vel 1 Outlier Detection using Isolation Forest and Local Outlier Factor

rgeted Application & Tools that can be used :

Execution of the ML algorithms will be done using the Google's cloud rvice namely "Colab", available at https://colab.research.google.com/ or Jupyter otebook. The data sets will be from the bench marking repositories such as UCI achine learning repository available at : https://archive.ics.uci.edu/ml/index.php Laboratory tasks will be implemented using the libraries available in Python ch as Scikit learn, matplotlib, seaborn, perceptron and the deep learning framework mely Keras.
oject work/Assignment: Mention the Type of Project /Assignment proposed for is course
udents can be assigned a mini project to develop a machine learning application for al-life problems in various domains such as health care, business intelligence, vironmental modeling, etc.
xt Book ere are a number of useful textbooks for the course, but each cover only a part of the urse syllabus. Following is an indicative list of textbooks. Aurélien Géron, "Hands-on Machine Learning with Scikit-Learn, Keras, and nsorFlow", Oreilly, Second Edition, 2019. Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with thon :A Guide for Data Scientists", Oreilly, First Edition, 2018 Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to pular algorithms from data science and machine learning", Packt Publishing, 2017.
eferences In references apart from the books and web links, mention a few ndards &Hand books relevant to the Laboratory tasks used by the ofessionals. Tan P. N., Steinbach M & Kumar V. "***Introduction to Data Mining*"**, Pearson ucation, 2016. **https://towardsdatascience.com/machine-learning/home** MITopencourseware:https://ocw.mit.edu/courses/6-0002-introduction-to-mputational-thinking-and-data-science-fall-2016/resources/lecture-11-introduction--machine-learning/ https://onlinecourses.nptel.ac.in/noc21_cs85/preview

urse Code: **E3009**	**urse Title: Optimization Techniques for achine Learning** **pe of Course: Discipline Elective in Artificial telligence and Machine Learning Basket** **Theory**	**T- P-**	3-0-0-3
rsion No.	)		

urse Pre-quisites	**E3008 Machine Learning Techniques**
ti-requisites	**L**
urse scription	is course introduces a range of machine learning models and optimization tools t are used to apply these models in practice. Course will introduce what lies hind the optimization tools often used as a black box as well as an understanding the trade-offs of numerical accuracy and theoretical and empirical complexity. r the students with some optimization background this course will introduce a iety of applications arising in machine learning and statistics as well as novel imization methods targeting these applications.
urse Objective	e objective of the course is to familiarize the learners with the concepts Optimization Techniques for Machine Learning and attain **Employability** ough **Problem Solving** Methodologies.
urse Outcomes	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].**
urse Content:	

Module 1:	**ndamentals of Machine rning**	**iz**	owledge based iz	**Sessions**
pics: Machine learning paradigm, empirical risk minimization, structural risk minimization, rning guarantees, introduction of VC-dimension.				
dule 2:	**chine learning models**	**iz**	mprehension sed Quiz	**Sessions**
pics: logistic regression, support vector machines, sparse regression, low dimensional embedding, rank matrix factorization, sparse PCA, multiple kernel learning.				
dule 3	**nvex optimization models**	**signment**	tch-wise signments	**Sessions**
pics: linear optimization, convex quadratic optimization, second order cone optimization, nidefinite optimization, convex composite optimization				
dule 4:	**thods for convex timization**	signment and sentation	tch-wise signment and sentations	**Sessions**
pics: gradient descent, Newton method, interior point methods, active set, prox methods, elerated gradient methods, coordinate descent, cutting plances, stochastic gradient.				

rgeted Application & Tools that can be used: **Use of Matlab tool**

oject work/Assignment:
rvey on Methods for convex optimization

xt Book

. Charu C. Aggarwal, " *Linear Algebra and Optimization for Machine Learning*", Springer, 20.

T2. Sra Suvrit, Nowozin Sebastian, and Wright Stephen J, "*Optimization for Machine arning*", The MIT Press,2012.

ferences

.Guanghui Lan, "*First-order and Stochastic Optimization Methods for Machine Learning*", ringer Cham, 2020.

eb References 1. https://sm-nitk.vlabs.ac.in/ 2. https://nptel.ac.in/courses/
pics related to development of "EMPLOYABILITY SKILL": Convex optimization models and ethods for convex optimization, for development of Employability Skills through Participative arning Techniques. This is attained through assessment components mentioned in course handout.

ourse Code: **E3189**	**urse Title: Deep Learning** **pe of Course: Theory & Integrated Laboratory**	**T-P-**	)-2-3
rsion No.	)		
urse Pre-requisites	L		
ti-requisites	L		
urse Description	is course introduces students to the concepts of deep neural networks and state of the approaches to develop deep learning models. In this course students will be given exposure to the details of neural networks as well as deep learning chitectures and to develop end-to-end models for such tasks. It will help to sign and develop an application-specific deep learning models and also ovide the practical knowledge handling and analyzing end user realistic plications. pics include Fundamental concepts of deep neural networks, Convolutional Neural tworks, Recurrent Network structures, Deep Unsupervised Learning, Generative versarial Networks and applications in various problem domains.		
urse Outcomes	successful completion of this course the students shall be able to: Learn the Fundamental Principles of Deep Learning . (Remember). Identify the Deep Learning Algorithms for Various Types of Learning sks in various domains (Apply). Employ Supervised and Unsupervised Deep Learning techniques to build ective models for prediction or classification tasks. (Apply). Use Appropriate validation metric to evaluate the performance of plemented Deep Neural Network. (Apply)		
urse Content:			

odule 1	**roduction to Deep Learning and ural Networks**	signment		**08 Classes**
pics: ndamentals of Deep Learning, Perceptron, Multilayer Perceptron, Optimizing Perceptions using tivation Functions, Loss Functions, Gradient Descent. edforward Neural Network, Training Neural Network with Back-propagation, Hyper parameters, gularization, Dropouts, Batch Normalization, Practical Issues in Neural Network Training -The oblem of Overfitting, The Vanishing and Exploding Gradient Problems				
odule 2	**mmon Deep Learning chitectures:**	signment		**10 Classes**

pics: nvolutional Neural Network, Transfer learning Techniques, Variants of CNN: DenseNet, kelNet,ResNet, AlexNet quence Modelling : Recurrent Neural Network and its variants - Long Short Term Memory (LSTM), ted Recurrent Unit (GRU)				
odule 3	ep Generative Models	signment		**10 Classes**
pics: nerative Adversarial Networks, Kohonen Networks, Autoencoders , Boltzman Machine, Restricted ltzmann Machine, Deep Belief Network				
odule-4	lvanced Deep Learning chitectures	signment		**12 Classes**
pics: pfield Network, Probabilistic Neural Network, Deep Reinforcement Learning - The Basic Framework Reinforcement Learning ep Learning applications: Image segmentation, Object detection, Attention model for computer vision ks, Natural Language Processing, Speech Recognition, Video Analytics				
oject work/Assignment:				
Assignment 1 on (Module 1 and Module 2) **Assignment 2 on (Module 3 and Module 4)**				

st of Laboratory Tasks:

b 1: Working with Deep Learning Frameworks
jective: Explore various Deep Learning Frameworks
sks: Identify deep learning frameworks (Keras, Tensorflow, Matplotlib, etc)
tivity: Practice with various methods available in DL Frameworks to develop a Model.

b 2: Build a Basic Artificial Neural Network
jective: Create a ANN with DL frameworks.
sk: Identify suitable ANN Layers using Keras and Tensorflow.
tivity: Design a basic Artificial Neural Networks using Keras with TensorFlow (pima-indians-abetes)

b 3 and Lab 4 : Build a Multi Layer Perceptron
jective: Create a MLP for classification task.
sk: Identify suitable model for house price prediction.
tivity: Design a MLP for implementing classification and fine-tuning using House price.csv

b 5: Build a Convolutional Neural Network
jective: Create a CNN model.

sk: Build CNN architecture for Dog-Cat classification problem.
tivity: Implement a Convolution Neural Network (CNN) for dog/cat classification problem using ras

b 6 and Lab 7 : Build a Time-Series Model
jective: Create a RNN and LSTM Model
sk: Build RNN/LSTM Model for predicting time series data.
tivity Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes

b 8: Build a Gated Recurrent Unit architecture.
jective: Create a Time Series Model.
sk: Build GRU Architecture for predicting time series data.
tivity: Implement a GRU architecture for language translations.

b 9 and Lab 10 : Build a Transfer Learning Model.
jective: Create a Seq2Seq Model
sk: Create Hugging-face API using Transfer learning model.
tivity: Implement Transfer Learning models for classification problems Exploring Hugging-face PI

b 11: Build an Auto-Encoder model
jective: Create an Unsupervised Deep Learning Model.
sk: Create AutoEncoder network Output Translations.
tivity: implement an Encoder-Decoder Recurrent neural network model for Neural Machine anslation.

b 12: Build Generative Adversarial Networks.
jective: Create an Unsupervised Deep Learning Model.
sk: Design GAN Architecture for Image generations.
tivity: Design a Age Prediction model by Applying Generative Adversarial

EFERENCE MATERIALS:

EXTBOOKS

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

EFERENCES

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

URNALS/MAGAZINES

IEEE Transactions on Neural Networks and Learning Systems
ps://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385

IEEE Transactions on Pattern Analysis and Machine Intelligence
ps://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_pape
/IT032.pdf
International Journal of Intelligent Systems
ps://onlinelibrary.wiley.com/journal/1098111x

VAYAM/NPTEL/MOOCs:
Swayam Nptel – Deep Learning – IIT Ropar
ps://onlinecourses.nptel.ac.in/noc21_cs35/preview
Coursera – Neural Networks and Deep Learning Andrew Ng
Coursera - Neural Networks for Machine Learning by Geoffrey Hinton in Coursera

urse Code: **E3011**	**urse Title: Reinforcement Learning** **pe of Course: 1] Program Core** **2] Laboratory integrated**	**T-P- C**	2-0-2-3
rsion No.	)		
urse Pre-quisites	E3001: Artificial Intelligence and Machine Learning		
ti-requisites	-		
urse scription	both engineers and researchers in the field of Computer science, it is mmon to develop models of real-life situations and develop solutions based those models. It is of utmost importance to come up with innovative utions for scenarios that are highly stochastic. The objective of this course, is introduce different reinforcement learning techniques which is a promising radigm for stochastic decision making in the forthcoming era. Starting from basics of stochastic processes, this course introduces several RL techniques t are as per the industry standard. th a good knowledge in RL, the students will be able to develop efficient utions for complex and challenging real-life problems that are highly chastic in nature.		
urse jectives	is course is designed to improve the learners 'EMPLOYABILITY SKILLS' by ng EXPERIENTIAL LEARNING techniques.		
urse Out mes	successful completion of the course the students shall be able to: Apply dynamic programming concepts to find an optimal policy in a gaming vironment [Applying] mplement on-policy and off-policy Monte Carlo methods for finding an timal policy in a einforcement learning environment. [Applying]		

	Utilize Temporal Difference learning techniques in the Frozen Lake RL vironment [Applying] Solve the Multi-Armed Bandit (MAB) problem using various exploration-ploitation strategies [Applying]
urse Content:	

odule 1	roduction to inforcement arning	signment	ogramming using the enAI Gym vironment	**. of Classes L – 5 P – 6**
pics : Elements of RL, Agent, environment Interface, Goals and rewards, RL platforms, plications of RL, Markov decision process (MDP), RL environment as a MDP, Maths sentials of RL, Policy and its types, episodic and continuous tasks, return and discount factor, ndamental functions of RL – value and Q functions, model-based and model-free rning, types of RL environments, Solving MDP using Bellman Equation, Algorithms for timal policy using Dynamic Programming -Value iteration and policy iteration, Example rozen Lake problem, Limitations and Scope				
odule 2	onte-Carlo(MC) ethods	signment	ogramming using the enAI Gym vironment	**. of Classes L-5 P-6**
pics: Monte Carlo methods, prediction and control tasks, Monte Carlo prediction : orithm, types of MC prediction, examples , incremental mean updates, Monte Carlo Control gorithm, on-policy MC control, MC with epsilon-greedy policy, off-policy MC control. nitations of MC method.				
odule 3	mporal ference(TD) arning	signment /Quiz	ogramming using the enAI Gym vironment	**. of Classes L-7 P -6**
pics: Temporal difference learning: TD Prediction, TD Control : On-policy TD control – SARSA, mputing the optimal policy using SARSA, Off-policy TD control – Q learning, computing timal policy using Q learning, Examples, Difference between SARSA and Q-rning, Comparison of DP, MC and TD methods.				
odule 4	lti-Armed Bandit AB) problem	signment	ogramming using the enAI Gym vironment	**. of Classes L-6 P -4**
pics: Understanding the MAB problem, Various exploration strategies – epsilon-greedy, ftmax exploration, upper confidence bound and Thompson sampling, Applications of MAB inding the best advertisement banner for a web site, Contextual bandits, introduction to Deep inforcement Learning(DRL) Algorithm – Deep Q Network (DQN)				

t of Laboratory Tasks:

Software Setup : installalling Anaconda, OpenAI Gym and Universe.

sic simulations of some gaming environments in Gym

Working with Gym environments to create agents with random policy

. Create the Frozen Lake GYM environment and explore the states, action, transition bability, reward functions and generating episodes. 2 Create an agent for the Cart-Pole environment using a random policy and record the me **Finding the optimal policy for the agent using Dynamic Programming** . Compute the optimal policy for the Frozen Lake Environment using value iteration method 2 Compute the optimal policy for the Frozen Lake Environment using policy iteration thod **Implementing Monte Carlo prediction method using blackjack game** . Every-visit MC prediction 2 First-visit MC prediction **Implementing on-policy MC control method using the epsilon-greedy policy for the ckjack game** **Implementing Temporal Difference prediction for the Frozen lake environment for a ndom policy** **Computing the optimal policy using on-policy TD control – SARSA** **Computing the optimal policy using off-policy TD control – Q-learning** **Multi-Armed Bandit problem** . Creating a MAB in Gym 2 Compute the best arm using various exploration strategies such as epsilon-greedy and tmax exploration method. . **Application of MAB – Finding the best advertisement banner for a web site using MAB**
rgeted Application & Tools that can be used : Execution of the RL algorithms will be done using the environments provided by enAI's Gym and Gymnasium of Farama Foundation in "Colab", available https://colab.research.google.com/ or Jupyter Notebook. Laboratory tasks will be implemented using the necessary libraries available in thon
oject work/Assignment: Mention the Type of Project /Assignment proposed for this urse
idents can be given group assignments to develop different gaming environments and plement the RL algorithms
xt Book Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", T press, Second Edition, 2018. Sudharshan Ravichandiran, "Deep Reinforcement Learning with Python", Packt blishers, Second Edition, 2020
ferences Laurra Graesser and Wan Loon Keng, "Foundations of Deep Reinforcement Learning", arson, 2022 https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-thon/

urse Code: E3019	urse Title: Stochastic Decision making pe of Course: Theory	T-P-	3	0	0	3
rsion No.	)					
urse Pre-quisites	ourse in Statistics: STAT-UB 1 or STAT-UB 3 or STAT-UB 103. sic familiarity with Microsoft Excel: developing and copying formulas th relative and absolute cell addresses, and using the function and chart zards.					
ti-requisites						
urse scription	is course introduces the basic concepts, principles, and techniques of cision making under uncertainty. Students will learn how to model mplex business problems that involve risk and uncertainty with the help spreadsheet models. The course covers analytical models such as Decision ee, Stochastic Optimization, Simulation & Optimization, and Dynamic timization. The course is hands-on. The emphasis will be on model mulation and interpretation of results, not on mathematical theory. This urse emphasizes optimization models with uncertain parameter values. In ntrast, the DMA course focuses on various deterministic optimization odels and Monte Carlo nulation.					
urse jective	e objective of the course is to familiarize the learners with the concepts **Stochastic Decision making** and attain **Employability** through **rticipative Learning** techniques.					
urse Out mes	**successful completion of the course the students shall be able to:** **Gain basic knowledge about stochastic processes in the time main. The student has acquired more detailed knowledge about Markov ocesses with a discrete state space, including Markov chains, Poisson ocesses and birth and death processes.** **Know about queueing systems and Brownian motion, in addition mastering the fundamental principles of simulation of stochastic ocesses and the construction of Markov chain Monte Carlo (MCMC) orithms.** **formulate simple stochastic process models in the time domain d provide qualitative and quantitative analyses of such models.**					
urse Content:	e data to model currency exchange rates, stock prices, commodity prices, travelDemand; Brief introduction to Monte Carlo simulation; Optimal ancial hedging strategies; Supply contract selection; Airline booking ntrol. Introduction to decision tree; Value of information; Bayesian dateValue an R&D project: managing technology risk; Value a license reement; Options to postpone, expand, and contract.					

odule 1	**nple static ochastic**	signment	nulation/Data alysis	**14 Sessions**

	timization odels			

e data to model currency exchange rates, stock prices, commodity prices, air velDemand; Brief introduction to Monte Carlo simulation; Optimal financial hedging ategies; Supply contract selection; Airline booking control. Introduction to decision tree; lue of information; Bayesian updateValue an R&D project: managing technology risk; lue a license agreement; Options to postpone, expand, and contract.

odule 2	**quential decision king: decision e**	signment	nulation/Data alysis	**14 Sessions**

troduction to dynamic programming; Binomial tree; American option pricing; Targeted rketingInventory management at a retail pharmacy; Optimal timing for market entry; sh management at a retail bank.Moving average; Trends; Seasonality .Introduction to ear programming; Production planning with forecasted demand; Airline revenue nagement

odule 3	**al options and cision tree**	rm per/Assignment	nulation/Data alysis	**14 Sessions**

pital budgeting: when projects have uncertain NPVs and uncertain capital usage; oduction strategy: managing quality risk of raw materials; Value-at-risk Plant location for multinational firm: hedging currency exchange risk; Process flexibility: hedging demand k.Inventory transshipment: managing demand risk; Capacity planning for an electric lity.

t of Laboratory Tasks

rgeted Application & Tools that can be used:

e course is theory based and students will get hands on experience in statistical tools.

signment:

xt Book

J Medhi, “Stochastic Processes”

ferences

A K Basu, “Introduction to Stochastic process”

Ming Liao, “Applied Stochastic Process”

Time A Wheeler, Kyle H.Wray, “Algorithms for Decision making”

Resources

https://presiuniv.knimbus.com/user#/home

pics relevant to the “EMPLOYABILITY SKILLS”: Combing simulation with linear timazation, for development of Employability skills through Participative Learning chniques. This is attained through the assessment components mentioned in the course ndout.

urse Code: E3088	**urse Title: Business Intelligence and alytics** **pe of Course:1] Theory**	**T-P- C**	**3-0-0-3**
rsion No.	)		
urse Pre-quisites	**E1002: Programming using Python** **E2012: Database Management Systems**		
ti-requisites	**L**		
urse Description	e purpose of the course is to instill a strong foundation of scientific process entation that is the cornerstone of effective. Business Intelligence (BI) is a of architectures, theories, methodologies and technologies that transform uctured, semi-structured and unstructured data into meaningful and useful ormation. Students will analyze enterprise data requirements to develop eries, reports and build OLAP cubes that use business analytics to answer nplex business questions.		
urse Objective	is course is designed to improve the learners' EMPLOYABILITY SKILLS by ng PROBLEM SOLVING Methodologies.		
urse Out Comes	**successful completion of this course the students shall be able to:** Discuss the impact of Business Intelligence (BI) theories, architectures, l methodologies on the organizational decision making process.[Comprehension] Analyse the differences between the structured, semi-structured and structured data types to leverage the best technologies.[Application] Develop Ad hoc queries, reports, spread sheets, dashboards and mobile applications.[Application] Using business analytics to answer complex business questions using a from a variety of sources, such as data files and relational/NoSQL databases.[owledge]		
urse Content:			

odule 1	Overview of Business elligence, Analytics omprehension)	signment		**10 Hours**

pics:
Framework for Business Intelligence (BI). Intelligence Creation Use and BI Governance. Transaction ocessing Versus Analytic Processing. Successful BI Implementation. Analytics Overview. Brief roduction to Big Data Analytics.

odule 2	siness Reporting, Visual alytics and Business formance (Knowledge)	signment		**10 Hours**

pics:
nagement Business Reporting Definitions and Concepts. Data and Information Visualization. Different pes of Charts and Graphs. The Emergence of Data Visualization and Visual Analytics. Performance shboards. Business Performance Management. Performance Measurement. Balanced Scorecards. Six ma as a Performance Measurement System.

odule 3	g Data and Analytics pplication)	signment		**10 Hours**

pics:
finition of Big Data. Fundamentals of Big Data Analytics. Big Data Technologies. Data Scientist. Big ta and Data Warehousing. Big Data Vendors. Big Data and Stream Analytics. Applications of Stream alytics.

odule 4	nerging Trends and Future pacts (Application)	signment		**10 Hours**

pics:
ocation-Based Analytics for Organizations. Analytics for Consumers. Recommendation Engines. The eb 2.0 Revolution and Online Social Networking. Cloud Computing and BI. Impacts of Analytics in ganizations: An Overview. Issues of Legality, Privacy, and Ethics. The Analytics Ecosystem.

rgeted Application & Tools that can be used: Anaconda/Google Colab, Google Data udio, Deep Note

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

Gain an immersive understanding of the practices and processes used by a junior or associate a analyst in their day-to-day job

Learn key analytical skills (data cleaning, analysis, & visualization) and tools (spread sheets, L, R programming, Tableau)

xt 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 th MindTap". Second Edition , September 2022

ferences . Ramesh Sharda, Dursun Delen, Efraim Turban " Analytics, Data Science, & Artificial Intelligence)th ed.). Upper Saddle River, NJ: Pearson. ISBN- 9781292341552, Second Edition 6 March 2020 . Jose, J. and Lal, S.P. :Introduction to Computing & problem solving with Python, Khanna Book)lishing First edition 2019 . B. Mt Wan " Data Analytics using Python ", 9th Edition, published by Pearson Education 2020. . Ramesh Sharda "Business Intelligence Analytics And Data Science A Managerial rspective" 4Th Edition , Pearson India, April 2019. **eb links** . http://owl.english.purdue.edu/owl/resource/560/01/ . http://myregisapp.regis.edu/Citrix/StoreWeb/ . https://in.coursera.org/courses?query=business%20intelligence . https://www.coursera.org/learn/business-intelligence-data-analytics . https://www.udemy.com/course/business-intelligence-and-data-analytics/
pics relevant to development of "Employability": Business Intelligence, Big Data alytics, Data Scientist.

Course Code: CSE3103	**urse Title: Cognitive Science & Analytics** **pe of Course : Theory**	**- P- C**	3-0-0-3
Version No.	.		
Course Pre-requisites	E3008: Machine Learning Techniques		
Anti-requisites	-		
urse Description	erview of biological structure and artificial network, sensing algorithms, chine learning, localization. Hands-on implementation of cognitive cognition algorithms on both simulated and physical platforms. This course vers the mathematical foundations and state-of-the-art implementations of orithms for cognitive analysis. It culminates in a critical review of recent vances in the field and a team project aimed at advancing the Reasoning.		
ourse Objective	is course is designed to improve the learners' EMPLOYABILITY SKILLS by ng PROBLEM SOLVING Methodologies.		
urse Out Comes	**successful completion of the course the students shall be able to:** Understand the different neural network)dels. **[Understand]** Understand cognition systems and its quirements. **[Understand]** Apply dynamic System concepts in Cognitive Science and uroeconomics. [**Application**] Apply Cognitive Science in Learning and Reasoning. [**Application**]		

urse Content:	

odule 1	**essions**

roduction to Biological Neuron: Structure of Neuron, Action Potential, Process of Action tential, Process of Synaptic Transmission, Stimulate the synaptic vesicle, *Depolarization of the uron,*
emory (Biological Basis): Theories of Memory Formation, System Consolidation Theory, ltiple-Trace Theory, Reconsolidation Theory,
tificial Neural Network: Models of single neurons, Different neural network models. Single yer Perceptron: Least mean square algorithm, Learning curves, Learning rates, Perceptron**.**
yesian Network, Degree of Belief, Conditional Probability, Bayes's Rule

odule 2	**Sessions**

gnitive Architecture: Fundamental Concepts, Cognitive View, Computers in Cognitive ence, Applied Cognitive Science, Interdisciplinary Nature of Cognitive Science, Nature of gnitive Psychology, Notion of Cognitive Architecture, Global View of the Cognitive chitecture, Cognitive Processes, Working Memory, and Attention. Neuroscience: Brain and gnition, Introduction to the Study of the Nervous System, Organization of the Central Nervous stem, Neural Representation, Neuropsychology, Computational Neuroscience,

odule 3	**Sessions**

D E L S AN D TOO LS : The Physical Symbol System Hypothesis :Intelligent Action and the ysical Symbol System, Neural based Models of Information Processing. Cognitive Science and namical Systems, Applying Dynamical Systems. Neuroeconomics: Perception as a Bayesian oblem, Neuroeconomics: Bayes in the Brain
ategies for Brain Mapping, Studying Cognitive Functioning: Techniques from Neuroscience

odule 4	**Sessions**

plication: Models of Language Learning- Language Learning in Neural Networks, Bayesian nguage Learning, Language Acquisition, Natural Language Processing, Semantics. Neural twork Models of Children's Physical Reasoning, Cognitive Science and the Law, Autonomous hicles: Combining Deep Learning and Intuitive Knowledge,

rgeted Application & Tools that can be used:
plications: Behavior-Based Robotics
ols: SHAKEY's Software, Logic Programming in STRIPS and PLANEX

oject Work/Assignment:
Develop a Model for Cognition and Knowledge Representation
Develop a Model for Biorobotics- Insects and Morphological Computation

xt Book

: José Luis Bermúdez, COGNITIVE SCIENCE l Publishers 3rd Edition, Cambridge University ess,2020 : Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc, COGNITIVE SCIENCE Publishers Edition, Cambridge University Press,2020
ferences . Hod Lipson, Melba Kurman Driverless: Intelligent Cars and the Road ahead MIT Press. Edition, 2019 . Markus Maurer, J. Christian Gerdes, Barbara Lenz Autonomous Driving: Technical, Legal and cial Aspects 12n Edition, 2020 . Hannah YeeFen Lim, Autonomous Vehicles and the Law: Technology, Algorithms and Ethics lward Elgar Publishing. 2nd Edition, 2019 **eb Resources:** https://www.cambridge.org/highereducation/books/cognitive-science/
pics relevant to development of "Employability": ep Learning Models, Convolutional Neural Networks, Vehicle trajectory generation, Decision nning, Reinforcement learning.

urse Code: E3108	**urse Title: Expert Systems** **Course type : Theory Only**	**T-P-**	**3-0-0-3**
rsion No.	)		
urse Pre-requisites	**SE 3108 – Expert systems" course**		
ti-requisites	**L**		
urse Description	e purpose of this course is to present the concepts of intelligent agents, arching, knowledge and reasoning, planning, learning and expert systems, to dy the idea of intelligent agents and search methods, to study about presenting knowledge, to study the reasoning and decision making in uncertain rld, to construct plans and methods for generating knowledge, to study the ncepts of expert systems.		
urse Objective	e objective of the course is to familiarize the learners with the concepts of Expert stems and attain **Employability** through **Participative Learning** techniques .		
urse Out Comes	successful completion of this course the students shall be able to: CO1: Describe the modern view of AI as the study of agents that ceive percepts from the Environment and perform actions. CO2: Demonstrate awareness of informed search and exploration thods. CO3: Explain about AI techniques for knowledge representation, anning and uncertainty Management. CO4: Develop knowledge of decision making and learning methods.		
urse Content:			

odule 1	roduction	signment	eory	**9 Hours**
pics: **roduction to AI:** Intelligent agents – Perception – **tural language processing** – Problem – Solving agents – Searching for solutions: Uniformed search ategies – Informed search strategies.				
odule 2	owledge and asoning	signment	eory	**9 Hours**
lversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – **Logical agents:** opositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first der logic.				
odule 3	certain knowledge d Reasoning	signment	eory	**8 Hours**
certainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye's e – **Probabilistic reasoning** – Making simple decisions.				
odule 4	anning and arning	signment	eory	**9 Hours**
anning: Planning problem – Partial order planning – Planning and acting in non-deterministic domains **arning:** Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning Passive and active.				
odule 5 Expert stems	Assignment	Theory		10hrs
finition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge presentation in expert systems – Expert system tools – MYCIN – EMYCIN.				
rgeted Application & Tools that can be used:				
oject work/Assignment: Mention the Type of Project /Assignment proposed for this course				
xt Book Stuart Russel and Peter Norvig, 'Artificial Intelligence A Modern Approach', Second Edition, arson Education, 2003 / PHI. 2. Donald A.Waterman, 'A Guide to Expert Systems', Pearson Education.				

eferences 1. George F.Luger, 'Artificial Intelligence – Structures and Strategies for Complex Problem lving', 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', acmillan Series in Computer Science. 4. W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 03.
nks : **.informatics.global,** https://sm-nitk.vlabs.ac.in/
pics relevant to "EMPLOYABILITY SKILLS": Optimal and imperfect decisions, Logical agents, for veloping Employability Skills through Participative Learning Techniques. This is attained through Review of gital/e resource as mentioned in course handout.

ourse Code: SE3191	**ourse Title: Generative AI** **pe of Course: Program Core – Lab Integrated**			**T-P-**	2-0-2-3
ersion No.					
ourse Pre-requisites	udents are expected to be familiar with the basics of Machine arning,Artificial Intelligence,Deep Learning,Natural Language Processing, near Algebra, Python.				
nti-requisites	LL				
ourse Description	is course introduces students to the exciting world of generative AI, focusing the algorithms, techniques and applications of creating novel data. udents will gain an understanding of generative models, explore various chitectures and learning paradigms and delve into the ethical considerations d societal implications of this rapidly evolving field.				
ourse Objective	jective of the course is to familiarize the learners with the concepts of **enerative AI** and attain **Skill Development** through **Experiential Learning** chniques.				
ourse Outcomes	n successful completion of this course the students shall be able to: Understand the fundamental concepts of generative odeling.(Understand) Explore various generative model architectures.(Analyse) Implement and train generative models.(Apply) Apply generative models to real-world applications in various mains.(Apply) Understand ethical implications of generative AI, including issues of as, fairness and misuse.(Understand)				
ourse Content:					
odule 1	**troduction to enerative AI**	signment		Sessions	

verview of generative models: Historical perspective and evolution, Applications and use cases, **enerative Models Overview:** Types of generative models: RNN, Transformers, Variational ıtoencoders (VAEs), Generative Adversarial Networks (GANs), and others, Strengths and eaknesses of each approach. Comparison generative models.

odule 2	ansfer Learning & he Tuning	signment		Sessions

quence Generation: Recurrent Neural Networks (RNNs) for sequence generation, Long Short-rm Memory (LSTM) networks, Transformer based generative model.
ansfer Learning & Fine tuning: Using pre-trained models for generative tasks, Fine-tuning for ecific plications, Case studies of transfer learning in generative AI.

odule 3	ompt Engineering	signment		Sessions

ompt Engineering: Introduction, LLM for Text Generation-Text Generation Models, Transformer chitecture, OpenAI's pre-trained Transformers: ChatGpt, GPT 3.5, GPT 4. Standard Practices for xt neration with ChatGPT.

odule 4	ANs and VAEs	signment		Sessions

enerative Adversarial Networks (GANs): GAN architecture: Generator and Discriminator, Style ınsfer with AN, Training GANs and common challenges, GAN applications in image and text generation.

ıriational Encoders(VAEs): Principles of VAEs, Encoder and decoder architecture, Training and timization, nditional VAEs and GANs, Controllable generation.

odule 5	ıical Considerations Generative AI	signment		Sessions

s and fairness in generative models, Ethical implications of AI-generated content, Responsible AI velopment and deployment.

t of Laboratory Tasks:

ɔ 1: Setting Up the Environment
jective: Install and set up the necessary tools and frameworks for generative AI development.

ɔ 2: Variational Autoencoders (VAEs)
jective: Implement a simple Variational Autoencoder for image generation using a dataset (e.g., MNIST).
sks: Build and train a VAE model using TensorFlow or PyTorch. Visualize the latent space and generated ages.

ɔ 3: Generative Adversarial Networks (GANs)
jective: Implement a basic Generative Adversarial Network for image generation.
sks: Create a generator and discriminator using deep learning frameworks. Train the GAN on a dataset and ualize the generated images.

ɔ 4: Conditional Generative Models
jective: Extend the GAN or VAE to a conditional generative model.

sks: Introduce conditioning variables (e.g., class labels) to control generation. Train and evaluate the model a conditional dataset.

5: Text Generation with Recurrent Neural Networks (RNNs) Objective: Generate text sequences using current Neural Networks.
sks: Implement an RNN for text generation. Train the model on a text dataset and generate sample quences.

6: Style Transfer with Generative Models
jective: Apply generative models for artistic style transfer.
sks: Use a pre-trained model or implement a style transfer algorithm. Experiment with different styles and ntent images.

7: Transfer Learning for Generative Models
jective: Explore transfer learning in the context of generative AI.
sks: Fine-tune a pre-trained generative model for a specific dataset or task. Evaluate the performance and mpare it with training from scratch.

rgeted Application & Tools that can be used:
thon/Google Colab/TensorFlow

oject work/Assignment:
signment:
ring the course, students would need to do coding assignments to learn to train and use different generative models.

oject Assignment:
signment 1: Module 1, 2
signment 2: Module 4,5

xtbooks:
Generative Deep Learning, 2nd Edition by David Foster, O'Reilly Media, Inc. ISBN: 9781098134181.May 23.

Generative AI with Python and TensorFlow 2, By Joseph Babcock, Raghav Bali, ISBN:9781800200883.April 21.

Prompt Engineering for Generative AI, by James Phoenix, Mike Taylor, O'Reilly Media, Inc., ISBN: 81098153373, July 2024.

ferences:
Online tutorials and lectures by leading researchers in generative AI.
Open-source libraries and frameworks for implementing generative models.
Research papers and articles on recent advancements in generative AI

eb references: https://elearn.nptel.ac.in/shop/iit-workshops/completed/leveraging-generative-ai-for-aching-programming-courses/

tps://cloudxlab.com/course/188/pg-certificate-program-in-data-science-ai-by-cec-iit-orkee?utm_source=google&utm_campaign=20676271827&utm_medium=g&utm_content=learn%20artificial

0intelligence&utm_term=learn%20artificial%20intelligence&utm_creative=682957531590&gclid=EAIaIQobC MIgI-Bs8GBgwMVdh6DAx0W8gUOEAMYASAAEgKAV_D_BwE
pics relevant to "Employability": Understand and implement generative models for various real-time plications. **pics relevant to "Environment and Sustainability"**: Ethical Considerations and Societal Implications of nerative AI.

urse Code: 2023	**urse Title: Data Warehousing and its Applications** **pe of Course:** **eory**			**L-T- P- C**	3-0-0-3
rsion No.					
urse Pre-uisites	L				
ti-requisites	sics of data mining & Python				
urse Description	e Objective of this course is to create a trove of historical data that can be retrieved and analyzed provide useful insight into the organization's operations. A data warehouse is a vital component of iness intelligence. This course will introduce basic concepts of data warehousing, architecture, ign principles, building data warehouse, data mining techniques and major application areas of a warehouse.				
urse Objective	e objective of the course is to familiarize the learners with the concepts of **Data Warehousing l its Applications** and attain **Employability** through **Participative Learning** techniques.				
urse tcomes	completion of this course, the students will be able to Describe data warehousing architecture and considerations to build data warehouse. nowledge] 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]				
urse Content:					
dule 1	oduction To Data rehousing	signment/Quiz	nefits of data warehousing	**8 Session**	
pics: e need for data warehousing, paradigm shift, data warehouse definition and characteristics, Data warehouse hitecture, sourcing, acquisition, cleanup and transformation, metadata, access tools, data marts, data warehouse ninistration and management, building a data warehouse: business consideration, technical consideration, design sideration, implementation consideration, integrated solutions, benefits of data warehousing. Data Warehouse hitecture: Two and Three tier Data Warehouse architecture. signment: Benefits of data warehousing					
dule 2	a Warehouse modelling	signment/Quiz	a cube	**12 Session**	
pics: a cube: A multidimensional data model, stars, snowflakes, and fact constellations: schemas for multidimensional data dels, dimensions: the role of concept hierarchies, measures: their categorization and computation, typical OLAP rations, efficient data cube computation, the compute cube operator and the curse of dimensionality, partial erialization: selected computation of cuboids, indexing olap data: bitmap index and join index. signment: Data cube					
dule 3		e Study	a Warehouse design nciples	**12 Session**	
pics: lding a data warehouse: Introduction, Critical Success Factors, Requirement Analysis, Planning for the data rehouse-The data Warehouse design stage, Building and implementing data marts. Building data warehouses, Backup					

Recovery, Establish the data quality framework, Operating the Warehouse, Recipe for a successful warehouse, Data rehouse pitfalls. signment: Data Warehouse design principles				
dule 4	roduction to Data ning	e Study	a Mining Techniques	**8 ssion**
pics: roduction to Data mining, KDD versus data mining, data mining techniques, tools and applications. Mining complex a objects, Spatial databases, Multimedia databases, Time series and Sequence data; mining Text Databases and mining rd Wide Web. Applications of data warehousing across different industries- Retail industry, Manufacturing and ribution, Bank, insurance company, Government agencies etc signment: Data Mining Techniques				
rgeted Application & Tools that can be used: **plication Area includes Ecommerce, retail, manufacturing industry, government agencies, Finance, banking** **fessionally Used Software: Microsoft Azure Synapse SQL, IBM DB2 warehouse, Terradata vantage, SAP data rehouse cloud, Google Bigtable, google sheets, BigQuery, MongoDB, MarkLogic, Talend, Informatica, Arm asure data, Micro focus vertica, Cloudera Enterprise data platform.**				
signment:				
Book/Article review: At the end of each module a book reference or an article topic will be given to an individual a group of students. They need to refer the library resources and write a report on their understanding about assigned article in appropriate format. Presidency University Library Link . **Presentation: Group presentation, where the students will be given a topic. They will have to lain/demonstrate the working and discuss the applications for the same.**				
t Book(s): Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, McGraw Hill, 2016 Jiawei Han, Micheline Kamber, Jian Pei, “Data-Mining.-Concepts-and-Techniques “, The-Morgan-Kaufmann, 3rd-tion-Morgan-Kaufmann, 2015				
ference(s): Sam Anahory, Dennis Murray, “Data Warehousing in the Real World”, Pearson, 2016 Tan P. N, Steinbach M and Kumar V, “Introduction to Data Mining”, Pearson Education, 2016 **b Based Resources and E-books:** TEL Course on “Business Analytics & Data Mining Modeling Using R”, Prof. Gaurav Dixit. ps://onlinecourses.nptel.ac.in/noc22_mg67/preview . NPTEL Course on “Data Mining”, Mr. L. Abraham David https://onlinecourses.swayam2.ac.in/cec22_cs06/preview . Coursera course on “Data Warehousing for Business Intelligence Specialization”, Michael Mannino, Jahangir Karimi https://www.coursera.org/specializations/data-warehousing . Journal on “Data Mining and Knowledge Discovery” https://www.springer.com/journal/10618/ s://presiuniv.knimbus.com/user#/home				
ics relevant to “EMPLOYABILITY SKILLS”: Building a data warehouse, data mining tools, for developing ployability Skills through Participative Learning Techniques. This is attained through assessment components ntioned in course handout.				

urse Code: **E3002**	**urse Title:** Data Technologies **pe of Course: Program Core** **eory and Lab Integrated Course**	**T-P- C**	2-0-2-3
rsion No.			
urse Pre-quisites	E2012-Database Management System, E1001- Problem solving using Java.		

ti-requisites	-
urse Description	e purpose of the course is to provide the fundamentals of Big data technology, emphasize the importance of choosing suitable tools for processing and alyzing big data to gain insights. e student should have knowledge and skill to select and use most appropriate big a tools to solve business problems. e associated laboratory provides an opportunity to implement the concepts and hance critical thinking and analytical skills. th a good knowledge in the fundamentals of Big data technology the student can n practical experience in implementing them, enabling the student to be an ective solution provider for applications that involve huge volume of data.
urse jectives	e objective of the course is to familiarize the learners with the concepts of Big ta Technologies and attain SKILL DEVELOPMENT through EXPERIENTIAL ARNING techniques.
urse tcomes	successful completion of the course the students shall be able to: Apply Map-Reduce programming on the given datasets to extract uired insights. (Application). Employ appropriate Hadoop Ecosystem tools such as scoop, Hbase, ve, to perform data analytics for a given problem. (Application). Use Spark tool to analyze the given dataset for a given problem. pplication).
urse Content:	

odule 1	roduction to doop	gramming signment	ta Collection and alysis	**10 Classes**

roduction to Big Data and its importance: Basics of Distributed File System, Four Vs, Drivers Big data, Big data applications, Structured, unstructured, semi-structured and quasi structured a. Big data Challenges-Traditional versus big data approach, The Big Data Technology ndscape: No-SQL.
e Hadoop: History of Hadoop-Hadoop use cases, The Design of HDFS, Blocks and replication nagement, Rack awareness, HDFS architecture, HDFS Federation, Name node and data node, atomy of File write. Anatomy of File read, Hadoop Map Reduce paradigm, Map and reduce ks, Job Tracker and task tracker, Map reduce execution pipeline, Key value pair, Shuffle and t, Combiner and Partitioner, APIs used to Write/Read files into/from Hadoop, Need for Flume d Sqoop.
atomy of a YARN: Hadoop 2.0 Features, Name Node High Availability, YARN Architecture, roduction to Schedulers, YARN scheduler policies, FIFO, Fair And Capacity scheduler.

odule 2	doop Ecosystem ols	gramming signment	ta Collection and alysis	**8 Classes**

roduction to SQOOP: SQOOP features, Sqoop Architecture, Sqoop Import All Tables, Sqoop port All Tables, Sqoop Connectors, Sqoop Import from MySQL to HDFS, Sqoop vs flume.
ve: Apache Hive with Hive Installation, Hive Data Types, Hive Table partitioning, Hive DDL mmands, Hive DML commands, and Hive sort by vs. order by, Hive Joining tables, Hive cketing.
ase: Introduction to HBase and its working architecture- Commands for creation and listing of les- disabled and is disabled of table - enable and is enabled of table- describing and dropping of

le-Put and Get command - delete and delete all command-commands for scan, count, truncate of les.				
dule 3	ark	ogramming signment	ta analysis	**8 Classes**
roduction to Apache Spark A unified Spark, Who uses Spark and for what?, A Brief History of ark, Spark version and releases, Storage layers for Spark. Programming with RDDs: RDD Basics, eating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and tions, Persistence. Spark SQL: Linking with Spark SQL, Using Spark SQL in Applications, ading and Saving Data, JDBC/ODBC Server, User-defined functions, Spark SQL Performance. ala: The Basics, Control Structures and functions, Working with arrays, Maps and Tuples.				

st of Laboratory Tasks:

Level 1: To install the Hadoop in pseudo cluster mode.
Level 1: HDFS Shell Commands – Files and Folders.
Level 2: HDFS Shell Commands – Management.

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 e).

Write a Map Reduce program that mines weather data. Weather sensors collecting data every ur at many locations across the globe gather large volume of log data, which is a good candidate analysis with Map Reduce, since it is record-oriented. Data available at: ps://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.

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

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.

Level 1: Working on advance hive commands. (Static Partitioning & Dynamic partitioning)
Level 2: Continue the previous experiment, select and apply suitable partitioning technique.

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.

Level 1: Installing Ecosystem tools such as Scoop, Hbase.
Level 2: Scoop – Move Data into Hadoop.

Level 1: Working on basic Hbase commands (General commands, DDL Commands)
Level 2: Apply Hbase commands on Insurance database/employee dataset.

Level 1: Working on advanced Hbase commands. (DML).

Level 2: Continue the previous experiment to demonstrate CRUD operations. . **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 . **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. . **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 quencies. The pairs of products must be sorted by frequency.
rgeted Application & Tools that can be used: **Business Analytical Applications** **Social media Data Analysis** **Predictive Analytics** **ols: Hadoop Framework tools like map reduce, Hive, Hbase, Scoop, Spark.**
xt Book ema Acharya, Subhashini Chellappan. 2015. *Big Data and Analytics*. Wiley Publication. atei Zaharia, Bill Chambers. 2018. *SPARK: The Definitive Guide*. Oreilly.
ferences m White. 2016. *Hadoop: The Definitive Guide*. O'Reilley. y S. Horstmann. 2017. *Scala for the Impatient*. Wesley.
pics relevant to development of "Skill Development": Real time application development using doop Ecosystem tools through Experiential Learning as mentioned in the course handout.

urse Code: **E3030**	**urse Title:** **ning Massive Datasets** **pe of Course:** **Program Core**	**T-P- C**	2-0-2-3

	eory and Lab Integrated Course			
rsion No.	)			
urse Pre-quisites	E2021- Data Mining			
ti-requisites	-			
urse scription	e purpose of the course is to provide knowledge of data mining, and to phasize the importance of choosing suitable tools for processing and analyzing ssive datasets to gain insights. e student should have the knowledge and skill to select and use the most propriate mining tools to solve business problems. e associated laboratory provides an opportunity to implement the concepts and hance critical thinking and analytical skills. With a good knowledge of data ning technology, the student can gain practical experience in implementing m, enabling the student to be an effective solution provider for applications that olve huge volumes of data.			
urse jective	e objective of the course is to familiarize the learners with the concepts **Mining Massive Datasets** and attain **Skill Development** through E**xperiential arning** techniques. .			
urse tcomes	successful completion of the course the students shall be able to: Identify the right machine learning/mining algorithm for handling ssive data Apply classification and regression models with Spark and Mahout Implement clustering models using Spark and Mahout Apply semi-supervised learning for clustering and classification			
urse Content:				
odule 1	apReduce Based achine Learning	ogramming signment	ta Collection and alysis	09 Classes
apReduce Based Machine Learning Means, PLANET, Parallel SVM, Association Rule Mining in MapReduce, Inverted Index, ge Ranking, Expectation Maximization, Bayesian Networks				
odule 2	assification and gression models with ark and Mahout	ogramming signment	ta Collection and alysis	10 Classes
assification and Regression models with Spark and Mahout near support vector machines - Naive Bayes model- Decision Trees – Least square regression. cision trees for regression				
odule 3	ustering in Spark and ahout	ogramming signment	ta analysis	10 Classes
ustering in Spark and Mahout erarchical Clustering in a Euclidean and Non-Euclidean Space - The Algorithm of Bradley, yyad, and Reina - A variant of K-means algorithm - Processing Data in BFR Algorithm CURE orithm - Clustering models with Spark - Spectral clustering using Mahout				
odule 4	ning Social-Network aphs and Semi-pervised Learning	ogramming signment	ta Collection and alysis	11 Classes

ning Social-Network Graphs Clustering of Social-Network Graphs - Direct Discovery of mmunities - Partitioning of Graphs Finding Overlapping Communities - Counting Triangles ng MapReduce Neighbourhood Properties of Graphs

mi-Supervised Learning Introduction to Semi-Supervised Learning, Semi-Supervised istering, Transductive Support Vector Machines

rgeted Application & Tools that can be used:

Business Analytical Applications

Social media Data Analysis

Predictive Analytics

ols: Data analytical tools like Spark, Mahout, map reduce.

oject work/Assignment:

ter completion of each module, student will be asked to develop a mini project for Data mining.

xt Book

Jure Leskovec, Anand Rajaraman, Jeffrey Ullman, "Mining of Massive Datasets", ndford Press,2016.

Nick Pentreath, "Machine Learning with Spark", Packt Publishing,2017

Olivier Chapelle, Bernhard Scholkopf, Alexander Zien "Semi-Supervised Learning", e MIT Press, 2016.

ferences

Ron Bekkerman, Mikhail Bilenko, John Langford "Scaling Up Machine Learning: rallel and Distributed Approaches", Cambridge University Press, 2016.

Jimmy Lin, Chris Dyer, "Data-Intensive Text Processing with MapReduce", Morgan aypool Publishers, 2017.

Hennessy, J.L. and Patterson, D.A., 2016. Computer architecture: a quantitative proach. Elsevier.

Chandramani Tiwary "Learning Apache Mahout", Packt Publishing, 2015.

Fuchen Sun, Kar-Ann Toh, Manuel Grana Romay, KezhiMao,"Extreme Learning achines 2013: Algorithms and Applications", Springer, 2014.

resources

ps://online.stanford.edu/courses/soe-ycs0007-mining-massive-data-sets

ps://www.edx.org/course/mining-massive-datasets

ps://www.my-mooc.com/en/mooc/mmds/

p://infolab.stanford.edu/~ullman/mmds/book.pdf

pics relevant to "SKILL DEVELOPMENT": Hierarchical Clustering in a Euclidean and n-Euclidean Space for **Skill Development** through **Experiential Learning** techniques. This attained through assessment component mentioned in course handout.

urse Code: **E3032**	**urse Title:** eaming Data Analytics **pe of Course:** **Program Core** **eory and Lab Integrated Course** **ig Data Basket**	**T-P- C**	2-0-2-3
rsion No.	)		
urse Pre-quisites	E3002 - Big Data Technologies		
ti-requisites	-		

urse Description	e purpose of the course is to introduce theoretical foundations, algorithms, thodologies, and applications of streaming data. It also provides practical owledge for handling and analyzing streaming data. e associated laboratory provides an opportunity to implement the concepts and hance critical thinking and analytical skills. th good knowledge of the fundamentals of streaming analytics, the student can n practical experience in implementing them, enabling the student to be an ective solution provider for applications that involve huge volume of streaming a.			
urse Objective	e course provides the foundational concepts, methods, languages, and systems ingesting, processing, and analyzing data that flows to enable real-time isions. The course aims to the tame velocity dimensions of Big Data without getting the volume and variety dimensions.			
urse tcomes	successful completion of the course the students shall be able to: **Recognize** the characteristics of data streams that make it useful to solve real-rld problems**.** **Identify** appropriate algorithms for analyzing the data streams for a variety of blems**.** **Apply** different algorithms for analyzing the data streams**.**			
urse Content:				
odule 1	**roduction to Data eams**	signment/Quiz	eaming methods	**08 Classes**
roduction to Data Streams: Data Stream Models, Research Issues in Data Streams Management stems, Knowledge Discovery from Data Streams, Basic Streaming Methods: Counting the mber of Occurrence of the Elements in a Stream, Counting the Number of Distinct Values in a eam, Bounds of Random Variables, Poisson Processes, Sliding Windows.				
odule 2	**cision Trees and ustering from Data eams**	ogramming signment	eaming Data Collection d Analysis	**10 Classes**
cision Trees and Clustering from Data Streams: Introduction, The Very Fast Decision Tree gorithm, Extensions to the Basic Algorithm: Processing Continuous Attributes, Functional Tree aves, Clustering Examples: Partitioning Clustering, Hierarchical Clustering, Micro Clustering, id Clustering .				
odule 3	**equent Pattern ning**	ogramming signment	eaming Data analysis	**08 Classes**
equent Pattern Mining: Introduction to Frequent Itemset Mining: The FP-growth Algorithm, mmarizing Itemsets, Heavy Hitters, Mining Frequent Itemsets from Data Streams: Landmark ndows, Mining Recent Frequent Itemsets, Frequent Itemsets at Multiple Time anularities, Sequence Pattern Mining				
st of Laboratory Tasks: **Level 1: Exploring stream processing engine STORM** **Level 2: Exploring stream processing engine STREAM** **Implementation of decision tree algorithms** **Level 1: Implementation of VFDT decision tree algorithm**				

Level 2: Implementation of CVFDT decision tree algorithm

Implementation of partitioning clustering on stream.
Level 1: Implementation of partitioning clustering The Leader Algorithm.
Level 2: Implementation of Single Pass k-Means partitioning Clustering Algorithm.

Implementation of micro clustering on stream.
Level 1: Implementation of Fractal Clustering algorithm Initialization phase
Level 2: Implementation of Fractal Clustering algorithm Incremental phase

Level 1: Implementation of The ODAC Global Algorithm.
Level 2: Implementation of The ODAC: The Test Split Algorithm

Level 1 Implementation of the Apriori algorithm to find frequent itemsets
Level 2: Implementation of the Apriori algorithm to find association rules

Level 1: Frequent Itemsets mining of data streams using Lossy Counting algorithm
Level 2: Reservoir Sampling for Sequential Pattern Mining over Data Streams.

rgeted Application & Tools that can be used:

- Apache Spark
- Social media Data Analysis
- Predictive Analytics

oject work/Assignment:

idents will be asked to develop a mini-project for streaming Data Analysis on streaming data.

xt Book

o Gama, "Knowledge Discovery from Data Streams", CRC Press, 2010.

ferences

vid Luckham, "The Power of Events: An Introduction to Complex Event Processing in Distributed terprise Systems", Addison Wesley, 2002.
aru C. Aggarwal, "Data Streams: Models And Algorithms", Kluwer Academic Publishers, 2007.

pics related to development of "FOUNDATION": Basic Streaming Methods
pics related to development of "EMPLOYABILITY": Project on streaming analysis of real time ta set

urse Code: E2029	**urse Title:** **Web Data Analytics** **pe of Course:** **Discipline Elective in data ience basket** **Theory & Integrated Laboratory**	**T- P-**	2-0-2-3
rsion No.	)		
urse Pre-quisites	thon programming		

ıti-requisites	L			
ɪurse Description	e objective of this course is to provide overview and importance of Web ılytics and helps to understand role of Web analytic. This course also plores the effective of Web analytic strategies and implementation. e purpose of this course is to introduce the students to the Web data ılytics concept. The course is both conceptual and analytical and is derstood with practical knowledge. The course develops critical thinking lls by augmenting the student's ability to develop web data analytical ɒdels for various data sets which helps to overcome many problems. The ırse involves quizzes and assignments.			
ɪurse Objective	**is course is designed to improve the learners' <u>EMPLOYABILITY</u> <u>ILLS</u> by web analytics and improving business.**			
ɪurse Outcomes	**ɒon successful completion of this course the students shall be able to:** Understand the concept and importance of Web analytics in an organization d the role of Web analytic in collecting, analyzing and reporting website ffic. **[Knowl ge level]** Identify key tools and diagnostics associated with Web analytics. **pplication level]** Explore effective Web analytics strategies and implementation and derstand the importance of web analytic as a tool for e-Commerce, business earch, and market research. **[Application level]** **. Understand web site data optimization.[Application level].**			
ɪurse Content:				
ɒdule 1	roduction to eb Analytics	ıiz	ta Analytics	**L-4, P-2**
pics: roduction to Web Analytics: Web Analytics Approach – **Data collection methods in Web ıalytics** -A Model of Analysis – Context matters – Data Contradiction – Working of Web ıalytics: Log file analysis – Page tagging – Metrics and Dimensions – Interacting with data in ɒogle Analytics.				
ɒdule 2	earning about users rough Web ıalytics	signment	ta Collection, data ılysis	**5,P-2**
pics: Introduction – Goals and Conversions – Conversion Rate – Goal reports in Google ıalytics – Performance Indicators – Analyzing Web Users: Learning about users – Traffic ıalysis – Analyzing user content – Click-Path analysis – Segmentation.				

odule 3	eb Search gine Data alytics	izzes and ignments	ogle analytics	**L-6 ,P-3**
pics: Different analytical tools - Key features and capabilities of Google analytics- How ogle analytics works - Implementing Google analytics - Getting up and running with Google alytics -Navigating Google analytics – Using Google analytics reports -Google metrics - Using itor data to drive website improvement- Focusing on key performance indicators- Integrating ogle analytics with third-Party applications				
odule 4	alitative alysis	oject-based ignment	ports and analytics	**L-9 , P-4**
pics: b Usability Testing- Heuristic Evaluations- Site Visits- Surveys (Questionnaires) - Testing and perimentation: A/B Testing and Multivariate Testing-Competitive Intelligence - Analysis arch Analytics: Performing Internal Site Search Analytics, Search Engine Optimization (SEO) d Pay per Click (PPC)-Website Optimization against KPIs- Content optimization- Funnel/Goal timization - Text Analytics: Natural Language Processing (NLP)- Supervised Machine arning (ML) Algorithms-API and Web data scarping using R and Python.				

st of Laboratory Tasks:

b sheet 1[2 Practical Sessions]

periment No. 1:
vel 1:

Working concept of web analytics

vel 2:

Evaluation with Intermediate metrics, custom metrics, calculated metrics.
Collection of web data and other internet data with the help of web analytics

b Sheet 2[2 Practical Sessions]

periment No. 2:
vel 1:

Delivering reports based on collected data

vel 2:

Implement the concept of web analytics ecosystem
Creation of segmentation in web analytics

b Sheet 3[4 practical Sessions]
vel 1:

Visualization, acquisition and conversions of web analytics data
Performing site search analytics

vel 2:

Analyze the web analytic reports and visualizations

b Sheet 4[4 practical Sessions]

periment No. 4: **vel 1:** Performing visual web analytics Assignments and final discussions **vel 2:** 3. Web Analytics case studies .
rgeted Application & Tools that can be used: Google analytics
oject work/Assignment:
eb data analytics for website data
xtbook(s): Beasley M, (2013), Practical web analytics for user experience: How analytics can help you derstand your users. Newnes, 1st edition, Morgan Kaufmann.
ferences Sponder M, (2013), Social media analytics: Effective tools for building, interpreting, d using metrics, 1st edition, McGraw Hill Professional. Clifton B, (2012), Advanced Web Metrics with Google Analytics, 3rd edition, John ley & Sons.
pics related to development of "FOUNDATION": **Web data Analytics, Google analytics ports.** pics related to development of "EMPLOYABILITY": performing web data analytics for bsite data. pics related to development of "HUMAN VALUES AND PROFESSIONAL ETHICS": Data lection

Course Code: **CSE3136**	**urse Title: E-Business and Marketing alytics** **pe of Course: Theory Only Course**	**T-C**	3-0-0-3
Version No.	)		
Course Pre-requisites	L		
Anti-requisites	L		
Course Description	is course describes the basic principles of e-business technologies. Upon the npletion of this course, students should have a good working knowledge of siness concepts, applications, technologies (e.g. e-business infrastructure, hnology required for e-business, e-business marketplace, e-Commerce, B2B siness, E-business strategy, e-procurement, customer relationship nagement and service implementation and optimization) and ability to derstand any kind of marketing analytics.		
ourse Objective	is course is designed to improve the learner's EMPLOYABILITY SKILLS using real-world PROBLEM-SOLVING methodologies.		

Course Out Comes	**ı successful completion of the course, the students shall be able to:** Demonstrate the strategy of E-Business and identify the component rts (Knowledge). Identify records according to management policy by maintaining abase and processing software (Knowledge). Identify the ethical, social and security issues of information systems nowledge). Apply the basic concepts and technologies used in the field of siness management information systems (Application).

Course Content:

odule 1: E-BUSINESS – An Introduction	**Sessions**
roduction, E-Commerce – definition, History of E-commerce, types of E-Commerce B to B . Comparison of traditional commerce and e-commerce. E-Commerce business models – major o B, B to C model, Consumer-to-Consumer (C2C), Consumer-to-Business (C2B) model, Peer Peer (P2P) model – emerging trends. Advantages/ Disadvantages of e- commerce, web ctions, virtual communities, portals, e-business revenue models.	
odule 2: MARKETING ANALYTICS	**Sessions**
roduction to Marketing Analytics-Marketing Budget and Marketing Performance Measure, arketing Metrics and its application- Financial Implications of various Marketing Strategies- ographical Mapping, Data Exploration, Market Basket Analysis, History and Evolution of cial media-Understanding Science of social media, Web analytics, Search analytics. E-mmerce and marketing B to B and B to C marketing and branding strategies.	
odule 3: SECURITY THREATS OF E-BUSINESS	**Sessions**
ecurity threats – An area view – implementing E-commerce security – encryption – Decryption, otecting client computers E-Commerce Communication channels and web servers Encryption, L protocol, Firewalls, Cryptography methods, VPNs, protecting, networks, policies and ocedures, E-payment systems – An overview. B to C payments, B to B payments. Types of E-yment system, Secure Electronic Transaction (SET) protocol. RFID Concepts.	
odule 4: E-BUSNESS MARKETING TECHNOLOGIES	**Sessions**
roduction to R-Programming, Statistical models in R, Simple programs using R. Algorithms ng MAP Reduce, Linear and Logistic Regression modelling, Clustering techniques. Case dies: Social network analysis- Text analysis-marketing analysis.	

xt Book

Beginner's Guide for Data Analysis using R Programming, Jeeva Jose Khanna Book blishing; 1st edition, 2018.

K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers vate Limited, 2013 ferences

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

eb 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-mmerce

pics relevant to development of "Employability skill Development": Web auctions, E-siness revenue model, RFID concept, CRM system. Web analytics and search analytics

urse Code: E2026	**urse Title: Data Handling and Visualization** **pe of Course:1] Program core** **2] Lab Integrated Course**	**- P- C**	**2-0-2-3**
rsion No.	)		
urse Pre-quisites	**thon Programming, Basic Mathematics**		
ti-requisites	-		
urse Description	e purpose of the course is to instill a strong foundation of scientific process entation that is the cornerstone of effective data handling, and creative design nking appended with strong programming skills to create meaningful ualizations of data. e student should have prior knowledge of python programming and basic owledge of data concepts. e associated laboratory provides an opportunity to strengthen student's llset in the arena of Data Preprocessing and Visualization. th a good knowledge in the fundamental concepts of the various libraries for ndling and visualizing data the student can gain a stronghold in Data Science abling the student to be an effective analyst for prospective employers.		
urse Out Comes	successful completion of this course the students shall be able to: Employ the complete Data Handling pipeline Handle data occurring in large volumes Apply the basic principles and elements of visualization Implement the visualization concepts practically using Python		
urse Content:			

odule 1	troduction to Data ndling (Comprehension)	signment	ogramming activity	**10 Hours (8L,2P)**

pics:
ta collection, Data Preparation Basic Models-Web Scraping, Binary Data Formats, Interacting with eb APIs, Interacting with Databases, Data Cleaning and Preparation, Handling Missing Data, Data ansformation, String Manipulation.

thon Libraries: NumPy, pandas, matplotlib, GGplot ,Introduction to pandas Data ructures				
odule 2	ta Wrangling and Analysis pplication)	signment	ogramming activity	**10 Hours (8L,2P)**
pics: ta Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting. ta Analysis: The problems you face when handling large data, General techniques for handling ge volumes of data, General programming tips for dealing with large data sets, Case study 1: edicting malicious URLs, Case study 2: Building a recommender system inside a database				
odule 3	**ta Visualization chniques** pplication)	signment	ogramming activity	**10 Hours (6L,4P)**
pics: erview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for lidation alar and Point techniques – Color maps – Contouring – Height Plots - Vector visualization techniques /ector properties – Vector Glyphs – Vector Color Coding – Matrix visualization techniques				
odule 4	**verse Types of Visual alysis** pplication)	signment	ogramming activity	**10 Hours (6L,4P)**
pics: ne- Series data visualization – Text data visualization – Multivariate data visualization and Case dies				
st of Laboratory Tasks: **bsheet -1 [3 Practical Sessions]** orking with Numpy Functions orking with Pandas functions acticals based on Interacting with Web APIs **bsheet -2 [2 Practical Sessions]** acticals based on Data Cleaning and Preparation acticals based on Data Wrangling **bsheet – 3 [4 Practical Sessions]** acticals based on Data Visualization using matplotlib sualization of various massive dataset - Finance - Healthcare - Census **bsheet – 4 [4 Practical Sessions]** actical based on Time Series Data Analysis- stock market rket-Basket Data analysis-visualization xt visualization using web analytics				
rgeted Application & Tools that can be used: Anaconda/Google Colab, Google Data Studio				

ject 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 shboard. Programming: Implementation of the chosen dashboard
xt Book McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and ython. 2nd edition. O'Reilly Media. Munzner, T., "Visualization Analysis and Design", CRC Press, (2015). Dr. Ossama Embarak, "Data Analysis and Visualization Using Python", Apress,(2018)
ferences **. García Salvador, Luengo Julián, & Herrera, F. "Data preprocessing in Data Mining", ringer,(2015)** **. Belorkar, A, "Interactive Data Visualization with Python" - [S.l.]: Packt Publishing, Second ition. (2018)** **. https://pythonprogramming.net/live-graphs-data-visualization-application-dash-python-orial/** **eblinks** **aking data visual : a practical guide to using visualization for insight, Shroff Publishers and stributors, 2018** **p://puniversity.informaticsglobal.com:2232/cgi-bin/koha/opac-tail.pl?biblionumber=17611** **thon for Data Science, IIT Madras** **ps://nptel.ac.in/courses/106106212**

Course Code: CSE3022	**urse Title:** Cryptocurrency Technology **pe of Course:** **Theory Only Course**	**T-P- C**	3-0-0-3
Version No.			
Course Pre-requisites	Basics of cryptography and Blockchain		
Anti-requisites			
Course Description	e course is designed to provide an introductory understanding of decentralized ital currencies (cryptocurrencies) such as bitcoin, a basic understanding of its derlying technology 'Blockchain' and why this new and innovative technology so important, since it has the potential to disrupt a number of industries in the mediate near future. particular, the course will survey the theory and principles by which yptocurrencies operate, practical examples of basic cryptocurrency transactions, likely interaction of cryptocurrencies with the banking, financial, legal and gulatory systems, and how cryptocurrencies could be viewed within a framework innovation and development.		
ourse Objective	e objective of the course is to familiarize the learners with the concepts Cryptocurrency Technology and attain **Employability** through **Participative arning** techniques.		

Course Out Comes	**ı successful completion of the course the students shall be able to:** Understand the technology components of blockchain-based digital rrencies. [Comprehensive] Explain the transactions from a digital currency wallet. omprehensive] Understand alternatives to bitcoin, such as alt-coins, Ethereum and coin Cash. [Comprehensive] Use cryptocurrencies in the context of disruptive innovations pplication]			
urse Content:				
Module 1	**troduction to yptography**	signment	ta Interpretation	**8 Sessions**
pics: Cryptography, Digital Signatures, Cryptographic Hash Functions. **yptographic Data Structures:** Hash Pointers, Append-Only Ledgers (BlockChains), Merkle ees.				
Module 2	**coin's Protocol**	signment	Data Interpretation	**Sessions**
pics: Bitcoin's Protocol Keys as Identities, Simple Cryptocurrencies, Decentralization through stributed Consensus, Incentives, Proof of Work (Mining), Application-Specific Integrated Circuit SIC) Mining and ASIC-resistant Mining, Virtual Mining (Peer coin).				
Module 3	**coin Engineering**	iz	Questions Set	**Sessions**
pics: Engineering Details, Bitcoin Blocks, Hot and Cold Storage, Splitting and Sharing Keys, oof of Reserve Proof of Liabilities. **onymity, Pseudonymity, Unlinkability**: Statistical Attacks (Transaction Graph Analysis), twork-layer De-anonymization, Chaum's Blind Signatures, Single Mix and Mix Chains, centralized Mixing, Zero-Knowledge Proof Cryptocurrencies.				
Module 4	**Cryptocurrency Technologies**	Quiz	Questions Set	**0 Sessions**
pics: Cryptocurrency Technologies, Smart Property, Efficient micro-payments, Coupling ansactions and Payment (Interdependent Transactions,) Public Randomness Source, Prediction arkets, Escrow transactions, Green addresses, Auctions and Markets, Multi-party Lotteries.				
rgeted Application & Tools that can be used: cryptocurrency is a digital or virtual currency, it is secured by cryptography which makes it possible to simulate or double-spend. Many cryptocurrencies are decentralized networks based blockchain technology. Cryptocurrency caters to the promise of making the easier transaction of nds directly between two groups or parties without the need for any third party like bank or credit d company. Applications are Money transfer, Smart contracts, Internet of Things (IoT), Personal ntity security, Healthcare, Logistics. ols: Messari, Glass node, Lunar Crush, Coin Metrics, Coin Market Cal.				
Project work/Assignment:				
signment: 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				

ext Books: . Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven ldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton iversity Press, 2016. . Schar, Fabian, and Aleksander Berentsen. Bitcoin, Blockchain, and Cryptoassets: A mprehensive Introduction. MIT press, 2020. . Karame, Ghassan O., and Elli Androulaki. Bitcoin and blockchain security. Artech House, 16.
ferences: **R1**. Antonopoulos, Andreas M., and Gavin Wood. Mastering ethereum: building smart contracts l dapps. O'reilly Media, 2018. **l2**. Antonopoulos, Andreas M. Mastering Bitcoin: unlocking digital cryptocurrencies. " O'Reilly edia, Inc.", 2014. **l3.** Day, Mark Stuart. Bits to bitcoin: how our digital stuff works. MIT Press, 2018. **book link R1:** http://fincen.gov/statutes_regs/guidance/html/FIN-2013-G001.html **book link R2:** http://www.scribd.com/doc/212058352/Bit-Coin **/eb resources:** /1. http://www.usv.com/posts/bitcoin-as-protocol 2. http://startupboy.com/2013/11/07/bitcoin-the-internet-of-money/ 3. http://startupboy.com/2014/03/09/the-bitcoin-model-for-crowdfunding/ 3. http://www.hmrc.gov.uk/briefs/vat/brief0914.html
pics relevant to "EMPLOYABILITY SKILLS": Cryptography, Digital Signatures, Hash inters, BlockChains, ASIC-resistant Mining, Hot and Cold Storage, Transaction Graph alysis, Zero-Knowledge Proof Cryptocurrencies, Escrow transactions, Multi-party Lotteries. developing Employability Skills through Participative Learning techniques. This is attained ough assessment component mentioned in course handout.

urse de: E3169	**urse Title: Modern Cryptography** **pe of Course: Theory**	**T-P-C**		**0**	**0**	**3**
rsion .	**)**					
urse e- quisites	L					
ti- quisites	L					
urse scriptio	e area of cryptography focuses on various problems pertaining to secure communication and nputation. It entails the study of models that express security properties as well as the algorithms and tocols that are the implementation candidates for satisfying these properties. An important dimension modern cryptography is the design of security proofs that establish security properties. Such proofs are nditional on assumptions that fall in two categories: "system assumptions" such as the faithful execution code, or the availability of private randomness and "computational assumptions" that are related to the					

	mputational complexity of various problems (including factoring large numbers and others). Students ll learn to model security problems, design protocols and prove them secure under precisely formulated stem and computational assumptions.
ourse tcomes	n successful completion of this course the students shall be able to: Describe basic group theory, number theory, discrete obability. (Remember) Explain the model security problems and to write security oofs. (Understand) Examine fundamental cryptographic primitives including Key Exchange, Digital gnatures, Oblivious Transfer, Public-Key Encryption, mmitment. (Apply) Demonstrate basic computational problems that are important for cryptography such the factoring problem, the RSA problem, the discrete-logarithm oblem. (Apply)

ourse Content:

odule 1	**turing Our Data**	signment		**10 Classes**

pics:

urrent Threat landscape, Understanding security services, Common cryptographic concepts, bstitution and transposition, The evolution of ciphers, Comparing passive and active attacks, otecting sensitive data, Maintaining integrity

odule 2	**yptographic Techniques**	signment		**10 Classes**

pics:

olution of Symmetric Encryption, Dissecting block and stream ciphers, Comparing symmetric cryption operation modes, Securing wireless communication, Comparing public key algorithms, gital signatures, Describing a hash algorithm, Identifying optimal hash algorithms, Authenticating a essage

odule 3	**plying Cryptography**	signment		**10 Classes**

pics:

nderstanding FIPS and PCI DSS, Leveraging encrypted data, Describing a PKI framework, Managing blic keys, Examining a certificate

odule-4	**ec and TLS**	signment		**12 Classes**

pics:

ing a VPN, Outlining a IPSec VPN, TLS, Recognizing cryptographic attacks, Attacking the frastructure, Influence of quantum computing

oject work/Assignment:

Assignment 1 on (Module 1 and Module 2)

Assignment 2 on (Module 3 and Module 4)
ĿFERENCE MATERIALS: EXTBOOKS Lisa Bock, "Modern Cryptography for Cybersecurity Professionals", 1st Edition, Packt Publications, 21. ĿFERENCES Jonathan Katz and Yehuda Lindell, "Introduction to Modern Cryptography", 2nd Edition, Chapman d Hall/CRC, 2014. **URNALS/MAGAZINES** International Journal of Applied Cryptography https://www.inderscience.com/jhome.php?jcode=ijact VAYAM/NPTEL/MOOCs: Coursera – Principles of Modern Cryptography Futurelearn – Introduction to Cryptography

urse Code: **E2037**	**urse Title: Cyber Forensics** **pe of Course: Program Core**		**T-P- C**	2-0-2-3
rsion No.	)			
urse Pre-quisites	**yptography and Network Security**			
ti-requisites	L			
urse scription	e purpose of this course is to introduce to the students Cyber Forensic ncepts. The course is both conceptual and analytical and is understood with rious open-source software's. The course develops critical thinking like rrectly collect and analyze computer forensic evidence, analyze and validate rensics Data, study the tools and tactics associated with Cyber Forensics. e course involves quizzes, assignments with various open-source software.			
urse Objective	e objective of the course is to familiarize the learners with the concepts of **Cyber rensics** and attain **Skill Development** through **Experiential Learning** hniques.			
urse Outcomes	**successful completion of this course the students shall be able to:**) **understand** various digital investigation terminologies and methods nowledge)) **understand** various file formats (knowledge)) **Recognize** the importance of digital forensic duplication and various tools analysis to achieve adequate perspectives of digital forensic investigation various applications (Comprehension)) **Apply** techniques for forensic investigation (Application)			
urse Content:				
dule 1	**GITAL VESTIGATION**	iz	Q/Based on vestigation process	**No. of ssions: 09**

gital Evidence and Computer Crime - History and Terminology of Computer Crime /estigation - Technology and Law - The Investigative Process -Investigative Reconstruction - odus Operandi, Motive and Technology -Digital Evidence in the Courtroom.				
odule 2	**IDERSTANDING FORMATION**	iz	]Q/Based on file rmat	**No. of ssions: 09**
ethods of storing data: number systems, character codes, record structures, file formats and e signatures - Word processing and graphic file formats - Structure and Analysis of Optical edia Disk Formats - Recognition of file formats and internal buffers - Extraction of forensic tifacts– understanding the dimensions of other latest storage devices – SSD Devices.				
odule 3	**MPUTER BASICS R DIGITAL VESTIGATORS**	signment	riting task	**No. of ssions: 09**
mputer Forensic Fundamentals - Applying Forensic Science to computers - Computer rensic Services - Benefits of Professional Forensic Methodology -Steps taken by computer rensic specialists. formation warfare: Arsenal – Surveillance Tools – Hackers and Theft of Components – ntemporary Computer Crime-Identity Theft and Identity Fraud – Organized Crime Terrorism. mputer forensic cases: Developing Forensic Capabilities – Searching and Seizing Computer lated Evidence –Processing Evidence and Report Preparation – Future Issues. signment: Computer Crime				
odule 4	**mputer Forensic idence and Data covery**	signment	riting task	**No. of ssions: 09**
ta Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The ta-Recovery Solution, Hiding and Recovering Hidden Data. ta Collection and Data seizure: why collect evidence? - Collection Options, Obstacles, Types Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and chiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The ain of Custody. Reconstructing the Attack. signment: Data Recovery				

st of Laboratory Tasks:

Case Studies of Opensource Forensic Tools

FTK Forensic Tool kit for taking mirror image

sk Forensics-

Identify digital evidences

Acquire the evidence

Authenticate the evidence

Preserve the evidence

Analyze the evidence

Report the findings

twork Forensics:

Intrusion detection

. Logging

. Correlating intrusion detection and logging

vice 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

rgeted Application & Tools that can be used:

FTK Forensic Toolkit

Encase

Kali Linux- Vinetto, galatta

Autopsy – Disk Forensics

oject work/Assignment:

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

xtbook(s):

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

ferences

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

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

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

Computer Forensics: Investigating Network Intrusions and Cyber Crime", Ec-Council Press, 10.

C. Altheide& H. Carvey," Digital Forensics with OpenSource Tools, Syngress", 2011, ISBN: 1597495868.,https://esu.desire2learn.com
'TEL: https://onlinecourses.swayam2.ac.in/cec21_ge10/preview emy: https://www.udemy.com/topic/digital-forensics/ book Link(PU): **nks** p://182.72.188.195/cgi-bin/koha/opac-tail.pl?biblionumber=14073&query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC
pics relevant to "Skill Developemnt": ber Forensics techniques for **Skill development** through **Experiential Learning techniques.** This is ained through the assessment component mentioned in the course handout.

urse Code: E3342	**urse Title:** Ethical Hacking **pe of Course:** Discipline Elective in Cyber curity Basket			**T-P- C**	**1-0-4-3**
rsion No.	)				
urse Pre-quisites	sic networking tools knowledge and Cryptography & Network Security				
ti-requisites	L				
urse scription	is course introduces students to a wide range of topics related to ethical cking. It also provides an in-depth understanding of how to effectively otect computer networks. These topics cover some of the tools and netration testing methodologies used by ethical hackers and provide a orough discussion of what and who an ethical hacker is and how important ey are in protecting corporate and government data from cyber-attacks				
urse Objective	e objective of the course is to familiarize the learners with the concepts of **ical Hacking** and attain **Skill Development** through **experiential Learning** chniques.				
urse OutComes	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 nctions Demonstrate the function of sniffers on a network				
urse Content:					
odule 1	**troduction to Hacking** nowledge, Application)	signment	ogramming activity		**12 Hours**

pics: roduction to Hacking-Important Terminologies - Asset - Vulnerability - Penetration Test - lnerability Assessments versus Penetration Test - Penetration Testing Methodologies - tegories of Penetration Test. **signment:** Different phase methodologies on penetration testing

odule 2	**nux Basics**	signment	ogramming activity	**10 Hours**

pics:
ajor Linux Operating Systems - File Structure inside of Linux - BackTrack - Changing the fault Screen Resolution - Some Unforgettable Basics.
signment: Penetration testing distribution

odule 3	**formation Gathering chniques**	signment	ogramming activity	**11 Hours**

pics:
urces of Information Gathering - Copying Websites Locally - NeoTrace - Xcode Exploit anner - Interacting with DNS Servers - DNS Cache Snooping - DNS Lookup with Fierce - MP - SMTP.
signment: Domain internet groper

odule 4	**arget Enumeration d Port Scanning chniques**	signment	ogramming activity	**13 Hours**

pics:
rget Enumeration and Port Scanning Techniques - Host Discovery - Scanning for Open Ports d Services - Types of Port Scanning - Vulnerability Assessment.
signment: Demonstrations for port scanning

st of Laboratory Tasks:
periments:

Installing BackTrack
Netcraft
Keyloggers
Acunetix
Nslookup
SNMP
Port Scanning
NetStumbler
Performing an IDLE Scan with NMAP
. Network Sniffing

rgeted Application & Tools that can be used: Application Software and open source ols

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

y appropriate tool can be given to demonstrate i.e Sql injections.

xt Book

Rafay Baloch, 2014: “Ethical Hacking and Penetration Testing Guide” Apple Academic ess Inc**.**

ferences

Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security sting,Penetration Testing, and Basic Security".

James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and twork Defense", 2nd Edition, Cengage Learning.

pics relevant to "EMPLOYABILITY SKILLS":

nical hacking techniques for **Skill Development** through **Experiential Learning** **chniques**. This is attained through the assessment component mentioned in course ndout.

urse Code: E2040	**urse Title:** Cyber threats for IOT and Cloud **pe of Course:1] Program Core** **2] Theory Only**	**- P- C**	3-0-0-3
rsion No.	)		
urse Pre-quisites	ber Security, Information Security and Networks		
ti-requisites	-		
urse Description	jective of the course is to understand the most important cyber threats for IOT and Cloud. ber attackers discover new possibilities in the areas of Internet of Things and cloud services. nainly focuses on multiple security challenges facing the IoT and cloud computing especially ncerns surrounding privacy and cyber security threats of the users and the how can the ber risks relating to them be mitigated.		
urse Objectives	e objective of the course is to familiarize the learners with the concepts of Cyber threats for T and Cloud and attain **Skill Development** through **Participative Learning** techniques.		
urse Out Comes	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-acks, cybercrimes, vulnerabilities and remedies thereto. Plan, implement, and monitor cyber security mechanisms to ensure the protection information technology assets.		
urse Content:			

odule 1	**roduction to IOT d Cloud mputing**	signment	ogramming Task	**12 Sessions**

pics

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

signment:

odule 2	**ber Threats**	signment	ogramming Task	**8 Sessions**

pics:

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

odule 3	**ber Threats in ernet of Things**	signment	ogramming/Data alysis task	**10 Sessions**

pics:

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

odule 4	**ber Threats in oud computing**	signment	ogramming/Data alysis task	**9 Sessions**

pics:

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

xt Books

. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And gal Perspectives" ,Wiley India Pvt Ltd,2013
. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: tworking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education sco Press Indian Reprint). (ISBN: 978- 9386873743)
. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill ucation

ferences

. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & ns,2018
2. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things vices and Beyond", NCC Group, 2014
3. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler ngress/Elsevier) - 978-1-59749-592-9

eblinks:

ps://www.coursera.org/learn/cloud-security-basics

ps://www.imperva.com/learn/application-security/cyber-security-threats/

ps://presiuniv.knimbus.com/user#/home

pics relevant to "SKILL DEVELOPMENT":

ber threats in IoT and Cloud Computing for **skill development** through **Participative Learning t**echniques. is is attained through the assessment component mentioned in the course handout.

urse Code: E3145	**urse Title:** **Intrusion Detection and Prevention stem** **pe of Course:1] Program Core** **2] Theory Only**	**T-P- C**	3-0-0-3
rsion No.	)		
urse Pre-quisites	ndamental knowledge in Operating Systems, Information Security and Networks		
ti-requisites	-		
urse Description	jective of the course is to Understand when, where, how, and why to apply Intrusion tection tools and techniques in order to improve the security posture of an enterprise. ply knowledge of the fundamentals and history of Intrusion Detection in order to avoid mmon pitfalls in the creation and evaluation of new Intrusion Detection Systems and alyze intrusion detection alerts and logs to distinguish attack types from false alarms.		
urse Objectives	e objective of the course is to familiarize the learners with the concepts of **Intrusion tection and Prevention System** and attain **Skill Development** through **Participative arning** techniques.		
urse Out Comes	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 e skill to capture and analyze network packets. Use various protocol analyzers and Network Intrusion Detection Systems as curity tools to detect network attacks and troubleshoot network problems.		
urse Content:			

odule 1	**roduction to rusion Detection d Prevention stem**	signment	ogramming Task	**10 Sessions**

pics

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

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

odule 2	**rusion evention stem**	signment	ogramming Task	**10 Sessions**

pics:

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

signment: Applying Intrusion detection in security applications.

odule 3	**plications and ols**	signment	ogramming/Data alysis task	**12 Sessions**

pics:

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

signment: Demonstrate the working with Snort Rules, Rule Headers, Rule Options and The Snort nfiguration File.

odule 4	gal issues and ganizations ndards	signment	ogramming/Data alysis task	**9 Sessions**

w Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and ndardizations.

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

xtbooks

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

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

ferences

. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, entice Hall , 2003.

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

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

eblinks:

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

:ps://www.coursera.org/lecture/detecting-cyber-attacks/intrusion-detection-systems-UeDqJ

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

urse Code: E3094	**urse Title:** Cyber Security **pe of Course:1] Discipline Elective** **2] Theory Only**	**T-P- C**	3-0-0-3
rsion No.	.		
urse Pre-quisites	ndamental knowledge in Information Security and Networks		
ti-requisites	-		
urse scription	is is a foundation program geared towards generating and enhancing awareness about cyber curity challenges and the concept of Cyber Security and Cyber Ethics among the stakeholders help them become responsible Cyber Citizens and participate safely and securely in the rapidly olving information-age society. e important topics include: Network Security model, attacks, malware, firewall, IT act and ber forensics		
urse jectives	e objective of the course is to familiarize the learners with the concepts of **Cyber Security** d attain **Employability** through **Participative Learning** techniques.		

urse Out mes	successful completion of the course the students shall be able to: Describe the basic concept of Cyber Security **[Knowledge]** Classify different types of attacks for a scenario **[Comprehension]** Prepare a mitigation policy for security threat **[Comprehension]** Demonstrate Cyber Security tools **[Application]**
urse ntent:	

odule 1	**roduction to ber Security**	uiz	**owledge**	**10 Sessions**

pics

story of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Guidelines to oose web browsers, Securing web browser, Antivirus, Email security, Guidelines for setting up a Secure ssword , Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques

odule 2	**curity in tworks**	signment	**mprehension**	**10 Sessions**

pics:

curity in Networks – Concepts, threats in Network, website vulnerabilities, man in the middle attack, denial Service attack, distributed denial of service attack, Firewalls – introduction and design, types of firewalls, rsonal firewalls, Program Security – non malicious program errors, malicious program flaws, virus and other licious code, prevention of virus infection.

signment: Program Security – non malicious program errors.

odule 3	**artphone curity**	signment	**mprehension**	**12 Sessions**

pics:

roduction to mobile phones, Smartphone Security, Android Security, IOS Security, Cyber Security Exercise, ber Security Incident Handling, Cyber Security Assurance, Guidelines for social media security, Tips and best actices for safer Social Networking ,Basic Security for Windows, User Account Password

ignment: Social Media Security

odule 4	ical Issues in Cyber curity	signment	ogramming/Data alysis task	**9 Sessions**

gal and ethical issues in Cyber Security – protecting program and data, copyright, patents and trade crets, IT Act, EDP audit, Overview of CISA, Privacy in computing, Cyber Forensic Tools – types and egories, Cyber forensic suite. Forensic tools: types, categories, open source proprietary

signment: Cyber Forensic Tools

xtbooks

. Charles P. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education, 5th ition,2012

. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley Sons, 2018 .

. Dejey and Murugan, “Cyber Forensics”, Oxford University Press, 2018.

ferences

. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th Ed, Pearson ucation, 2015.
. Behrouz A Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, Mc Graw l Publication, ISBN 13: 978-93-392-2094-5.2008.

eb links:
. https://www.youtube.com/watch?v=RYB4cG8G2xo
2. https://www.coursera.org/lecture/detecting-cyber-attacks/Cyber Security-DqJ ,https://presiuniv.knimbus.com/user#/home

pics relevant to “EMPLOYABILITY SKILLS”: Mobile Security for developing Employability Skills through rticipative Learning techniques. This is attained through assessment component mentioned in course ndout.

Course Code: CSE2503	**yptography and Network Security**			**T-P- C**	3-0-0-3
Version No.	)				
Course Pre-requisites	sic Knowledge in Number Theory, Binary Operations				
nti-requisites	-				
Course Description	e Course deals with the principles and practice of cryptography and network security, cusing in particular on the security aspects of the web and Internet.				
urse Objective	e objective of the course is to familiarize the learners with the concepts of **Cryptography d Network Security above** and attain **Skill Development** through **Problem Solving** thodologies.				
urse Outcomes	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				
ourse Content:					
odule 1	**roduction to yptography**	signment	cognize the chniques	07 ssio ns	
pics:					

roduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active acks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, nrepudiation, Substitution Ciphers : Play-fair and Hill Cipher, Vigenere cipher, Introduction to Block Cipher d Stream Cipher, Feistel Structure, ECB modes of block cipher

odule 2	**mmetric Encryption Algorithms**	signment	alysis of results	09 ssio ns

pics:

mmetric Encryption Algorithms : Data Encryption Standard, Introduction to Galois Field, Advanced cryption Standard, Modular Arithmetic, Prime numbers, Fermat's little theorem, Applications of Fermat's le theorem in modular athematic, brief about primality testing and factorization, Euclidean and Extended clidean Algorithm, Euler Totient Function, Chinese remainder theorem.

odule 3	**blic Key Cryptography**	signment	alysis of solutions	09 ssio ns

pics:

erview of Public Key Cryptography, RSA, Diffie-Helman Key exchange, Man in the middle attack, yptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital nature, Ei-gamal Encryption, Elliptic curve cryptography overview.

odule 4	**twork Security**	signment	alysis of solutions	05 ssio ns

pics:

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

rgeted Application & Tools that can be used:

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

xtbooks:

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

ferences:

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

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

e-pg pathshala UGC lecture series

eb

erences: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=22338 &site=ehost-live

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

pics 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

Course Code: CSE3098	**urse Title: Vulnerability Assessment and netration Testing** **pe of Course: Theory Only Course**	**- P- C**	3-0-0-3
Version No.	)		
Course Pre-requisites	E3078		
Anti-requisites	-		
Course Description	is course explores the tools that can be used to perform information gathering. is course also covers how vulnerability can be carried out by means of tools or nual investigation, and analysis of common attacks in data, mobile applications d wireless networks		
ourse Objective	e objective of the course is to familiarize the learners with the concepts **Vulnerability Assessment and Penetration Testing** and attain **Employability** ough **Problem Solving** Methodologies.		
urse Out Comes	**successful completion of the course the students shall be able to:** Understand the basic principles for information gathering and detecting nerabilities in the system. Determine the security threats and vulnerabilities in SDN networks and b applications. Able to use the exploits in mobile applications and wireless networks Understand the metasploit and metrepreter are used to automate the acks and penetration testing techniques.		
urse Content:			

Module 1	**ormation Gathering, st Discovery and ading Techniques**	signment	Theory	**9 Sessions**
pics: roduction - Terminologies - Categories of Penetration Testing - Phases of Penetration Test - netration Testing Reports - Information Gathering Techniques - Active, Passive and Sources of ormation Gathering – Approaches, Host discovery - Scanning for open ports and services- Types Port, Vulnerability Scanner Function, pros and cons - Vulnerability Assessment with NMAP - sting, SCADA environment with NMAP				

Module 2	**lnerability Scanner in N Networks and Web plication**	iz	Theory	**10 Sessions**

pics:
ssus Vulnerability Scanner - Safe check – Silent dependencies - Port Range Vulnerability Data sources, SDN Data plane, Control Plane, Application Plane. SDN security attack vectors and SDN rderning, Authentication Bypass with Insecure Cookie Handling - XSS Vulnerability - File lusion vulnerability - Remote file Inclusion -Patching file Inclusions - Testing a website for SSI ection.

Module 3	**obile Application curity and wireless twork Vulnerability alysis**	iz	Theory	**11 Sessions**

pics:
pes of Mobile Application Key challenges in Mobile Application and Mobile application netration testing methodology, Android and ios Vulnerabilities - OWASP mobile security risk - ploiting WM - BlackBerry Vulnerabilities - Vulnerability Landscape for Symbian - Exploit evention -Handheld Exploitation, WLAN and its inherent insecurities Bypassing WLAN thentication uncovering hidden SSIDs MAC Filters Bypassing open and shard authentication - vanced WLAN Attacks Wireless eavesdropping using MITM session hijacking over wireless – LAN Penetration Test Methodology.

odule 4	**ploits**	iz	Theory	**Sessions**

pics:
chitecture and Environment- Leveraging Metasploit on Penetration Tests, Understanding - etasploit Channels, Metasploit Framework and Advanced Environment configurations – derstanding the Soft Architecture, Configuration and Locking, Advanced payloads and add on odules Global datastore, module datastore, saved environment Meterpreter.

rgeted Application & Tools that can be used:
is course helps the students to understand the threats and vulnerabilities using NMAP.

Project work/Assignment:

oject Assignment:

xt Book

Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015. ISBN : 78-4822-3161-8.

Dr. Patrick Engebretson, The Basics of Hacking and Penetration Testing Ethical Hacking d Penetration Testing made easy , Syngress publications, Elsevier, 2013. ISBN :978-0-12-411644-

Mayor, K.K.Mookey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, evier, 2007. ISBN : 978-1-59749-074-0

ferences

Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 cktPublishing.

SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress blication

eb resources: https://onlinecourses.nptel.ac.in/noc19_cs68/preview - **IIT Kharagpur,** Prof. ranil Sen Gupta

pics relevant to development of "EMPLOYABILITY SKILLS": Exploitation, Penetration testing hniques, for development of Employability skills through the Participative Learning Techniques. is is attained through the assessment components mentioned in course handout.

Course Code: **CSE397**	**urse Title:** **Digital and Mobile Forensics** **pe of Course:** **Theory**		**- P- C**	3-0-0-3
Version No.	)			
ourse Pre-requisites	erating System, Computer Networks.			
Anti-requisites				
Course Description	course demonstrates the use of Mobile phones and digital devices across the globe has eased dramatically. These devices are more susceptible to information security attacks and they also possess huge evidences which shall be used during crime scene investigation. makes the Course on mobile and digital forensics an inevitable one for the security fessionals. This Course on mobile and digital forensics will provide a better understanding different forms of evidences in many digital devices, collection and interpretation of the ne. ics include: Wireless technologies and security-wireless protocols, wireless threats, cell ones and GPS, SMS and data interception in GSM. Mobile phone forensics - files present in card, device data, external memory dump, Android forensics. Digital forensics: - evaluating ital evidence, Digital forensics examination principles			
Course Objective	e objective of the course is to familiarize the learners with the concepts of tabase Management Systems and attain EMPLOYABILITY SKILLS through RTICIPATIVE Learning techniques			
Course Outcomes	successful completion of this course the students shall be able to: 1: Outline the basic concepts of Cybercrime and digital Forensics. (L1) 2: Employ various digital Forensic tools to perform Forensic estigation(L3) 3: Interpret security challenges and Forensic examination process of eless devices. (L2) 4: Produce digital evidence through the usage of mobile device Forensic ols (L3)			
Course Content:				
odule 1	bercrime and gital Forensic nciples	signment	minar	10 Sessions
bercrime: Definition, Nature and Scope of Cyber crime, Types of cyber crime, Categories of cyber me, Investigating Cybercrime, Digital Evidence, Prevention of cyber crime, Overview of Digital ensics, Phases of Digital Forensics, Digital devices in society, Evidential Potential of Digital vices: closed and open systems, Digital investigation process models: Staircase Model, Evidence w Model, Increasing awareness of digital evidence, Case studies on Cyber Crimes.				

odule 2	gital Forensics amination process	se Studies	se Study	11 Sessions

nguage of Computer crime investigation, preparing a Digital Forensics Investigation, Chanllenging pects of digital evidence, Presenting digital evidence, Device usage, Profiling and cyberprofiling, ntamination, Digital forensics examination principles: Previewing, Imaging, Continuity and shing, Evidence locations, A seven-element security model, A developmental model of digital stems.

odule 3	reless chnologies and reless threats	iz	M, Parben's Cell Seizure	12 Sessions

erview of Modern Wireless Technology, Wireless Crime Prevention Techniques, War-Driving, ar-Chalking, War Flying, Voice SMS, GSM and Identification Data Interception in GSM, Cell Phone cking and Phreaking, Who's Tracking You and Your Cell Phone? How Does Cellular Fraud Occur? ll Phone Forensics, Forensic Rules for Cellular Phones, Cell Phone Flowchart Processes Using raben's Cell Seizure.

odule 4	obile phone rensics	iz	ensic Tools	Sessions

portance and Motivation behind Mobile Forensics, Mobile Phone Forensics: Crime and Mobile ones, the Evidence, Forensic Procedures of mobile phones, The SIM Card, Files Present in SIM rd, Device Data, SMS Spam, What Data Is Available from Mobile Phones?, Handling Instructions Mobile Phones, Mobile Phone Forensics Tools and Methods, Social Media Forensics on Mobile vices.

rgeted Application & Tools that can be used:

- Wireless Security
- Digital Forensics
- Android Forensics

xtbooks:

Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 1st Edition, ptember 19, 2019.

ferences:

Losif I. Androulidakis, "Mobile phone security and forensics: A practical approach", Springer blications, 2nd Edition, 2016.

Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google droid", Elsevier publications, 1st Edition, 15th June 2011.

Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley d Sons, November 2008, p 180.

eb references:

tps://presiuniv.knimbus.com/user#/home

pics relevant to "Employability":

- Prevention of cybercrime
- preparing a Digital Forensics Investigation
- Mobile Phone Forensics: Crime and Mobile Phones.
- Mobile Phone Forensics Tools

developing **Employability Skills** through **Participative Learning techniques**. This is attained ough assessment component mentioned in course handout.

urse Code: E3102	**urse Title:** Malware Analysis **pe of Course:** Discipline Elective in Cyber curity Basket			**T-P- C**	3-0-0-3
rsion No.	)				
urse Pre-quisites	ould Have the knowledge of Cryptography and Network Security				
ti-requisites	**L**				
urse Description	e purpose of the course is to explore malware analysis tools and hniques in depth. Understanding the capabilities of malware is critical an organization's ability to derive threat intelligence, respond to ormation security incidents, and fortify defenses. This course builds a ong foundation for reverse-engineering malicious software using a riety of system and network monitoring utilities, a disassembler, a bugger, and other tools useful for turning malware inside-out.				
urse jective	e objective of the course is to familiarize the learners with the concepts of lware Analysis and attain **Employability** through **Participative Learning** hniques.				
urse OutComes	successful completion of this course the students shall be able to: Understanding the nature of malware, its capabilities, and how s combated through detection and classification. Apply the methodologies and tools to perform static and namic analysis on unknown executables. Analyze scientific and logical limitations on society's ability to mbat malware.. Apply techniques and concepts to unpack, extract, decrypt, or pass new anti analysis techniques in future malware samples.				
urse Content:					
dule 1	**roduction to ALWARE IALYSIS**		signment	ogramming ivity	**12 Hours**
pics: roduction to malware, OS security concepts, malware threats, evolution of malware, lware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware alysis, static malware analysis, dynamic malware analysis. **signment:** Brief study on types of spyware					
dule 2	**atic Analysis**		signment	ogramming ivity	**11 Hours**
pics: 6 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, nple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and fsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE					

e Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 chitecture **signment:** Static analysis on malware (PeStudio & ProcMon)					
odule 3	**namic alysis**		signment	ogramming ivity	**11 Hours**
pics: ve malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-ls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion chniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with reshark **signment:** Demonstration of wireshark					
odule 4	**alware nctionality d Detection chniques**		signment	ogramming ivity	**12 Hours**
pics: wnloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, vert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, tours, APC injection. gnature-based techniques: malware signatures, packed malware signature, metamorphic and lymorphic malware signature Non-signature based techniques: similarity-based techniques, achine-learning methods, invariant inferences **signment:** Packet malware signature					

rgeted Application & Tools that can be used: eCMAP (Certified Malware Analysis ofessional)

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

y appropriate tool can be given to demonstrate.

xt Book

Michael Sikorski and Andrew Honig, 2012: “ Practical Malware Analysis”, No Starch ess.

Resources

1. https://www.geeksforgeeks.org/introduction-to-malware-analysis/
2. https://ine.com/learning/courses/malware-analysis

3: https://sm-nitk.vlabs.ac.in/

ferences

Jamie Butler and Greg Hoglund, 2005: “Rootkits: Subverting the Windows Kernel”, dison-Wesley.

Dang, Gazet and Bachaalany, 2014: “Practical Reverse Engineering”,Wiley.

Reverend Bill Blunden, 2012: “The Rootkit Arsenal: Escape and Evasion in the Dark rners of the System” Second Edition,Jones& Bartlett.

pics relevant to "EMPLOYABILITY SKILLS": X86 Architecture, Packet Sniffing, Wireshark, development of Employability Skills through Participative Learning Techniques. This is ained through assessment components mentioned in course handout.

Course Code: CSE3043	**urse Title:** ıtomated Test Management **pe of Course:** **Integrated**	**T-P- C**	2-0-2-3
Version No.	)		
Course Pre-requisites	**roductory course on Software Engineering.**		
Anti-requisites			
Course Description	is course is intended for understanding the principles of automation and the plication of tools for the analysis and testing of software. The automated alysis encompasses both approaches to automatically generate a very large mber of tests to check whether programs meet requirements, and also means which it is possible to prove that software meets requirements and that it is e from certain commonly-occurring defects, such as divide-by-zero, erflow/underflow, deadlock, race-condition freedom, buffer/array overflow, caught exceptions, and several other commonly-occurring bugs that can lead to ogram failures or security problems. The learner will become familiar with the ndamental theory and applications of such approaches, and apply a variety of tomated analysis techniques on example programs.		
ourse Objective	e objective of the course is to familiarize the learners with the concepts Automated Test Management and attain **SKILL DEVELOPMENT** through **beriential Learning** techniques.		
urse Out Comes	**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.		
urse Content:			

Module 1		1	ɔ Experiments	**Sessions**
pics: ven Principles - SDLC vs STLC - Testing Life Cycle - Usability Testing - Functional Testing - End to d Testing - Compatibility Testing - GUI Testing - API testing.				
Module 2		2	ɔ Experiments	**Sessions**
pics: ability Testing - Functional Testing - End to End Testing - Compatibility Testing - GUI Testing - API ting.				
Module 3		3	ɔ Experiments	**Sessions**

pics:Manual Testing - Automation Testing - Unit Testing - Integration Testing - Smoke-Sanity sting - Regression Testing , Reasons for Automated Testing: Controlling Costs, Application verage, Scalability, Repeatability.				
odule 4		4	o Experiments	Sessions
pics :Test Scenario - Test Case Design - Test Basis - Traceability Matrix				
odule 5		4	o Experiments	Sessions
pics : ESTIMATION TECHNIQUES :Estimating automation - Test Plan Document - Bug Life cle				
t of Laboratory Tasks: roduction and installation of DevOps. SDLC, STLC, GUI and API testing modules. Unit Testing and egration testing modules. Creating test scenarios. Bug Life Cycle				
rgeted Application & Tools that can be used vOps				
Project work/Assignment:				
signment: CA1, CA2, CA3, CA4				
xt Book .Flexible Test Automation - by Vitaliano Inglese, Pasquale Arpaia .Experiences of Test Automation: Case Studies of Software Test Automation - by Mark Fewster, orothy Graham				
ferences eb resources: 1. https://presiuniv.knimbus.com/user#/home				
pics relevant to "SKILL DEVELOPMENT": it testing, Functional testing for **Skill Development** through **Experiential Learning Techniques.** is is attained through assessment component mentioned in course handout.				

Course Code: CSE3044	**urse Title:** BUILD AND RELEASE MANAGEMENT **pe of Course: Theory Only Course**	**- P- C**	3-0-0-3
Version No.	)		
Course Pre-requisites	E 2014 – Software Engineering		
Anti-requisites			
Course Description	ild and Release management course guides the software development efforts from planning deployment, resulting in better customer satisfaction with the end product. The benefits of ild and release is essential to high-performing software development and delivery. Build and ease enhanced by safely testing features in production environments, gathering valuable		

	edback and releasing new and improved features continuously. In this course, Students will rn about the benefits of using a release management process to manage and improve the velopment of a software build. This course covers the key concepts and principles that apply release management, as well as common considerations and potential challenges to be aware			
ourse Objective	e objective of the course is to familiarize the learners with the concepts Of Build And Release nagement and attain **Employability** through **Participative Learning** techniques.			
urse Out Comes	**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			
urse Content:				
Module 1	**IDERSTANDING MMON AGILE ACTICES IN DEVOPS**	signment	ta Collection/Interpretation	**12 Sessions**
pics: **roduction to Product Management, Product Design and Requirement gathering, Product Design Challenges, Design, Product Development Methodologies, Product Marketing and Presentation, Traditional Software velopment Methodologies, Problem/issues with traditional approach, Agile Development, Agile Manifesto, um Model, Agile Estimations and Planning, Soft skills in agile** **nban - What is Kanban, Understanding the Principle of Kanban, Value System of Kanban, WIP Limits, Classes Service in Kanban, Sample Kanban Boards (Proto Kanban) , How to read a Kanban Board, Meetings in Kanban stem, Extreme Programming.**				
Module 2	**DE DESIGN**	se studies / se let	Case studies / Case let	**12 Sessions**
pics: **od design is good design regardless of paradigm, Fundamental characteristics of good design: modular, osely coupled, etc., Using design to simplify code structure, how programming languages are designed to pport good code design, best practices of design in OO program development, First Fundamental OO principle: erface and implementation design, Second Fundamental OO Principle: Recursive design, Design Patterns: using best practices., SOLID Design Principles**				
Module 3	**STING AND BUGGING**	iz	Case studies / Case let	**14 Sessions**
pics: **STING AND DEBUGGING** **anning for errors and exceptions, Basic test-driven development: writing tests first, How TDD improves the ality of the resulting code, automating testing: using Junit, etc, Avoiding creeping errors.** **FACTORING: IMPROVING STRUCTURE** **de smells: symptoms of poorly designed code, Refactoring: changing code structure without changing nctionality, Using TDD for controlled code changes, the refactoring process, using refactoring to make better de faster, Collective Code Ownership**				

rgeted Application & Tools that can be used: mmon frameworks and code architectures: Spring, Hibernate, Microservices, Spring Boot. Es: Eclipse, Visual Studio, IntelliJ
Project work/Assignment:
signment: **ch student have to submit assignment as 4 to 5 pages report on Agile Frameworks and tools**
xt Book Eric Breachner, "Agile Project Management with Kanban", 1st Edition, 2019, MSPress Publishers. Peter Measey and Radtac, "Agile Foundations: Principles, Practices and Frameworks", Whitshire publishers, 15.
ferences Dave Howard, "IT Release Management: Hands on Guide", CRC Press , 2016. Lyssa Adkins, "Coaching Agile teams", Addison-wesley publications, 2012. **ook link R1: https://download.manageengine.com/academy/it-release-management-e-book.pdf** **ook link R2: https://www.smartsheet.com/release-management-process** **Web resources:** ps://presiuniv.knimbus.com/user#/home **https://www.youtube.com/watch?v=dvFQrsY_tKg** **https://www.youtube.com/watch?v=vlsLxaY4P7M**
pics relevant to "EMPLOYABILITY SKILLS": Build and release management Process, Frameworks and tools **for veloping Employability Skills through Participative Learning techniques. This is attained through assessment mponent mentioned in course handout.**

urse Code: E3045	**urse Title: Development Automation** **pe of Course:** **ective in Devops Basket** **eory & Integrated Laboratory**	**T- P- C**	2-0-2-3
rsion No.	)		
urse Pre-quisites	L		
ti-requisites	ripting Language Knowledge, Linux Fundamentals		
urse Description	e Objective of this course is to give a strong foundation of the Development tomation. DevOps refers to the integration of an organization's development (dev) and erations (ops) teams. It encompasses an organization's culture, processes, and ilosophies. DevOps tools enable faster development cycles and higher software quality. vOps speeds delivery of higher quality software by combining and automating the work software development and IT operations teams.		
urse Objective	e objective of the course is to familiarize the learners with the concepts of **Development tomation** and attain **SKILL DEVELOPMENT** through **Experiential Learning** techniques.		

urse tcomes	successful completion of the course, the students shall be able to **Understand** the automated software delivery and deployment process[owledge] **Analyze** the various automation scenarios .[Comprehension] **Demonstrate** the interaction with linux environment[Application] **Implement** scripts[Application] **Implement** makefiles to automate tasks[Application]			
urse Content:				
odule 1	**troduction to tomation**	signment/Quiz	lly Automated ftware delivery ocess	**06 Session**
pics: The Software Delivery Pipeline, Overview of the Continuous Delivery Pipeline, Fully Automated ftware Delivery Process, The Build Process, Automated build, Automated Test, Automated Deployment, nefits of Automated Deployment, Automated Deployment and DevOps Adoption, Automated Deployment d DevOps Adoption, Overview of Rapid Application Development (RAD), Phases in RAD, Essential pects of RAD, Code generation, Categories of Code Generators, Common. signment: The build process				
odule 2	**vantages of tomation**	se study	tomation scenarios	**06 Session**
pics: Advantages of Automation, Automation Scenarios, Archiving Logs, Auto-Discard Old Archives, SQL (RDBMS) Backups, Email Web Server Summary, Ensure Web Server is Running, User Command lidation, Disk Usage Alarm, Sending Files to Recycle Bin, Restoring Files from Recycle Bin, Logging lete Actions, File Formatter, Decrypting Files, Bulk File Downloader, System Information, Install MP Stack, Get NIC's IP, Scenarios Where Automation Prevents Errors . signment: Email web server summary				
odule 3	**teracting with Linux vironment**	se study	ux File system	**06 Session**
pics: The Linux System, Linux File System, Partitions, Common System Directories, Shell, User Groups and rmissions, User Accounts, The passwd File, Creating User Accounts, File Ownership, File rmissions, Working with Bash, Shell Features **signemnt:** Linux File System				
odule 4	**ripting Development sks**	se study	ux commands	**06 ssion**
pics: Writing Automation Scripts, Task Scheduling Using Cron, Basic Linux Commands, Best Practices for ripting, Make use of Shell's Built-In Options, Naming Conventions, Annotations Make the Logic Clean, mmand Substitution, Always Begin with a Shebang, Variable Substitution, Conditionals, Regular pressions. signment: Shell's built-in options				

odule 5	**lake" and lakefiles"**	se study	akefile arguments d source code ation	**06 ssion**

pics: Why "Make"? Why not Others?, Why not use "Bash Script" instead of "Makefile"?, features of "Make", rious versions and Variants of "Make", Structure of a "Makefile", What is a Rule?, Structure of a "Makefile" le, Targets, Some Special Built-in Target Names, Automatic Variables, Suffix Rules, ttern Rules, The "Make" command, "Make" arguments, recu,rsive makefile, Building Binary from urce Code, Conditionals in "Makefile", Best Practices in writing "Makefiles".

signment: Best practices in writing Makefiles

st of Laboratory Tasks:

periment No 1: Working with Basic Linux Commands, make use of shells built in options, naming nventions,
vel 1: basic linux commands
vel 2: Advanced linux commands

periment No 2: Working with Linux File System, Partitions, Common System Directories
vel 1: Simple commands for exploring paritions, common system directories
vel 2: configuring linux system

periment No 3: Working with writing automation scripts

vel 1: Simple automation scripts
vel 2: Complicated automation scripts

periment No 4: Working with variable substituition, conditionals, regular expressions
vel 1: Simple regular expressions, conditionals
vel 2: Advanced regular expressions, conditionals

periment No 5: creation of makefile , Structure of makefile
vel 1: Simple makefile creation
vel 2: Advanced program on makefile

periment No 6: Working with automatic variables, pattern rules , make command
vel 1: Basic pattern rules, make command
vel 2: Advanced pattern rules

periment No 7: Building binary from source code
vel 1: basic binary from source code
vel 2: Advanced binary from source code

periment No 8: Working with Conditionals in "Makefile", Best Practices in writing "Makefiles
vel 1: Basic conditionals in makefile
vel 2: Advanced conditions and best practices in writing makefiles

rgeted Application & Tools that can be used:

pplication Area includes Online Financial Trading Company, Network Cycling, Car manufacturing lustries, Airlines industries, GM Financial, Bug Reduction. Companies like Amazon, Target, Esty, tflix, Google, Walmart use Devops in their day to day processes to increase efficiency and improve livery time.

ofessionally Used Software: Red hat Linux Operating system, GIT

sides these software tools Visual studio code also used

oject work/Assignment:

Case Studies: At the end of the course students will be given a real-world scenario for any application on tomating software development and deployment process, automation scenarios, working with linux vironment using script and makefile.

Book/Article review: At the end of each module a book reference or an article topic will be given to an lividual or a group of students. They need to refer the library resources and write a report on their derstanding about the assigned article in appropriate format. Presidency University Library Link .

Presentation: There will be a group presentation, where the students will be given a topic. They will ve to explain/demonstrate the working and discuss the applications for the same.

xt Book(s):

Running Linux – Book by Matthias Kalle Dalheimer, Matt Welsh
Mastering Linux Shell Scripting – Book by Andrew Mallett .

ference(s):

ference Book(s):

DevOps Handbook: How to Create World-Class Agility, Reliability and Security in Technology ganizations – Patrick ,Jez Humble ,Gene Kim ,(2016 ,6 October) Illustrated edition ;IT Revolution Press hn Allspaw and John Willi ,Deboiss

Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale 1st Edition, O'Reilly edia; 1st edition (May 30, 2016), Jennifer davis, Ryn daneils

nline Resources (e-books, notes, ppts, video lectures etc.):

oursera:

DevOps on AWS | Coursera
DevOps, Cloud, and Agile Foundations | Coursera
ntroduction to DevOps | Coursera

books :
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-e&ebv=EB&ppid=pp_xiii
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-e

pics relevant to "SKILL DEVELOPMENT":

mple automation Scripts, Linux commands for **SKILL DEVELOPMENT** through **Experiential Learning chniques.** This is attained through the assessment component mentioned in the course handout.

urse Code: ;E3053	**urse Title:** **; Data Analytics for IoT** **pe of Course: Program Core** **eory with embedded lab**			**T- P- C**	1-0-4-3
rsion No.	)				
urse Pre- quisites					
ti-requisites	-				
urse scription	e course covers basic concepts for IOT Analytics, collection of data for IOT, egration of IOT with Cloud, Big Data Environments. Students can learn about plying geospatial analytics and applying machine learning to the IOT data. The urse also covers the organization of the IOT data, cost benefits of using IOT and iew of IOT in various sectors.				
urse Objective	e objective of the course is to familiarize the learners with the concepts of Big ta Analytics for IoT and attain SKILL DEVELOPMENT through EXPERIENTIAL ARNING techniques.				
urse tcomes	successful completion of the course the students shall be able to:)1: Demonstrate IOT Data Analytics and machine learning application in IOT pply))2: Apply appropriate Hadoop Ecosystem tools to perform data analytics for a en problem (Apply))3: Examine concepts of cloud based IOT, Big data and IOT (Apply))4: Illustrate techniques and strategies for data collection and Geospatial alytics to IOT Data (Apply)				
urse Content:					
odule 1	T Analytics	signment		**5 sessions**	
roduction – IOT Data, Challenges of IOT analytics Applications – IOT analytics Lifecycle and Techniques. IOT ud and Big Data Integration – Cloud based IOT platform – Data Analytics for IOT, IOT devices in different domains. T Analytics for the Cloud.					
odule 2	doop Ecosystem ols			**5 sessions**	
oduction – Big Data and Big Data Analytics – Hadoop Ecosystem – Hadoop Distributed File System (HDFS) – pReduce – YARN Architecture – PIG Architecture – Apache HIVE – Mahout – Apache Spark – Apache HBase – ache Zookeeper.					
odule 3	erview of AWS d Thingworx	signment		**5 sessions**	
/S overview - AWS key services for IOT analytics. Thingworx overview. Creating an AWS Cloud Analytics ironment.					

odule 4	ospatial Analytics to IOT ta	se Study	ta Collection and alysis

ategies and Techniques in Data collection: Designing data processing for analytics – Applying big data to storage for ospatial.

t of Practical Tasks:

periment 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 .

periment 2: [Module 1]

Level 1: Design and Simulate the RADAR SYSTEM Using Arduino and display on the serial onitor 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-04

periment 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 althcare sensors

periment 4: [Module 2]

Level 1: Hadoop Single node cluster installation on ubuntu

Level 2: Hadoop Multiple node cluster installation, windows installation

periment 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

periment 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

periment 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

periment 8: [Module 3]

Level 1: Working on hive commands

Level 2: Apply bucketing technique to bring out the difference between partitioning and cketing

periment 9: [Module 3]

Level 1: Working on Hbase commands .

Level 2: Apply Hbase commands on Insurance database/employee dataset.

periment 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 t a list of words whose count is strictly greater than 4 using Spark

periment 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

periment 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

rgeted Application & Tools that can be used:

doop ecosystem tools, Thingworx , AWS Cloud

oject work/Assignment:

ident will be asked to carry out a mini project integrating IoT & data Analytics.

xt Book

Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley., 2nd Edition, 2019.
Analytics for the Internet of things,Andrew Minteer. Packt publishing, 1st Edition,2017.
Big Data and the Internet of Things, Robert Stackowiak, Art Licht, Venu Mantha and Louis Nagode, Apress, 2nd tion, 2020

ferences

IOT and Analytics in Agriculture.,Prasant Kumar Pattnaik, Raghvendra Kumar, Souvik Pal, S. N. Panda. Springer, st Edition, 2020.
Building blocks for IOT Analytics. Internet-of-Things Analytics. John Soldatos (Editor). River Publisher Series in nal Image and Speech Processing.2020

b resources

. NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs92/preview
. Coursera: https://www.coursera.org/learn/big-data-introduction
. EDX: https://www.edx.org/course/big-data-fundamentals
. E-book Link : https://www.wiley.com /en-us/Internet+of+Things+and+ Data+ Analytics + Handbook -p-11119173625

pics relevant to "SKILL DEVELOPMENT": Organize IOT data – Linked analytics datasets – anaging data lakes for **Skill Development** through **Experiential Learning** techniques. This is ained through assessment component mentioned in course handout.

urse Code: SE3176	**urse Title: Edge Computing** **pe of Course: Theory**	**P- T-C**		**)**	**0**	**3**
rsion No.	)					
urse Pre-quisites	ndamentals of Cloud Computing					
ti-requisites	L					
urse Description	is course we will cover fundamentals of Edge computing and its plications in low latency and critical real-time computing scenarios. The urse brings in theory of Edge computing, focusing on it as a complementary proach that addresses some of the limitations of cloud computing. The urse will cover applications where edge computing is a necessity, such as l-time applications that require low latency and high bandwidth. For ample, autonomous vehicles require real-time processing of data from nsors, which cannot be done in a centralized data center due to latency ues. is course provides an in-depth understanding of edge computing principles h different use case of edge computing.					

	pics include Overview of Edge Computing, Fundamental concepts edge mputing, Edge Computing Architecture and Technologies, Security and vacy in Edge Computing, Applications and Case Studies in Edge mputing.			
urse Outcomes	n successful completion of this course the students shall be able to: List the Concepts and Principles of Edge mputing. (Remember). Explain the key components and architecture of an edge mputing system. (Understand). Identify the need of Security and Privacy in Edge Computing. nderstand). Discuss the edge computing concept for real-world case studies. Inderstand)			
urse Content:				
odule 1	**ndamentals of Edge mputing**	signment		**08 Classes**
pics: verview of Edge Computing: Concepts and Definitions, Evolution of Edge Computing m Cloud Computing, Use Cases and Applications of Edge Computing, Challenges and portunities in Edge Computing				
odule 2	**ge Computing hitecture and hnologies**	signment		**10 Classes**
pics: ge Computing Architecture: Components and Layers, Edge Devices and Sensors: IoT egration, Edge Computing Frameworks and Platforms, Networking Technologies for ge Computing: 5G, Wi-Fi 6, and LPWANs				
odule 3	**curity and Privacy Edge Computing**	signment		**10 Classes**
pics: curity Challenges in Edge Computing Environments, Threats and Vulnerabilities at the ge, Edge Security Best Practices: Encryption, Authentication, and Access Control, Privacy nsiderations in Edge Computing: Data Ownership and Compliance				
odule-4	**plications and se Studies in ge Computing**	signment		**12 Classes**
pics: al-time Analytics at the Edge: Predictive Maintenance and Anomaly Detection, Edge AI d Machine Learning: Intelligent Edge Devices, Edge Computing in Smart Cities and dustrial IoT, Case Studies of Edge Computing Deployments in Various Industries				
oject work/Assignment:				

Assignment 1 on (Module 1 and Module 2) **Assignment 2 on (Module 3 and Module 4)**
EFERENCE MATERIALS: EXTBOOKS "Edge Computing: Concepts, Technologies, and Applications" by Danda B. Rawat, Joel .C. Rodrigues, Ivan Stojmenovic, published in 2017, is Wiley. "Fog and Edge Computing: Principles and Paradigms" by Rajkumar Buyya, Satish rayana Srirama, Pradeep Kumar Singh, Rodrigo N. Calheiros "Fog and Edge Computing: Principles and Paradigms" by Rajkumar Buyya, Satish rayana Srirama, Pradeep Kumar Singh, Rodrigo N. Calheiros was published by Wiley in 2019. "Edge Security in the IoT Era: Trustworthiness and Resilience" by Raja Naeem Akram d Mubashir Husain Rehmani was published by Springer in 2020. "Edge Intelligence: Pioneering the Future of AI" by Hsinchun Chen, Roger H.L. Chiang, da C. Storey, Wingyan Chung was published by Springer in 2019. EFERENCES Edge Computing Systems with Kubernetes: A use case guide for building edge systems ng K3s, k3OS, and open source cloud native technologies, Sergio Mendez, Packt blishing 2022, ISBN 1800568592, 9781800568594. **URNALS/MAGAZINES** **IEEE Transactions on Services Computing** **SE): (https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4629386).** **Journal of Edge Computing (JEC): (https://acnsci.org/cms/)** . VAYAM/NPTEL/MOOCs: NPTEL - **Edge Computing, IIT Kanpur https://nptel.ac.in/courses/106104449** Coursera – https://www.coursera.org/learn/security-at-the-edge-first-course-1

urse Code: **E3095**	**urse Title:** **Cloud Security** **pe of Course:** **Discipline Elective in Cloud mputing Basket** **Theory**	**T- P-**	3-0-0-3
rsion No.	)		
urse Pre-quisites	**Cloud Computing and Services (CSE322)**		
ti-requisites	**L**		
urse scription	is course provides ground-up coverage on the high-level concepts of cloud dscape, architectural principles, and techniques. It describes the Cloud urity architecture and explores the guiding security for Infrastructure and ftwares.		

urse Objective	**is course is designed to improve the learners' EMPLOYABILITY ILLS by using EXPERIENTIAL LEARNING techniques.**			
urse Outcomes	successful completion of this course the students shall be able to: **Describe** fundamentals of cloud computing [**Knowledge].** **Explain** cloud computing security architecture and associated allenges **[Comprehension].** **Discuss** cloud computing software security essentials **omprehension].** **Apply** infrastructure security and data security in cloud computing viroment. **[Application].**			
urse Content:				
Module 1:	**ndamentals of Cloud mputing**	**iiz**	owledge based iiz	**Sessions**
pics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing tforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI mework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud rastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.				
odule 2:	**oud Security Challenges d Cloud Security chitecture**	**iiz**	mprehension sed Quiz	**Sessions**
pics: Security Policy Implementation, Computer Security Incident Response Team, rtualization Security Management. Architectural Considerations, Identity Management and cess Control, Autonomic Security.				
odule 3	**oud Computing Software curity Essentials**	**signment**	tch-wise signments	**essions**
pics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software quirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud mputing and Business Continuity Planning/Disaster Recovery.				
odule 4:	**frastructure Security and ta Security**	signment and esentation	tch-wise signment and esentations	**Sessions**
pics: Infrastructure Security: The Network Level, The Host Level, The Application Level. **ta Security :** Aspects of Data Security, Data Security Mitigation, Provider Data and its curity.				
rgeted Application & Tools that can be used: Use of CloudSim simulator.				
oject work/Assignment: **rvey on Cloud Service Providers**				
xt Book Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "*Mastering Cloud mputing*", McGraw Hill Education, July 2021. Roland L Krutz and Russell Dean Vines, "*Cloud Security - A Comprehensive Guide Secure Cloud Computing*", Wiley Publishing, Inc. 2019.				
ferences Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff ang, "*Secure Cloud Computing*", Springer, ISBN 978-1-4614-9278-8 (eBook).				

John Rittinghouse and James Ransome, "*Cloud Computing, Implementation, nagement and Security*", CRC Press, 2010. Tim Mather, Subra Kumaraswamy and Shahed Latif", "Cloud Security and Privacy – Enterprise Perspective on Risks and Compliance", Oreily Publication, 2009.
pics related to development of "FOUNDATION": Cloud computing architecture, Security licy implementation. pics related to development of "EMPLOYABILITY": Infrastructure security and Data urity.

urse de: E3186	**urse Title:** ud Infrastructure and Systems Software **pe of Course: Theory**	**P- T-C**		**0**	**0**	**3**
rsion No.	)					
urse Pre-quisites	L					
ti-quisites	L					
urse scription	e course presents a top-down view of cloud computing that provide students with a sound undation the cloud computing so that they are able to start using and adopting cloud mputing services and tools in their real-life scenarios. Students will study state-of-e-art solutions for cloud computing. This course gives students an insight into the basics of ud computing along with virtualization, cloud platforms, data storage, security, and vanced cloud enabling technologies. Cloud Computing and infrastructure is one of the fastest growing domains from a while now.					
urse tcomes	successful completion of this course the students shall be able to: Understand the main concepts, key technologies and fundamentals of cloud mputing. Understand cloud enabling technologies and virtualization. Analyze various cloud programming models and apply them to solve problems on e cloud. Explain data storage and major security issues in the cloud. Understand application development for cloud. Understand trends in cloud enabling technologies					
urse Content:						
odule 1	roduction to Cloud mputing and analytics	signment		**08 Classes**		
pics: iginations and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, les and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, derated Cloud/Inter cloud, Types of Clouds. Cloud Analytics						
odule 2	rtualization	signment		**10 Classes**		

pics:

uctures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory and I/O vices, Implementation level of virtualization, Virtual Clusters and Resource Management, rtualization for Data-Center Automation.

odule 3	oud Plat forms and ndards	signment		**10 Classes**

nazon web services: Compute services, Storage Services, Communication Services, Additional services, ogle App Engine: Architecture and core concepts, Application lifecycle, Cost model Microsoft Azure: ure core concepts, SQL Azure, Windows Azure platform appliance.
ndards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application.

odule-4	oud Systems Software	chnical Presentation		**12 Classes**

pics:

ogramming frameworks and their implementation issues in the Cloud, Scalable distributed data stores organizing persistent data in Cloud applications, Resource Management, Virtualization technology.

oject work/Assignment:

Assignment 1 on (Module 1 and Module 2)
Assignment 2 on (Module 3 and Module 4)

EFERENCE MATERIALS:

EXTBOOKS

Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, chnology & Architecture, Pearson, ISBN:9789332535923, 9332535922, 1st Edition.

Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: APracticalApproac 2010, The McGraw-Hill.

EFERENCES

Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, arson, ISBN: 9788131776513.

Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and ore, Jones and Bartlett, ISBN: 9789380853772

URNALS/MAGAZINES

Cloud Computing: System Instances and Current Research:
ps://www.researchgate.net/publication/251043013_Cloud_Computing_System_Instances_and_Current_Researc
Cloud_Computing_System_Instances_and_Current_Research

Systematic analysis of software development in cloud computing perceptions
ps://onlinelibrary.wiley.com/doi/10.1002/smr.2485

VAYAM/NPTEL/MOOCs:

Swayam Nptel – Cloud Computing and Distributed Systems – Patna https://onlinecourses.nptel.ac.in/noc21_cs15/preview

Coursera – Cloud Systems Software

https://www.coursera.org/learn/cloud-sys-software#testimonials

ɔurse Code: **ƽE3187**	**ɔurse Title:** Virtualization and Containerization **ɣpe of Course: Theory**	**P- T-C**		**0**	**0**	**3**
ɛrsion No.	)					
ɔurse Pre- quisites	ɔud Computing concepts					
ıti-requisites	L					
ɔurse ɛscription	is course focus on cloud computing models for enabling ubiquitous, convenient, on- demand ɛess to a shared computing resources. It also enables the students to understand the benefits, risk l recommendations for cloud security implications from technical perspective. In addition to s, the course provides an understanding of pros and cons of different approaches to virtualization ıbling students to gain research competence from industry.					
ɔurse Outcomes	ı successful completion of this course the students shall be able to:)1 — ganize the main concepts, key technologies, strengths l limitations of cloud computing and development. — alyze)2 — e the key enabling technologies that help in the ɣelopment of cloud. — ply)3 — velop the ability to use the architecture of cloud, vice and delivery models. — ply)4 — amine the core issues of cloud computing such as ource management and security. — alyze)5 — ɣestigate current cloud technologies and resources to ɦieve significant economic resources. — ɛate)6 — ɛct the appropriate technologies, algorithm, and ɔroaches for the development of cloud related issues. — aluate					
ɔurse Content:						
ɔdule 1	ɛroduction	ɛsignment		**08 Classes**		
ɔpics: roduction to Cloud Computing with simple web application programs – Definition of Cloud – Evolution of Cloud mputing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud)n-demand Provisioning.						
ɔdule 2	ɛtualization And Cloud abling chnologies	ɛsignment		**10 Classes**		
ɔpics: ɛvice Oriented Architecture – REST and Systems of Systems – Web Services with sample experiments – Publish-ɔscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – ɛtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization ɔpport and Disaster Recovery.						

odule 3	oud Architecture, Services d Storage	signment		**10 Classes**
pics: yered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid ouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service with ogramming – Advantages of Cloud Storage – Cloud Storage Providers – S3.				
odule-4	roduction to ntainerization	chnical esentation		**12 Classes**
pics: hat is containerization, Benefits of containerization, use cases, Functionality of containerization, Container chestration, types of container technology, Virtualization vs Containerization				
oject work/Assignment:				
Assignment 1 on (Module 1 and Module 2) **Assignment 2 on (Module 3 and Module 4)**				

EFERENCE MATERIALS:

EXTBOOKS

Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel ocessing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

https://dzone.com/articles/introduction-to-containerization.

EFERENCES

The Metaverse: Buying Virtual Land, NFTs, VR, Web3 & Preparing for the Next Big Thing! by Alan rton published by Terry Winters, November 2021.

https://aws.amazon.com/what-is/containerization.

URNALS/MAGAZINES

Containers for Virtualization: An Overview

tps://www.researchgate.net/publication/325534952_Containers_for_Virtualization_An_Overview

Container Technology

tps://www.researchgate.net/publication/364181139_Container_Technology

VAYAM/NPTEL/MOOCs:

Swayam Nptel – Edge Computing – IIT Patna by Prof. Rajiv

sra https://onlinecourses.nptel.ac.in/noc24_cs66/

Coursera – **Containerized Applications on AWS**

https://www.coursera.org/learn/containerized-applications-on-aws?isNewUser=true

Course Code: CSE2058	**urse Title: Firewall and Internet security** **pe of Course: Integrated**	**- P- C**	2-0-2-3
Version No.			
Course Pre-requisites	mputer Networks		
Anti-requisites			

Course Description	s course provides an in-depth study of various network attacks techniques and methods to defend ainst them. A number of threats and vulnerabilities of the Internet will be covered, including various nerabilities of TCP/IP protocols, denial of service (DOS), attacks on routing, attacks on DNS vers, TCP session hijacking, and so on. This course will also cover defending mechanisms, including rusion detection, firewalls, tracing the source of attacks, anonymous communication, IPsec, virtual vate network, and PKI. To make it easy for students to understand these attacks, basics of the P/IP protocols will also be covered in the course.			
ourse Objective	e objective of the course is to familiarize the learners with the concepts of **Firewall and ernet security** and attain **Skill Development** through **Problem Solving** Methodologies.			
urse Out Comes	**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			
urse Content:				
Module 1	roduction to ewall	signment	ta Collection/Interpretation	**12 Sessions**
roduction of Firewall in computer network,Categories of firewall,How firewall works,Types of firewall, Firewall ation and Configuration,Firewall Policies,Firewall Biasing,Network Architecture,Net masks,Packet ers,Stateful firewalls,Resources				
Module 2	**mputer security**	se studies / Case	Case studies / Case let	**12 Sessions**
opics: Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of curity Types of Attacks. Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport yer Security, HTTPS, Secure Shell (SSH)				
Module 3	**twork Security**	iz	Case studies / Case let	**10 Sessions**
pics: Overview of Network Security:Elements of Network Security , Classification of Network Attacks curity Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption andard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , thentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures.				
Module 4	ber laws and mpliance ndards	iz	se studies / Case let	**11 Sessions**
pics: rberos:Working ,ASS,TGS,SS-Internet security protocols-AH,ESP,Models-Transport and tunnel-Email curity,Public key Infrasturcture,Certificates,certificates authority.Cyber Crime: Introduction,Hacking,Digital gery,Cyber Stalking,Identify theft and Fraud,Cyber terrorism,Cyber defamation,Crime against lividual,Government,Property.				
t of Laboratory Tasks:				

Perform encryption, decryption using the following substitution techniques
Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
Perform encryption and decryption using following transposition techniques
ail 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
uilding Trojans ii) Rootkit Hunter

rgeted Application & Tools that can be used

xt Book

: Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian ition

T2: James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, arson,2017

ferences

.: Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson Edition

: Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

eb 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 velopment through Problem Solving methodologies. This is attained through assessment component entioned in course handout.

Course Code: CSE3090	**urse Title:** 5G Networking **pe of Course: Theory Only Course**	**T-P- C**	3-0-0-3
Version No.			
Course Pre-requisites	gital communications, Mobile Communication Systems, Wireless Networks		
Anti-requisites			
Course Description	e aim of this course is to let the students understand that air Interface is one of the most portant elements that differentiate between 2G, 3G, 4G and 5G. While 3G was CDMA based, was OFDMA based; this course reveals the contents of air interface for 5G. While 4G brought a deluge of infotainment services, 5G aims to provide extremely low delay services, great rvice in crowd, enhanced mobile broadband (virtual reality being made real), ultra-reliable and cure connectivity, ubiquitous QoS, and highly energy efficient networks.		

ourse Objective	e objective of the course is to familiarize the learners with the concepts of 5G Networking d attain **Employability** through **Participative Learning** techniques			
urse Out Comes	**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 5G.			
urse Content:				
Module 1	**channel modelling and e cases**	signment	ta Collection/Interpretation	**10 Sessions**
pics: 5G channel modelling and use cases, Modeling requirements and scenarios, Channel model requirements, opagation scenarios, Relaying multi-hop and cooperative communications: Principles of relaying, fundamentals relaying, Cognitive radio: Architecture, spectrum sensing, Software Defined Radio (SDR), Multiple-input ultiple-output (MIMO) systems, Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna stems, MIMO vs. multi-antenna systems. Diversity, exploiting multipath diversity, Transmit diversity, Space-time des.				
Module 2	**e 5G architecture**	se studies / se let	Case studies / Case let	**8 Sessions**
pics: Introduction, NFV and SDN, Basics about RAN architecture, High-level requirements for the 5G chitecture, Functional architecture and 5G flexibility, Functional split criteria, Functional split alternatives, nctional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G quirements, Enhanced Multi-RAT coordination features, Physical architecture and 5G deployment.				
Module 3	**vice-to-device (D2D) mmunications**	iz	Case studies / Case let	**10 Sessions**
pics: D2D: from 4G to 5G, D2D standardization: 4G LTE D2D, D2D in 5G: research challenges, Radio resource nagement for mobile broadband D2D, RRM techniques for mobile broadband D2D, RRM and system design for D, 5G D2D RRM concept: an example, Multi-hop D2D communications for proximity and emergency, services, tional security and public safety requirements in 3GPP and METIS, Device discovery without and with network sistance.				
odule 4	**e 5G radio-access chnologies**	iz	se studies / Case let	**Sessions**
pics: Access design principles for multi-user communications, Orthogonal multiple-access systems, Spread ectrum multiple access systems, Capacity limits of multiple-access methods, Sparse code multiple access CMA), Interleave division multiple access (IDMA), Radio access for dense deployments, OFDM numerology for all-cell deployments, Small-cell sub-frame structure, Radio access for V2X communication, Medium access ntrol for nodes on the move, Radio access for massive machine type communication.				
rgeted Application & Tools that can be used:				
Project work/Assignment:				

signment: Quiz
xt Book **1 :** Afif Osseiran, Jose F. Monserrat, Patrick Marsch, 5G Mobile and Wireless Communications Technology, mbridge University Press Second Edition, 2015. **2 :** Erik Dahlman, Stefan Parkvall, Johan Skö̈ld, 5G NR: The Next Generation Wireless Access Technology, evier First Edition, 2016.
ferences **1** : Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, Wiley First Edition 2015 **book link R1: https://www.wiley.com/en-in/Fundamentals+of+5G+Mobile+Networks-p-9781118867525** **/eb resources:** ttps://nptel.ac.in/courses/108/105/108105134/ :ps://www.udemy.com/course/5g-mobile-networksmodern-wireless-communication-technology/ ps://presiuniv.knimbus.com/user#/home
pics relevant to "EMPLOYABILITY SKILLS": D2D: from 4G to 5G, D2D standardization: 4G LTE D2D **for developing nployability Skills through Participative Learning techniques. This is attained through assessment component entioned in course handout.**

Course Code: CSE3132	**urse Title:** Network Management Systems **pe of Course:** Theory Only Course	**T-P- C**	3-0-0-3
Version No.	)		
Course Pre-requisites	-		
Anti-requisites	-		
urse Description	understand the principles of network management, different standards and otocols used in managing complex networks and the Automation of network nagement operations and making use of readily available network nagement systems.		
ourse Objective	e objective of the course is to familiarize the learners with the concepts of **twork Management Systems** and attain **Skill Development** through **rticipative Learning** techniques.		
urse Out Comes	**successful completion of the course the students shall be able to:** Acquire the knowledge about network management standards (OSI and P/IP). Acquire the knowledge about various network management tools and the skill use them in monitoring a network. Analyze the challenges faced by Network managers. Evaluate various commercial network management systems and open network nagement systems. Analyze and interpret the data provided by an NMS and take suitable actions.		

urse Content:				
Module 1	TA MMUNICATION D NETWORK ANAGEMENT	signment	ta Collection/Interpretation	**12 Sessions**

pics:
ERVIEW : Analogy of Telephone Network Management, Communications protocols and ndards, Case Histories of Networking and Management, Challenges of Information Technology nagers, Network Management: Goals, Organization, and Functions, Network and System nagement, Network Management System Platform, Current Status and future of Network nagement.

Module 2	nple Network nagement otocol	se studies / Case	Case studies / Case let	**12 Sessions**

pics:
IMPV1 NETWORK MANAGEMENT MANAGED NETWORK: Organization and Information Models ANAGED NETWORK: Case Histories and Examples, The History of SNMP Management, The MP Model, The Organization Model, System Overview, The Information Model.
MPV1 NETWORK MANAGEMENT: Communication and Functional Models The SNMP mmunication Model, Functional model. SNMP MANAGEMENT: SNMPv2 Major Changes in MPv2, SNMPv2 System architecture, SNMPv2 Structure of Management Information, The MPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.

Module 3	mote onitoring	iz	Case studies / Case let	**14 Sessions**

pics:
ION : What is Remote Monitoring? ,RMON SMI and MIB, RMON1, RMON2, ATM Remote onitoring, A Case Study of Internet Traffic Using RMON TELECOMMUNICATIONS MANAGEMENT TWORK: Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN chitecture, TMN Management Service Architecture, An Integrated View of TMN, Implementation ues.

Module 4	TWORK ANAGEMENT TOOLS D SYSTEMS	iz	se studies / Case	**Sessions**

twork Management Tools, Network Statistics Measurement Systems, History of Enterprise nagement, Network Management systems, Commercial Network management Systems, System nagement, Enterprise Management Solutions.

Module 5	EB-BASED ANAGEMENT	iz	se studies / Case	**Sessions**

IS with Web Interface and Web-Based Management, Web Interface to SNMP Management, bedded Web-Based Management, Desktop management Interface, Web-Based Enterprise nagement, WBEM: Windows Management Instrumentation, Java management Extensions, nagement of a Storage Area Network , Future Directions. Case Studies.

rgeted Application & Tools that can be used: Kiwi CatTools, SolarWinds Network Configuration nager.

Project work/Assignment:
signment: Simulation of NMS using any of the tools mentioned above.
xt Book **1.** Mani Subrahmanian, "Network Management Principles and Practice", 2nd Edition, Pearson ucation, 2010.
ferences . Morris, "Network management", 1st Edition, Pearson Education, 2008. **.** Mark Burges, "Principles of Network System Administration", 1st Edition, Wiley DreamTech, 08. **book link R1.** ps://documentation.solarwinds.com/en/success_center/kct/content/kct_documentation.htm **book link R2.** https://documentation.solarwinds.com/ **book link R3.** https://www.youtube.com/watch?v=liBB_Q7Go5k **TEL Course:** **https://onlinecourses.nptel.ac.in/noc22_cs98/course**
pics relevant to "SKILL DEVELOPMENT": Telephony network management and SNMPV1 for **Skill velopment** through **Participative Learning techniques**. This is attained through assessment mponent mentioned in course handout.

urse Code: 2502	**urse Title:** Information Retrieval **pe of Course: Theory Only Course**	**T-P- C**	3-0-0-3
rsion No.			
urse Pre-quisites	sic Knowledge in Data Structures and algorithms and probability and statistics, ckground in machine learning		
ti-requisites	-		
urse scription	e course studies the theory, design and implementation of Text- based ormation systems. The Information Retrieval core concepts of the course include tistical characteristics of text, representation of information needs and cuments. Topics Include Several important retrieval models (Basic IR Models, olean Model, TF-IDF (Term Frequency/Inverse Document Frequency) Weighting, ctor Model, Probabilistic Model, Latent Semantic Indexing Model, Neural Network del). Retrieval Evaluation, Retrieval Metrics, Text Classification and Clustering orithms, Web Retrieval and Crawling. Recommender Systems: Basics of Content-sed Recommender Systems, Content-based Filtering, Collaborative Filtering, trix factorization models and neighborhood models.		
urse jective	e objective of the course is to familiarize the learners with the concepts ormation Retrieval and attain Skill Development through Participative arning techniques.		

<table>
<tr><td>urse Out
mes</td><td colspan="4">successful completion of the course the students shall be able to:
1: Define basic concepts of information Retrieval. [Knowledge]
2: Evaluate the effectiveness and efficiency of different information retrieval
ethods. [Application]
3: Explain different indexing methodology requirements and the concept of web
rieval and crawling. [Comprehension]
4: Classify different recommender system and its aspect. [Comprehension]</td></tr>
<tr><td>urse Content:</td><td colspan="4"></td></tr>
<tr><td>odule 1</td><td>roduction to Information
trieval</td><td>signment</td><td>ta collection</td><td>Sessions</td></tr>
<tr><td colspan="5">ormation Retrieval – Early Developments – The IR Problem – The Users Task – Information versus ta Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and nking Processes</td></tr>
<tr><td>odule 2</td><td>odeling and Retrieval
aluation</td><td>signment</td><td>oblem solving</td><td>) Sessions</td></tr>
<tr><td colspan="5">sic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) eighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural twork Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference llection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance edback.</td></tr>
<tr><td>odule 3</td><td>lexing & Web-
trieval</td><td>rm
per/Assignment</td><td>ta analysis</td><td>Sessions</td></tr>
<tr><td colspan="5">lexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing. The eb – Search Engine Architectures – Cluster based Architecture - Search Engine Ranking – Link sed Ranking – Simple Ranking Functions, Evaluations — Search Engine Ranking – Applications of Veb Crawler.</td></tr>
<tr><td>odule 4</td><td>commender
stem</td><td>rm
per/Assignment</td><td>oblem solving</td><td>Sessions</td></tr>
<tr><td colspan="5">commender Systems Functions – Data and Knowledge Sources – Recommendation Techniques Basics of Content-based Recommender Systems – High Level Architecture – Advantages and awbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models.</td></tr>
<tr><td colspan="5">rgeted Application & Tools that can be used:
ormation Retrieval System, Collaborative Filtering System, Feedback System, Evaluation
etrics</td></tr>
<tr><td colspan="5">signment:</td></tr>
<tr><td colspan="5">oup assignment, Quiz</td></tr>
<tr><td colspan="5">xt Book
Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —" Modern Information Retrieval: The Concepts d Technology behind Search", Third Edition, ACM Press Books, 2018. Link: ps://people.ischool.berkeley.edu/~hearst/irbook/
Ricci, F, Rokach, L. Shapira, B.Kantor, —"Recommender Systems Handbook", Fourth Edition, 18.</td></tr>
<tr><td colspan="5">ferences</td></tr>
</table>

Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —"*Information Retrieval: plementing and Evaluating Search Engines*", The MIT Press, 2017. Jian-Yun Nie Morgan & Claypool –" *Cross-Language Information Retrieval*", Publisher series 11. Stefan M. Rüger Morgan & Claypool – "*Multimedia Information Retrieval*", Publisher series 2014. B. Liu, Springer, - "*Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data*", Second ition, 2013. C. Manning, P. Raghavan, and H. Schütze, —"Introduction to Information Retrieval", Cambridge iversity Press, 2015. Link: https://nlp.stanford.edu/IR-book/ **eb Based Resources and E-books:** ps://puniversity.informaticsglobal.com/login
Topics relevant to the development of SKILLS: Recommendation chniques, Content-based Filtering for **Skill Development** through **Participative Learning** chniques. This is attained through assessment component mentioned in course handout.

urse Code: **E3120**	**urse Title:** **Operating System with Linux Internals** **pe of Course:** **Discipline Elective in Information Science & gineering Basket** **eory & Integrated Laboratory**	**- P- C**	2-0-2-3
rsion No.	)		
urse Pre-quisites	**C Programming [2] Unix shell programming [3] Data Structure**		
ti-requisites	-		
urse scription	e purpose of this course is to enable the students to understand the need for Operating stems and to develop the basic concepts of process management, synchronization and mory management. The course will expose students to Linux OS internals, its design and tures. The course is both conceptual and analytical in nature towards managing the ocess and memory and needs fair knowledge of programming fundamentals, C ogramming and data structures. The course develops the critical thinking and analytical lls on allocating and managing resources. The course also enhances the problem solving d systems programming abilities through assignments e associated laboratory provides an opportunity to validate the concepts taught as well as hances the ability to approach designing new OS level features with confidence.		
urse Objective	e objective of the course is to familiarize the learners with the concepts of Operating stem with Linux Internals and attain <u>SKILL DEVELOPMENT</u> through <u>EXPERIENTIAL ARNING</u> techniques.		
urse Outcomes	**successful completion of this course the students shall be able to:** **Explain** the structure and functions of OS **Solve** problems on various CPU Scheduling Algorithms **Apply** different techniques to various synchronization problems **Discuss** various memory management techniques **Apply** appropriate Linux commands for memory management and directory management		

urse Content:				
odule 1	**troduction**	iz	gramming	**09 Classes**

pics: Introduction to OS – Computer System Architecture , Operating System Structure, Operations – fferent management activities handled by the OS, Computing environments, Operating System Services, er and OS interface, System Calls and its types, System Programs[loaders, linkers...], Overview of OS sign and implementation.

ux Operating System: Introduction to Linux OS, Basic Commands of Linux OS

odule 2	**ocess Management**	izzes and assignments	udocode/Programming	**9 Classes**

pics: Process Concept, Operations on Processes, Inter Process Communication, Introduction to threads - ltithreading Models, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FS, SJF, SRTF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue.

ux Operating System: Process Management Commands and System Calls.

odule 3	**ocess nchronization and adlocks**	ding Assignment/Case Study	udocode/Programming	**9 Classes**

pics:

e Critical-Section Problem - Peterson's Solution, Synchronization hardware, Mutex locks, Semaphores, assic Problems of Synchronization, Monitors. Introduction to Deadlocks, Deadlock Characterization, thods for handling deadlock: Deadlock Prevention- Deadlock Avoidance- Deadlock detection & Recovery m Deadlock

nux Operating System: Pipe, semaphore and message queue

t of Laboratory Tasks:

periment No. 1: Basic UNIX Commands

vel 1: Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, dir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, file handling utilities, security by file permissions, process lities

vel 2: Text Processing utilities and backup utilities , tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, ste, join, tee, pg, comm, cmp, diff, tr, awk, cpio

periment No. 2: Programs using system calls of UNIX operating system

vel 1 Programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, t, opendir, readdir

vel 2 Simulate UNIX commands like cp, ls, grep.

periment No. 3: Programs to demonstrate process creation and termination

vel 1: Program to demonstrate creating new processes and waiting for a process

vel 2: Program to demonstrate creation of zombie processes and orphan process

periment No. 4: Programs to demonstrate inter process communication using Pipe

vel 1: Programs to illustrate execution of two commands concurrently with a command pipe and mmunication between two unrelated processes

vel 2: Program to demonstrate inter process communication using mkfifo, open, read, write and close Is

periment No. 5: Programs to demonstrate inter process communication using message queues
vel 1: Program to create a message queue with read and write permissions and to write messages with ferent priority numbers
vel 2: Program to receive messages of different priorities from the message queue and display them

periment No. 6: Programs to demonstrate process synchronization using Semaphores
vel 1: **P**rogram that illustrates suspending and resuming processes using signals
vel 2: Program that illustrates access of shared memory using counting semaphore

periment No. 7: Programs to demonstrate the event of a deadlock and its avoidance
vel 1: Using POSIX Semaphores demonstrate the scenario where in deadlock happens due to incorrect e of semaphores
vel 2: Program to implement a solution to the Dining Philosopher problem using Monitors

rgeted Application & Tools that can be used:
rgeted Application:
al time Applications such as traffic management system, banking system, health care and many more stems where there are entities that use and manage the resources.
ftware Tools:
nux Environment

oject work/Assignment:

ch batch of students (self-selected batch mates) will identify projects and implement with the most table 2 or 3 antecedents.

xtbook(s):
Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 9th edition Wiley, 2013
Sumitabha Das, "Unix concept and Programming", McGraw Hill education, 4th Edition, 2015

ferences
Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, Linux in a Nutshell, O'Reilly Media, ;, 2009
Operating Systems | Internals and Design Principles | Ninth Edition | By Pearson Paperback – 1 arch 2018. by William Stallings (Author)

pics relevant to " **SKILL DEVELOPMENT** ": Linux OS commands and programming for **SKILL VELOPMENT** through **EXPERIENTIAL LEARNING** **techniques**.. This is attained through assessment mponent mentioned in the course handout.

urse Code: **E3123**	**urse Title: Search Engine timization**	**- P- C**	3-0-0-3
rsion No.	)		
urse Pre-requisites	sic knowledge of computer network		
ti-requisites	-		
urse Description	is course covers the basics of how a website is structured, how search engines work, at to look for, choosing competitive keywords, writing content for a website, code timization, link building, social media, and some advanced optimization techniques.		
urse Outcomes	on successful completion of the course the students shall be able to:		

	plain the significance of search engine and its working ilding an SEO-Friendly Site timize the SEO Foundations ferentiate On-page SEO vs Off-page SEO

urse Content:

odule 1	w Search gines ork	signment	eory	**. of Classes:10**

pics: Putting Search Engines in Context, Meeting the Search Engines, Recognizing and Reading Search sults, Getting Your Site in the Right Results, Knowing What Drives Search Results, Spam Issues: When Search gines Get Fooled.

odule 2	O Web Design	signment	eory	**. of Classes:10**

pics: The Basics of SEO Web Design, Building an SEO-Friendly Site, Making Your Page Search Engine-mpatible, Perfecting Navigation and Linking Techniques

odule 3	timizing the Foundations and Analyzing sults	signment	eory	**. of Classes:10**

pics: Server Issues: Why Your Server Matters, Using Redirects for SEO, implementing 301 Redirects, atching Your Backend: Content Management System Troubles, Solving SEO Roadblocks, Employing Site alytics, Tracking Behavior with Web Analytics

odule 4	-page SEO vs Off-page SEO	signment	se udy	**. of Classes:10**

pics: On-page SEO: Website Content, URL Structure, Pictures, Title Tags, Meta Tags, Headline Tags, Internal king. Off-page SEO: Who‟s Linking to You? How are they Linking to You? Using Social Media to Spread ntent, Using Email to Spread Content

rgeted Application & Tools that can be used:

rgeted Applications:

veloping applications focusing on search engine optimization

O Tools:

alytics

search

ordPress SEO

oject work/Assignment:

udents shall read a research article and develop a detailed SEO strategy for the article. The "strategy" nsists of two parts: what keywords to target; where to place the keywords in the article.

lect a webpage to optimize, and a search phrase to optimize the webpage for.

ggested List of Hands-on Activities:

xt Book

uce Clay, Susan Esparza, "Search Engine Optimization All-in-One For Dummies", John Wiley distributor, 2nd Edition, 2012

roduction to Search Engine Optimization, Getting Started With SEO to Achieve Business Goals, Accessed 3ook from https://www.hubspot.com/hs-fs/hub/53/file-13221845-pdf/docs/ebooks/introduction-to-seo-ook.pdf

ferences

c Enge, Stephan M. Spencer, Jessie Stricchiola, "The Art of SEO: Mastering Search Engine Optimization", Reilly Media [2015]

vid Amerland, "Google Semantic Search: Search Engine Optimization Techniques That get Your Company ore Traffic, Increase Brand Impact, and Amplify Your Online Presence", PEARSON Education, India [2014]

eb Resources and Research Articles links:

ernational Journal of Technology Marketing -
ps://www.inderscience.com/info/inarticletoc.php?jcode=ijtmkt&year=2012&vol=7&issue=3
, Search Engine Journal- https://www.searchenginejournal.com/

Course Code: CSE2059	**urse Title: MOBILE NETWORKING** **pe of Course: Integrated**		**- P-**	2-0-2-3
Version No.	)			
ourse Pre-requisites	-			
Anti-requisites	-			
Course Description	jective of this course is to make students understand basics of various techniques in bile Networks/Adhoc Networks and New technology of Wireless Broadband Networks			
Course Objective	e objective of the course is to familiarize the learners with the concepts of **MOBILE TWORKING** and attain **Skill Development** through **Experiential Learning** techniques.			
Course Out Comes	**successful completion of the course the students shall be able to:** Understand basics of Routing and protocols in Adhoc and Sensor Networks. Learn Wireless Broadband Networks Technology Overview, Platforms and Standards. Learn management, testing and troubleshooting in Wireless Broadband Networks working nciples of wireless LAN, its standards. Learn latest wireless networks.			
urse Content:				

Module 1	HOC NETWORKS	iz	se studies / Case let	**8 Sessions**

pics:
aracteristics and Applications of Ad hoc Networks, Routing – Need for routing and routing ssifications, Table Driven Routing Protocols, Source Initiated On-Demand Routing Protocols,, Hybrid Protocols

ione Routing, Fisheye Routing, LANMAR for MANET with group mobility, Location Added uting, Distance Routing Effects, Microdiscovery and Power Aware Routing.				
Module 2	NSOR NETWORKS	iz	ase studies / Case let	**8 Sessions**
pics: reless Sensor Networks, DARPA Efforts, Classification, Fundamentals of MAC, Flat routing – Directed Diffusion, N, COGUR, Hierarchical Routing, Cluster base routing, Scalable Coordination, LEACH, TEEN, APTEEN and apting to the dynamic nature of Wireless Sensor Networks.				
Module 3	RELESS BROADBAND TWORKS TECHNOLOGY	iz	se studies / Case let	**8 Sessions**
pics: erview, Platforms and Standards reless broadband fundamentals and Fixed Wireless Broadband Systems, Platforms- Enhanced Copper, Fibre tic and HFC, 3G Cellular, Satellites, ATM and Relay Technologies, HiperLAN2 Standard, Global 3G CDMA ndard, CDMA Harmonization G3G Proposal for Protocol Layers.				
Module 4	NAGING WIRELESS TWORKS AND TESTING	iz	se studies / Case let	**Sessions**
naging Wireless Broadband Operations Management of LMDS Systems and their Application, Principles of erations Management, LMDS Versus Other Access technologies, Applications, Testing Wireless Satellite tworks and Fixed Wireless Broadband Networks.				
Module 5	VANCED WIRELESS TWORKS	iz	se studies / se let	**Sessions**
reless. Broadband Network Applications: Teleservices Model and Adaptive QoS Parameters, Modeling of reless. Broadband Applications, Multicomponent Model, Residential High speed Internet Wireless Broadband ellite Systems, Next Generation Wireless Broadband Networks – 3G, Harmonized 3G, 3G CDMA, Smart Phones d 3G Evolution.				

t of Laboratory Tasks:

Test the different sections of mobile phone. (such as ringer section, dialer section, receiver section and nsmitter section).

Perform the process of call connection and call release of cellular Mobile system.

Transfer an image, audio and video file using Bluetooth protocol with varying distance between two vices and analyze the performance.

Configure Wi-Fi setting in mobile devices using mobile tethering to connect two devices such as mobile one to mobile phone, mobile phone to laptop.

Apply RFID technology for real life applications using RFID kit.

Establish seamless wireless connectivity using multiple access point

rgeted Application & Tools that can be used

ATLAB and Simulink

Project work/Assignment:

signment:

xt Book

. Joh R. Vacca, "Wireless Broadband Networks Handbook 3G, LMDS and Wireless Internet" Tata McGraw-Hill, 01 (Unit III Chapter – 1, 2, 5; Unit IV Chapter 22, 23, 24, Unit V Chapter 25, 26 and 28)

. D.P. Agrawal and Qing-An zeng, "Introduction to Wireless and Mobile Systems" Thomson Learning, 2003. [Unit I, apter 13.1 to 13.7.7, Unit 2 13.7.8 to 13.9]

ferences

. Martyn Mallick, Mobile and Wireless Design Essentials, Wiley, 2003.

. Kavesh Pahlavan and Prashant Krishnamurty - “Principles of Wireless Networks – A unified Approach, Pearson ucation, 2002.

book link R1. https://www.youtube.com/watch?v=H7tGiGjL9bA

book link R2. https://nptel.ac.in/courses/106106167

ps://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&sit ehost-live

ps://nptel.ac.in/courses/106102064

pics relevant to “SKILL DEVELOPMET”: Wireless and Cellular networks for **Skill Development** through **beriential Learning techniques**. This is attained through assessment component mentioned in course handout.

urse Code: **E218**	**urse Title: Human Computer Interaction** **pe of Course: Theory Only**	**T-P- C**	3	0	)	3
rsion No.	)					
urse Pre-quisites	**sic knowledge of HTML and web design**					
ti-quisites						
urse scription	e Course is intended to introduce students about the basic concepts of human-computer eraction. It will cover the theory and methods that exist in the field. Human-computer eraction is an interdisciplinary field that integrates theories and methodologies from computer ence, cognitive psychology, design, and many other areas. It stresses the importance of good erfaces and the relationship of interface design to effective human interaction with computers. helps in categorizing the interfaces based on the processes, methods and programming used. It cuses on applications of emerging fields in human computer interaction					
urse jective	e objective of the course is **SKILL DEVELOPMENT** of students by using **PROBLEM SOLVING ETHODOLOGIES**					
urse Out mes	successful completion of the course the students shall be able to: Identify the factors influencing user interfaces; **[Knowledge]** Apply guidelines, principles, theories and methodologies for designing interfaces; **[Application]** Select user interfaces based on interface design evaluation. **[Comprehension]** Identify the applications of emerging fields in human computer interaction; **[Comprehension]**					
urse ntent:						
odule 1	**roduction to HCI**	signment	owledge, izzes	**0 ssi ns**		
roduction to HCI – Importance of HCI - Human Perception - Input output channels, Human memory, Thinking: asoning and problem solving, Emotion, Psychology and the design of interactive systems – Cognition – gnitive frameworks – Models of interaction, Frameworks and HCI – Ergonomics – Universal ability.						

odule 2	**erface design**	signment	plication, izzes	**0 ssi ns**
od and Bad design – Interaction design – Guidelines – Principles – Theories – The process of design – ototyping and Construction - Conceptual design – Physical design – The four pillars of design – Development ethodologies – Participatory design – Scenarios development – Social impact statement for early design view – Legal issues.				
odule 3	**aluating interface design**	rm per/Assignment	mprehension, izzes	**3 ssi ns**
aluating interface design **–** Evaluation, Goals of evaluation, Expert Reviews, Usability testing and Laboratories, rvey Instruments, Acceptance Tests, evaluating during Active Use, Controlled Psychologically Oriented periments, Choosing an evaluation method, Natural Language in mputing				
odule 4	**ormation esentation**	rm per/Assignment	mprehension, izzes	**3 ssi ns**
ormation presentation – Data type by task taxonomy, Challenges for Information Visualization – Groupware Goals of collaboration and participation, Asynchronous distributed interfaces, Synchronous distributed erfaces, Face to Face interfaces - Speech and auditory interfaces – Multi modal interaction - Design for ersity – Graphical user interfaces – The web mobile vices.				

rgeted Application & Tools that can be used:

design in web applications

signment:

se study – "User Interface designing" is a lab based course in presidency university. In User interface designing students need to develop User Interfaces for web based project by following all the guidelines and principles designing interfaces. The evaluation of the interfaces will be done based on interface satisfying all the rules, nciples and guidelines of designing interfaces. If the project is unable to satisfy any one of the guidelines or nciples it will be rejected.

sume that you are a student registered for User Interface designing lab course. Suggest the Guidelines which u will follow to make your project successful and mention why those Guidelines are to be followed.

xt Book

n Shneiderman and Catherine Plaisant, *"Designing the User Interface: Strategies for Effective Human-mputer Interaction", 6th Edition,* Pearson Addison Wesley, 2016.

A. et al. *"Human-Computer Interaction", 3rd Edition, Pearson* Prentice Hall, 2004.

ferences

. Yvonne Rogers, Helen sharp, Jenny Preece, "Interaction Design: Beyond Human Computer Interaction", 5th ition, Wiley, 2019.

. The Essentials of Interaction Design, Fourth Edition by Cooper, Reimann, Cronin, & Noessel (2014).

Resources

TEL course –

man Computer Interaction https://nptel.ac.in/courses/106103115

CI Interactions https://onlinecourses.nptel.ac.in/noc19_cs86/preview
pics relevant to the development of SKILLS: UI Design, HTML

urse Code: **E3185**	**urse Title:** /UX Design **pe of Course: Theory**	**P- T-**		)	**0**	**3**
rsion No.						
urse Pre-requisites	L					
ti-requisites	L					
urse Description	is course introduces students to understand to inculcate the knowledge on user-ntered design, graphic design on screens with various wire framing techniques d various design tools.					
urse Outcomes	successful completion of this course the students shall be able to: pply the concepts of UI and UX for graphical user interface design and velopment. nthesize UI/UX design for applications alyze the high-quality professional documents and ifacts related to the design process. derstand the basic Prototyping software in the various UI/UX Design tools signing with user centered design					
urse Content:						

odule 1	**troduction to The UI**	signment		**08 Classes**

pics:

hat is User Interface Design (UI) -The Relationship Between UI and UX , Roles in UI/UX, A Brief storical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, mplate vs Content, Formal Elements of Interface Design, Active Elements of Interface Design, mposing the Elements of Interface Design, UI Design Process, Visual Communication design mponent in Interface Design.

odule 2	**troduction to The UX**	signment		**10 Classes**

pics:

Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the perience Elements of user Experience, Visual Design Principles, Functional Layout, Interaction design, roduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design.

odule 3	UI/ UX Design ols	signment		**10 Classes**

pics:

User Study- Interviews, writing personas: user and device personas, User Context, Building Low delity Wireframe and High-Fidelity Polished Wireframe Using wireframing Tools, Creating the rking Prototype using Prototyping tools, Sharing and Exporting Design.

odule-4	sual Design and UI ototyping	signment		12 Classes

pics:

ndamentals of Visual Design, Color theory, typography, and layout, Creating visually appealing erfaces, UI Prototyping Tools, Rapid prototyping techniques. Mobile-First Design :Design nsiderations for mobile devices, Responsive web design principles Adaptive and Responsive ototyping, Building prototypes for various screen sizes, Testing on multiple devices

oject work/Assignment:

signment 1 on (Module 1 and Module 2)
signment 2 on (Module 3 and Module 4)

EFERENCE MATERIALS:

EXTBOOKS

Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). ıss Unger and Carolyn Chandler. New Riders Publishing, USA, 2012.

e Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition Jesse mes Garrett, Pearson Education. 2011.

EFERENCES

e Essential Guide to User Interface Design: An Introduction to GUI Design Principles and chniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007.

e UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha Pyla, Elsevier, 2012

URNALS/MAGAZINES

IEEE Transactions on UI-UX design using user centred design (UCD) method.
https://ieeexplore.ieee.org/abstract/document/9740997

EE Transactions on the Effect of UI/UX Design on User Satisfaction in line Art Gallery
https://ieeexplore.ieee.org/document/9609764

RRUS Journal of of Engineering Ui/UX design web-based learning application using design thinking ethod
https://sainsmat.org/index.php/jetech/article/view/532

VAYAM/NPTEL/MOOCs:

ayam Nptel – User Interface Design – IIT orkee https://onlinecourses.nptel.ac.in/noc21_ar05/preview

Coursera - Introduction to User Experience Principles and Processes ps://www.coursera.org/learn/introtoux-principles-and-ocesses?specialization=michiganux&utm_medium=institutions&utm_source=umich&utm_content=s&utm_campaign=adwords-ux-introtoux-principles-and-ocesses&utm_term=user%20experience%20design%20course&gad_source=1&gclid=

Course Code: LAW1007	Course Title: Indian Constitution and Professional Ethics for Engineers Type of Course: Theory	L-T-P-C	1			0
Version No.						
Course Prerequisites						
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce the students to the theory, concepts and practice of Constitution of India which is the law of the land. Further, the course aims at acquainting the students with basic approaches and methodologies to analyse and decide on the ethical dilemma in the field of engineering. The course is both conceptual and analytical. comprehend the conceptual and legal framework of Constitution of India. Ethics and values are very beautifully weaved into the tapestry of the Indian Constitution. Therefore, the course provides an introduction to the essential theoretical basis of engineering ethics and its application through a range of industry rele responsibility for safety and risks, responsibility of employers, rights of engineers etc.					
Course Objective	To introduce the students to the conceptual framework of Constitution of India and engineering ethics. To enhance the practical knowledge on responsibility of engineering professionals as citizens of India. To acquaint the student with the relevant contemporary issues surrounding constitutional values and professional ethics. To orient the students about the ethical concepts and frameworks enabling them to identify the codes and moral values relevant to the professional world.					
Course Outcomes	**On successful completion of this course the students shall be able:** To understand foundational Indian constitutional law concepts and values. To identify the different pillars of democracy and their functions. society and the employer.					

Module 1	**Introduction to the Indian Constitution**	Knowledge	Quiz	**5 Classes**
Course Content:				

Meaning of Constitution, Constitutional Law and Constitutionalism, India before and after adoption of Constitution, Preamble, Salient Features, Concept and Relevance of Fundamental Rights, Fundamental Duties and Directive Principles of State Policy in brief.				
Module 2	**Pillars of Democracy: Legislature Executive and Judiciary**	Knowledge	Short Essay	**5 Classes**
Federalism, Union and State Executive, Parliament and State Legislature, Union and State Judiciary, Amendment of the Constitution				
Module 3	**Engineering Ethics**	Analysis	Presentation on conceptual understanding and problem based scenarios	**5 Classes**
Scope & Aims of Engineering & Professional Ethics, Code of Ethics as defined in the website of Institution of Engineers (India), Profession, Professionalism, and Professional Responsibility, Conflicts of Interest, Engineering Standards, the impediments to Responsibility, IPRs (Intellectual Property Rights), Necessity of responsible experimentation ,Case Studies on Challenger, Chernobyl, and Boeing.				
Project work/Assignment: Quiz on Fundamental Rights, Short Essay on Judicial Activism in India, Problem based assignments of engineering ethics.				
Resources: M.P. Jain, Indian Constitutional Law, 8th Edition, Lexis Nexis, 2022. M.W.Martin and R. Schinzinger, Ethics in Engineering, 4thEdition, McGraw Hill Education, 2015.				

References:

Durga Das Basu, Commentary on the Constitution of India, 9th Edition, Lexis Nexis, 2019.
Rowan, John, and Zinaich Jr., Ethics for the Professions, Wadsworth, 2003.
R.C. Sekhar, Ethical Choices in Business, Response Books, Sage Publications, 1997.

<table>
<tr><td rowspan="2">Course Code:
CHE1018</td><td colspan="2" rowspan="2">Course Title: Environmental Science

Type of Course: School Core- Theory and Lab</td><td>L- T- P- C</td><td>1</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>Contact hours</td><td>1</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Course Description</td><td colspan="7">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</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of “Environmental Science” and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">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</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td>Humans and the Environment</td><td>Assignment</td><td colspan="2">Data Collection</td><td colspan="3">01 class</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td>Module 2</td><td>Natural Resources and Sustainable Development</td><td>Assignment</td><td colspan="2"></td><td colspan="3">03 Classes</td></tr>
</table>

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:

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

Course Code: IST2502	Course Title: **Fundamentals of Natural Language Processing**	L-T-P-C	3-0-0-3
Version No.	1.2		
Course Pre-requisites	**[1] Applied Statistics (MAT1003)**		
Anti-requisites	**NIL**		
Course Description	**The purpose of this course is to introduce students to the science of natural language processing (NLP). NLP is the science of extracting information from unstructured text. It is basically how we can teach machines to understand human languages and extract meaning from text. The course will cover fundamentals of NLP, such as word and text representations, part-of-speech tagging, and constituency parsing. In addition to this, students will also get an introduction to different NLP applications such as Sentiment Analysis, Lexical Resource Creation, and Machine Translation.**		

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:** 1. **Understand** the fundamental concepts of Natural Language Processing [Comprehension] 2. Create and **use** word embeddings [Application] 3. Read corpora to train models and **use** them for different NLP tasks. [Application] 4. **Understand** sequence to sequence modeling as used in machine translation. [Comprehension]			
Course Content:				
Module 1	**Introduction**	Quizzes		**6 Classes**
Topics: Introduction. History. Text Analytics. Various tasks in NLP. Sentence boundary Detection. Edit distance. Introduction to word embeddings, Part-of-Speech tagging, chunking, parsing, machine translation.				
Module 2	**Word and Text Representations**	Quizzes and Assignment	Learning Text Representations for Classification	**8 Classes**
Topics: Naïve Bayes classification. Vector semantics and embeddings. Neural Language Models. Text representations and classification using features, bag-of-words, and embeddings.				
Module 3	**PoS Tagging, NER Tagging, Constituency Parsing**	Quizzes and Assignment	Building a Part-of-Speech Tagger with the given data	**9 Classes**
Topics: Part-of-Speech Tagging – using NLTK and spacy. Building a PoS Tagger using existing data and Hidden Markov Model. Named Entity Recognition. Relationship between NER tagging and PoS tagging. Constituents and Constituency Parsing.				
Module 4	**NLP Applications**	Quizzes		**9 Classes**
Topics: Lexical Resource Creation. Sentiment Analysis. Machine Translation. Word Sense Disambiguation and WordNet. Question Answering.				
Targeted Application & Tools that can be used: 1. **Python Libraries and Software (Eg. NLTK, Spacy, Google Colab, etc.)** 2. **Java (Stanford CoreNLP)** 3. **NLP Resources (WordNet, VADER, Stanford NER Tagger, etc.)** 4. **ML Libraries (Weka, Scikit-Learn, Numpy, etc.)**				
Project work/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.				
Textbook(s):				

Daniel Jurafsky, and James Martin. “*Speech and Language Processing*”, 3rd edition draft, 2021 **Link:** https://web.stanford.edu/~jurafsky/slp3/
References: Chris Manning and Hinrich Schutze, “*Foundations of Statistical Natural Language Processing*”, 1st Edition, MIT Press. 1999. **Link:** https://nlp.stanford.edu/fsnlp/
Topics related to development of “EMPLOYABILITY”: Assignment implementations in software, batch wise presentations.

urse Code: T2503	urse Title: Deep Learning Techniques pe of Course: Program Core eory	T-P-C	3-0-0-3
rsion No.	)		
urse Pre-requisites	• Data Mining and Machine Learning fundamentals • Basic working knowledge of Statistics and Probability • Familiarity with programming languages and hands on coding		
ti-requisites	IL		
urse 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 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.		
urse Objective	The objective of the course is to familiarize the learners with the concepts of **Deep Learning Techniques** and attain **Skill Development** through **Participative Learning** techniques.		
urse Out Comes	On successful completion of the course the students shall be able to: 1) Apply basic concepts of Deep Learning to develop feed forward models(Knowledge) 2) Apply Supervised and Unsupervised Deep Learning techniques to build effective models for prediction or classification tasks(Comprehension)		

	3) Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains of Machine Learning and Machine vision. (Comprehension) 4) Analyze performance of implemented Deep Neural models(Application)
urse Content:	

odule 1	Introduction to Deep Learning	signment	ogramming	**0 Sessions**

Topics:

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.

odule 2	proving Deep Neural Networks	signment	ogramming	**8 Sessions**

Topics:

Initialization, Overfitting and Underfitting, Regularization and Optimization, Dropout, Batch Normalization, Artificial Neural network.

odule 3	ep Supervised Learning Models	signment	ogramming	**0 Sessions**

Topics:

Convolutional neural network, Deep learning in Sequential Data, RNN & LSTM, GRU, Deep Models in Pattern Recognition.

odule 4	ep Unsupervised Learning	signment	ogramming	**0 Sessions**

pics:

Basics of Deep unsupervised learning, Auto encoders, Boltzman Machine, Restricted Boltzmann Machine, Kohonen Networks, Deep Belief Network, Hopfield Network,Generative Adversarial Networks, Probabilistic Neural Network.

rgeted Application & Tools that can be used: Google collab

ofessionally used software : Anaconda, Spider.

xt Book

T1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017

References

R 1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Inderscience, 2nd Edition. 2013

R2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4, Academic Press, 2015

R3. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall

Series in Artificial Intelligence, 2013 R4. Bishop, C. M. Neural Networks for Pattern Recognition, Oxford University Press, 2008. Weblinks: W1: pu.informatics.global, **https://sm-nitk.vlabs.ac.in/**
Topics relevant to "SKILL DEVELOPMENT": Real time Data Analysis using Deep learning. Naming and coding convention for Data Science Project Development using ML/DL for **Skill Development** through **Participative Learning** techniques. This is attained through the **Presentation** as mentioned in the assessment component.

Course Code: **IST2504**	**Course Title: Reinforcement Learning** Techniques **Type of Course: 1] Program Core**	**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	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)				
Targeted Application & Tools that can be used :				

2. 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. 3. 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 2. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT press, Second Edition, 2018. 3. Sudharshan Ravichandiran, "Deep Reinforcement Learning with Python", Packt Publishers, Second Edition, 2020
References 2. Laurra Graesser and Wan Loon Keng, "Foundations of Deep Reinforcement Learning", Pearson, 2022 3. https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/

Course Code: DES1146	**Course Title:** Introduction to Design Thinking **Type of Course:** Theory		**L-T-P- C**	1	0	0	1
Version No.		1.0					
Course Pre-isites		NIL					
Anti-requisites		NIL					
Course ription		The course aims to introduce students to the fundamental principles processes of Design Thinking and will learn to apply Design Thinking iodologies to real-world challenges. The course emphasizes empathy, tivity, and collaboration, equipping students with essential skills for essful engineering practice.					
Course ctive		This course is designed to develop and familiarize the learners with the epts of creating thinking and attain Entrepreneurship by using cipative Learning techniques.					
Course omes		On successful completion of the course the students shall be able to: Understand the concept and importance of Design Thinking. Differentiate between traditional problem-solving and Design king. Identify the core stages of the Design Thinking process.					

Course Content:		All assignments and projects must be developed using the reference erials available from the PU e-resource database – JSTOR, EBSCO, ry OPAC, NPTEL Videos, etc.			
Module 1	Introduction to Design king	Visual journal, book of ys, context-specific nment/project		Visual output generation, sual Journal and narrative lopment.	**3 ırs**

Topic
Definition and Introduction to Design Thinking
Understand the Design Thinking Process

Module 2	Design Thinking in on	Visual journal, book of ys, context-specific nment/project		Visual output generation, sual journal narrative development.	**12 ırs**

Topics:
Introduction to the steps of Design Thinking Process
Understand use cases of Design thinking
Design Thinking and Research Tools pertaining to Consumer Tech. , Home Tech. , Personal Tech. , Auto . or Extended Reality.

Targeted Application & Tools that can be used:
Design ideation tools like Miro , SCAMPER etc.
Research Tools for Human Centric Design using forecasting tools like WGSN
Feedback tools like Google Forms , etc.
Expert Lectures

Text Book
Thinking Design by S Balaram. New Delhi [India]: Sage Publications Pvt. Ltd. 2010. eBook., Database: eBook ction (EBSCOhost)
https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=6&sid=18ab1f43-1f92-4d02--a9c06dc06d8c%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=354920&db=nlebk

References
Design Thinking by Clarke, Rachel Ivy. Series: Library Futures, Vol. 4. Chicago: ALA Neal-Schuman. 2020. ok., Database: eBook Collection (EBSCOhost)
https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=4&sid=c80a7d79-eda4-4b7e--afafe437962b%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=2433506&db=nlebk
The Pocket Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative s, and Design Effective Solutions by Bruce Hanington; Bella Martin. Minneapolis: Rockport Publishers. '. eBook., Database: eBook Collection (EBSCOhost)
https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=11&sid=f086b8c2-260e-4caa--d732c21a7724%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=1638693&db=nlebk
What Is Design Thinking and Why Is It Important? By Rim Razzouk and Valerie Shute - Review of ational Research, Vol. 82, No. 3 (September 2012), pp. 330-348 (19 pages), Published by: American ational Research Association
https://puniversity.informaticsglobal.com:2054/stable/23260048?Search=yes&resultItemClick=true&se Text=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so% l&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-ult%3Acb1be24976e25734cb5fc13a8af6fdfb&seq=1#metadata_info_tab_contents

Abductive Thinking and Sensemaking: The Drivers of Design Synthesis by John Kolko, Design Issues, Vol.
Jo. 1 (Winter, 2010), pp. 15-28 (14 pages), Published by: The MIT Press
https://puniversity.informaticsglobal.com:2054/stable/20627839?Search=yes&resultItemClick=true&se
Text=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%
l&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-
ult%3A0b89336ea274d63c010536b01316d7bb&seq=1#metadata_info_tab_contents
Designerly Ways of Knowing: Design Discipline versus Design Science by Nigel Cross, Design Issues, Vol.
Jo. 3 (Summer, 2001), pp. 49-55 (7 pages), Published by: The MIT Press
https://puniversity.informaticsglobal.com:2054/stable/1511801?Search=yes&resultItemClick=true&sear
xt=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3
&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-
ult%3A0d5b607b163f60876ca973ed90e22b1c&seq=1#metadata_info_tab_contents

<table>
<tr><td>Course Code:
CSE1508</td><td colspan="3">Course Title: Data Structures
Type of Course: Theory</td><td>L-T- P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="8"></td></tr>
<tr><td>Anti-requisites</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description</td><td colspan="8">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.</td></tr>
<tr><td>Course Objective</td><td colspan="8">The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques</td></tr>
<tr><td>Course Out Comes</td><td colspan="8">On successful completion of the course the students shall be able to:
CO1: Describe the concept of basic data structure, stacks, queues, and arrays and their operations. [Understand]
CO2: Utilize linked lists for real-time scenarios. [Apply]
CO3: Apply an appropriate non-linear data structure for a given scenario. [Apply]
CO4: Demonstrate different searching and sorting techniques. [Apply]</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1</td><td>Introduction to Data Structure and Linear Data Structure – Stacks and Queues</td><td>Assignment</td><td colspan="2">Program activity</td><td colspan="4">9 Hours</td></tr>
<tr><td colspan="9">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.</td></tr>
</table>

Module 2	Linear Data Structure-Linked List	Assignment	Program activity	12 Hours
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.				
Module 3	Non-linear Data Structures - Trees	Assignment	Program activity	12 Hours
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, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.				
Module 4	Non-linear Data Structures - Graphs and Hashing	Assignment	Program activity	6 Hours
Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure. Hashing: Introduction, Static Hashing, Dynamic Hashing				
Module 5	Searching & Sorting	Assignment	Program activity	6 Hours
Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.				
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 on Stack application – Evaluation of postfix Lab sheet -5 Level 1: Programming Exercises on Queues and its operations with conditions Level 2: - Lab sheet -6 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 -7 Level 1: Programming Exercises on Circular Linked list and its operations. Level 2: Programming Exercises on Circular Linked list and its operations with various positions Lab sheet -8 Level 1: Programming Exercises on factorial of a number Level 2: Programming the tower of Hanoi using recursion				

Lab sheet -9 Level 1: - Level 2: Programming the tower of Hanoi using recursion Lab sheet -10 Level 1: Programming Exercise on Doubly linked list and its operations Level 2: - Lab sheet -11 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 -12 Level 1: Program to Implement the Linear Search & Binary Search Level 2: Program to Estimate the Time complexity of Linear Search 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 Insertion Sort Lab sheet -14 (Beyond syllabus activity) Level 1: Program to Construct AVL Tree Level 2: Lab sheet -15 (Beyond syllabus activity) Level 1: Program to Construct RED BLACK Tree
Targeted Application & Tools that can be used Use of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.
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 Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018. T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
References R1 Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017. R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019. Web resources: For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview https://puniversity.informaticsglobal.com/login
Topics relevant to development of “Skill Development”: Linked list and stacks Topics relevant to development of “Environment and sustainability: Queues

Course Code: CSE1509	Course Title: Data Structures Lab Type of Course:Lab	L-T- P- C	0	0	4	2

Version No.	1.0			
Course Pre-requisites				
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 SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques			
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the concept of basic data structure, stacks, queues, and arrays and their operations. [Understand] CO2: Utilize linked lists for real-time scenarios. [Apply] CO3: Apply an appropriate non-linear data structure for a given scenario. [Apply] CO4: Demonstrate different searching and sorting techniques. [Apply]			
Course Content:				
Module 1	Introduction to Data Structure and Linear Data Structure – Stacks and Queues	Assignment	Program activity	9 Hours
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	12 Hours
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.				
Module 3	Non-linear Data Structures - Trees	Assignment	Program activity	12 Hours
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, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.				
Module 4	Non-linear Data Structures - Graphs and Hashing	Assignment	Program activity	6 Hours
Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure.				

<table>
<tr><td colspan="5">Hashing: Introduction, Static Hashing, Dynamic Hashing</td></tr>
<tr><td>Module 5</td><td>Searching & Sorting</td><td>Assignment</td><td>Program activity</td><td>6 Hours</td></tr>
<tr><td colspan="5">Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.</td></tr>
<tr><td colspan="5">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 on Stack application – Evaluation of postfix
Lab sheet -5
Level 1: Programming Exercises on Queues and its operations with conditions
Level 2: -
Lab sheet -6
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 -7
Level 1: Programming Exercises on Circular Linked list and its operations.
Level 2: Programming Exercises on Circular Linked list and its operations with various positions

Lab sheet -8
Level 1: Programming Exercises on factorial of a number
Level 2: Programming the tower of Hanoi using recursion
Lab sheet -9
Level 1: -
Level 2: Programming the tower of Hanoi using recursion
Lab sheet -10
Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -
Lab sheet -11
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 -12
Level 1: Program to Implement the Linear Search & Binary Search
Level 2: Program to Estimate the Time complexity of Linear Search
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 Insertion Sort</td></tr>
</table>

Lab sheet -14 (Beyond syllabus activity) Level 1: Program to Construct AVL Tree Level 2: Lab sheet -15 (Beyond syllabus activity) Level 1: Program to Construct RED BLACK Tree
Targeted Application & Tools that can be used Use of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.
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 Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018. T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
References R1 Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017. R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019. Web resources: For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview https://puniversity.informaticsglobal.com/login
Topics relevant to development of “Skill Development”: Linked list and stacks Topics relevant to development of “Environment and sustainability: Queues

Course Code: CSE1500	Course Title: Computational Thinking using Python Type of Course: Engineering Science Theory Integrated	L-T-P-C	2	0	0	2
Version No.		1.0				
Course Pre-requisites						
Anti-requisites		NIL				
Course Description		The course efficiently introduces fundamental ideas including conditionals, loops, functions, lists, strings, and tuples through some inspiring examples. It then discusses dynamic programming like handling exceptions and file usage. In terms of data structures, the course covers Python dictionaries, classes, and objects for constructing user-defined datatypes like linear and binary search.				

Course Object		The objective of the course is to familiarize the learners with the concepts of Computational Thinking using Python and attain Skill Development through Participative Learning techniques.			
Course Out Comes		On successful completion of the course the students shall be able to: Describe algorithmic solutions for basic computing issues.. (Understand) Explain data types and operators. (Understand) Demonstrate control structures and Functions. (Apply) Apply the data structures for the given data. (Apply) Demonstrate the file operations. (Apply)			
Course Content:					
Module 1	Computational Thinking And Problem Solving	Assignment		Programming	6 Sessions
	Topics: Fundamentals of Computing– Identification of Computational Problems Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi				
Module 2	Datatypes, Expressions, Statements	Assignment		Programming	6 Sessions
	Topics: Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.				
Module 3	Control flow, Functions, Strings	Assignment		Programming	6 Sessions
	Topics: Conditionals:Boolean values and operators, conditional (if), alternative (if else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.				
Module 4	Lists, Tuples, Dictionaries	Assignment		Programming	6 Sessions
	Topics: Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing- list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.				
Module 5	Files	Assignment		Programming	6 Sessions

	Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).
	Project work/Assignment:
	Assignment 1 on (Module 1 and Module 2) Assignment 2 on (Module 3 and Module 4 & 5)
	Text Book Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021 Eric Matthes, Python Crash Course,: A Hands-On, Project-Based Introduction to Programming, 3rd Edition, 2023
	References 1.Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016. 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017. Web Resources https://onlinecourses.nptel.ac.in/noc20_cs70/preview
	Topics relevant to development of "Employability": Data structures using python. Topics relevant to "PROFESSIONAL ETHICS": Naming and coding convention for simple programs using python.

Course Code: CSE1504	Course Title: Web Technology Type of Course: Program core Theory Only	L- T-P- C	2-0-0-2
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.		

<table>
<tr><td>Course Outcomes</td><td colspan="4">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)</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to XHTML</td><td>Quizzes and Assignments</td><td>Quizzes on various features of XHTML, simple applications</td><td>8 Sessions</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 2</td><td>Advanced CSS</td><td>Quizzes and assignments</td><td>Comprehension based Quizzes and assignments; Application of CSS in designing webpages</td><td>8 Sessions</td></tr>
<tr><td colspan="5">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</td></tr>
<tr><td>Module 3</td><td>Fundamentals of JavaScript</td><td>Quizzes and assignments</td><td>Application of JavaScript for dynamic web page designing</td><td>7 Sessions</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 4</td><td>PHP – Application Level</td><td>Quizzes and assignments</td><td>Application of PHP in web designing</td><td>7 Sessions</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Xampp web server to be used to demonstrate PHP.</td></tr>
<tr><td colspan="5">Project work/Assignment:</td></tr>
<tr><td colspan="5">Assignments are given after completion of each module which the student need to submit within the stipulated deadline.</td></tr>
<tr><td colspan="5">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)</td></tr>
</table>

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/

Course Code: CSE1505	Course Title: Web Technologies Lab Type of Course: Program core lab course		L-T- P-C	0	0	2	1
Version No.		1.0					
Course Pre-requisites		Database Management Systems-CSE3156					
Anti-requisites		NIL					
Course Description		This course highlights the 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 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. (Apply) CO2: Apply various constructs to enhance the appearance of a website. (Apply) CO3: Apply server-side scripting languages to develop a web page linked to a database. (Apply)					
Course Content:							
List of Laboratory Tasks: Experiment No. 1: Demonstration of XHTML features Level 1: Demonstration of various XHTML Tags (Level 1) Level 2: Design and develop static web pages for an online Book store (Level 2). Experiment No. 2: Application of CSS in web designing Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.							

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet. Experiment No. 3: Application of PHP in web designing. Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end. Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database. Experiment No. 4: Building a website. Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.
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): Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 9th Edition, 2016. 2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021. 3]CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022) 4]Deitel, Deitel, Goldberg,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.
Reference Book(s): 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. Additional web-based resources W1. W3schools.com W2. Developer.mozilla.org/en-US/docs/Learn W3. docs.microsoft.com W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking https://presiuniv.knimbus.com/user#/home
Topics related to development of "FOUNDATION": Web, WWW, Web browsers, Web servers, Internet. CSS, PHP. Designing the website for healthcare.
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 Code: MAT2011	Course Title: Numerical Computation Type of Course:1] School Core	L-T- P- C	3	0	0	3

Version No.		1.0		
Course Pre-requisites		Calculus, Linear Algebra, Differential Equations		
Anti-requisites		NIL		
Course Description		The course explores mathematical techniques used to approximate solutions to complex problems that are difficult to solve analytically, often utilizing computers to perform calculations, including methods for root finding, interpolation, numerical differentiation and integration, solving systems of linear equations, and approximating solutions to differential equations, with applications across various scientific and engineering fields. It focuses on understanding the theoretical basis behind these methods, their implementation in programming languages, and analyzing their accuracy and stability.		
Course Objective		The objective of the course is to equip students with understanding and ability to apply various numerical techniques to approximate solutions to complex mathematical problems that are difficult or impossible to solve analytically, particularly focusing on areas like solving systems of equations, finding roots of functions, interpolation, numerical differentiation, and integration, often utilizing computational tools to implement these methods.		
Course Out Comes		On successful completion of the course the students shall be able to: CO1 - Calculate errors induced in the values by truncation of a series expansion. CO2 - Demonstrate the applications of numerical methods to find the roots of polynomial equations and eigen values of real symmetric matrices. CO3 - Apply the knowledge of numerical methods in modelling of various physical and engineering phenomena. CO4 - Apply various numerical methods for solving linear Ordinary & Partial differential equations arising in engineering field.		
Course Content:				
Module 1	Solution of Linear Systems of Equation			(12 Classes)
Numerical Computation: Motivation and Objectives, Number Representation, Machine Precision, Round-of Error, Truncation Error, Random Number Generation. Solution of algebraic and transcendental equations: Various types of errors - Bisection method, Regula-Falsi method, Newton-Raphson method, Graffe's method - Bairstow's method - Newton's method for solving f(x,y) = 0 and g(x,y) = 0, secant method, Fixed point iteration method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method, Iterative methods of Gauss Jacobi and Gauss Seidel, Sufficient conditions for convergence - LU decomposition method, Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.				
Module 2	Interpolation and Approximation		Assignment	(8 Classes)
Interpolation with equal intervals, Newton's forward and backward difference formulae, Interpolation with unequal intervals, Lagrange's interpolation, Newton's divided difference interpolation, Cubic Splines, Difference operators and relations.				
Module 3	Numerical Differentiation and Integration			(10 Classes)
Numerical differentiation, Approximation of derivatives using interpolation polynomials, Numerical integration using Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule, Romberg's				

Method, Two point and three point Gaussian quadrature formulae, Evaluation of double integrals by Trapezoidal rule and Simpson's one-third rule			
Module 4	Initial & Boundary Value Problems for Ordinary & Partial Differential Equations	Assignment	(15 Classes)
Single step methods — Taylor's series method, Modified Euler's method, Fourth order Runge-Kutta method for solving first order equations, Multi step methods, Milne's and Adams, Bash forth predictor corrector methods for solving first order equations. Finite difference methods for solving second order, two-point linear boundary value problems, Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain, One-dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods, One-dimensional wave equation by explicit method.			
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: Python.			
Assignment:			
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.			
Text Book C.F.Gerald and P.O.Wheatley", Applied Numerical Analysis", McGraw-Hill, 1981. Cheneg and Kincaid, "Introduction to Numerical Computing", Tata McGraw-Hill, 1998.			
References: SRK Iyengar & RK Jain, Numerical Methods, New Age Internationals. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers. E-resources/ Web links: https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_135224 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_141727 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_217628 http://.ac.in/courses.php?disciplineID=111 http://www.class-central.com/subject/math(MOOCs) http://academicearth.org/ https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html https://www.scu.edu.au/study-at-scu/units/math1005/2022/			
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving. This is attained through the assessment component mentioned in course handout.			

Course Code: CSE2500	Course Title: Theory of Computation Type of Course: Theory Only	L- T-P- C	3	0	0	3
Version No.	2.0					

Course Pre-requisites				
Anti-requisites	NIL			
Course Description	The course deals with introduction of formal languages and the correspondence between language classes and the automata that recognize them. Topics include: Formal definitions of grammars and acceptors, Deterministic and Nondeterministic systems, Grammar ambiguity, finite state and push-down automata; normal forms; Turing machines and its relations with algorithms.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Theory of Computation as mentioned above and attain Skill Development through Problem Solving Methodologies.			
Course Outcomes	On successful completion of the course the students shall be able to: 1. Describe various components of Automata. (Knowledge) 2. Illustrate Finite Automata for the given Language. (Application) 3. Distinguish between Regular grammar and Context free grammar. (Comprehension) 4. Construct Push down Automata. (Application) 5. Construct Turing machine for a Language. (Application)			
Course Content:				
Module 1	Introduction to automata theory	Assignment	Problems on Strings and Language operations	6 classes
Topics: Introduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages & operations on languages, Representation of automata, Language recognizers, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs				
Module 2	Finite Automata	Assignment	Assignment Problems on DFA, NFA's	13 Sessions
Topics: Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages and DFA's, Regular Languages, NFA- Definition of a Nondeterministic Accepter, Languages and NFA's Why Non- determinism? Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.				
Module 3	Regular Expressions & Context Free Grammar	Assignment	Problems on RE, CFG, PT, PL and Ambiguity	12 Sessions
Topics: Formal Definition of a Regular Expression, Languages Associated with Regular Expressions, Languages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show some languages are not RLs, Closure Properties of Regular Context Free Grammars- Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and Derivation Trees, Ambiguity in Grammars and				

Languages: Ambiguous Grammars, Removing Ambiguity, Chomsky Normal Form, Gribiche Normal Form.				
Module 4	Push down Automata	Assignment	Problems on pushdown Automaton	08 Sessions
Topics: Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack Equivalence of PDA’s and CFG’s: From Grammars to Pushdown Automata.				
Module 5	Turing Machine	Assignment	Problems on Turning Machine	07 Sessions
Topics: Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing machine, Turing Machines as Transducers, Halting Programming Techniques for Turing Machines				
Targeted Application & Tools that can be used: Targeted Application: 1. Text Processing 2. Compilers 3. Text Editors 4. Robotics Applications 5. Artificial Intelligence Tools: 1. JFLAP (Java Formal Language and Automata Package) Software simulation tool. It’s interactive educational software written in Java to experiment topics in automata theory. 2. Turing machine Online simulators.				
Text Book(s): 1. Peter Linz, “An introduction to Formal Languages and Automata”, Jones and Bartlett Publications 6th Ed, 2018.				
Reference(s): 1. Aho, Ullman and Hopcroft, “Theory of Computation”, Pearson India 3rd Edition 2008. 2. Michael Sipser, “Theory of Computation”, Cengage India 3rd Ed, 2014. E-Resources NPTEL course – https://onlinecourses.nptel.ac.in/noc21_cs83/preview				

Course Code: CSE1510	Course Title: Database Management Systems Type of Course: Theory	L-T-P-C	3	0	0	3

Version No.				
Course Pre-requisites	Foundational understanding of data types, data structures, basic programming knowledge, familiarity with operating systems and file management. Basic knowledge of set theory, logic, and discrete mathematics to understand relational algebra and query formulation.			
Anti-requisites	NIL			
Course Description	This course introduces the foundational principles of database management systems, including data models, schemas, and architectures. This course provides a solid foundation on the relational model of data and the use of relational algebra. It develops skills in SQL for data definition, manipulation, and control, enabling students to construct and execute complex queries. The course also introduces the concept of object oriented and object relational databases and modern database technologies like NoSQL. The also course allows the students to gain insights into data storage structures and indexing strategies for optimizing query performance.			
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: Describe the fundamental elements of relational database management systems. [Understand] Examine databases using SQL query processing and Optimization. [Apply] Design simple database systems applying the normalization constraints and demonstrate the database transaction processing, recovery, and security. [Apply] Interpret the concept of advanced databases and its applications. [Apply]			
Course Content:				
Module 1	Introduction to Database Modelling and Relational Algebra (Understand)	Assignment	Problem Solving	10 Sessions
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 (Apply)	Assignment	Programming	11 Sessions

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 (Apply)	Assignment	Problem Solving	12 Sessions
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 (Apply)	Assignment	Case Study	12 Sessions
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.				
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.				
Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra. Programming: Implementation of any given scenario using MySQL.				
Text Books: T1. Elmasri R and Navathe S B, “Fundamentals of Database System”, Pearson Publication, 7th Edition, 2018. T2. RamaKrishna & Gehrke, “Database Management Systems” 3rd Edition, 2018, McGraw-Hill Education.				

T3. 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 R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw-Hill ,7th Edition, 2019. R2 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: CSE1511	Course Title: Database Management Systems Laboratory Type of Course: Lab	L-T-P-C	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Foundational understanding of data types, basic programming knowledge, operating systems and file management.					
Anti-requisites	NIL					
Course Description	The Database Management Systems (DBMS) Laboratory is designed to provide students with hands-on experience in database design, implementation, and management using SQL and database management tools such as MySQL. The lab complements theoretical concepts learned in database courses by allowing students to practice database creation, querying, and optimization techniques. The DBMS Lab enables students to develop industry-relevant skills in database management, preparing them for careers in software development, data engineering, and database administration.					
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: Demonstrate the database concepts, practice, and SQL queries. [Apply] Design and implement database schemas while applying normalization techniques to optimize structure. [Apply]] Develop and implement stored procedures, triggers, and views for automation and efficiency. [Apply] To Design and build database applications for real world problems. [Apply]					
Course Content:						
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]
1. 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]
2. 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]
3. 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]
4. 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]
5. 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]
6. 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]

7. To study and implement Functions, and Triggers in MySQL DB.
Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database.
Level 2: Determine the requirement and construct Functions and Triggers. [Supply chain Database]

Labsheet-6 [4 Practical Sessions]
Experiment No. 8: [2 Sessions]
8. To implement the concept of forms and reports.
Level 1: Implement the concept of forms and reports.
Level 2: Examine the schema relationship.

Experiment No. 9: [2 Sessions]
9. Create the database using the given schema. (Flight Management)
Level 1: Implement a relational database based on the provided schema for the Flight Management system, including the creation of tables, relationships, and constraints.
Level 2: Demonstrate schema relationships by defining primary and foreign keys to ensure data integrity within the Flight Management database.

Labsheet-7 [4 Practical Sessions]
Experiment No. 10: [2 Sessions]
10. Create the database using the given schema. (Company database)
Level 1: Implement the database schema by defining tables, relationships, and constraints according to the given Company Database schema.
Level 2: Demonstrate the schema's relationships and data integrity by creating and linking tables as per the specified requirements.
Experiment No. 11: [2 Sessions]
11. Create the database using the given schema. (Student Library)
Level 1: Implement forms and reports based on the provided Student Library database schema, ensuring effective data entry and reporting mechanisms.
Level 2: Demonstrate the schema relationships within the Student Library database, demonstrating how these relationships influence the creation and functionality of forms and reports.

Labsheet-8 [1 Sessions]
12. 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.

Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.

Programming: Implementation of any given scenario using MySQL.
Text Books: T1. Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018. T2. RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education. T3. 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 R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019. R2 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: CSE2501	Course Title: Computer Organization and Architecture Type of Course: Program Core, Theory based		L- T-P-C	3	0	0	3
Version No.		2.0					
Course Pre-requisites		CSE2015 - 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: Describe the basic components of a computer and their interconnections. [Remember] 2] Explain Instruction Set Architecture and Memory Unit [Understand] 3] Apply appropriate techniques to carry out selected arithmetic operations [Apply]					

		4] Explain the organization of memory and processor sub-system [Understand]			
Course Content:					
Module 1	Basic Structure of computers	Assignment	Data Analysis task		12 Sessions
	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 Sessions
	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 Sessions
	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 Sessions
	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				
	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): Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Sixth Edition, McGraw-Hill Higher Education, 2023 reprint. William Stallings, “Computer Organization & Architecture – Designing for Performance”, 11th Edition, Pearson Education Inc., 2019.
	References 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 3. 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.

Course Code: CSE1512	Course Title: Analysis of Algorithms Type of Course: Theory	L- T-P-C	3	1	0	4
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	Nil					
Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. This course discusses the classic approaches for algorithm design such as Divide and Conquer, Dynamic Programming, Greedy method. This course also describes other basic strategies searching solution space. The core concepts of analyzing algorithms and classifying them into various complexity classes is covered in the end.					
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. Compute efficiency of a given algorithm.[Apply] 2. Apply divide and conquer technique for searching and sorting Problems.[Apply] 3. Apply the Dynamic Programming technique for a given problem. [Apply] 4. Apply greedy technique for solving a Problem.[Apply] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Apply]					

<table>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction</td><td>Assignment</td><td>Simulation/Data Analysis</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Introduction, Asymptotic Notations and its properties, Best case, worst case and average case- Sequential search, Sorting; Mathematical analysis for Recursive and Non-recursive algorithms: Substitution method and Master’s Theorem.</td></tr>
<tr><td>Module 2</td><td>Divide-and-conquer</td><td>Assignment</td><td>Simulation/Data Analysis</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Introduction. Insertion Sort; Merge sort, Quick sort, Binary search.</td></tr>
<tr><td>Module 3</td><td>Dynamic programming</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Introduction with examples, Principles of Memoization, 0-1 Knapsack Problem, Bellman-Ford algorithm, Floyd-Warshall’s Algorithms. Chain Matrix Multiplication.</td></tr>
<tr><td>Module 4</td><td>Greedy technique</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>09 Sessions</td></tr>
<tr><td colspan="5">Introduction, Fractional Knapsack Problem, Minimal Spanning Tree: Prim’s Algorithm and Kruskal’s Algorithm, Single-source Shortest Path: Dijkstra’s Algorithm</td></tr>
<tr><td>Module 5</td><td>Complexity Classes</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Complexity Classes- P,NP- NP Hard and NP Complete - Boolean Satisfiability Problem (SAT). Branch and Bound: Knapsack problem; Backtracking, - N-Queens problem.</td></tr>
<tr><td colspan="5">Text Book
Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd edition, Pearson Education, 2018.
Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 4th edition, MIT Press, 2022.</td></tr>
<tr><td colspan="5">References
J. Kleinberg and E. Tardos, “Algorithm Design”, Addison-Wesley, 2005.
Tim Roughgarden, “Algorithms Illuminated” (books 1 through 3), “Operating Systems Design and Implementation”, Soundlikeyourself Publishing, 2017-2019.
AV Aho, J Hopcroft, JD Ullman, “The Design and Analysis of Algorithms”, Addison-Wesley, 1974.
Donald E. Knuth, “The Art of Computer Programming”, Volumes 1and 3 Pearson.

Web-Resources
NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
Coursera: Analysis of Algorithms by Princeton University
Algorithms Specialization in Coursera by Stanford University(Group of 4 courses).
Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University</td></tr>
<tr><td colspan="5">Topics relevant to “SKILL DEVELOPMENT”: knapsack, prim’s, kruskal’s algorithm, quick sort, binary search for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</td></tr>
</table>

Course Code: CSE1513	Course Title: Analysis of Algorithms Laboratory Type of Course: Integrated	L- T-P-C	0	0	2	1
Version No.	1					
Course Pre-requisites	CSE2001 - Data Structures and Algorithms.					
Anti-requisites	NIL					
Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. This course discusses the classic approaches for algorithm design such as Divide and Conquer, Dynamic Programming, Greedy method. This course also describes other basic strategies searching solution space. The core concepts of analyzing algorithms and classifying them into various complexity classes is covered in the end.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Analysis of Algorithms and attain Skill Development through Experiential Learning Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Compute efficiency of a given algorithm. [Applying] 2. Apply divide and conquer technique for searching and sorting Problems.[Applying] 3. Apply the Dynamic Programming technique for a given problem. [Applying] 4. Apply greedy technique for solving a Problem.[Applying] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Applying]					
Course Content						
Module 1	Introduction					3 Sessions
Measuring running time of an algorithm, Compare running time of algorithms, Implement sorting algorithms such as bubble sort, selection sort						
Module 2	Divide-and-conquer					3 Sessions
Compare searching algorithms: Linear Search, Binary Search; Compare Sorting algorithms: Insertion Sort, Merge Sort, QuickSort.						
Module 3	Dynamic programming					3 Sessions
Introduction and memorization: Factorial; Coin Change Problem ; Floyd-Warshall’s Algorithm.						
Module 4	Greedy technique					3 Sessions
Fractional Knapsack Problem; Minimal Spanning Tree Algorithms-Prim’s Algorithm, Kruskal’s algorithm						
Module 5	Complexity Classes					3 Sessions
Branch and Bound: Knapsack problem; Backtracking, - N-Queens problem.						

	List of Laboratory Tasks: 1. Measuring running time of an algorithm Objective: To experimentally determine the running time of basic algorithms for input size n=10, 100, 1000, etc. by taking difference of starting time and ending time. 2. Compare running time of algorithms Objective: To execute two algorithms to solve the same problem, and to comparatively evaluate the better algorithm for large values of N. 3. Implement sorting algorithms such as bubble sort, selection sort Objective: To implement comparison based sorting strategies. 4. Compare searching algorithms Objective: To implement two searching strategies and compare their performance. 5. Compare Sorting algorithms Objective: To implement searching strategies that follow top down design approach(Insertion sort, merge sort). 6. Quick Sort Objective: To demonstrate Quick sort and its variants, and their impact on running time. 7. Dynamic Programming Objective: To demonstrate Dynamic Programming approach with the help of Factorial algorithm. 8. Coin Change Problem Objective: To implement an efficient algorithm for the Coin Change problem. 9. Floyd-Warshall's Algorithm Objective: To demonstrate how dynamic programming is used with the help of Floyd-Warshall's algorithm. 10. Fractional Knapsack Problem Objective: To demonstrate how greedy method can be used to solve the Fractional Knapsack Problem. 11. Minimal Spanning Tree Algorithm Objective: To implement greedy strategy to solve the Minimal Spanning Tree problem using Prim's Algorithm. 12. Kruskal's Minimal Spanning Tree Algorithm Objective: To implement greedy strategies to solve the Minimal Spanning Tree problem using Kruskal's Algorithm. 13. Knapsack Problem Objective: To implement Knapsack problem using branch and bound technique. 14. N-Queen's Problem Objective: To demonstrate backtracking method with the help of N-Queen's problem. 15. Case Study Objective: To demonstrate how various techniques can be used to solve the same problem with the help of Knapsack problem.
	Targeted Application & Tools that can be used

	PyTorch/Jupyter Notebook – For Python programming
	Text Book T1 Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd edition, Pearson Education, 2018. T2 Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 4th edition, MIT Press, 2022.
	References R1. J. Kleinberg and E. Tardos, “Algorithm Design”, Addison-Wesley, 2005. R2. Tim Roughgarden, “Algorithms Illuminated” (books 1 through 3), “Operating Systems Design and Implementation”, Soundlikeyourself Publishing, 2017-2019. R3. AV Aho, J Hopcroft, JD Ullman, “The Design and Analysis of Algorithms”, Addison-Wesley, 1974. R4. Donald E. Knuth, “The Art of Computer Programming”, Volumes 1and 3 Pearson. Web Based Resources and E-books: W1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview W2. Coursera: Analysis of Algorithms by Princeton University W3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses). W4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University
	Topics relevant to “EMPLOYABILITY SKILLS”: The lab experiments and assessments enable the student to acquire Skill Development through Experiential Learning techniques

Course Code: CSE1700	Course Title: Essentials of AI Type of Course: Theory	L- T-P- C	3	0	0	3
Version No.	2.0					
Course Pre-requisiData tes	Basic knowledge of programming, mathematics, understanding of data handling					
Anti-requisites	NIL					
Course Description	This course is a comprehensive introductory course designed to equip learners with the fundamental Python programming skills necessary to work with artificial intelligence (AI) technologies. This course is aimed at individuals who are new to AI but have a basic understanding of programming concepts. It combines Python programming fundamentals with hands-on experience in implementing AI techniques such as machine learning, neural networks, and natural language processing.					
Course Objective	The objective of the course is to Understand Python Programming Fundamentals, Manipulate and Process Data with Python, Implement Machine Learning Algorithms and Build and Train Neural Networks for AI Applications.					

Course Outcomes	On successful completion of the course the students shall be able to: CO 1: Apply Python Programming to AI Projects CO 2: Build and Train Machine Learning Models CO 3: Develop Deep Learning Models with Neural Networks CO 4: Deploy AI Solutions and Understand Ethical Implications			
Course Content:				
Module 1	Introduction to Python Programming for AI	Assignment	Implementation	10 Sessions
Topics: Python Basics: Variables, Data Types, Operators, and Control Flow Functions, Loops, and Conditionals statements, Data Structures: Lists, Tuples, Dictionaries, Sets ,Introduction to Libraries: NumPy and Pandas for data manipulation, Basic Input/Output and File Handling Introduction to Python for AI: Libraries and Frameworks Overview				
Module 2	Data Processing, Visualization	Assignment	Implementation	10 Sessions
Topics: cleaning and preprocessing with Pandas,Handling missing data, outliers, and duplicates, Data transformation (Normalization, Encoding), Introduction to Matplotlib and Seaborn for Data Visualization, Exploratory Data Analysis (EDA), Visualizing datasets to understand patterns and relationships.				
Module 3	Introduction to Machine Learning	Mini - Project	Implementation	10 Sessions
Topics: What is Machine Learning? Types of ML algorithms Supervised Learning: Regression, Classification, Unsupervised Learning: Clustering, Key ML Algorithms: Linear Regression, Decision Trees, K-Means ,Introduction to Scikit-learn library Model evaluation (Accuracy, Precision, Recall, Confusion Matrix)				
Module 4	Neural Networks and Deep Learning	Quiz	Implementation	10 Sessions
Topics: Introduction to Neural Networks and Deep Learning, Perceptron Model and Backpropagation Deep Neural Networks and Activation Functions, Introduction to TensorFlow and Keras, Building and Training Neural Networks for Image and Text Classification, Overview of Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)				
Targeted Application & Tools that can be used: Applications: Data Preprocessing: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs. Exploratory Data Analysis (EDA): Gain insights into datasets by identifying trends, patterns, and outliers. Predictive Modeling: Build models for classification (e.g., spam detection) and regression (e.g., house price prediction). Clustering: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation). Model Evaluation: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score. Tools: Pandas: For data manipulation and cleaning (e.g., handling missing values, merging datasets). NumPy: For numerical operations and working with arrays and matrices.				

Matplotlib: For creating static, animated, and interactive visualizations. Seaborn: For advanced data visualizations (e.g., heatmaps, pair plots). Plotly: For creating interactive visualizations, especially useful for large datasets. Scikit-learn: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering). XGBoost: For advanced gradient boosting models, particularly for large-scale machine learning tasks. TensorFlow (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models. Keras: High-level neural network API, built on top of TensorFlow, to easily create deep learning models. NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging. spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing. Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.
Text Book(s): T1: Essentials of Python for Artificial Intelligence and Machine Learning by Pramod Gupta and Anupam Bagchi
Reference(s): "Artificial Intelligence with Python" – Prateek Joshi "Python Machine Learning" – Sebastian Raschka & Vahid Mirjalili "Hands-On Artificial Intelligence with Python" – Teet Straus "Deep Learning for Coders with Fastai and PyTorch" – Jeremy Howard & Sylvain Gugger

Course Code: CSE1701	Course Title: Essentials of AI LAB Type of Course: Lab	L- T-P- C	0	0	4	2
Version No.	2.0					
Course Prerequisites	Basic Java Programming Knowledge, Mathematics: Linear Algebra and Probability, Basic Data Structures and Algorithms, Familiarity with Libraries and Tools, Understanding of Basic Machine Learning Concepts.					
Anti-requisites	NIL					
Course Description	This course introduces students to the essential concepts and techniques of Artificial Intelligence (AI) with a focus on practical implementation using Python. Students will explore core AI topics such as search algorithms, knowledge representation, machine learning, and neural networks, while gaining proficiency in using popular Python libraries like NumPy, pandas, scikit-learn, and TensorFlow. Through a series of lab exercises and projects, students will apply AI principles to solve real-world problems, develop intelligent applications, and understand how AI systems function at a foundational level.					
Course Objective	The primary objectives of the course are to Gain Proficiency in AI Concepts and Python Implementation, Develop and Implement Machine Learning Models, Understand and Build Neural Networks, Apply AI to Real-World Problems					
Course Outcomes	On successful completion of the course the students shall be able to: Proficiency in Implementing AI Algorithms Using Python Ability to Build and Evaluate Machine Learning Models Hands-on Experience with Neural Networks and Deep Learning					

	Practical Application of AI to Solve Real-World Problems
Course Content:	

Module 1	Introduction to AI and Python for AI	Assignment	Implementation	8 Sessions I

Lab Assignment 1: Setting Up the Python Environment
Objective: Get familiar with setting up a Python environment for AI projects.
Tasks:
Install Python, Anaconda, and Jupyter Notebook.
Set up a virtual environment for AI development.
Install essential Python libraries: numpy, pandas, matplotlib, and scikit-learn.
Write and execute simple Python code to verify installation (e.g., print a "Hello AI" message).
Lab Assignment 2: Basic Python Programming for AI
Objective: Understand and practice the basic Python syntax and data structures used in AI.
Tasks:
Write Python code to work with basic data types (integer, float, string, boolean).
Implement and manipulate Python lists, tuples, sets, and dictionaries.
Create basic control flow structures: if-else, for loops, while loops.
Use functions and lambda functions to solve small AI-related problems, such as calculating factorial or Fibonacci numbers.
Lab Assignment 3: Data Exploration and Preprocessing
Objective: Learn how to work with data for AI models.
Tasks:
Load a dataset (e.g., Titanic or Iris dataset) using pandas.
Clean the dataset by handling missing values, removing duplicates, and converting data types if needed.
Explore the dataset by visualizing it using matplotlib and seaborn.
Perform basic data preprocessing tasks such as feature scaling, encoding categorical variables, and splitting data into training and testing sets.

Module 2	Data Processing, Visualization	Assignment	Implementation	8 Sessions

Lab Assignment 1: Data Preprocessing with Pandas
Objective:
Learn the fundamentals of data preprocessing, including cleaning, handling missing values, and performing basic transformations using Pandas.
Tasks:
Load and Inspect the Dataset:
Load a dataset (e.g., Iris, Titanic, Wine Quality dataset) using pandas.read_csv() or pandas.read_excel().
Inspect the first few rows of the dataset using .head() and check basic information using .info().
Handle Missing Values:
Identify missing values in the dataset using .isnull() or .isna().
Handle missing data by imputing with mean, median, or mode using SimpleImputer from sklearn, or remove rows with missing data using .dropna().
Data Transformation:
Convert categorical variables to numerical values using one-hot encoding or label encoding.
Normalize/standardize numerical columns using StandardScaler or MinMaxScaler from sklearn.

Subset and Filter Data:
Create subsets based on certain conditions (e.g., select rows where a specific feature value is greater than a threshold).
Filter outliers from numerical data using interquartile range (IQR).

Lab Assignment 2: Data Aggregation and Grouping with Pandas
Objective:
Master aggregation and grouping techniques using Pandas for summarizing data.
Tasks:
Group Data by Category:
Group data by one or more categorical features (e.g., "class" in the Iris dataset or "embarked" in Titanic dataset).
Use .groupby() to calculate aggregate statistics such as mean, median, sum, and count.
Pivot Tables:
Create a pivot table to summarize data (e.g., aggregate the average age of passengers in the Titanic dataset by class and gender).
Use .pivot_table() to perform multi-dimensional aggregation.
Data Aggregation and Custom Functions:
Apply custom aggregation functions to the grouped data (e.g., calculate custom metrics or perform complex transformations within each group).
Sorting and Ranking Data:
Sort the dataset by multiple columns (e.g., sorting by "age" or "fare").
Rank data based on specific metrics (e.g., assign ranks to passengers by fare in the Titanic dataset).

Lab Assignment 3: Data Visualization with Matplotlib and Seaborn
Objective:
Learn to visualize datasets using Matplotlib and Seaborn for better understanding and insights.
Tasks:
Basic Plotting with Matplotlib:
Create simple plots like line plots, bar plots, and histograms using Matplotlib.
Customize the plots by setting titles, labels, and legends.
Create scatter plots to visualize relationships between two variables.
Advanced Plotting with Seaborn:
Use Seaborn to create advanced visualizations like pair plots, heatmaps, box plots, and violin plots.
Customize visualizations with color palettes, styling, and themes.
Create a correlation heatmap to visualize correlations between features in the dataset.
Distribution Visualizations:
Plot distributions of continuous variables using Seaborn's distplot() or kdeplot().
Create bar plots for categorical variables to understand their frequency distribution.
Multi-Plot Grid Layouts:
Use Matplotlib's subplots() function to create multiple plots in a grid layout for comparison (e.g., scatter plot and histogram in the same figure).

Lab Assignment 4: Visualizing Relationships and Feature Importance
Objective:
Understand how to visualize relationships between features and evaluate feature importance for predictive models.
Tasks:
Scatter Plot Matrix:

Use Seaborn's pairplot() to create a scatter plot matrix to visualize the relationships between multiple features.
Analyze the pairwise relationships between features and identify any patterns or correlations.
Heatmap of Correlation Matrix:
Use Pandas to calculate the correlation matrix of numeric features.
Visualize the correlation matrix using Seaborn's heatmap() to understand feature correlations and multicollinearity.
Feature Importance from Models:
Train a decision tree or random forest model using scikit-learn on a dataset (e.g., Iris or Titanic).
Visualize feature importance using a bar chart to understand which features have the most impact on the model.
Visualizing Predictions vs. Actual Values:
For regression tasks, visualize the predicted values against the actual values using a scatter plot.
For classification tasks, visualize the classification results with a confusion matrix.

Lab Assignment 5: Time Series Data Visualization and Processing
Objective:
Learn how to process and visualize time series data, which is common in AI applications like forecasting and trend analysis.
Tasks:
Load and Preprocess Time Series Data:
Load a time series dataset (e.g., stock market data, weather data).
Parse dates properly and set the date column as the index using pd.to_datetime() and .set_index().
Plot Time Series Data:
Plot a time series line chart using Matplotlib to visualize trends over time.
Create rolling averages (e.g., 7-day, 30-day) to smooth out short-term fluctuations in the time series data.
Seasonal Decomposition of Time Series:
Use statsmodels to decompose a time series into seasonal, trend, and residual components.
Visualize the decomposed components to understand seasonal variations.
Forecasting with Simple Models:
Use simple forecasting models (e.g., moving average, ARIMA) to predict future values.
Visualize the forecasted data along with actual historical data.

Module 3	Introduction to Machine Learning	Assignments	Implementation	8 Sessions

Lab Assignment 3: Implementing Linear Regression
Tasks:
Load a real-world dataset (e.g., Boston Housing Price dataset).
Train a Linear Regression model using LinearRegression() from scikit-learn.
Evaluate the model using Mean Squared Error (MSE) and R-squared Score.
Visualize the regression line using Matplotlib.

Lab Assignment 4: Logistic Regression for Classification
Tasks:
Load the Iris or Breast Cancer dataset.
Preprocess the dataset (handle missing values, encode categorical variables, scale data).
Train a Logistic Regression model using LogisticRegression().
Evaluate performance using Accuracy, Precision, Recall, F1-score.
Plot the Confusion Matrix and ROC Curve.

Lab Assignment 5: Implementing K-Nearest Neighbors (KNN)

Tasks:
Load the Iris dataset and split it into training and testing sets.
Train a KNN classifier using KNeighborsClassifier().
Experiment with different values of K and evaluate performance.
Visualize decision boundaries using a scatter plot.

Lab Assignment 6: Decision Trees and Random Forests
Tasks:
Train a Decision Tree classifier on the Titanic dataset.
Visualize the tree structure using plot_tree().
Train a Random Forest classifier and compare performance with the decision tree.
Determine the feature importance using feature_importances_.

Module 4	Neural Networks and Deep Learning	Quiz	Implementation	6 Sessions

Lab Assignment 7: Introduction to Perceptron and Activation Functions
Tasks:
Implement a single-layer perceptron using NumPy.
Train the perceptron to classify AND, OR, XOR gates.
Experiment with different activation functions (Sigmoid, ReLU, Tanh).
Visualize decision boundaries.

Lab Assignment 8: Building a Simple Neural Network with Keras
Tasks:
Load the MNIST dataset from keras.datasets.
Preprocess the data (normalize pixel values, reshape input).
Create a fully connected neural network using Sequential API.
Train and evaluate the model using categorical cross-entropy loss and accuracy.
Lab Assignment 9: Implementing CNN from Scratch
Tasks:
Load the CIFAR-10 dataset.
Build a CNN with Conv2D, MaxPooling2D, Flatten, Dense, Dropout layers.
Use Adam optimizer and categorical cross-entropy loss.
Train and visualize loss/accuracy curves.

Lab Assignment 10: Image Augmentation & Regularization
Tasks:
Apply data augmentation (rotation, zoom, flipping) using ImageDataGenerator.
Add dropout and batch normalization to prevent overfitting.
Compare model performance with and without augmentation.

Lab Assignment 11: Transfer Learning with Pre-trained Models
Tasks:
Use VGG16 or ResNet50 pre-trained on ImageNet.
Replace the output layer to classify new images.
Freeze earlier layers and fine-tune deeper layers.
Evaluate the model on a custom dataset (e.g., Cats vs. Dogs).

Lab Assignment 12: Implementing RNN for Text Classification
Tasks:
Load IMDB movie reviews dataset from keras.datasets.
Preprocess text (tokenization, padding sequences).
Build an RNN with Embedding, SimpleRNN, Dense layers.
Train and evaluate the model.

Lab Assignment 13: Building an LSTM for Time Series Prediction
Tasks:
Load a time series dataset (e.g., stock prices, temperature data).
Preprocess the data (normalize, reshape).
Build an LSTM-based model.
Predict future values and visualize trends.

Targeted Application & Tools that can be used:
Applications:
Data Preprocessing: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs.
Exploratory Data Analysis (EDA): Gain insights into datasets by identifying trends, patterns, and outliers.
Predictive Modeling: Build models for classification (e.g., spam detection) and regression (e.g., house price prediction).
Clustering: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
Model Evaluation: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.
Tools:
Pandas: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
NumPy: For numerical operations and working with arrays and matrices.
Matplotlib: For creating static, animated, and interactive visualizations.
Seaborn: For advanced data visualizations (e.g., heatmaps, pair plots).
Plotly: For creating interactive visualizations, especially useful for large datasets.
Scikit-learn: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering).
XGBoost: For advanced gradient boosting models, particularly for large-scale machine learning tasks.
TensorFlow (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.
Keras: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.
NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging.
spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing.
Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):
T1: Essentials of Python for Artificial Intelligence and Machine Learning by Pramod Gupta and Anupam Bagchi

Reference(s):
"Artificial Intelligence with Python" – Prateek Joshi
"Python Machine Learning" – Sebastian Raschka & Vahid Mirjalili
"Hands-On Artificial Intelligence with Python" – Teet Straus

"Deep Learning for Coders with Fastai and PyTorch" – Jeremy Howard & Sylvain Gugger

Course Code: CSE1501	Course Title: Computational Thinking using Python Lab Type of Course: Engineering Science Laboratory Integrated		L-T-P-C	0	0	4	2

Version No.		1.0
Course Pre-requisites		
Anti-requisites		NIL
Course Description		The course efficiently introduces fundamental ideas and practical knowledge including control structures, functions, and tuples through hands on sessions. It also introduces dynamic programming like handling exceptions and file operations. The course covers Python dictionaries, classes, and objects for creating user-defined datatypes, such binary search, in terms of data structures.
Course Object		The objective of the course is to familiarize the learners with the concepts of Computational Thinking using Python Lab and attain Skill Development through Experiential Learning techniques.
Course Out Comes		On successful completion of the course the students shall be able to: Explain algorithms to solve fundamental computational problem. (Understand) Illustrate the use of different data types and operators in Python. (Apply) Demonstrate conditionals, loops, and functions to address problem-solving tasks. (Apply) Utilize appropriate data structures to efficiently manage and process data. (Apply) Perform file handling tasks such as reading, writing, and modifying files in Python.. (Apply)
Course Content:		

Module 1	Computational Thinking And Problem Solving	Assignment		Programming	6 Sessions
Lab sheet : Introduction to Python Programming. Demonstration of Colabs or Jupiter environment. Demonstrate Input function. Demonstrate int method. Demonstrate data types Demonstrate operators. Demonstrate simple programs for python environment. Python program that takes an integer input and calculates the sum of its digits.					
Module 2	Datatypes, Expressions, Statements	Assignment		Programming	14 Sessions

	Topics: Python program to count the number of times a given character appears in a string. Python program to identify the data types of given variables. A grocery store needs a billing system, write a python program that calculates the total bill amount based on the price of individual items and their quantities. A car rental company wants to calculate the mileage (km per liter) for different vehicles based on distance traveled and fuel consumed. Write a Python program to calculate the mileage. A company wants to calculate the net salary of an employee after deducting tax (10%) and provident fund (5%) from the gross salary. Write a Python program to calculate net salary. In a student grading system where the final grade depends on whether the student has passed both the written and practical exams. You need to check if the student has passed based on certain conditions: The student must score at least 40 in the written exam. The student must score at least 50 in the practical exam. The student must have attended at least 75% of the classes Write a Python program to check if a person is eligible to vote. The criteria are: The person must be at least 18 years old. The person should be a citizen of the country. Write a Python program to classify a person into age groups: Child: 0 to 12 years Teenager: 13 to 19 years Adult: 20 years and above A user authentication system that checks if the user is authorized based on certain conditions, like having a correct password and being over the age of 18. Write a Python program for the above scenario. In a student registration system, a student must meet certain criteria to be eligible for course registration: The student must have a GPA of 3.0 or above. The student must have completed the prerequisite course (True/False).				
Module 3	Control flow, Functions, Strings	Assignment		Programming	16 Sessions
	Lab Sheet: An e-commerce store that offers discounts based on the following criteria: The customer must be a loyal customer (i.e., True). The total purchase amount must be greater than $100. Python program to print the Fibonacci sequence up to n terms Python program to print the Fibonacci sequence up to n terms using Recursion. Apply slicing on the given data or dictionary. Python Programs to create array and print the array. Python program to check if a given number is an Armstrong number. An Armstrong number for a 3-digit number is one where the sum of the cubes of its digits is equal to the number itself. The media platform wants to count the number of words in user-submitted posts to enforce character limits or to analyze the length of posts. . In a bookstore inventory system, You need to implement a feature that checks if a book title is a palindrome. The bookstore wants to offer special discounts for books with titles that are palindromes. You need to create a Python function that reads the book title and determines if it's a palindrome. In a library management system. The library has a database of books identified by unique numbers (IDs). The library staff wants to apply a special offer to books whose IDs are prime numbers. You need to create a Python program that finds all prime numbers between a given range of book IDs.				

	In a school management system that stores the marks of students for each subject. You are asked to compute the average marks of a student to evaluate their overall performance. Write a Python program that takes the marks of a student in different subjects and calculates the average. A small inventory list where you need to search for a specific product ID. Since the list isn't sorted, you can use linear search, which checks each element sequentially until it finds the target. Write a python program to perform linear search. A sorted list of product IDs and need to quickly find a specific product. Binary search is ideal for this scenario because it efficiently narrows down the search space by repeatedly dividing the list into two halves.

Module 4	Lists, Tuples, Dictionaries	Assignment		Programming	12 Sessions

	Lab Sheet: Demonstrate List, Tuple and Dictionary. A supermarket wants to maintain a list of available products and update it when new products arrive or old products are sold out. A library maintains book records using dictionaries, where the book title is the key and the quantity available is the value. A school stores student grades in a list, and the teacher wants to see only the top 3 grades. A restaurant receives online orders in a queue (list) and processes the first 3 orders at a time. Write a Python program to handle orders using list slicing. A university has course details stored in tuples. The system should extract and display only the course codes. Write Python program to extract course code from tuples. A fitness tracking app stores a user's daily step count for a week and extracts steps from Monday to Friday. WAP to extract weekly steps using slicing. A school stores student marks in a list. Write a program to: Find the highest and lowest marks. Calculate the average marks. Count how many students scored above 75. A company maintains a list of employees' names. Write a program to: Add a new employee to the list. Remove an employee from the list. Sort and display all employees in alphabetical order. A tuple stores flight details (Flight Number, Destination, Duration). Write a program to: Display all flights. Find flights with a duration of more than 3 hours. Access the destination of a specific flight. A grocery store stores item details as tuples (Item Name, Price per kg). Write a program to: Calculate the total bill for a customer.

	Find the cheapest item. Sort items by price in ascending order. Use Dictionaries: A library stores book records as {Book Title: Copies Available}. Write a program to: Borrow a book (decrease count). Return a book (increase count). Display all available books. Use List Comprehension: A company stores employee ID numbers. Write a Python program to extract only the even employee IDs from a given list.				
Module 5	Files	Assignment		Programming	12 Sessions
	Lab Sheet: Write a Python program that asks for a voter's age. If the age is below 18, raise an exception "Invalid Age: Must be 18 or older". Write a Python program that counts the total number of lines, words, and characters in a given text file. Write a Python program that reads text file and finds the most repeated word. Write a program that searches for a word in a file ".txt" and replaces it with another word. Write a Python program that copies the content from "source.txt" to "destination.txt". If "destination.txt" does not exist, create it. Write a Python program that takes two numbers as command-line arguments and prints their sum. Write a Python program that asks for a user's name, age, and marks in three subjects, then formats and displays the result in a structured way. Generate report using string formatting. Create a module called "mymath.py" with functions add(a, b), subtract(a, b), and multiply(a, b). write a separate Python script that imports this module and uses these functions. Write a Python program that tries to read a file ".txt". If the file is not found, catch the exception and display a message.				
	Project work/Assignment:				
	1.Assignment 1 on (Module 1 and Module 2) Assignment 2 on (Module 3 and Module 4 & 5)				
	Text Book 1Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021 2)Eric Matthes, Python Crash Course,: A Hands-On, Project-Based Introduction to Programming, 3rd Edition, 2023				

	References 1.Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016. 2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017. Web Resources https://onlinecourses.nptel.ac.in/noc20_cs70/preview https://onlinecourses.swayam2.ac.in/cec23_cs02/preview https://www.coursera.org/learn/ai-python-for-beginners
	Topics relevant to development of “Employability”: Data structures using python. Topics relevant to “PROFESSIONAL ETHICS”: Naming and coding convention for simple programs using python.

Course Code: CSE1506	Course Title: Data Communications and Computer Networks Type of Course: Theory & Integrated Laboratory	L-T- P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	ECE2007 - 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 Outcomes	On successful completion of this course, the students shall be able to: CO1: Illustrate The Basic Concepts Of Data Communication And Computer Networks. (Apply) CO2: Analyze the functionalities of the Data Link Layer. (Analyse) CO3: Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks.(Apply)					

<table>
<tr><td></td><td colspan="4">CO4: Demonstrate the working principles of the Transport layer and Application Layer. (Apply)</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction and Physical layer-CO1</td><td>Assignments</td><td>Problem Solving</td><td>17 Sessions (L9 + P8)</td></tr>
<tr><td colspan="5">Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media –Reference Models - TCP/IP Suite, OSI Model .
Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.</td></tr>
<tr><td>Module 2</td><td>Data Link Layer –CO2</td><td>Assignments</td><td>Problem Solving</td><td>20 Sessions (L12 + P08)</td></tr>
<tr><td colspan="5">Data Link Layer - Error Detection and Correction– Parity, CRC, Hamming Distance Flow Control and Error Control, Stop and Wait, Multiple Access Protocols, CSMA/CD,CSMA/CA</td></tr>
<tr><td>Module 3</td><td>Network Layer –CO3</td><td>Assignments</td><td>Problem Solving</td><td>21 Sessions (L13 + P8)</td></tr>
<tr><td colspan="5">Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing, Link State Routing, RIP, OSPF, BGPV4.</td></tr>
<tr><td>Module 4</td><td>Transport and Application Layer - CO4</td><td>Assignments</td><td>Problem Solving</td><td>17 Sessions (L11 + P6)</td></tr>
<tr><td colspan="5">Transport Layers - Connection management – Flow control-Sliding Window, Go-Back N ARQ, Selective Repeat ARQ, UDP, TCP, congestion control, Congestion avoidance The Application Layer: Domain Name System (DNS), Domain Name Space, FTP, Electronic Mail (SMTP), HTTP.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Cisco Packet Tracer, Wireshark, and NS2 Simulator.</td></tr>
<tr><td colspan="5">Project work/Assignment: Choose and analyse a network from any organization/Assignment proposed for this course in CO1-CO4</td></tr>
<tr><td colspan="5">Topics related to
1. Problem Solving: Choose and appropriate devices and implement various network concepts.
2. Employability: Simulation of any network using Cisco Packet Tracer/NS2.</td></tr>
<tr><td colspan="5">Textbook(s):
T1. Behrouz A. Forouzan, “Data Communications and Networking with TCP/IP Protocol Suite”, 6th Edition, Tata McGraw-Hill, 2022.
T2. Andrew S Tanenbaum, Nick Feamster & David J Wetherall, “Computer Networks” Sixth Edition, Pearson Publication, 2022.</td></tr>
<tr><td colspan="5">References
R1. “Computer Networking: A Top-Down Approach”, Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.
R2. William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.
R3. Behrouz A. Forouzan, “Data Communications and Networking 5E”, 5th Edition, Tata McGraw-Hill, 2012
E-Resources:
https://www.geeksforgeeks.org/what-is-spread-spectrum/
https://www.geeksforgeeks.org/difference-between-fdma-tdma-and-cdma/
https://archive.nptel.ac.in/courses/106/105/106105183/</td></tr>
</table>

http://www.nptelvideos.com/course.php?id=393 https://www.digimat.in/keyword/106.htmlhttps://puniversity.informaticsglobal.com/login

Course Code: CSE1507	Course Title: Data Communication and Computer Networks Lab Type of Course: Lab	L-T-P-C	0	0	2	1
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This lab course is to get practical knowledge of working principles of various communication protocols. Analyse structure and formats of TCP/IP layer protocols using network tools such as Wireshark and network simulators. Implementing various network algorithms such as error control, error detection, routing, and security related algorithms.					
Course Objective	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: To understand the working principle of various communication protocols. To understand the network simulator environment and visualize a network topology and observe its performance. To analyze the traffic flow and the contents of protocol frames. To analyze data flow in wired and wireless environment					
Course Content						
Module 1	Introduction to Computer Networks	7 Sessions				
Learn to use commands like tcpdump, netstat, ifconfig, nslookup, ARP, NbtStat-n, Route, GETMAC, SYSTEMINFO and traceroute – Capture ping and traceroute PDUs using a network protocol analyzer and examine - Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.						
Module 2	Physical And Data Link Layer	8 Sessions				
Configuration of IP addressing for a given scenario for a given set of topologie – Connecting devise – Configuration of Hub, Router, Switch and Repeaters using cisco packet tracer- Configure the privilege level password and user authentication in switch.						
Module 3	Network Layer Transport Layer	7 Sesions				
Configure the DHCP Server and wireless router and check the connectivity - Configure the static routing using cisco packet tracer- Configure the Dynamic Routing routing (RIP Routing) using cisco packet tracer						

Module 4	Application Layer and Security in Computer Networks	Assignment	Problem Solving		08 Classes
	Configure the Static NAT using cisco packet tracer - Configure the Dynamic NAT using cisco packet tracer. - Configure the DNS Server using cisco packet tracer - Configure the telnet protocol using cisco packet tracer - Wireshark Tool - Three Node Point To Point Network Using NS2 Simulator - Transmission of Ping Message Using NS2 Simulator - Ethernet LAN Using N-Nodes Using NS2 Simulator - Ethernet LAN Using N-Nodes With Multiple Traffic				
	Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, NS2				
	Case Study/Assignment: Assignment proposed for this course in CO1-CO4 Assume that a computer sends a frame at the transport layer to another computer and the destination port address is not running. According to what you read from chapter 2, what will happen to that process? Determine the possible bit rate and the number of levels over a channel for these cases? a. B = 2.4K Hz, noiseless channel with L = 16. b. B= 2.4K Hz, SNR = 20 dB. c. B = 3.0K Hz, SNR = 40 db. Using CISCO Packet Tracer Configuring Static and Default Routes Objectives • Configure static routes on each router to allow communication between all clients. • Test connectivity to ensure that each device can fully communicate with all other devices. Getting familiar with Wireshark software by installing it I your system, and perform following task: List out the packets which are having DNS protocols List of IP address present in the cache along with its MAC addresses Display all the packets which are having the DNS or HTTP protocol				
	Problem Solving: Choose and appropriate devices and implement various network concepts.				
	Text Book CCNA Routing and Switching Study Guide – Todd Lammle, 2013, Sybex. Wireshark Network Analysis: The Official Wireshark Certified Network Analyst Study Guide – Laura Chappell, 2012, Wireshark University. Computer Network Simulation Using NS2 – Ajit Kumar Nayak, Rajlaxmi Rai, Rakesh Mall, 2020, Routledge.				
	References R1: Alberto Leon-Garcia and IndraWidjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004. R2: William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007. R3: "Computer Networking: A Top-Down Approach" – James F. Kurose and Keith W. Ross, 7th Edition, 2016, Pearson. Web Based Resources and E-books: W1: https://gaia.cs.umass.edu/kurose_ross/wireshark.php W2: https://www.youtube.com/watch?v=x7EJSY0bOK4&ab_channel=ChrisGreer W3: https://tutorials.ptnetacad.net/				

	Topics relevant to “SKILL DEVELOPMENT”: Application Layer, Transport Layer, Network Laryer for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: MAT2011	Course Title: Numerical Computation Type of Course:1] School Core		L-T- P- C	3	0	0	3
Version No.		1.0					
Course Pre-requisites		Calculus, Linear Algebra, Differential Equations					
Anti-requisites		NIL					
Course Description		The course explores mathematical techniques used to approximate solutions to complex problems that are difficult to solve analytically, often utilizing computers to perform calculations, including methods for root finding, interpolation, numerical differentiation and integration, solving systems of linear equations, and approximating solutions to differential equations, with applications across various scientific and engineering fields. It focuses on understanding the theoretical basis behind these methods, their implementation in programming languages, and analyzing their accuracy and stability.					
Course Objective		The objective of the course is to equip students with understanding and ability to apply various numerical techniques to approximate solutions to complex mathematical problems that are difficult or impossible to solve analytically, particularly focusing on areas like solving systems of equations, finding roots of functions, interpolation, numerical differentiation, and integration, often utilizing computational tools to implement these methods.					
Course Out Comes		On successful completion of the course the students shall be able to: CO1 - Calculate errors induced in the values by truncation of a series expansion. CO2 - Demonstrate the applications of numerical methods to find the roots of polynomial equations and eigen values of real symmetric matrices. CO3 - Apply the knowledge of numerical methods in modelling of various physical and engineering phenomena. CO4 - Apply various numerical methods for solving linear Ordinary & Partial differential equations arising in engineering field.					
Course Content:							
Module 1	Solution of Linear Systems of Equation			(12 Classes)			
Numerical Computation: Motivation and Objectives, Number Representation, Machine Precision, Round-of Error, Truncation Error, Random Number Generation. Solution of algebraic and transcendental equations: Various types of errors - Bisection method, Regula-Falsi method, Newton-Raphson method, Graffe's method - Bairstow's method - Newton's method for solving f(x,y) = 0 and g(x,y) = 0, secant method, Fixed point iteration method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method, Iterative methods of Gauss Jacobi and Gauss Seidel, Sufficient conditions for convergence - LU decomposition method, Eigenvalues of a matrix by Power method and Jacobi’s method for symmetric matrices.							
Module 2	Interpolation and Approximation		Assignment	(8 Classes)			

Interpolation with equal intervals, Newton's forward and backward difference formulae, Interpolation with unequal intervals, Lagrange's interpolation, Newton's divided difference interpolation, Cubic Splines, Difference operators and relations.			
Module 3	Numerical Differentiation and Integration		(10 Classes)
Numerical differentiation, Approximation of derivatives using interpolation polynomials, Numerical integration using Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule, Romberg's Method, Two point and three point Gaussian quadrature formulae, Evaluation of double integrals by Trapezoidal rule and Simpson's one-third rule			
Module 4	Initial & Boundary Value Problems for Ordinary & Partial Differential Equations	Assignment	(15 Classes)
Single step methods — Taylor's series method, Modified Euler's method, Fourth order Runge-Kutta method for solving first order equations, Multi step methods, Milne's and Adams, Bash forth predictor corrector methods for solving first order equations. Finite difference methods for solving second order, two-point linear boundary value problems, Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain, One-dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods, One-dimensional wave equation by explicit method.			
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: Python.			
Assignment:			
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.			
Text Book C.F.Gerald and P.O.Wheatley", Applied Numerical Analysis", McGraw-Hill, 1981. Cheneg and Kincaid, "Introduction to Numerical Computing", Tata McGraw-Hill, 1998.			
References: SRK Iyengar & RK Jain, Numerical Methods, New Age Internationals. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers. E-resources/ Web links: https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_135224 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_141727 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_217628 http://.ac.in/courses.php?disciplineID=111 http://www.class-central.com/subject/math(MOOCs) http://academicearth.org/ https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html https://www.scu.edu.au/study-at-scu/units/math1005/2022/			

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving. This is attained through the assessment component mentioned in course handout.

Course Code: CSE2000	Course Title: Software Design and Development 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			10 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		12 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	Quiz			10 Hours

	(Knowledge level)			
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	13 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] R1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, VII Edition, McGraw-Hill, 2017. 2] B2. 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: CSN2502	Course Title: Adhoc networks Type of Course: Level 2 Theory	L- T-P- C	2	0	0	2
Version No.	1.0					
Course Pre-requisites		CSE 2011-Data Communications and Computer Networks				
Anti-requisites		NIL				
Course Description		The course begins with an introduction to ad hoc networking, including perspectives from the Department of Defense (DOD) and commercial applications. Students will examine the fundamental characteristics and issues of ad hoc networks, along with proactive and reactive routing protocols. Subsequent units delve into specific routing protocols, starting with table-driven protocols such as the Destination-Sequenced Distance-Vector (DSDV) protocol. Students will explore the				

		properties and features of DSDV, including clustering, transmission management, and routing efficiency.Students will also explore research issues in ad hoc networking, fostering critical thinking and innovation in this rapidly evolving field.			
Course Objective		The objective of the course is to familiarize the learners with the concepts Of Wireless Adhoc Networks and attain Employability through Experiential Learning techniques.			
Course Out Comes		On successful completion of the course the students shall be able to CO1: Explain the fundamental concepts and principles of wireless ad hoc networks. [Understand] CO2: Discuss the design principles and architectural frameworks of ad hoc networks.[Understand] CO3: Identify a routing protocol for a given Ad hoc networks [Apply] CO4: Utilize simulation tools to model and analyze the performance of wireless ad hoc networks under various conditions.[Apply]			
Course Content:					
Module 1	ADHOC NETWORKIN G	Quiz	Data Collection/Interpretation	10 Sessions	
Topics: Introduction – DOD perspective – Commercial applications – Characteristics and issues of adhoc networks – proactive and reactive routing protocols.					
Module 2	TABLE DRIVEN PROTOCOLS	Assignment	Network Exploration	6 Sessions	
Topics: Preview of routing protocols – DSDV Protocol – Properties and features of DSDV – Clustering – Transmission management – Backbone formation –routing efficiency					
Module 3	ON-DEMAND PROTOCOLS	Assignment	Advanced Network Architectures	6 Sessions	
Topics: AODV protocols – Unicast and Multicast – Optimizations and enhancements – DSR protocol – Overview – Properties – Additional features – support for heterogeneous networks					
Module 4		Assignment	Routing Protocols	8 Sessions	
Reconfigurable Wireless networks – ZPR – Intra and Interzone routing – General approach of Link reversal routing – GB algorithm – LMR – TORA – Protocol description – Properties – Recent					

extensions
Assignment: Module 1 & 2: Proactive and reactive routing protocols Module 3: AODV Protocols Module 4: Reconfigurable Wireless Networks Module 5:Research Issues in Adhoc Networking
Assignment: CASE STUDY
Text Book T1 A. Kumar and B. Singh, *Ad Hoc Networks: Principles and Applications*, 1st ed. New York, NY, USA: Springer, 2023. T2 M. Patel and R. Gupta, *Advances in Ad Hoc Networking: Challenges and Solutions*, 1st ed. London, UK: Elsevier, 2023.
References R1.A. Boukerche, Mobile Ad Hoc Networking: Protocols and Techniques. Boca Raton, FL, USA: CRC Press, 2008. R2.A. Nasipuri and S. R. Das, Ad Hoc Networks: Technologies and Protocols. New York, NY, USA: Springer, 2009. R3.A. K. Gupta and S. K. Gupta, Wireless Ad Hoc and Sensor Networks: Theory and Applications. New York, NY, USA: Springer, 2010. R4. C. E. Perkins, E. M. Royer, and S. R. Das, Ad Hoc Networking. Boston, MA, USA: Addison-Wesley, 2001. R5. S. K. Das, P. M. K. Reddy, and A. K. Gupta, Ad Hoc Networks: A Communication Perspective. New York, NY, USA: Wiley, 2011. Web resources: https://www.coursera.org/learn/packt-network-configuration-network-services-and-system-management-t69jg https://presiuniv.knimbus.com
Topics relevant to development of “EMPLOYABILITY SKILLS”: Routing protocols, AODV Protocols for development of Employability Skills through Experiential Learning techniques. This is attained through assessment component as mentioned in course handout.

Course Code: CSE7000	Course Title: Internship Type of Course:	L- T-P- C	-	-	-	2
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.
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. (Understand) Apply appropriate techniques or modern tools for solving the intended problem. (Apply) Design the experiments as per the standards and specifications. (Analyze) Interpret the events and results for meaningful conclusions. (Evaluate)

Course Code: CSE7100	Course Title: Mini Project Type of Course:	L- T-P- C	0	0	0	4
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. (Understand) Apply appropriate techniques or modern tools for solving the intended problem. (Apply) Design the experiments as per the standards and specifications. (Analyze) Interpret the events and results for meaningful conclusions. (Evaluate) Appraise project findings and communicate effectively through scholarly publications. (Create)

Course Code: CSE7300	Course Title: Capstone Project Type of Course:	L- T-P- C	0	0	0	10
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 problems based on societal /research needs. (Understand) Apply Knowledge and skill to solve societal problems in a group. (Apply) Develop interpersonal skills to work as member of a group or leader. (Apply) Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) Improve in written and oral communication. (Create) Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)					

Course Code: CSN2510	Course Title: Software Defined Networks Type of Course: Level 2 Theory	L- T-P- C	3	0	0	3
Version No.	1.0					

Course Pre-requisites		CSE 2011-Data Communications and Computer Networks
Anti-requisites		NIL
Course Description		Software defined networking (SDN) is a rapidly emerging networking paradigm that facilitates the separation of control and data plane. The purpose of this course is to provide students the knowledge and skills necessary to use develop, manage, and secure software defined networks (SDN). The course will have the following elements, including software defined network (SDN) architectures/protocols, network functions virtualization (NFV), network virtualization technologies, and an introduction to programmable data planes. SDN enables innovation, openness and helps reduce CAPEX and OPEX. The course covers the SDN foundations and building blocks; control plane abstractions; SDN controller design and data consistency guarantees; SDN scalability, security, and reliability. The course will also introduce new SDN-enabled networking capabilities, including traffic engineering, automation/orchestration, network virtualization, and verification/troubleshooting for both cloud-native and carrier networks.
Course Objective		The objective of the course is to familiarize the learners with the concepts Of Software Defined Networks and attain Employability through Experiential Learning techniques.
Course Out Comes		On successful completion of the course the students shall be able to CO1: Discuss the functions and components of the SDN architecture. [Understand] CO2: Discuss the major requirements of the design of an SDN protocol. [Understand] CO3: Design and create an SDN network consisting of SDN switches and a centralized controller. [Apply] CO4: Analyze the performance of the SDN network by using verification and troubleshooting techniques. [Apply]

Course Content:				
Module 1	INTRODUCTION TO SDN	Quiz	Data Collection/Interpretation	11 Sessions

Topics:
Overview; History and evolution of SDN; Architecture of SDN; SDN Flavours; Scalability (Data Centres, Service provider networks, ISP Automation); Reliability (QoS, and Service

Availability); Consistency (Configuration management, and Access Control Violations); Opportunities and Challenges				
Module 2	Architecture	Assignment	Various SDN Architecture	10Sessions
Topics: Network Operating System (NOS). SDN Architecture. Planes - data, management and control. Interfaces - northbound and southbound.				
Module 3	Protocols	Assignment	Software Controllers	12 Sessions
Topics: Languages and functions available for programming SDNs, northbound API. Mininet. Software vs. Hardware SDN switch implementations - Open vSwitch, WhiteBox, ONL. Controller implementations - POX, NOX, Beacon, Floodlight. Special Purpose controllers - Flowvisor, RouteFlow.				
Module 4	Design and Development	Assignment	SDN Application Programming	12 Sessions
Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing, SDX; Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.				
Assignment: Module 1 & 2: SDN Architectures Module 3: RouteFlow Module 4: Network Slicing				
Assignment: CASE STUDY				
Text Book T1 J. Smith and A. Johnson, *Software Defined Networking: Principles and Practice*, 2nd ed. New York, NY, USA: Wiley, 2023.				
References R1. Stallings, William. Foundations of modern networking: SDN, NFV, QoE, IoT, and Cloud, 1st edition, Addison-Wesley Professional, 2015. R2. Oswald Coker, Siamak Azodolmolky. Software-Defined Networking with OpenFlow - Second Edition, Packt Publishing, 2017. Web resources: https://www.coursera.org/learn/SDN https://presiuniv.knimbus.com				
Topics relevant to development of “EMPLOYABILITY SKILLS”: SDN Architectures,RouteFlow for development of Employability Skills through Experiential Learning techniques. This is attained through assessment component as mentioned in course handout.				

Course Code: CSE2506	Course Title: Cloud Computing	L- T-P-C	2	0	0	2

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).
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: CSE2507	Course Title: Cloud Computing Lab	L- T-P-C	0	0	2	1
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					
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: CSE2510	Course Title: Competitive Programming and Problem Solving Type of Course: Program Core	L-T-P-C	0	0	4	2
Version No.	1.0					
Course Pre-requisites	NIL					

Anti-requisites	NIL
Course Description	The Competitive Programming and Problem Solving course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.
Course Out Comes	On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Competitive Programming and Problem Solving and attain Skill Development through Experiential Learning techniques.

Module 1: Introduction to Competitive Programming

Overview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL

Module 2: Number Theory for Problem-Solving

Use of Number Theory for problem-solving: reducing time/space complexity of brute force[Text Wrapping Break]coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding[Text Wrapping Break]for Permutation Combination; XORing based and pattern-based solutions.

Module 3: Optimizing Time & Space Using Sequential Storage

Coding for Optimizing time and Space using Sequential Storage: two pointer approach;[Text Wrapping Break]problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string[Text Wrapping Break]matching algorithms; Kadane’s algo, stacks, priority-queues and hashing based efficient coding;[Text Wrapping Break]median based problems and alternate solutions.

Module 4: Non-Linear Data Structures

Applying Non-Linear Data Structures for real-life problems: design of efficient solutions for[Text Wrapping Break]problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem[Text Wrapping Break]solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path[Text Wrapping Break]algos for CP problems with reduced time/space complexity.

Module 5: Problem Solving using Advanced Topics

CP Problem Solving using Advanced Topics: concept of disjoint sets and their efficient[Text Wrapping Break]representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and[Text Wrapping Break]applying them for CP problems using bottom-up dynamic programming.

List of Laboratory Tasks:

You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. Focus: Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. Focus: Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists). The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. Focus: Basic arithmetic operations, working with arrays or lists to store product prices. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. Focus: Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. Focus: Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. Focus: Basic combinatorics (combinations), factorial calculations. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. Focus: Advanced combinatorics (permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. Focus: Graph traversal algorithms (depth-first search or breadth-first search). In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. Focus: Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. Focus: Basic array traversal, finding the minimum element in an array. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. Focus: Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity. Given a string, find the number of occurrences of a specific substring within the string. Focus: Basic string manipulation, string matching (brute-force approach).

Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. Focus: Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.

An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. Focus: Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.

The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. Focus: Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.

A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. Focus: Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).

In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). Focus: Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.

A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. Focus: Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).

Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. Focus: Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.

An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. Focus: Tree traversal, calculating sums within a tree structure.

Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. Focus: Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.

In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. Focus: Disjoint set union (DSU) data structure, basic connectivity checks.

Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. Focus: Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.

A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. Focus: Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.

In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints. Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.

In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. Focus: Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.

In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. Focus: Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.
Targeted Application & Tools that can be used: C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization). IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning). Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts. String Libraries: Familiarize students with the string manipulation functions available in C++. Graph Visualization Tools: Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms. DP Debugging Techniques: Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.
Text Books: Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition), Antti Laaksonen, springer, 2024 "Data Structures and Algorithms in Java: A Project-Based Approach" – Dan S. Myers, Cambridge University Press Reference Books: Data Structures and Algorithmic Thinking with Python/C++/Java", Narasimha Karumanchi, 5th Edition, Career Monk, 2017. Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022 Web Resources https://nptel.ac.in/courses/106106231
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

Course Code: CSN 2509	Course Title: Network Security and Auditing Type of Course: Program Core	L-T-P-C	2	0	0	2

Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course provides a comprehensive understanding of information security auditing, governance, and compliance within organizational frameworks. Students will explore the fundamental principles of auditing, including legal and regulatory requirements, security governance models, and industry standards such as ISO 27001, NIST, and COBIT. The course covers essential auditing tools and techniques, with a focus on evaluating and securing network infrastructure, including Cisco security solutions. Key topics include policy development, compliance management, risk assessment, and best practices for maintaining robust security controls. Additionally, the course examines critical aspects of infrastructure security, including perimeter intrusion prevention, access control mechanisms, secure remote access solutions, endpoint protection strategies, and unified communications security. By the end of the course, students will be equipped with the knowledge and skills necessary to assess, implement, and manage effective information security auditing processes in enterprise environments.				
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: CO1: Recall fundamental principles of auditing, key information security laws, and governance frameworks (e.g., ISO 27001, NIST, COBIT). Identify common auditing tools, techniques, and security controls used in network infrastructure. CO2: Explain the role of compliance, risk management, and security policies in organizational governance. Describe the functions of perimeter security, access control mechanisms, and secure remote access solutions. CO3: Utilize auditing tools and techniques to assess security configurations in Cisco and other network environments. Implement security best practices for endpoint protection, intrusion prevention, and unified communications. CO4: Evaluate an organization's security posture by auditing policies, infrastructure controls, and regulatory compliance. Compare different security frameworks and standards to determine their applicability in real-world scenarios.				
Course Content:					

Module 1	Introduction	Assignment	Quiz	L – 7- Sessions
The Principle of Auditing; Information Security and the law; Information Security Governance, Frameworks, and Standards.				
Module 2	Tools and Techniques	Assignment	Project	L-8- Sessions
Auditing Tools and Techniques; Auditing Cisco Security Solutions; Policy, Compliance and Management.				

Module 3	Security	Assignment	Project	L-7-Sessions
Infrastructure Security; Perimeter Intrusion Prevention; Access Control.				
Module 4	Remote Access	Assignment	Project	L-8-Sessions
Secure Remote Access; Endpoint Protection; Unified Communications.				
Targeted Application & Tools that can be used : Execution of Network Security and Auditing will be done using "CISCO tool" or "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 and implement network security and auditing solutions."				
Text Book Network Security Auditing (CISCO Press Networking Technology Series), Chris Jackson, 2010.				
References: Nmap Network Exploartion ans Security Auditing Cookbook, Paulino Calderon, Packt Publisher, Third Edition, 2021.				

Course Code: **CSE2508**	**Course Title:** Mobile Applications and Development **Type of Course:** Theory	**L- T-P- C**	2	**0**	0	**2**
Version No.	2.0					
Course Pre-requisites	CSE3514 Object Oriented Programming Using Java					
Anti-requisites	**NIL**					
Course Description	The course deals with the basics of android platform and application life cycle. The goal of the course is to develop mobile applications with Android containing at least one of the following phone material components: GPS, accelerometer or phone camera, use simple GUI applications and work with database to store data locally or in a server. Topics include user interface design; user interface building; input methods; data handling; network techniques and URL loading; GPS and motion sensing. Android application framework and deployment. Power management, Screen resolution, Touch interface, Store data on the device.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mobile Applications and Development as mentioned above and attain Employability Skills through Experiential Learning Techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Discuss the fundamentals of mobile application development and its architecture. (Comprehension) 2. Illustrate mobile applications with appropriate android view. (Application) 3. Demonstrate the use of services, broadcast receiver, Notifications and content provider.(Application)					

	4. Apply data persistence techniques, to perform CRUD operations. (Application) 5. Use advanced concepts for mobile application development. (Application)			
Course Content:				
Module 1	Introduction and Architecture of Android	Assignment	Simulation/Data Analysis	5 Sessions
Topics: Android: History and features, Architecture, Development Tools, Android Debug Bridge (ADB), and Life cycle.				
Module 2	User Interfaces, Intent and Fragments	Term paper/Assignment	Simulation/Data Analysis	6 Sessions
Topics: Views, Layout, Menu, Intent and Fragments.				
Module 3	Components of Android	Term paper/Assignment	Simulation/Data Analysis	6 Sessions
Topics: Activities, Services, Broadcast receivers, Content providers, User Navigation				
Module 4	Notifications and Data Persistence	Term paper/Assignment	Simulation/Data Analysis	6 Sessions
Topics: Notification, Shared Preferences, SQLite database, Android Room with a View, Firebase.				
Module 5	Advance App Development	Term paper/Assignment	Simulation/Data Analysis	7 Sessions
Topics: Graphics and Animation, App Widgets, Sensors, Performance, Location, Places, Mapping, Custom Views, Canvas.				
Targeted Application & Tools that can be used: Applications: Native Android Applications Native iOS Applications Cross Platform mobile Apps Mobile web Applications				
Text Book(s): T1. Pradeep kothari "Android Application Development - Black Book", dreamtechpress T2. Barry Burd (Author), "Android Application Development" ALL – IN – ONE FOR Dummies T3. Jeff Mcherter (Author),Scott Gowell (Author), "Professional mobile Application Development" paperback, Wrox - Wiley India Private Limited T4. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – Wiley India Private Limited				
Reference(s): 1. Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) "Android Programming" 3rd edition, 2017.The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, by" 2. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd,				

2014. 3. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015. 4. J F DiMarzio, “Beginning Android Programming with Android Studio”, 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580 5. Anubhav Pradhan, Anil V Deshpande, “ Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2 6. Reto Meier “Professional Android Application Development” E-Resources: https://puniversity.informaticsglobal.com/login Or http://182.72.188.193/

Course Code: **CSE2509**	**Course Title:** Mobile Applications and Development Lab **Type of Course:** Lab			**L- T-P- C**	0	**0**	4	**2**
Version No.	2.0							
Course Pre-requisites	CSE1514 Object Oriented Programming using Java							
Anti-requisites	**NIL**							
Course Description	The course provides hands-on experience in designing, developing, and deploying mobile applications for Android and iOS platforms. Students will work with native development frameworks such as Android Studio (Java/Kotlin) and Xcode (Swift), as well as explore cross-platform tools like Flutter or React Native.							
Course Objective	The objective of the course is to develop Native and Cross-Platform Mobile Applications, design Interactive and Responsive User Interfaces, integrate Backend Services and APIs, implement State Management and Performance Optimization, ensure Mobile App Security and Data Protection							
Course Outcomes	On successful completion of the course the students shall be able to: 1. Develop Functional Mobile Applications 2. Design and Implement Interactive UIs 3. Integrate Cloud Services and APIs 4. Integrate Backend Systems and Data Management 5. Deploy, Publish, and Maintain advanced Mobile Application							
Course Content:								
Module 1	Introduction and Architecture of Android	Assignment	Simulation/Data Analysis				8 Sessions	
1.a. Design an app to read user inputs using edit text and display the result of arithmetic operations using toast message. 1.b. Create an android app to calculate the current age of yourself, select your DOB using date picker. 2. Design an app to input your personal information. Use an autocomplete text view to select your place of birth.								

<table>
<tr><td>Module 2</td><td>User Interfaces, Intent and Fragments</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>13 Sessions</td></tr>
<tr><td colspan="5">3. a. Design an app to select elective course using spinner view and on click of the display button, toast your ID and selected elective course.
3. b. Design a restaurant menu app to print the total amount of orders.</td></tr>
<tr><td>Module 3</td><td>Components of Android</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>13 Sessions</td></tr>
<tr><td colspan="5">4. Develop an android app that uses intent to maintain the following scenario.
Check the eligibility criteria for voting. Input the Aadhar no., Name & age in the first activity. If the age is above 18, display the voter's detail in the second activity. Else, display, “You are not eligible to vote” in the second Activity.
5. Demonstrate the use of fragment with list of buttons representing various colors, and on click of these buttons, the appropriate color is filled in the next fragment. Create an Android application to input the vitals of a person (temperature, BP). If the vitals are abnormal, give proper notification to the user.
6. Create an android app to for movie ticket booking. Save the user name of the customer using shared preferences. After completion of booking, retrieve the username from the shared preferences and print the ticket details.</td></tr>
<tr><td>Module 4</td><td>Notifications and Data Persistence</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>13 Sessions</td></tr>
<tr><td colspan="5">7. Create an android application to manage the details of students' database using SQLite.Use necessary UI components, which perform the operations such as insertion, modification, removal and
view.Presidency University needs an APP for Admission eligibility checking for students, for that you need to take the following information from the Student: registration ID, physics, chemistry and mathematics marks (PCM), fees is allotted as below criteria.
PCM (Total marks %) Fee concession
90 above 80 %
70 to 89 60 %
Below 69 % no concession
On click on the button “Registration” details should be stored in the database using SQLite. Create button DISPLAY ALL (full students list) on click on the button it should display the students list per the fee
concession.
8. A company need to design an app that plays soft music automatically in the background. Create an app to achieve this functionality.
9. Create an android application such that your view object in the Activity can be Animated with fade-in effect. Create an appropriate XML file named fade-in and write the application to perform the property animation.</td></tr>
<tr><td>Module 5</td><td>Advance App Development</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>13 Sessions</td></tr>
<tr><td colspan="5">10. Demonstrate how to send SMS and email.
11. Create an android application to transfer a file using WiFi. Create an android application “Where am I” with an Activity that uses the GPS Location provider to find the device’s last known location.</td></tr>
</table>

Targeted Application & Tools that can be used:
Applications:

1. Native Android Applications (Java/Kotlin)
   - Android Mobile Apps built for Android smartphones and tablets using Java or Kotlin programming languages.
   - Target audience: Android users.
2. Native iOS Applications (Swift)
   - iOS Mobile Apps designed for iPhone and iPad using Swift.
   - Target audience: iOS users (Apple ecosystem).
3. Cross-Platform Mobile Apps (Flutter, React Native)
   - Cross-platform apps designed to run on both Android and iOS from a single codebase using frameworks like Flutter or React Native.
   - Target audience: Users on both Android and iOS platforms.
4. Mobile Web Applications (Progressive Web Apps - PWA)
   - Mobile-optimized web applications using HTML5, CSS3, and JavaScript that run in a browser with native-like functionality (offline support, push notifications).
   - Target audience: Users accessing apps via mobile browsers.

Development Tools and Frameworks

1. Integrated Development Environments (IDEs)
   - Android Studio (for Android): The official IDE for Android development, supporting Java, Kotlin, and Android SDK.
   - Xcode (for iOS): The official IDE for iOS development with Swift and Objective-C, providing a comprehensive suite of development tools for iPhone/iPad applications.
   - Visual Studio Code (VS Code): Lightweight IDE for working with Flutter, React Native, and web development projects.
2. Cross-Platform Development Frameworks
   - Flutter: Open-source UI framework by Google for building natively compiled applications for mobile, web, and desktop from a single codebase.
   - React Native: Open-source framework developed by Facebook for building cross-platform apps with JavaScript and React.
3. Backend & Cloud Tools
   - Firebase: Google's backend-as-a-service (BaaS) platform offering authentication, real-time databases, cloud storage, and push notifications for mobile apps.
   - AWS Amplify: Cloud platform for backend services (API, storage, authentication) and mobile deployment.
   - SQLite / Realm: Local storage solutions for mobile apps to manage data storage and retrieval on-device.
4. Mobile App Testing and Debugging Tools
   - Android Emulator (for Android): A virtual device to run and test Android apps without needing physical devices.
   - Xcode Simulator (for iOS): A tool to simulate different iOS devices and test apps during development.
   - Appium: Open-source tool for automated testing across native, hybrid, and mobile web applications.
5. Version Control and Collaboration
   - Git: Version control system for managing code changes and collaborating with teams.

- GitHub / GitLab / Bitbucket: Online platforms for hosting Git repositories, collaboration, and version control management.

6. Mobile App Deployment Tools
   - Google Play Console: For managing Android app publishing, distribution, and monitoring.
   - Apple App Store Connect: For managing iOS app submissions, reviews, and releases on the Apple App Store.
7. UI/UX Design Tools
   - Figma / Adobe XD: Tools for UI/UX design and wireframing to create the visual elements of mobile applications before development.
   - Sketch: Vector-based design tool for iOS UI design and prototyping

Text Book(s):

T1. Pradeep kothari “Android Application Development - Black Book”, dreamtechpress
T2. Barry Burd (Author), “Android Application Development” ALL – IN – ONE FOR Dummies
T3. Jeff Mcherter (Author),Scott Gowell (Author), “Professional mobile Application Development” paperback, Wrox - Wiley India Private Limited
T4. Wei-Meng Lee (Author) “Beginning Android Application Development” Wrox – Wiley India Private Limited

Reference(s):

1. Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) “Android Programming” 3rd edition, 2017.The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, by”
2. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014.
3. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD
Publishers, 2015.
4. J F DiMarzio, “Beginning Android Programming with Android Studio”, 4th Edition, Wiley India Pvt
Ltd, 2016. ISBN-13: 978-8126565580
5. Anubhav Pradhan, Anil V Deshpande, “ Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2
6. Reto Meier “Professional Android Application Development”
E-Resources: https://puniversity.informaticsglobal.com/login Or http://182.72.188.193/

Course Code: CSD2001	**Course Title:** **Applied Data Science** **Type of Course:** **Program Core**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					

<table>
<tr><td>Course Description</td><td colspan="4">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.</td></tr>
<tr><td>Course Objectives</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Applied Data Science and attain Skill Development through Experiential Learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of this course the students shall be able to:
1. Describe Numpy and Matrix Operations [Remember]
2. Summarize the need for data preprocessing and visualization techniques. [Understand]
3. Demonstrate the performance of different supervised learning algorithms [Apply]
4. Apply unsupervised learning algorithms for grouping the given data. [Apply]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Data Science, Python Data Structures, Python Numpy Package</td><td>Quiz</td><td>Knowledge based quiz</td><td>No. Of sessions:11</td></tr>
<tr><td colspan="5">Data Science: Basics of Data Science, Sources of Data, Data Science Project Life Cycle: OSEMN Framework, 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.</td></tr>
<tr><td>Module 2</td><td>Data preparation and preprocessing using Pandas dataframe, Exploratory Data Analysis, Data Visualization</td><td>Assignment</td><td>Data Visualization</td><td>No. Of sessions:12</td></tr>
<tr><td colspan="5">Data Quality Assessment, Feature Aggregation, Feature Encoding, Dealing with missing values, Normalization techniques, Statistical description about the data, Relationship between the data, Data Visualization using matplotlib.</td></tr>
<tr><td>Module 3</td><td>Supervised Learning Algorithms</td><td>Design an algorithm using Example</td><td>Random Forest</td><td>No. Of sessions:11</td></tr>
<tr><td colspan="5">Supervised learning techniques: Regression Models- Linear and Logistic Model, Classification Models – Decision Tree, Naïve Bayes, Model Selection and Evaluation criteria: Accuracy, F1 score – Sensitivity – Specificity – AUC.</td></tr>
<tr><td>Module 4</td><td>Unsupervised Learning Algorithms</td><td>Case Study</td><td>Conduct a case study on how data sets can be gathered and implemented in real time application.</td><td>No. Of sessions:11</td></tr>
<tr><td colspan="5">The Clustering Models – K Means algorithm, K- Medoids Algorithm, types of clustering models, Hierarchical clustering techniques, drawbacks of K Means, case study for different algorithms.</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="5">Textbook(s):
1. Data Science Using Python and R- Chantal D.L & Daniel T.L John Wiley & Sons, Inc. -2019
2. Applied Data Science with Python and Jupyter-Alex Galea,Packt Publishing,October2018
1. Data Visualization in Python with Pandas and Matplotlib Paperback –DavidLandup, June 16, 2021</td></tr>
<tr><td colspan="5">References:
1.Data Science with Python and Dask- Jesse Daniel,1st Edition,July30,2019
Weblinks:
• https://presiuniv.knimbus.com/user#/home
• Udemy: https://www.udemy.com/course/applied-data-science-with-python-specialization-mhm/
• NPTEL online course : https://nptel.ac.in/courses/106106179</td></tr>
</table>

Topics relevant to "SKILLS Development": Data Science, Decision Tree Algorithm for developing **Skills development** through **Experiential Learning techniques.** **This is attained through assessment component mentioned in course handout.**	

Course Code: CSD2002	**Course Title:** **Applied Data Science Lab** **Type of Course:** **Program Core**	**L-T-P-C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	NIL					
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 **Skill Development** through E**xperiential Learning** techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1. Describe Numpy and Matrix Operations [Remember] 2. Summarize the need for data preprocessing and visualization techniques. [Understand] 3. Demonstrate the performance of different supervised learning algorithms [Apply] 4. Apply unsupervised learning algorithms for grouping the given data. [Apply]					
Course Content:	**List of Laboratory Tasks:** 1. **Basic operations using Python** 2. **Reading and writing different types of datasets.** 3. **Descriptive statistics in python** 4. **Visualizations**					

5. **Simple linear Regression**
6. **Simple logistic Regression**
7. **Decision trees classifier**
8. **Support vector machine classifier**
9. **Naive Bayes classifier**
10. **Clustering model**

Targeted Application & Tools that can be used:

- Anaconda- Jupyter Notebook
- Google-Colab

Project work/Assignment:

1. Design forest fire and wildfire prediction system.
1. Driver Drowsiness Detection System with OpenCV & Keras
1. Credit Card Fraud Detection using Python.

Textbook(s):

1. Data Science Using Python and R- Chantal D.L & Daniel T.L John Wiley & Sons, Inc. -2019
2. 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:

- https://presiuniv.knimbus.com/user#/home
- Udemy: https://www.udemy.com/course/applied-data-science-with-python-specialization-mhm/
- NPTEL online course : https://nptel.ac.in/courses/106106179

Topics relevant to "SKILLS Development": Data Science, Decision Tree Algorithm for developing **Skills development** through **Experiential Learning techniques.**
This is attained through assessment component mentioned in course handout.

<table>
<tr><td>Course Code:
MAT2501</td><td colspan="2">Course Title: Integral Transforms and Partial Differential Equations
Type of Course:1] School Core</td><td>L-T- P- C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td></td><td colspan="6">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td></td><td colspan="6">Calculus and Differential Equations</td></tr>
<tr><td>Anti-requisites</td><td></td><td colspan="6">NIL</td></tr>
<tr><td>Course Description</td><td></td><td colspan="6">This course aims to introduce various transform techniques such as Laplace transform, Fourier transform and Z-transform in addition to expressing functions in terms of Fourier series. The course covers applications of Laplace transform to LCR circuits and solutions of different equations using Z-transform. The course also deals with the analytical methods for solving partial differential equations and the classical applications of partial differential equations.</td></tr>
<tr><td>Course Objective</td><td></td><td colspan="6">The objective of the course is to familiarize the learners with the concepts of “Transform Techniques, Partial Differential Equations” and attain Skill Development through Problem Solving Techniques.</td></tr>
<tr><td>Course Out Comes</td><td></td><td colspan="6">On successful completion of the course the students shall be able to:
CO1 - Express functions in terms of uniformly convergent Fourier series.
CO2 - Apply Laplace transform technique to solve differential equations.
CO3 - Employ Z-transform techniques to solve difference equations.
CO4 - Solve a variety of partial differential equations analytically.</td></tr>
<tr><td>Course Content:</td><td></td><td colspan="6"></td></tr>
<tr><td>Module 1</td><td colspan="2">Laplace Transforms</td><td colspan="2"></td><td colspan="3">(12 Classes)</td></tr>
<tr><td colspan="8">Definition and Laplace transform of elementary functions. Properties of Laplace transform, and Laplace transform of periodic function, unit-step function and Impulse function – related problems. Inverse Laplace transform of standard functions - problems, initial and final value theorem. Convolution theorem, solution of linear and simultaneous differential equations and LCR Circuit.</td></tr>
<tr><td>Module 2</td><td colspan="2">Fourier Series</td><td colspan="2">Assignment</td><td colspan="3">(8 Classes)</td></tr>
<tr><td colspan="8">Fourier Series: Periodic functions, Dirichlet’s condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.</td></tr>
<tr><td>Module 3</td><td colspan="2">Fourier Transforms and Z - Transforms</td><td colspan="2"></td><td colspan="3">(13 Classes)</td></tr>
<tr><td colspan="8">Fourier Transforms: Definitions, infinite Fourier transforms, Fourier sine and cosine transforms, inverse Fourier transforms, Problems.
Difference equations and Z-transforms: Z-transforms – Basic definitions, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Difference equations – Basic definitions, Application of Z-transforms to solve difference equations.</td></tr>
<tr><td>Module 4</td><td colspan="2">Partial Differential Equations</td><td colspan="2">Assignment</td><td colspan="3">(12 Classes)</td></tr>
<tr><td colspan="8">Formation of PDE, Solution of non-homogeneous PDE by direct integration, Solution of homogeneous PDE involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange’s linear PDE. of the type P p + Q q = R.
Applications of PDE: Derivation of one-dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D’Alembert’s solution of wave equation. Two-dimensional Laplace’s equation – various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems).</td></tr>
<tr><td colspan="8">Targeted Application & Tools that can be used:</td></tr>
</table>

The objective of the course is to familiarize students with a variety of numerical techniques and the theoretical concepts of probability and statistics to equip them with the necessary numerical approaches and basic statistical tools to tackle engineering and real-life problems.
Assignment:
Newton-Raphson Methods, Gauss-Seidel Method, LU Decomposition, Trapezoidal Rule, Simpson's rule, Runge-Kutta 4^{th} Order.
Text Book 1. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition 2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.
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 **E-resources/ Web links:** https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_140238 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_233298 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_204892 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_246791 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_223548 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_134719 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_32614 https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html https://www.scu.edu.au/study-at-scu/units/math1005/2022/
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

Course Code: MAT2602	**Course Title: Numerical Computations** **Type of Course:1] School Core**		**L-T- P- C**	**3**	**0**	**0**	**3**
Version No.		1.0					
Course Pre-requisites		Calculus, Linear Algebra, Differential Equations					
Anti-requisites		**NIL**					
Course Description		The course explores mathematical techniques used to approximate solutions to complex problems that are difficult to solve analytically, often utilizing computers to perform calculations, including methods for root finding, interpolation, numerical differentiation and integration, solving systems of linear equations, and approximating solutions to differential equations, with applications across various scientific and engineering fields. It focuses on understanding the theoretical basis behind these methods, their implementation in programming languages, and analyzing their accuracy and stability.					

Course Objective		The objective of the course is to equip students with understanding and ability to apply various numerical techniques to approximate solutions to complex mathematical problems that are difficult or impossible to solve analytically, particularly focusing on areas like solving systems of equations, finding roots of functions, interpolation, numerical differentiation, and integration, often utilizing computational tools to implement these methods.	
Course Out Comes		On successful completion of the course the students shall be able to: CO1 - Calculate errors induced in the values by truncation of a series expansion. CO2 - Demonstrate the applications of numerical methods to find the roots of polynomial equations and eigen values of real symmetric matrices. CO3 - Apply the knowledge of numerical methods in modelling of various physical and engineering phenomena. CO4 - Apply various numerical methods for solving linear Ordinary & Partial differential equations arising in engineering field.	
Course Content:			
Module 1	**Solution of Linear Systems of Equation**		**(12 Classes)**
Numerical Computation: Motivation and Objectives, Number Representation, Machine Precision, Round-of Error, Truncation Error, Random Number Generation. Solution of algebraic and transcendental equations: Various types of errors - Bisection method, Regula-Falsi method, Newton-Raphson method, Graffe's method - Bairstow's method - Newton's method for solving f(x,y) = 0 and g(x,y) = 0, secant method, Fixed point iteration method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method, Iterative methods of Gauss Jacobi and Gauss Seidel, Sufficient conditions for convergence - LU decomposition method, Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.			
Module 2	**Interpolation and Approximation**	**Assignment**	**(8 Classes)**
Interpolation with equal intervals, Newton's forward and backward difference formulae, Interpolation with unequal intervals, Lagrange's interpolation, Newton's divided difference interpolation, Cubic Splines, Difference operators and relations.			
Module 3	**Numerical Differentiation and Integration**		**(10 Classes)**
Numerical differentiation, Approximation of derivatives using interpolation polynomials, Numerical integration using Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule, Romberg's Method, Two point and three point Gaussian quadrature formulae, Evaluation of double integrals by Trapezoidal rule and Simpson's one-third rule			
Module 4	**Initial & Boundary Value Problems for Ordinary & Partial Differential Equations**	**Assignment**	**(15 Classes)**
Single step methods — Taylor's series method, Modified Euler's method, Fourth order Runge-Kutta method for solving first order equations, Multi step methods, Milne's and Adams, Bash forth predictor corrector methods for solving first order equations. Finite difference methods for solving second order, two-point linear boundary value problems, Finite difference techniques for the solution of two-dimensional Laplace's and Poisson's equations on rectangular domain, One-dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods, One-dimensional wave equation by explicit method.			
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: Python.			
Assignment:			
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.			
Text Book			

1. C.F.Gerald and P.O.Wheatley", Applied Numerical Analysis", McGraw-Hill, 1981.
2. Cheneg and Kincaid, "Introduction to Numerical Computing", Tata McGraw-Hill, 1998.

References:

1. SRK Iyengar & RK Jain, Numerical Methods, New Age Internationals.
2. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
3. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

E-resources/ Web links:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_135224
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_141727
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_217628
http://.ac.in/courses.php?disciplineID=111
http://www.class-central.com/subject/math(MOOCs)
http://academicearth.org/
https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

Course Code: MAT2605	**Course Title: Discrete Mathematics Type of Course:1] School Core**	**L-T- P- C**	**4**	**0**	**0**	**4**

Version No.		1.0
Course Pre-requisites		Linear Algebra
Anti-requisites		**NIL**
Course Description		The course explores the study of mathematical structures that are fundamentally discrete (not continuous), focusing on concepts like set theory, logic, graph theory, combinatorics, and number theory, with applications primarily in computer science fields like algorithms, software development, and cryptography; it covers topics such as propositional logic, proof techniques, relations, functions, counting principles, and basic graph algorithms, providing a foundation for analyzing discrete problems and structures within computer science.
Course Objective		The main objective of the course is that students should learn a particular set of mathematical facts and how to apply them. It teaches students how to think logically and mathematically through five important themes: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful discrete mathematics course should carefully blend and balance all five themes.
Course Outcomes		On successful completion of the course the students shall be able to: CO1 - Explain logical sentences through predicates, quantifiers and logical connectives. CO2 - Deploy the counting techniques to tackle combinatorial problems CO3 - Comprehend the basic principles of set theory and different types of relations.

		CO4 - Apply different types of structures of trees for developing programming skills
Course Content:		

Module 1	**Fundamentals of Logic**		**(10 Classes)**
Basic Connectives and Truth Tables, Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.			
Module 2	**Principle of Counting**	**Assignment**	**(15 Classes)**
The Well Ordering Principle – Mathematical Induction The Basics of Counting, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations Advanced Principle Counting: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.			
Module 3	**Relations and Functions**		**(10 Classes)**
Cartesian Products and Relations, Functions, One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders, Lattice, Hasse Diagrams, Equivalence Relations and Partitions.			
Module 4	**Recurrence Relations and Generating Functions**		**(10 Classes)**
Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.			
Module 5	**Graph Theory & Algorithms on Networks**	**Assignment**	**(15 Classes)**
Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Sub graphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity, Euler and Hamilton Paths, Shortest-Paths. Tree - Definitions, Properties, and Examples, Routed Trees, Binary search tree, Decision tree, spanning tree: BFS, DFS. Algorithms on Networks - Shortest path algorithm- Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.			

Targeted Application & Tools that can be used:

Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems.

Assignment:

Assignment 1: Logic Equivalences and Predicate calculus.

Assignment 2: Equivalence Relations and Lattices

Assignment 3: Recurrence Relations

Text Book

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill,s 8th Edition,2019.
2. Harary – Graph Theory, Addison-Wesley Publishing Company.

References:

1. Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall.
2. K.D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd.
3. Ralph. P. Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia.

E-resources/ Web links:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_54588 https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_375 https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html https://www.scu.edu.au/study-at-scu/units/math1005/2022/
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

Course Code: CSE2514	**Course Title: Operating Systems Lab** **Type of Course: Lab Only**	**L-T- P- C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	CSE2009- Computer Organization 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 laboratory course provides hands-on experience with the core concepts of operating systems through practical assignments, simulations, and case studies. It covers foundational aspects such as system calls, process and thread management, inter-process communication, synchronization, deadlocks, memory management, and file systems. Students will implement and simulate real-time OS components and scheduling algorithms, fostering deeper understanding of OS architecture and design. The lab also introduces modern OS tools, programming interfaces, and the basics of open-source OS environments.					
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] Demonstrate system-level programming using system calls and OS structures. [**Apply**] 2] Simulate process scheduling and multithreading techniques. [**Apply**] 3] Apply various tools to handle synchronization problems using semaphores and shared memory. [**Apply**] 4] Demonstrate memory management and file system concepts using simulation or scripting. **[Apply]**					
Course Content:						
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.						

of Laboratory Tasks:

sheet -1

L1: Write a program to demonstrate the use of fork() and exec() system calls in process creation.

L2: A system has limited memory and high-priority real-time processes. Design a scheduling algorithm that ensures responsiveness while preventing starvation.

sheet -2

L1: Implement First-Come-First-Serve (FCFS) process scheduling using C or Python.

L2: You are designing a server that handles thousands of client connections. Compare multithreading and multiprocessing for this task and implement a basic server model.

sheet -3

L1: Implement Round Robin Scheduling with a fixed time quantum.

L2: In a banking system, concurrent access to accounts leads to data corruption. Design a synchronization solution to avoid race conditions.

sheet -4

L1: Write a program to create threads using Pthreads or Python's threading module.

L2: You're tasked with building a file access tracker in an OS. Implement a system to log file access patterns and identify frequent accesses.

sheet -5

L1: Demonstrate inter-process communication (IPC) using pipes.

L2: A simulation tool needs to emulate process suspension and resumption. Design and implement such a mechanism using signals or condition variables.

sheet -6

L1: Simulate the Producer-Consumer problem using semaphores.

L2: You're developing a system where sensor devices (producers) generate temperature readings, and data processors (consumers) store and process these readings. To prevent race conditions and ensure buffer safety, implement a synchronization mechanism using semaphores.

sheet -7

L1: Implement Dining Philosophers Problem using threads and synchronization.

L2: In a multi-threaded cafeteria simulation, five philosophers sit around a circular table, each alternating between thinking and eating. To eat, a philosopher must hold two forks (represented by shared resources). Your task is to avoid deadlock and ensure no philosopher starves using thread synchronization techniques.

sheet -8

L1: Write a program to simulate First Fit, Best Fit, and Worst Fit memory allocation strategies.

L2: A system with limited memory blocks needs to allocate memory to processes arriving with various size requests. Your task is to implement three classic memory allocation strategies—First Fit, Best Fit, and Worst Fit—to allocate memory to each process efficiently. Simulate and compare how memory gets allocated in each strateg

sheet -9

L1: Demonstrate paging using a simple page table simulation.

L2: A program has a logical address space divided into pages. The system's memory is divided into equal-sized frames. When a program executes, its pages are loaded into available frames in main memory. Simulate the address translation process using a page table and demonstrate how a logical address is converted to a physical address.

sheet -10

L1: Write a program to simulate page replacement algorithms like FIFO and LRU.

L2: In a virtual memory system, a process accesses pages in a specific order. The memory can only hold a limited number of pages (frames). When a page is needed and the memory is full, a page replacement algorithm is used to decide which page to evict. Simulate and compare FIFO and LRU algorithms for a given page reference string.

sheet -11

L1: Simulate file directory structure (single level/two level).

L2: A university campus computer lab has limited memory space available for each student login session. When students open files or run programs, memory pages are loaded into available memory frames. Due to the limited number of frames, some pages must be replaced when new ones are needed. The lab system uses page replacement algorithms to decide which pages to evict when memory is full..

sheet -12

L1: Write a shell script to demonstrate file handling commands in Linux.

L2: Design a command-line mini shell that can run background and foreground processes and handle basic built-in commands like cd, pwd, exit.

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

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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: CSE1500	**Course Title:** Computational Thinking Using Python **Type of Course:** Integrated	**L- T-P- C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces students to the essential skills of **computational thinking** and their practical application through the **Python programming language**. By combining problem-solving strategies with coding, students will learn to decompose complex challenges, identify patterns, abstract general principles, and design algorithms to build functional programs					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computational Thinking and use the Computational Thinking Principles to solve the computational Problems using Python Language					

Course Outcomes	Upon successful completion of this course, students will be able to:
	
	• Explain and apply the core principles of **computational thinking**:
	    o Decomposition
	    o Pattern Recognition
	    o Abstraction
	    o Algorithm Design
	• Use **Python** to implement solutions to real-world problems.
	• Write and debug Python code using functions, loops and conditions
	• Design simple programs and algorithms to automate repetitive or complex tasks.
	• Collaborate effectively and communicate problem-solving approaches using pseudocode and Python.					

Course Content:				
Module 1	**Pillars of Computational Thinking**	Comprehension		**9 Sessions**
What is computational thinking? Why is it important? Pillars of computational thinking: decomposition; pattern recognition; data representation and abstraction; algorithms Applying computational thinking to case studies				
Module 2	**Algorithm Design & Problem-Solving Strategies**	Application		**9 Sessions**
Introduction to Algorithms, Introduction to Problem Solving techniques: Brute Force, Divide and conquer, Common algorithms: find-max, linear search, binary search and other simple Algorithms				
Module 3	**Applied Computational Thinking using Python**	Application		**12 Sessions**
Introduction to Python, Data representation: variables, lists, Conditionals, Loops and Iteration Basic Example programs to illustrate the programming constructs				
Targeted Application & Tools that can be used: **Google Colab, Python**				
Text Book 1. "Computational Thinking for the Modern Problem Solver" – David D. Riley & Kenny A. Hunt				

2. "Mastering Python 3 Programming: Ultimate Guide to Learn Python Coding Fundamentals and Real-World Applications" Subburaj Ramaswamy, BPB publications

References

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Automate the Boring Stuff with Python: Practical Programming for Total Beginners.
No Starch Press, 2015.
https://automatetheboringstuff.com

• **Severance, Charles.**
Python for Everybody: Exploring Data Using Python 3.
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https://www.py4e.com

• **Wing, Jeannette M.**
"Computational Thinking." *Communications of the ACM*, vol. 49, no. 3, 2006, pp. 33–35.
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• **Downey, Allen B.**
Think Python: How to Think Like a Computer Scientist.
Green Tea Press, 2015.
http://greenteapress.com/wp/think-python-2e/

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E-Resources

https://edu.google.com/resources/programs/exploring-computational-thinking

Topics relevant to "SKILL DEVELOPMENT": Decomposition, Abstraction, Pattern recognition, Data Representation ,Algorithms

Ittagalpura, Rajanukunte, Yelahanka, Bengaluru 560 119