



**PRESIDENCY  
UNIVERSITY**

# **PROGRAMME REGULATIONS & CURRICULUM**

2021-25

**PRESIDENCY SCHOOL OF  
COMPUTER SCIENCE & ENGINEERING**  
**BACHELOR OF TECHNOLOGY (B.TECH.)**  
**COMPUTER SCIENCE AND ENGINEERING**  
**(CYBER SECURITY-CCS)**



# PRESIDENCY UNIVERSITY

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

**SCHOOL OF COMPUTER SCIENCE AND ENGINEERING**

## **PROGRAM REGULATIONS AND CURRICULUM**

### **2021-2025**

**B. Tech. – COMPUTER SCIENCE AND  
ENGINEERING(Cyber Security-CCS)**

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

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

**Regulations No: PU/AC-24.7/SOCSE04/CCS/2021-25**

**Resolution No. 7 of the 24<sup>th</sup> Meeting of the Academic Council held on 3<sup>rd</sup> August 2024, and  
Ratified by the Board of Management in its 24<sup>th</sup> Meeting held on 5<sup>th</sup> August 2024**

## **April 2024**

## Table of Contents

Clause No.	Contents	Page Number
<b>PART A – PROGRAM REGULATIONS</b>		
1.	Vision & Mission of the University and the School / Department	3
2.	Preamble to the Program Regulations and Curriculum	4
3.	Short Title and Applicability	5
4.	Definitions	6
5.	Program Description	7
6.	Minimum and Maximum Duration	8
7.	Programme Educational Objectives (PEO)	9
8.	Programme Outcomes (PO) and Programme Specific Outcomes (PSO)	10
9.	Admission Criteria (as per the concerned Statutory Body)	10
10.	Lateral Entry / Transfer Students requirements	11
11.	Change of Branch / Discipline / Specialization	13
12.	Specific Regulations regarding Assessment and Evaluation	15
13.	Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc.	16
14.	Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements	17
15.	Minimum Total Credit Requirements of Award of Degree	20
16.	Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies	20
17.	ture – Basket Wise Course List	20
18.	P r	22
19.		
20.		31

21.		36
22.		37
23.		41

## **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 2021-2025.
- b. These Regulations are subject to, and pursuant to the Academic Regulations.
- c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2021-2025 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 2021-2025.

### 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, 2021-2025;*
- 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, 2021;*
- 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 2021-2025 are subject to, and, pursuant to the Academic Regulations, 2025. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2021-2025 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 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 19.0 of Academic Regulations) in the prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

## **7 Programme Educational Objectives (PEO)**

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

PEO1. Demonstrate as a Computer Engineering Professional

PEO2. Engage in lifelong learning through research and professional development

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

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

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

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

## **9 Admission Criteria (as per the concerned Statutory Body)**

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

- 9.1 An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.
- 9.2 Provided further, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics /

Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.

- 9.3 The applicant must have appeared for Joint Entrance Examinations (JEE) Main / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level Engineering Entrance Examinations.
- 9.4 Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.
- 9.5 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.
- 9.6 Candidates must fulfil the medical standards required for admission as prescribed by the University.
- 9.7 If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.
- 9.8 The decision of the BOM regarding the admissions is final and binding.

## **10 Lateral Entry / Transfer Students requirements**

### **10.1 Lateral Entry**

The University admits students directly to the second year (3<sup>rd</sup> 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 2<sup>nd</sup> year (3<sup>rd</sup> 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 (5<sup>th</sup> and 6<sup>th</sup> 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 1<sup>st</sup> 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 3<sup>rd</sup> Semester (commencement of the 2<sup>nd</sup> Year) of the B.Tech. Program and culminating with the 8<sup>th</sup> Semester (end of the 4<sup>th</sup> 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 1<sup>st</sup> year (1<sup>st</sup> or 2<sup>nd</sup> 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 3<sup>rd</sup> Semester of the Program. i.e., the Program Structure and Curriculum from the 3<sup>rd</sup> to 8<sup>th</sup> 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 1<sup>st</sup> Year of the concerned B.Tech. Program shall be waived for the student(s) admitted to the concerned B.Tech Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Tech. Degree in the concerned Program shall be prescribed / calculated as follows:

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1<sup>st</sup> Year (1<sup>st</sup> and 2<sup>nd</sup> 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. (Cyber Security Engineering) is "N" Credits, and, if the total credits prescribed in the 1<sup>st</sup> Year (total credits of the 1<sup>st</sup> and 2<sup>nd</sup> Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Cyber Security

Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.8 Further, no other waiver except the Courses prescribed for the 1<sup>st</sup> 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 2<sup>nd</sup> year (3<sup>rd</sup> Semester) of the B.Tech. Program of the University**

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

**10.2.1** The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1, 10.1.2 and 10.1.3.

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

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

**10.2.4** The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1<sup>st</sup> Year of the B.Tech. 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 2<sup>nd</sup> Year of the B.Tech. Program of the University.

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

## **11 Change of Branch / Discipline / Specialization**

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a change of Branch, at the end of 1<sup>st</sup> 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 1<sup>st</sup> Year of the B.Tech. Program and obtained a CGPA of not less than 6.50 at the end of the 2<sup>nd</sup> 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 3<sup>rd</sup> 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 3<sup>rd</sup> 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 3<sup>rd</sup> 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 8.8 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 8.10 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

Table 1: 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%	



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

\*CSE3150-Front End Full stack development  
CSE3151-Java Full Stack Development  
CSE3152-.Net Full Stack development

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

Normally, for Practice/Skill based Courses, without a defined credit structure (L-T-P) [NTCC], but with assigned Credits (as defined in Clause 5.2 )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-clause 8.9.1,8.9.2 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. ANNEXURE B 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 17.313.3 (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.**

<b>Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses</b>		
<b>Sl. No.</b>	<b>Course Duration</b>	<b>Credit Equivalence</b>
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 (13.0), 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. (Cyber Security) Program Structure (2021-2025) totalling 162 credits. Table 3.0 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.

<b>Table 3: B.Tech. (Cyber Security) 2021-2025: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets</b>	
<b>Baskets</b>	<b>Credit Contribution</b>
SCHOOL CORE	59
PROGRAM CORE	61
DISCIPLINE ELECTIVE	30
OPEN ELECTIVE	15
<b>TOTAL CREDITS</b>	<b>Min. 160</b>

In the entire Program, the practical and skill based course component contribute to an extent of approximately 57% out of the total credits of 160 for B.Tech. (Cyber Security) 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).**

<b>Table 3.1 : List of School Core</b>					
S.No	Course Name	L	T	P	C
1	English for Technical Writing	2	0	0	2
2	Advanced English / Foreign Language	2	0	0	2
3	PPS (Soft Skills)	2	0	0	2
4	PPS (Quantitative Aptitude)	2	0	0	2
5	Management Course (Engineering Economics and Cost Estimation)	2	0	2	3
6	Probability and Statistics	3	1	0	4
7	Physics-I	3	0	0	3
8	Physics-I Lab	0	0	2	1
9	Calculus and Linear Algebra	3	1	0	4
10	Chemistry-I	3	0	0	3
11	Chemistry-I Lab	0	0	2	1
12	Transform Techniques, Partial Differential Equations and Their Applications	3	1	0	4
13	Engineering Graphics	2	0	0	2
14	Problem Solving Using C	1	0	4	3
15	Basic Engineering Sciences	2	0	0	2
16	Problem Solving using JAVA	1	0	4	3
17	Basics of Electrical and Electronics Engineering	3	0	2	4
18	Data Structures and Algorithms	3	0	2	4
19	Programming in Python	1	0	4	3
20	Mastering Object-Oriented Concepts in Python	0	0	2	1
21	Data Structure and Web Development with Python	0	0	2	1
22	Capstone Project	0	0	0	4

	Internship	0	0	0	9
23	Python Full-Stack Development	0	0	2	1
<b>Total No. of Credits</b>					<b>59</b>

<b>Table 3.4 : List of Program Core Courses</b>					
S. No	Course Name	L	T	P	C
1	Web Technologies	2	0	2	3
2	Design and Analysis of Algorithms	3	0	0	3
3	Computer Organization and Architecture	3	0	0	3
4	Operating Systems	3	0	0	3
5	Data Communications and Computer Networks	3	0	0	3
6	Database Management Systems	2	0	2	3
7	Cloud Computing	3	0	0	3
8	Software Engineering	3	0	0	3
9	Digital Design	2	0	2	3
10	Discrete Mathematical Structures	3	0	0	3
11	Theory of Computation	2	0	2	3
12	Artificial Intelligence and Machine Learning	2	0	2	3
13	Cryptography and Network Security	2	0	2	3
14	Data Analysis and Visualization	2	4	4	4
15	Fundamentals of Data Analytics	2	0	2	3
16	Cyber Forensics	2	0	2	3
17	Ethical Hacking	1	0	4	3
18	Cyber threats for IOT and Cloud	3	0	0	3
19	Web Security	2	0	2	3
20	Intrusion Detection and Prevention System	3	0	0	3
<b>Total No. of Credits</b>					<b>61</b>

### **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 10-12 weeks in an industry / company or academic / research institution during the 8<sup>th</sup> Semester , subject to the following conditions:

**18.1.1** The Internship shall be 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 Capstone Project**

A student may opt to do a Project Work for a period of 10-12 weeks in an Industry / Company or academic / research institution or the University



Department(s) as an equivalence of Internship during the 7<sup>th</sup> Semester as applicable, subject to the following conditions:

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

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

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

**18.2.4** A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the 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.

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

### **18.3 Research Project / Dissertation**

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

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

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

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

Artificial Intelligence and Machine Learning Basket									
1	CSE3005	Applied Artificial Intelligence	3	0	3	S		CSE3001	
2	CSE3016	Neural Networks and Fuzzy Logic	3	0	3	S/ EM		MAT1002	
3	CSE3087	Applied Machine Learning	2	2	3	S		CSE3001	
4	CSE3009	Optimization Techniques for Machine Learning	3	0	3	S/EM		CSE3087	
5	CSE3010	Deep Learning Techniques	3	0	3	S		CSE3087	
6	CSE3011	Reinforcement Learning	2	2	3	S		CSE3008	
7	CSE3014	Fundamentals of Natural Language Processing	3	0	3	S		CSE3001	
8	CSE3015	Advanced Natural Language Processing	2	2	3	S/ EM		CSE3014	
9	CSE3017	Autonomous Navigation and Vehicles	3	0	3	S/ EM		MAT1002	
10	CSE3018	Digital Health and Imaging	3	0	3	S/ EM		CSE3008	
11	CSE3019	Stochastic Decision Making	3	0	3	S/ EM		MAT1003	
12	CSE3088	Business Intelligence and Analytics	3	0	3	S/ EM		CSE3008	
13	CSE3103	Cognitive Science & Analytics	3	0	3	S/ EM		CSE3008	
14	CSE3108	Expert Systems	3	0	3	S/ EM		CSE3008	
Big Data Basket									
1	CSE2021	Data Mining	3	0	3	S/ EM	-	MAT1001	-
2	CSE2022	Domain Specific Predictive Analytics	3	0	3	S/EM	-	CSE2027	-

3	CSE2023	Data Warehousing and its Applications	3	0	3	S/EM	-	MAT1001	-
4	CSE2024	No SQL Databases	2	2	3	S	-	CSE2074	-
5	CSE3002	Big Data Technologies	2	2	3	S	-	CSE2074	
6	CSE3030	Mining Massive Datasets	2	2	3	S/EM	-	CSE2027	-
7	CSE3031	Web Intelligence and Analytics.	2	2	3	S	-	CSE2027	-
8	CSE3032	Streaming Data Analytics	2	2	3	S	-	CSE2027	-
9	CSE3033	Information Visualization	2	2	3	S/EM	-	CSE2027	-
10	CSE3034	Big Data Security and Privacy.	3	0	3	S	-	CSE3002	-
Block Chain Basket									
1	CSE3021	Blockchain for Public Sector	3	0	3	S/EM	-	CSE2020	-
2	CSE3022	Crypto Currency Technology	3	0	3	S/EM		CSE2019	-
3	CSE3024	Emerging Areas in Blockchain	3	0	3	S/EM	-	CSE2020	-
4	CSE3025	Industry Use Cases using Blockchain	3	0	3	S/EM	-	CSE2020	-
5	CSE2019	Foundations of Blockchain Technology	3	0	3	S	-		
6	CSE2020	Blockchain Technology And Applications	3	0	3	S	-		
7	CSE3020	Smart Contract and Solidity	2	2	3	S	-	CSE2019	
8	CSE3023	Distributed Ledger Technology	2	2	3	S		CSE 2019	
9	CSE3028	Blockchain Security and Performance	2	2	3	S		CSE2019	
Cyber Security Basket									
1	CSE2037	Cyber Forensics	2	2	3	S		MAT1001	
2	CSE2038	Privacy and Security in Online Social Media	3	0	3	S/EM		CSE1001	
3	CSE2039	Ethical Hacking	2	2	3	S		CSE1001	

4	CSE2040	Cyber Threats for IoT and Cloud	3	0	3	S			
5	CSE3145	Intrusion Detection and Prevention System	3	0	3	S	-	CSE2037	
6	CSE3094	Cyber Security	3	0	3	S/EM		CSE3078	
7	CSE3096	Cyber Digital Twin	3	0	3	S/EM		CSE2013	
8	CSE3097	Web Security	2	2	3	S	-	CSE2011	
9	CSE3098	Vulnerability Assessment and Penetration Testing	3	0	3	S/EM		CSE3078	
10	CSE3099	Digital and Mobile Forensics	2	2	3	S/EM	-	CSE2011	
11	CSE3100	Security Assessment and Testing	2	2	3	S/EM	-	CSE2011	
12	CSE3101	Digital Watermarking and Steganography	3	0	3	S/EM	-	CSE3078	
13	CSE3102	Malware Analysis	3	0	3	S/EM	-	CSE3078	
Data Science Basket									
1	CSE2025	Business Continuity and Risk Analysis	3	0	3	S/EM	-	CSE2027	-
2	CSE2026	Data Handling and Visualization	2	2	3	S/EM	-	CSE2027	
3	CSE2028	Statistical Foundations of Data Science	2	2	3	S/EM		MAT1003	
4	CSE2029	Web Data Analytics	2	2	3	S/EM		CSE2027	-
5	CSE3035	R programming for Data Science	1	4	3	S		CSE2027	-
6	CSE3036	Predictive Analytics	2	2	3	S	-	CSE2026	
7	CSE3037	Optimization for Data Science	2	2	3	S		CSE2027	
8	CSE3038	Applied Data Science	2	2	3	S		CSE2027	
9	CSE3039	Social Media Analytics	2	2	3	S		CSE3036	-
10	CSE3136	E-Business and Marketing Analytics	3	0	3	S/EM		CSE2025	
11	CSE3137	Text Mining and Analytics	3	0	3	S/EM	-	CSE3001	

DevOps Basket										
1	CSE3040	Agile Structures and Frameworks	3	0	3	S	-		-	
2	CSE3042	Applied DevOps	2	2	3	S/EM	-	CSE2014	-	
3	CSE3043	Automated Test Management	2	2	3	S	-	CSE2014	-	
4	CSE3044	Build and Release Management	3	0	3	S/EM	-	CSE2014	-	
5	CSE3045	Development Automation	2	2	3	S	-	CSE2014	-	
6	CSE3046	DevOps Tools Internals	2	2	3	S	-		-	
7	CSE3050	Software Project Management	3	0	3	S/EM	-	CSE2014	-	
8	CSE3051	System Monitoring	3	0	3	S/EM	-	CSE3120	-	
9	CSE3052	System Provisioning and Configuration Management	3	0	3	S	-	CSE2014	-	
IoT Basket										
1	CSE2032	Introduction to Fog Computing	3	0	3	S	-	CSE2011		
2	CSE3053	Big Data Analytics for IoT	1	4	3	S	-	CSE3002		
3	CSE3055	Wireless Communication in IoT	3	0	3	S	-	CSE2011		
4	CSE3063	Privacy and Security in IoT	3	0	3	S		CSE3078		
5	CSE3066	Mobile Application for IoT	3	0	3	S		CSE2011		
6	ECE3075	IoT: Architecture and Protocols	3	0	3	S / EM				
7	ECE3076	IoT Platforms and Application Development	2	2	3	S / EM				
8	ECE3086	Industrial Internet of Things (IIoT)	3	0	3	S / EM	-			
9	ECE3088	Internet of Medical Things (IoMT)	3	0	3	S / EM	-			
General Basket										
1	CSE2033	Go Programming	3	0	3	S/ EM	-	CSE1002	-	

2	CSE2066	Computer Graphics	3	0	3	S	-		-
3	CSE3146	Advanced Java Programming	1	4	3	S	-	CSE1001	-
4	CSE2036	Programming in C++	1	4	3	S/ EM	-	CSE1001	-
5	CSE3068	Advanced Database Management Systems	2	2	3	S/ EM	-	CSE2074	-
6	CSE3069	Introduction to Bioinformatics	3	0	3	S/ EM	-		-
7	CSE3070	Advanced Computer Networks	3	0	3	S/ EM		CSE2011	-
8	CSE3071	Computer Vision	2	2	3	S/ EM	-	MAT 1003	-
9	CSE3072	Wireless Sensor Networks	3	0	3	S/ EM		CSE 2011	
10	CSE3073	Game Design and Development	3	0	3	S/ EM	-		-
11	CSE3074	Microprocessors and Microcontrollers	3	0	3	S/ EM			
12	CSE3075	Mobile Application Development	1	4	3	S	-	CSE1001	-
13	CSE3077	Compiler Design	2	2	3	S	-		-
14	CSE3079	Parallel Computing	3	0	3	S/ EM	-	CSE2009	-
15	CSE3080	Quantum Computing	3	0	3	S/ EM	-	MAT1002	-
16	CSE3081	Digital Image Processing	2	2	3	S/ EM		MAT1002	-
17	CSE3082	Object Oriented Analysis and Design	3	0	3	S	-	CSE1001	
18	CSE3083	Advanced Computer Architecture	3	0	3	S/ EM	-	CSE2009	-
19	CSE3084	Software Quality Assurance	2	2	3	S/ EM	-	CSE2014	-
20	CSE3085	Real Time Operating System	3	0	3	S/ EM	-	CSE2010	-
21	CSE3086	Information Theory and Coding	3	0	3	S/ EM		MAT1002	-
22	CSE3089	Software Architecture	3	0	3	S/ EM	-	CSE2009	
23	CSE3090	5G Networking	3	0	3	S/ EM		CSE2011	-

24	CSE3091	Programming in C# and .NET	1	4	3	S/ EM	-	CSE1001	
25	CSE2052	Distributed Systems	3	0	3	S/ EM	-	CSE2010,	-
Cloud Computing Basket									
1	CSE2034	Edge Computing	3	0	3	S/EM	-	CSE2011	
2	CSE3095	Cloud Security	3	0	3	S/EM	-	CSE2013	
3	CSE3054	Data Center Design	3	0	3	S/EM	-	CSE2013	
4	CSE3127	Cloud Application Development	3	0	3	S/EM		CSE2013	
5	CSE3129	Middleware Technologies	3	0	3	S/EM	-	CSE2011	
Information Science & Engineering Basket									
1	CSE3126	E-Commerce	3	0	3	S/EM	-	CSE2007	
Information Science & Technology Basket									
1	CSE2054	Storage Area Networks	3	0	3	S	-	CSE2011	
2	CSE2055	Information System Audit	3	0	3	S	-	CSE2011	
3	CSE2056	Web 2.0	2	2	3	S/EM	-	CSE2007	
4	CSE2057	Cloud Computing and Virtualization	3	0	3	S/EM	-	CSE2011	
5	CSE2058	Firewall and Internet Security	2	2	3	S		CSE2011	
6	CSE2059	Mobile Networking	2	2	3	S	-	CSE2011	
7	CSE2060	Information Security and Management	3	0	3	S/EM		CSE2011	
8	CSE3128	Human Computer Interaction	3	0	3	S/EM	-	CSE2007	
9	CSE3143	Infrastructure Management	3	0	3	S/EM		CSE2011	
10	CSE3132	Network Management Systems	3	0	3	S	-	CSE2011	

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

<b>Table 3.6 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 12</b>												
Sl. No.	Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Prerequisites/ Corequisites	Anti requisites	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											
1	CSE2002	Programming in Java	2	0	2	3	S/EM	-	-	-	-
2	CSE2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
3	CSE2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
4	CSE2005	Web design fundamentals	2	0	2	3	S/ EM/EN	-	-	-	-
5	CSE3111	Artificial Intelligence : Search Methods For Problem Solving	3	0	0	3	S/ EM/EN	-	-	-	-
6	CSE3112	Privacy And Security In Online Social Media	3	0	0	3	S/ EM/EN	-	-	-	-
7	CSE3113	Computational Complexity	3	0	0	3	S/ EM/EN	-	-	-	-
8	CSE3114	Deep Learning for Computer Vision	3	0	0	3	S/ EM/EN	-	-	-	-
9	CSE3115	Learning Analytics Tools	3	0	0	3	S/ EM/EN	-	-	-	-
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	Introdcuton 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 (not to be offered for Mechanical Department students)											
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	-	-	MEC 2008	-
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

### 21.1 NPTEL - Open Elective Courses for B. Tech. (Cyber Security)

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	Introduction 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

Sl. No.	Course Code	Course Name	L	P	Credits	Basket
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				T			
Semester 1						19	
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	School Core
2	CSE1001	Problem Solving using JAVA	2	0	2	3	School Core
3	ENG1001/ ENG 1002	Foundation of English/Technical English	1	0	2	2	School Core
4	ECE1001	Elements of Electronics Engineering	3	0	2	4	School Core
5	XXXXXXX	Open Elective-1	3	0	0	3	Open Elective
6	CSE1002	Innovative Projects - Arduino using Embedded 'C'	0	0	4	2	School Core
7	PPS1001	Introduction to soft skills	0	0	2	1	School Core
Semester 2 + Summer Term						28	
1	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	School Core
2	MAT1003	Applied Statistics	1	0	2	2	School Core
3	CSE2001	Data Structures and Algorithms	3	0	2	4	Program Core
4	ENG1002/ENG2001	Technical English/Advanced English	1	0	2	2	School Core
5	PHY1002	Optoelectronics and Device Physics	2	0	2	3	School Core
6	ECE2007	Digital Design	2	0	2	3	Program Core
7	CSE2067	Web Technologies	2	0	2	3	Program Core
8	CSE2014	Software Engineering	3	0	0	3	Program Core
9	XXXXXXX	Open Elective-II	3	0	0	3	Open Elective
10	PPS1002	Soft Skills for Engineers	0		2	1	

				0			School Core
11	KAN1001/KAN1002	Kali Kannada/Thili Kannada	1	0	0	1	School Core
12	CHE1001	Environmental Studies	2	0	0	0	School Core
Semester 3						21	
1	CSE2011	Data Communications and Computer Networks	3	0	0	3	Program Core
2	CSE2009	Computer Organization and Architecture	3	0	0	3	Program Core
3	CSE2074	Database Management Systems	2	0	2	3	Program Core
4	MAT2004	Discrete Mathematical Structures	3	0	0	3	Program Core
5	CSE2027	Fundamentals of Data Analytics	3	0	0	3	Program Core
6	CSEXXXX	Discipline Elective –I	3	0	0	3	Discipline Elective
7	PPS2001	Reasoning and Employment Skills	0	0	2	1	School Core
8	CSE1003	Innovation Project - Raspberry Pi using Python	0	0	4	2	School Core
Semester 4						25	
1	MAT2003	Numerical Methods for Engineers	1	0	2	2	School Core
2	CSE2007	Design and Analysis of Algorithms	3	0	0	3	Program Core
3	CSE2018	Theory of Computation	3	0	0	3	Program Core
4	CSE3343	Cloud Computing	2	0	2	3	Program Core
5	CSE2010	Operating System	3	0	0	3	Program Core
6	CSE3078	Cryptography and Network Security	3	0	0	3	Program Core
7	CSE2015	Data Analysis and Visualization	2	0	4	4	Program Core
8	CSEXXXX	Discipline Elective –II	3	0	0	3	Program Core
9	PPS2002	Being Corporate Ready	0		2	1	



				0			School Core
Semester 5						22	
1	CSE3001	Artificial Intelligence and Machine Learning	2	0	2	3	Program Core
2	CSE2037	Cyber Forensics	2	0	2	3	Program Core
3	CSE3342	Ethical Hacking	1	0	4	3	Program Core
4	CSEXXXX	Discipline Elective –III	3	0	0	3	Discipline Elective
5	CSEXXXX	Discipline Elective –IV	3	0	0	3	Discipline Elective
6	CSEXXXX	Discipline Elective –V	3	0	0	3	Discipline Elective
7	XXXXX XX	Open Elective –III(Course from Management Basket)	3	0	0	3	Open Elective
8	PPS4002	Introduction to Aptitude	0	0	2	1	School Core
Semester 6						22	
1	CSE3097	Web Security	2	0	2	3	Program Core
2	CSE2040	Cyber Threats for IoT and Cloud	3	0	0	3	Program Core
3	CSE3145	Intrusion detection and Prevention	3	0	0	3	Program Core
4	CSEXXXX	Discipline Elective – VI	3	0	0	3	Program Core
5	CSEXXXX	Discipline Elective – VII	3	0	0	3	Discipline Elective
6	CSEXXXX	Discipline Elective –VIII	3	0	0	3	Discipline Elective
7	XXXXXXXX	Open Elective –IV	3	0	0	3	Open Elective
8	PPS3002	Programming skills for employment	0	0	2	1	School Core
9	PIP1001	Apprenticeship	0	0	0	0	School Core
Semester 7						14	
1	CSEXXXX	Discipline Elective -IX	3	0	0	3	Discipline Elective
2	CSEXXXX	Discipline Elective –X	3	0	0	3	Discipline Elective
3	XXXXXXXX	Open Elective – V (Course from Management Basket)	3	0	0	3	Open Elective
4	PIP2001	Capstone Project	-		-	4	School Core

5	PPS3018	Preparedness for Interview	0	0	2	1	School Core
6	XXXXXXX	Open Elective-VI**	-		-	1	Open Elective
Semester 8						9	
1	PIP4004	Internship	-		-	9	School Core

Open Elective-VI\*\*-Students who have not earned the 15 credits of Open Elective until 7th semester are eligible towards the registration and completion of the Open Elective VI course under NPTEL MOOC

## 23 Course Catalogue

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

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

<b>Course Code:</b> MAT1001	<b>Course Title:</b> Calculus and Linear Algebra <b>Type of Course:</b> School Core Lab Integrated	<b>L-T-P- C</b>	2	1	2	4
<b>Version No.</b>	3.0					
<b>Course Pre-requisites</b>	Basic Concepts of Limits, Differentiation, Integration					
<b>Anti-requisites</b>	NIL					
<b>Course Description</b>	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.					
<b>Course Objective</b>	The objective of the course is <u>Skill Development</u> of student by using <u>Problem Solving Techniques</u> .					
<b>Course Out Comes</b>	<p>On successful completion of the course the students shall be able to:</p> <ol style="list-style-type: none"> <li>1) Comprehend the knowledge of applications of matrix principles.</li> <li>2) Understand the concept of partial derivatives and their applications.</li> <li>3) Apply the principles of integral calculus to evaluate integrals.</li> <li>4) Adopt the various analytical methods to solve differential equations.</li> <li>5) Demonstrate the use of MATLAB software to deal with a variety of mathematical problems.</li> </ol>					
<b>Course Content:</b>						
<b>Module 1</b>	<b>Linear Algebra</b>					<b>10 Classes</b>
<p>Review: Types of matrices, elementary transformations, rank of a matrix, normal form, Solution of systems of linear equations: (Homogenous and non-homogenous system) <math>AX = O</math> and <math>AX = B</math> using rank method.</p> <p><b>Linear Algebra:</b>            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.</p>						

<b>Module 2</b>	<b>Partial Derivatives</b>			<b>10 CLASSES</b>
<p>Review: Differential calculus with single variable.</p> <p><b>Partial Derivatives:</b>  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.</p>				
<b>Module 3</b>	<b>Advanced Integral calculus</b>			<b>12 Classes</b>
<p>Review: Integral calculus for single integrals.</p> <p><b>Advanced Integral calculus:</b>  Beta and Gamma functions–interrelation-evaluation of integrals using gamma and beta functions; error function-properties. Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates.  Engineering applications of partial derivatives.</p>				
<b>Module 4</b>	<b>Ordinary Differential Equations</b>	<b>Assignment</b>	<b>Programming</b>	<b>12 Classes</b>
<p>Review: First order and first-degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non- Homogeneous Equations reducible to Homogeneous form.</p> <p>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 <math>e^{ax}</math>, <math>\sin ax</math>, <math>\cos ax</math>, <math>e^{ax}f(x)</math>, <math>x^n f(x)</math> etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, D-operators and Inverse D- operators, Method of Variation of Parameters.  Engineering applications of differential equations.</p>				
<p><b>List of Laboratory Tasks:</b></p> <p>Introductory Task: Introduction to usage of the software and simple programming tasks. [ 3 Sessions]  Experiment N0 1: Solution of Simple differentiation with single variable and use of chain Rule.  Experiment No. 2: Solution based on application of Tailors' Series using software  Experiment No. 3: Application of Maxima and Minima condition using software.  Experiment No. 4 Computation of different functions for a specific problem</p>				

<p>Experiment No. 5 Computation of Area under a curve.</p> <p>Experiment No. 6 Solution of a set of simultaneous equations in matrix method</p> <p>Experiment No. 7 Computation of Eigen Values and Eigen Vectors.</p> <p>Experiment No. 8 Solution of Partial Differential equation</p> <p>Experiment No. 9 solution using Cauchy Equation and Lagrange's Equation</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.</p> <p>Tools Used: MatLab, Zylink.</p>
<p><b>Assignment:</b></p> <ol style="list-style-type: none"> <li>1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB.</li> <li>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.</li> </ol>
<p><b>Text Book</b></p> <ol style="list-style-type: none"> <li>1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011</li> <li>2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.</li> </ol>
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Victor Henner, Tatyana Belozerovala, Mikhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.</li> <li>2. Walter Ledermann, Multiple integrals, Springer, 1st edition</li> <li>3. Lay, Linear Algebra and its applications, 3rd Ed., 2002, Pearson Education India.</li> <li>4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and sons, Inc. 10th Edition</li> <li>5. MatLab usage manual</li> </ol> <p><b>E-resources/ Web links:</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/109104124">https://nptel.ac.in/courses/109104124</a></li> <li>2. <a href="https://nptel.ac.in/courses/111106051">https://nptel.ac.in/courses/111106051</a></li> <li>3. <a href="https://nptel.ac.in/courses/111102137">https://nptel.ac.in/courses/111102137</a></li> <li>4. <a href="https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/">https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/</a></li> <li>5. <a href="https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus">https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus</a></li> <li>6. <a href="https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/">https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/</a></li> <li>7. <a href="https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html">https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html</a></li> <li>8. <a href="https://www.scu.edu.au/study-at-scu/units/math1005/2022/">https://www.scu.edu.au/study-at-scu/units/math1005/2022/</a></li> </ol>
<p><b>Topics relevant to the development of Foundation Skills: All solution methods</b></p> <p><b>Topics relevant to development of Employability skills: Use of Matlab software.</b></p>

<b>Course Code:</b> MAT1001	<b>Course Title:</b> Calculus and Linear Algebra		<b>L-T-P- C</b>	2	1	2	4
	<b>Type of Course:</b> School Core Lab Integrated						
<b>Version No.</b>	3.0						
<b>Course Pre-requisites</b>	Basic Concepts of Limits, Differentiation, Integration						
<b>Anti-requisites</b>	NIL						
<b>Course Description</b>	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.						
<b>Course Objective</b>	The objective of the course is <u>Skill Development</u> of student by using <u>Problem Solving Techniques</u> .						
<b>Course Out Comes</b>	<p>On successful completion of the course the students shall be able to:</p> <ol style="list-style-type: none"> <li>1) Comprehend the knowledge of applications of matrix principles.</li> <li>2) Understand the concept of partial derivatives and their applications.</li> <li>3) Apply the principles of integral calculus to evaluate integrals.</li> <li>4) Adopt the various analytical methods to solve differential equations.</li> <li>5) Demonstrate the use of MATLAB software to deal with a variety of mathematical problems.</li> </ol>						
<b>Course Content:</b>							
<b>Module 1</b>	<b>Linear Algebra</b>						<b>10 Classes</b>
<p>Review: Types of matrices, elementary transformations, rank of a matrix, normal form, Solution of systems of linear equations: (Homogenous and non-homogenous system) <math>AX = O</math> and <math>AX = B</math> using rank method.</p> <p><b>Linear Algebra:</b>  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.</p>							

<b>Module 2</b>	<b>Partial Derivatives</b>			<b>10 CLASSES</b>
<p>Review: Differential calculus with single variable.</p> <p><b>Partial Derivatives:</b>  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.</p>				
<b>Module 3</b>	<b>Advanced Integral calculus</b>			<b>12 Classes</b>
<p>Review: Integral calculus for single integrals.</p> <p><b>Advanced Integral calculus:</b>  Beta and Gamma functions—interrelation-evaluation of integrals using gamma and beta functions; error function-properties. Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates.  Engineering applications of partial derivatives.</p>				
<b>Module 4</b>	<b>Ordinary Differential Equations</b>	<b>Assignment</b>	<b>Programming</b>	<b>12 Classes</b>
<p>Review: First order and first-degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non- Homogeneous Equations reducible to Homogeneous form.</p> <p>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 <math>e^{ax}</math>, <math>\sin ax</math>, <math>\cos ax</math>, <math>e^{ax}f(x)</math>, <math>x^n f(x)</math> etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, D-operators and Inverse D- operators, Method of Variation of Parameters.  Engineering applications of differential equations.</p>				
<p><b>List of Laboratory Tasks:</b></p> <p>Introductory Task: Introduction to usage of the software and simple programming tasks. [ 3 Sessions]  Experiment N0 1: Solution of Simple differentiation with single variable and use of chain Rule.  Experiment No. 2: Solution based on application of Tailors' Series using software  Experiment No. 3: Application of Maxima and Minima condition using software.  Experiment No. 4 Computation of different functions for a specific problem</p>				

<p>Experiment No. 5 Computation of Area under a curve.</p> <p>Experiment No. 6 Solution of a set of simultaneous equations in matrix method</p> <p>Experiment No. 7 Computation of Eigen Values and Eigen Vectors.</p> <p>Experiment No. 8 Solution of Partial Differential equation</p> <p>Experiment No. 9 solution using Cauchy Equation and Lagrange's Equation</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.</p> <p>Tools Used: MatLab, Zylink.</p>
<p><b>Assignment:</b></p> <ol style="list-style-type: none"> <li>3. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB.</li> <li>4. 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.</li> </ol>
<p><b>Text Book</b></p> <ol style="list-style-type: none"> <li>3. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011</li> <li>4. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.</li> </ol>
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>6. Victor Henner, Tatyana Belozerovala, Mikhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.</li> <li>7. Walter Ledermann, Multiple integrals, Springer, 1st edition</li> <li>8. Lay, Linear Algebra and its applications, 3rd Ed., 2002, Pearson Education India.</li> <li>9. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and sons, Inc. 10th Edition</li> <li>10. MatLab usage manual</li> </ol> <p><b>E-resources/ Web links:</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/109104124">https://nptel.ac.in/courses/109104124</a></li> <li>2. <a href="https://nptel.ac.in/courses/111106051">https://nptel.ac.in/courses/111106051</a></li> <li>3. <a href="https://nptel.ac.in/courses/111102137">https://nptel.ac.in/courses/111102137</a></li> <li>4. <a href="https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/">https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/</a></li> <li>5. <a href="https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus">https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus</a></li> <li>6. <a href="https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/">https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/</a></li> <li>7. <a href="https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html">https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html</a></li> <li>8. <a href="https://www.scu.edu.au/study-at-scu/units/math1005/2022/">https://www.scu.edu.au/study-at-scu/units/math1005/2022/</a></li> </ol>



**Topics relevant to the development of Foundation Skills: All solution methods**

**Topics relevant to development of Employability skills: Use of Matlab software.**

Course Code: CSE1001	Course Title: Problem Solving using JAVA Type of Course: Integrated	L- T-P- C	2 -0-2-3
Version No.	2.0		
Course Pre-requisites	Basic Programming knowledge.		
Anti-requisites	NIL		
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques		
Course Out Comes	On successful completion of the course the students shall be able to: C.O. 1: Describe the basic programming concepts. [Knowledge] C.O. 2: Apply the concept of classes, objects and methods to solve problems. [Application] C.O. 3: Apply the concept of arrays and strings. [Application] C.O. 4: Implement inheritance and polymorphism building secure applications. [Application] C.O. 5: Apply the concepts of interface and error handling mechanism. [Application]		
Course Content:			

Module 1	Basic Concepts of Programming and Java	Assignment	Data Collection/Interpretation	12 Sessions
Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.				
Module 2	Classes, objects, methods and Constructors	Case studies / Case let	Case studies / Case let	12 Sessions
Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods.  Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.				
Module 3	Arrays, String and String buffer	Quiz	Case studies / Case let	14 Sessions
Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.				
Module 4	Inheritance and Polymorphism	Quiz	Case studies / Case let	14 Sessions
Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.				
Module 5	Input & Output Operation in Java	Quiz	Case studies / Case let	14 Sessions
Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.				
<p style="text-align: center;">List of Laboratory Tasks:</p> <p style="text-align: center;">P1 - Problem Solving using Basic Concepts.</p> <p style="text-align: center;">P2 - Problem Solving using Basic Concepts and Command Line Arguments.</p> <p style="text-align: center;">P3 - Programming assignment with class, objects, methods and Constructors.</p> <p style="text-align: center;">P4 - Programming assignment with method overloading.</p> <p style="text-align: center;">P5 - Programming assignment with constructor overloading.</p> <p style="text-align: center;">P6 - Programming assignment with Static members and static methods.</p>				

<p>P7 - Programming assignment with Nested classes.</p> <p>P8 - Programming assignment using Arrays.</p> <p>P9 - Programming assignment using Strings.</p> <p>P10 - Programming assignment using String Builder.</p> <p>P11 - Programming assignment using Inheritance and super keyword.</p> <p>P12 - Programming assignment using Method overriding and Dynamic method invocation.</p> <p>P13 - Programming assignment using Final keywords.</p> <p>P14 - Programming assignment using Abstract keywords.</p> <p>P15 - Programming assignment using Interface.</p> <p>P16 - Programming assignment using Interface.</p> <p>P17 - Programming assignment CharacterStream Classes</p> <p>P18 - Programming assignment Read/Write Operations with File Channel</p>
Targeted Application & Tools that can be used : JDK /eclipse IDE/ net Beans IDE.
<p>Text Book</p> <p>T1 Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education.</p>
<p>References</p> <p>R1: Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson</p> <p>R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.</p> <p>E book link R1: <a href="http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf">http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf</a></p> <p>E book link R2: Java(tm) Design Patterns: A Tutorial( [PDF] [7qmsenjl97t0] (vdoc.pub)</p> <p>Web resources</p> <p><a href="https://youtube.com/playlist?list=PLu0W_9lI9agS67Uits0UnJyrYiXhDS6q">https://youtube.com/playlist?list=PLu0W_9lI9agS67Uits0UnJyrYiXhDS6q</a></p> <p><a href="https://puniversity.informaticsglobal.com:2229/login.aspx">https://puniversity.informaticsglobal.com:2229/login.aspx</a></p>
<p>Topics relevant to development of "Skill Development":</p> <p>Static Polymorphism</p> <p>Method overloading, constructors</p> <p>constructor overloading</p> <p>this keyword</p> <p>static keyword and Inner classes</p> <p>Inheritance and Polymorphism.</p>

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

<b>Course Code:</b> <b>ENG1002</b>	<b>Course Title:</b> Technical English <b>Type of Course:</b> 1] School Core 2] Laboratory integrated		<b>L-T-P-C</b>	1-0-2-2
<b>Version No.</b>	1.0 V. 3			
<b>Course Pre-requisites</b>	Intermediate Level English			
<b>Course Anti-requisites</b>	NIL			
<b>Course Description</b>	Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.			
<b>Course Objectives</b>	The objective of this course is to develop the learners' <b>EMPLOYABILITY SKILLS</b> by using <b>EXPERIENTIAL LEARNING</b> and <b>PARTICIPATIVE LEARNING TECHNIQUES</b> .			
<b>Course Outcomes</b>	<b>On successful completion of the course, the students shall be able to:</b> <ol style="list-style-type: none"> <li>1. Develop proficiency in using technical vocabulary and terminology.</li> <li>2. Apply language skills for better speaking skills in technical fields.</li> <li>3. Write technical descriptions</li> <li>4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.</li> </ol>			
<b>Course Content:</b>				
<b>Module 1</b>	<b>Fundamentals of Technical Communication</b>	<b>Worksheets &amp; Quiz</b>	<b>Vocabulary building</b>	<b>9 Classes</b>
Introduction to Technical English Differences between Technical English and General English Technical Writing Basics Technical Vocabulary				

<b>Module 2</b>	<b>Technical Presentation</b>	<b>Presentations</b>	<b>Speaking Skills</b>	<b>12 Classes</b>
<b>Introduction</b> Planning the Presentation Creating the Presentation Giving the Presentation				
<b>Module 3</b>	<b>Technical Description</b>	<b>Assignment</b>	<b>Group Presentation</b>	<b>12 Classes</b>
Product Description Process Description User Manuals Transcoding: Diagrams, charts and images				
<b>Module 4</b>	<b>Technical Writing</b>	<b>Assignment</b>	<b>Writing Skills</b>	<b>12 Classes</b>
<b>Email Writing</b> Persuasive and Descriptive Language Professional Email Etiquette Writing clear and concise technical emails Communicating technical information effectively <b>Technical Report Writing</b> Types of technical reports (Lab reports, research reports, etc.) Components of technical reports Writing an abstract and executive summary Structure and content organization Transcoding: diagrams, charts and images				
<b>List of Laboratory Tasks:</b> 1. Module-1 Level 1: Worksheets Level 2: Worksheets 2. Module 2 Level 1: Preparing Presentation Level 2: Giving Presentation (Individual) 3. Module-3 Level 1: Product Description & User Manual				

<p>Level 2: Process Description &amp; Transcoding</p> <p>4. Module 4</p> <p>Level 1: Email Writing</p> <p>Level 2: Report Writing</p>
<p><b>Targeted Applications &amp; Tools that can be used:</b></p> <ol style="list-style-type: none"> <li>1. Flipgrid</li> <li>2. Quizzes</li> <li>3. Youtube Videos</li> <li>4. Podcast</li> </ol>
<p><b>Project work/Assignment: Mention the Type of Project /Assignment proposed for this course</b></p> <ol style="list-style-type: none"> <li>1. Bring out the essence of technical communication with reference to the conventions of technical communication, with examples</li> <li>2. Prepare a technical presentation on the importance of Technical Communication and its relevance in a technical field, with real-life examples.</li> </ol>
<p>The following individual, as well as group Assignments, will be given to the students.</p> <ol style="list-style-type: none"> <li>1. Presentation</li> <li>2. Describing a product/process</li> <li>3. Individual Reports</li> </ol>
<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. Kumar, Sanjay; Pushpalatha. <i>English Language and Communication Skills for Engineers</i>. Oxford University Press. 2018.</li> <li>2. Brieger, Nick and Alison Paul. <i>Technical English Vocabulary and Grammar</i>. <a href="https://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf">https://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf</a></li> </ol>
<p><b>Reference Book:</b></p> <ol style="list-style-type: none"> <li>1. Chauhan, Gajendra Singh, and Kashmiramka, Smita, <i>Technical Communication</i>. Cengage Publication. 2018.</li> <li>2. Sunder Jain. <i>Technical Report Writing</i>. Centrum Press, 2013.</li> <li>3. John Bowden. "Writing a Report: How to Prepare, Write &amp; Present Really Effective Reports?". 9th Edition 2011</li> </ol> <p>Comfort, Jeremy et. al. 1984. <i>Business Reports in English</i>. Cambridge University Press.</p> <ol style="list-style-type: none"> <li>4. Sharma, R.C. and K. Mohan. 2011. <i>Business Correspondence and Report Writing</i>, Fourth Edition. Tata McGraw Hill.</li> </ol>
<p><b>Web Resources:</b></p> <p>1: <a href="https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&amp;unique_id=JSTOR1_3307">https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&amp;unique_id=JSTOR1_3307</a>.</p> <p>2: <a href="https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=5&amp;sid=3a77d69b-abe5-4681-b39d-32dfdeb8f4a5%40redis&amp;bdata=JnNpdGU9ZWWhvc3QtbGl2ZQ%3d%3d#AN=154223466&amp;db=iih">https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=5&amp;sid=3a77d69b-abe5-4681-b39d-32dfdeb8f4a5%40redis&amp;bdata=JnNpdGU9ZWWhvc3QtbGl2ZQ%3d%3d#AN=154223466&amp;db=iih</a></p> <p>3: Last, Suzan, et. al. <i>Technical Writing Essentials</i>. University of Victoria, British Columbia, 2019 (E-Book)</p>

4 Wambui, Tabita Wangare, et al. *Communication Skills- Volume 1*, LAP LAMBRET, USA, 2012  
( E Book)

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

ENG2001	Advanced English	L- T- P- C	1	0	2	2
Version No.	1.3					
Course Pre-requisites	ENG1002 Technical English					
Anti-requisites	NIL					
Course Description	The course emphasizes on technical communication at advanced level by exploring critical reading, technical presentation and review writing. The purpose of the course is to enable learners to review literature in any form or any technical article and deliver technical presentations. Extensive activities in practical sessions equip to express themselves in various forms of technical communications. Technical presentations and the module on career setting focus on learners’ area of interests and enhance their English language writing skills to communicate effectively.					
Course Out Come	On successful completion of the course the students shall be able to: 1. Develop a critical and informed response reflectively, analytically, discursively, and creatively to their reading. 2. Communicate effectively, creatively, accurately and appropriately in their writing. 3. Deliver technical presentations 4. Design resume and create professional portfolio to find a suitable career					
Course Content: Theory						
Module 1	Critical Reasoning and Writing	Writing Essays	Critical Reading	4 Classes		
Topics: <ul style="list-style-type: none"><li>A Catalog of Reading Strategies</li><li>The Myth of Multitasking</li></ul>						

<ul style="list-style-type: none"><li>• A Guide to Writing Essays Speculating about Causes or Effects</li><li>• Is Google Making Us Stupid (Self Study)</li></ul>				
Module 2	Technical Presentation	Presentation	Oral Skills	3 Classes
Topics: <ul style="list-style-type: none"><li>• Planning the presentation</li><li>• Creating the presentation</li><li>• Giving the presentation</li></ul>				
Module 3	Writing Reviews	Prezi	Review Writing	4 Classes
Topics: <ul style="list-style-type: none"><li>• Review Writing</li><li>• Short film reviews</li><li>• Advanced English Grammar (Self Study)</li></ul>				
Module 4	Starting your Career	Online Writing Lab	Writing Skills	4 Classes
Topics: <ul style="list-style-type: none"><li>• Preparing a Resume</li><li>• Writing Effective Application Letter</li><li>• Creating a Professional Portfolio</li></ul>				
Course Content: Practical Sessions				
Module 1	Critical Reasoning and Writing			8 Classes
1. Reading and Analyzing Level 1 – Annotation Level 2 - Assumptions 2. Writing Narrative Essays Level 1 – Draft 1 Level 2 – Draft 2				
Module 2	Technical Presentation			10 Classes
3. Fishbowl In Fishbowl, students form concentric circles with a small group inside and a larger group outside. Students in the inner circle engage in an in-depth discussion, while students in the outer circle listen and critique content, logic, and group interaction. Level 1 – within group Level 2 – Among 2 group 4. Technical Group Presentation				
Module 3	Writing Reviews			4 Classes
5. Practice Worksheets Level 1 – Eliminating the Passive Voice				



Level 2 – Simple, compound and complex sentences		
6. Writing Short Film Reviews		
Module 4	Starting your Career	6 Classes
7. Collaborative Project Job search and writing report Writing Resume		
Module 1-4	Academic Journal	2 Classes
8. Academic Journal Writing Level 1- Mid Term Level 2 – End Term		
Targeted Application & Tools that can be used: Writing reports, Review writing, Group Discussion, Dyadic interviews, Grammarly.com		
Project work/Assignment:		
Academic Journal – Assignment In Academic Journal (CIJ), students compile task and activities completed in each module and submit to the instructor at the middle and end of the semester.		
References		
1. Hering, Heik. <i>How to Write Technical Reports: Understanding Structure, Good Design, Convincing Presentation</i> . Springer.		
2. Johnson, Richard. (2010) <i>Technical Communication Today</i> . Pearson, 2015		
3. Rice B. Adelrod, Charles R. Cooper and Ellen C. Carillo. (2020) <i>Reading Critically Writing Well: A Reader and Guide</i> . Beford/St. Martin’s Macmillan Learning, New York.		
4. The Princeton Review. (2010) <i>MCAT Verbal Reasoning &amp; Writing</i> . The Princeton Review, Inc.		
5. <a href="https://www.hitbullseye.com/Strong-and-Weak-Arguments.php">https://www.hitbullseye.com/Strong-and-Weak-Arguments.php</a> Accessed on 10 Dec 2021		
6. <a href="https://www.inc.com/guides/how-to-improve-your-presentation-skills.html">https://www.inc.com/guides/how-to-improve-your-presentation-skills.html</a> Accessed on 10 Dec 2021		
Topics Relevant to “employability”: Critical Reasoning, Presentation, Review Writing and Starting Career		
Topics Relevant to “Human Values and Professional Ethics”: Critical reasoning		

<b>Course Code:</b> ECE1001	<b>Course Title:</b> Elements of Electronics Engineering  <b>Type of Course:</b> School Core	<b>L- T-P- C</b>	3	2	4
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	<b>Theory &amp; Integrated Laboratory</b>					
<b>Version No.</b>	1.0					
<b>Course Pre-requisites</b>	NIL					
<b>Anti-requisites</b>	<b>Fundamentals of Electronics (ECE1003)</b>					
<b>Course Description</b>	<p>The purpose of this course is to enable the students to learn the fundamental concepts of electronic devices and circuits. The course aims at nurturing the students with the fundamental principles of electronics engineering, prevailing in various engineering applications. The nature of the course is conceptual and analytical which imparts knowledge of electronic components and their behavior under various operating conditions. The course develops thinking skills of the students, encouraging their quest for knowledge about electronic devices and their usage in higher semester courses.</p> <p>The associated laboratory provides an opportunity to validate the concepts taught in theory classes and enable the students to work with basic electronic circuits using electronics components.</p>					
<b>Course Objectives</b>	<b>This Course is designed to improve the learners “SKILL DEVELOPMENT” by using PARTICIPATIVE LEARNING techniques</b>					
<b>Course Outcomes</b>	<p><b>On successful completion of this course the students shall be able to:</b></p> <ol style="list-style-type: none"> <li>1) Identify various electrical and electronic components and basic electrical laws.</li> <li>2) Explain applications of Diodes and BJTs.</li> <li>3) Summarize the concepts of Digital Electronics and Communication Systems.</li> <li>4) Discuss the basic concepts of microprocessor and computer organization.</li> <li>5) Perform experiments to familiarize various Electrical &amp; Electronic components and equipment.</li> <li>6) Verify Basic Electrical Circuit configurations and Laws.</li> </ol>					
<b>Course Content:</b>						
<b>Module 1</b>	<b>Module-1: Electrical Electronic Components</b>	<b>Basic and</b>	Assignment / Quiz	Identification of Practical electronic and electrical components / Memory Recall based Quizzes	<b>10 Sessions</b>	
<p>Topics:  <b>ELECTRICAL CIRCUITS AND LAWS:</b> DC Circuits: Classification of Electrical Elements, Ohm’s law, Series and Parallel Circuits, Kirchhoff’s Voltage and Current laws, Power and Energy, Transformers and their types.</p>						

<b>ELECTRONIC MATERIALS AND COMPONENTS:</b> Conductors, Insulators, Semi-Conductor Material, P-N Junction diode, Characteristics and Parameters, Ideal Diode approximations, DC load line.				
<b>Module 2</b>	<b>Applications of Diodes and Introduction to BJT</b>	Assignment / Quiz	Simulation Task / Memory Recall based Quizzes	<b>12 Sessions</b>
<p>Topics:</p> <p><b>RECTIFIERS:</b> Half-wave rectifier, Two-diode Full-wave rectifier, Bridge rectifier, Capacitor filter circuit (only qualitative approach).</p> <p><b>ZENER DIODE:</b> Zener diode, Zener Characteristics, Zener diode as a voltage regulator.</p> <p><b>BIPOLAR JUNCTION TRANSISTORS:</b> BJT Construction and Operation, BJT Voltages and Currents, Common Base, Common Emitter Configuration and Characteristics, Current amplification Factor alpha and beta, DC Load line w.r.t. fixed bias circuit (Q-Point), Voltage divider bias circuit.</p>				
<b>Module 3</b>	<b>Digital Electronics and Communication System</b>	Assignment / Quiz	Simulation Task / Memory Recall based Quizzes	<b>11 Sessions</b>
<p>Topics:</p> <p><b>NUMBER SYSTEMS:</b> Decimal Number System, Binary Number System, Hexadecimal Number System, Conversions: Binary to and from Hexadecimal; Hexadecimal to and from Decimal; 1's and 2's Complement of Binary Numbers, Binary Addition.</p> <p><b>BOOLEAN ALGEBRA:</b> Boolean Laws and Theorems, De Morgan's theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, X-NOR Gate, NAND Gate, NOR Gate.</p> <p><b>COMMUNICATION SYSTEM:</b> Block diagram of communication system, Modulation: Definition of Modulation, Need of Modulation, Types of Modulation: Amplitude Modulation and Frequency Modulation (Waveforms only).</p>				
<b>Module 4</b>	<b>Microprocessors and Computer Organization</b>	Assignment / Quiz	Memory recall based Quizzes	<b>8 Sessions</b>
<p>Topics:</p> <p><b>INTEL 8086 MICROPROCESSOR:</b> Basic Architecture and features of 8086 Microprocessor.</p> <p><b>COMPUTER ORGANISATION:</b> Basic structure of Computer Organisation describing the various Computer types, Functional Units, Basic Operational concepts, Bus Structures, Memory System: RAM and ROM.</p>				
<p><b>List of Laboratory Tasks:</b></p> <p><b>Experiment No. 1:</b> Study of Resistors, Measuring instruments and DC Power Supply.</p> <p><b>Level 1:</b> Identification of resistor values from color bands and verification with Multimeter.</p> <p><b>Level 2:</b> Connecting a resistive circuit to a DC Power Supply and observing the input and output values using Voltmeters, Ammeters and hence calculate resistance values.</p> <p><b>Experiment No. 2:</b> Study of Reactive components, Multimeter, CRO and Function Generator.</p> <p><b>Level 1:</b> Identification of various types of capacitive and inductive components and verification with Multimeter.</p> <p><b>Level 2:</b> Connecting a reactive circuit to a function generator and observing the input and output waveform on CRO and calculation of Reactance and Impedance.</p> <p><b>Experiment No. 3:</b> Study of Ohm's Law.</p> <p><b>Level 1:</b> Rig up the circuit and verify Ohm's Law.</p>				

**Level 2:** Connect a  $100\Omega$  Resistor to a Voltage source of 0-5V. Plot a V- I graph by tabulating the Voltage Vs Current Values accordingly. Repeat the experiment for  $1K\Omega$  resistor and compare the results.

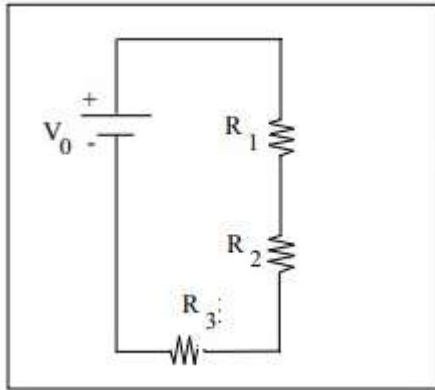
**Experiment No. 4:** Study of Series and Parallel Resistor Connections.

**Level 1:** Carry out the equivalent resistance of given four resistors  $100\Omega$  each connected in series and parallel combination using breadboard.

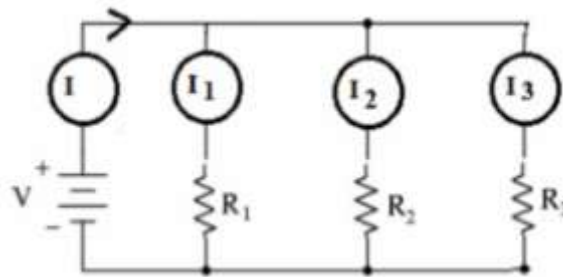
**Level 2:** Rig up a Current Divider Circuit and a Voltage Divider Circuit and verify the results.

**Experiment No. 5:** Study of Kirchhoff's Voltage Law and Kirchhoff's Current Law.

**Level 1:** Verify KVL and KCL with circuit (a) and circuit (b) with #values.

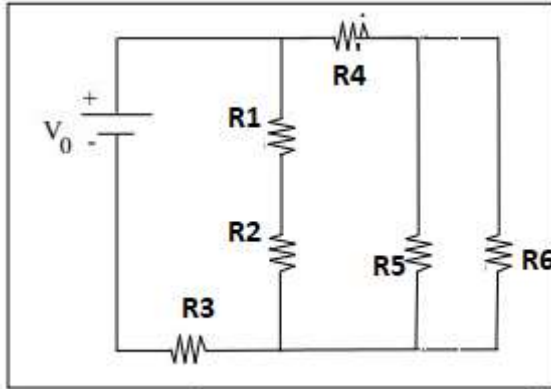


(a)



(b)

**Level 2:** Verify KCL with the help of given circuit having # values and carry out the equivalent resistance of the circuit by experimental and analytical methods.



**Experiment No. 6:** Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions.

**Level 1:** Carry out the experiment to find cut-in voltage on forward characteristics for Silicon P-N Junction diode.

**Level 2:** Carry out experiment to plot VI Characteristics of Silicon P-N Junction Diode in both forward and reverse biased conditions for Si P-N Junction diode.

**Experiment No. 7:** Study of Bipolar Junction Transistor in different regions of operation.

**Level 1:** Carry out the experiment to understand the importance of active, cut off and saturation regions.

**Level 2:** Carry out the experiment to design and analyze the operation of transistor as switch.

**Experiment No. 8:** Study of basic Digital Logic Gates using Integrated Chips IC's: NOT, AND, OR, XOR, NAND and NOR Gates

**Level 1:** Carry out the experiment to study and verify the truth table of logic gates using Digital ICs.

**Level 2:** Implementation of operation of a basic Boolean expression using basic gates.

**Experiment No. 9:** Study of Computer Organization: Identification of Components on Motherboard: CPU: Processor Chips (Processor Socket), PCI, Parallel Ports, Universal Serial Bus: USB, I/O Connectors, RAM Slots.

**Level 1:** Carry out the experiment to familiarize a computer system layout and mark the positions of SMPS, Motherboard, FDD, HDD, CD / DVD drive and add on cards.

**Level 2:** Study of a Desktop PC and its assembling.

**Targeted Application & Tools that can be used:**

**Student will be able to find career opportunities in various domains such as Analog Electronics, Digital Electronics, Microprocessors, VLSI Design, Telecommunication, Computers and Wireless Communication.** The students will be able to join a profession which involves basics to high level of electronic circuit design.

**Professionally Used Software: 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.

**Project work/Assignment:**

**1. Case Studies:** At the end of the course students will be given a ‘real-world’ application based circuits like Power Amplifier, Signal/Function Generator etc. as a case study. Students will be submitting a report which will include Circuit Diagrams, Design, Working Mechanism and Results etc. in appropriate format.

**2. Book/Article review:** At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. [Presidency University Library Link](#).

**3. Presentation:** There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

**4. Project/Programming Assignment:** Students will be made into group and given the programming assignment at the end of each module. Students need to use MULTISIM for this assignments.

**Sample Assignment 1:** AC to DC power conversion using rectifier circuits both HWR and FWR.

**Sample Assignment 2:** Plot the V-I Characteristics of Zener Diode and illustrate the use of Zener diode to maintain a Constant Voltage Level.

**Sample Assignment 3:** Implementation of Boolean Expression using AND-OR and NAND-NAND Logic.

**Textbook(s):**

**T1.** John Hiley, Keith Brown and Ian McKenzie Smith, "*Hughes Electrical and Electronic Technology*", Pearson, 12<sup>th</sup> Edition

**T2.** William Stallings, "Computer Organization and Architecture Designing for Performance", Pearson Education, 10<sup>th</sup> Edition.

**Reference(s):**

**Reference Book(s):**

**R1.** Smarajit Ghosh, "*Fundamentals of Electrical and Electronics Engineering*", PHI, 2<sup>nd</sup> Edition

**R2.** D.P. Kothari, I. J. Nagrath, "*Basic Electronics*", McGraw Hill Education, 1<sup>st</sup> Edition

**R3.** Rajendra Prasad, "*Fundamentals of Electronics Engineering*", Cengage Learning, 3<sup>rd</sup> Edition

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

1. Video lectures on “BASIC ELECTRONICS” by Prof. Dr. Chitralkha Mahanta, Department of Electronics and communication Engineering, IIT Guwahati”:  
<https://nptel.ac.in/courses/117/103/117103063/>
2. Lecture Series on “ Useful Laws in Basic Electronics” by Prof. T.S.Natarajan, Department of physics, IIT Madras: <https://www.youtube.com/watch?v=vfVVF58FtCc>
3. Lecture Series on “Introduction to Bipolar Junction Transistors BJT ” by All About Electronics Youtube Channel:  
[https://www.youtube.com/watch?v=-VwPSDQmdjM&list=PLwjK\\_ iyK4LLDoFG8FeiKAr3ISrRkPSxqq](https://www.youtube.com/watch?v=-VwPSDQmdjM&list=PLwjK_ iyK4LLDoFG8FeiKAr3ISrRkPSxqq)
4. Lecture Series on “ PN Junction Diode ” by All About Electronics Youtube Channel:  
<https://www.youtube.com/watch?v=USrY0JspDEg>
5. Lecture Series on “Introduction to Digital Electronics” by All About Electronics Youtube Channel:  
[https://www.youtube.com/watch?v=DBTna2ydmC0&list=PLwjK\\_ iyK4LLBC\\_so3odA64E2MLgIRKafl](https://www.youtube.com/watch?v=DBTna2ydmC0&list=PLwjK_ iyK4LLBC_so3odA64E2MLgIRKafl)
6. Lecture Series on “Introduction to Microprocessors” by Bharat Acharya Education :  
<https://www.youtube.com/watch?v=0M74z5jEAYa>
7. Lecture Notes on : “Electronic Devices”, Bipolar Junction Transistors, 2<sup>nd</sup> Chapter, by Shree Krishna Khadka (PDF) Bipolar Junction Transistor (researchgate.net)  
[https://www.researchgate.net/publication/323384291\\_Bipolar\\_Junction\\_Transistor](https://www.researchgate.net/publication/323384291_Bipolar_Junction_Transistor)

### E-content:

1. Ali Habeb Aseeri , Fouzeyah Rajab Ali, “Bipolar Junction Transistor as a Switch”, IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 13, Issue 1 Ver. I (Jan. – Feb. 2018), PP 52-57.
2. Osama S. HAMAD, Othman SIDEK, Mahfoozur REHMAN,Kamarulazizi IBRAHIM, Magdy H. MOURAD, “FABRICATION PROCESS OF SILICON-ON-INSULATOR AND LATER BIPOLAR TRANSISTORS”, Journal of Annals of Faculty of Engineering Hunedoara-Journal of Engineering; TOME-VII,2009, ISSN 1584-2665.
3. Amos, S. W. Principles of transistor circuits: Introduction to the design of amplifiers, receivers, and digital circuits. (6th ed.). London: Butterworths, 1981.
4. Arns. R. G, The other transistor: Early history of the metal-oxide semiconductor field-effect transistor. Engineering Science and Education Journal. 7: 223-240, (1998).
5. Colinge, J. P. & Greer, J. C. Nanowire transistors: Physics of devices and materials in one dimension. Cambridge: Cambridge University Press, (2016).
6. Grundmann, M. The physics of semiconductors: An introduction including nanophysics applications. (2nd ed.). Berlin: Springer Science and Business Media, (2010).
7. B. R. Rau and J. A. Fisher, "Instruction level parallel processing: History overview and perspective", J. Supercomputer., vol. 7, no. 1, pp. 9-50, 1993

Topics related to development of “FOUNDATION SKILLS”: Electrical & Electronic component and laws, Fundamentals of Digital Electronics, Communication Systems, Microprocessors and Computer Organization.

<b>Course Code:</b> <b>PHY1002</b>	<b>Course Title: Optoelectronics and Device Physics</b>  <b>Type of Course: 1] School Core &amp; Laboratory integrated</b>	L-T-P-C	2-0-2-3
<b>Version No.</b>	1.0		
<b>Course Pre-requisites</b>	NIL		
<b>Anti-requisites</b>	NIL		
<b>Course Description</b>	<p>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: <b>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.</b></p>		
<b>Course Out Comes</b>	<p>On successful completion of the course the students shall be able to:</p> <p>CO1: Describe the concepts of semiconductors, magnetic materials and superconductors.</p> <p>CO2: Apply the concept of materials in the working of optoelectronic and magnetic devices.</p>		

	CO3: Discuss the quantum concepts used in advanced microscopy and quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields. CO5: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. <b>[Lab oriented]</b> .			
<b>Course Objective</b>	The objective of the course is to familiarize the learners with the concepts of “Optoelectronics and device physics “and attain <b>Skill Development</b> through <b>Experiential Learning</b> techniques			
<b>Course Content:</b>				
<b>Module 1</b>	<b>Fundamentals of Materials.</b>	Assignment	Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and ferromagnetic materials using excel/ origin software.	<b>No. of Classes: 07</b>
	Topics: Concept of energy bands, charge carriers, carrier concentration, concept of Fermi level, Hall effect, Magnetic materials, Superconductors:			
<b>Module 2</b>	<b>Advanced Devices and applications</b>	Assignment	Data collection on efficiency of solar cells.	<b>No. of Classes: 8</b>
	Topics: p-n junctions, Zener diode, transistor characteristics, Optoelectronic devices:, Solar cells, I-V characteristics, and LEDs			
<b>Module 3</b>	<b>Quantum concepts and Applications</b>	Term paper	Seminar on quantum computers.	<b>No. of classes: 8</b>
	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			



<b>Module 4</b>	<b>Lasers and Optical fibers</b>	Term paper	Case study on medical applications of Lasers.	<b>No. of classes :07</b>
	<p>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.</p> <p>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.</p>			
	<p>List of Laboratory Tasks:</p> <p>Experiment No. 1: Experimental errors and uncertainty using excel</p> <p>Level 1: Calculation of accuracy and precision of a given data</p> <p>Level 2: propagation of errors in addition, subtraction, multiplication and division.</p> <p>Experiment NO 2: To determine the wavelength of semiconductor diode Laser and to estimate the particle size of lycopodium powder using diffraction.</p> <p>Level 1: Determination of Wavelength of Laser</p> <p>Level 2: Finding the particle size of lycopodium powder.</p> <p>Experiment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier.</p> <p>Level 1: To determine the proportionality of Hall Voltage and magnetic flux density</p> <p>Level 2: To determine the polarity of Charge carrier.</p> <p>Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions.</p> <p>Level 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage.</p> <p>Level 2: To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance.</p> <p>Experiment No. 5: To study input and output characteristics of a given Transistor.</p> <p>Level 1: To determine the input resistance of a given transistor.</p> <p>Level 2: To determine current transfer characteristics and transistor parameters of a given transistor.</p>			

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.

	<p>Experiment No. 12: Determination of Stefan's constant and verification of Stefan-Boltzmann Law.</p> <p>Level 1: Determination of Stefan's constant</p> <p>Level 2: Verification of Stefan-Boltzmann Law.</p>
	<p><b>Targeted Application &amp; Tools that can be used:</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Origin, excel and Mat lab soft wares for programming and data analysis.</li> </ol>
	<p><b>Project work/Assignment: Mention the Type of Project /Assignment proposed for this course</b></p>
	<p><b>Assessment Type</b></p> <ul style="list-style-type: none"> <li>• Midterm exam</li> <li>• Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)</li> <li>• Quiz</li> <li>• End Term Exam</li> <li>• Self-Learning</li> </ul> <ol style="list-style-type: none"> <li>1. Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons.</li> <li>2. Write a report on importance of quantum entanglement in supercomputers.</li> </ol>
	<p><b>Text Book</b></p> <ol style="list-style-type: none"> <li>1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications, 2018.</li> </ol>
	<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1<sup>st</sup> Edition, Pearson Publications, 2002.</li> <li>2. Principles of Quantum Mechanics by R Shankar, 2<sup>nd</sup> edition, springer Publications, 2011.</li> <li>3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3<sup>rd</sup> edition, Pearson Publications, 2017.</li> <li>4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012.</li> </ol>

	5. Introduction to Quantum Mechanics, David J <u>Griffiths</u> , Cambridge University Press, 2019
	<b>E-Resources:</b> <ol style="list-style-type: none"> <li>1. <a href="https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=553045&amp;site=ehost-live">https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=553045&amp;site=ehost-live</a></li> <li>2. <a href="https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=833068&amp;site=ehost-live">https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=833068&amp;site=ehost-live</a></li> <li>3. <a href="https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=323988&amp;site=ehost-live">https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=323988&amp;site=ehost-live</a></li> <li>4. <a href="https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=1530910&amp;site=ehost-live">https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=1530910&amp;site=ehost-live</a></li> <li>5. <a href="https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=486032&amp;site=ehost-live">https://search.ebscohost.com/login.aspx?direct=true&amp;db=nlebk&amp;AN=486032&amp;site=ehost-live</a></li> </ol>
	<b>Topics relevant to “SKILL DEVELOPMENT”:</b> 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.

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

<b>Course Objective</b>	The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the <b>SKILL DEVELOPMENT</b> through EXPERIENTIAL <b>LEARNING</b> .			
<b>Course Outcomes</b>	<b>On successful completion of this course the students shall be able to:</b> <ol style="list-style-type: none"> <li><b>Describe</b> the concepts of number systems, Boolean algebra and logic gates.</li> <li><b>Apply</b> minimization techniques to simplify Boolean expressions.</li> <li><b>Demonstrate</b> the Combinational circuits for a given logic</li> <li>Demonstrate the Sequential and programmable logic circuits</li> <li><b>Implement</b> various combinational and sequential logic circuits using gates.</li> </ol>			
<b>Course Content:</b>				
<b>Module 1</b>	<b>Fundamentals of Number systems- Boolean algebra and digital logic</b>	Application Assignment	Data Analysis task	<b>06 classes</b>
<b>Topics:</b> Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.				
<b>Module 2</b>	<b>Boolean function simplification</b>	Application Assignment	Data Analysis task	<b>08 Classes</b>
<b>Topics:</b> Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.				
<b>Module 3</b>	<b>Combinational Logic circuits:</b>	Application Assignment	Programming Task & Data Analysis task	<b>08 Classes</b>
<b>Topics:</b> Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.				
<b>List of Laboratory Tasks:</b> <b>Experiment N0 1:</b> Verify the Logic Gates truth table <b>Level 1:</b> By using Digital Logic Trainer kit <b>Level 2:</b> By using Analog devices like RPS, Volt meter, Resistors and ICs  <b>Experiment No. 2:</b> Verify the Boolean Function and Rules <b>Level 1:</b> By using Digital Logic Trainer kit <b>Level 2:</b> By using Analog devices like RPS, Volt meter, Resistors and ICs  <b>Experiment No. 3:</b> Design and Implementations of HA/FA <b>Level 1:</b> By using basic logic gates and Trainer Kit <b>Level 2:</b> By using Universal logic gates and Trainer Kit  <b>Experiment No. 4:</b> Design and Implementations of HS/FS <b>Level 1:</b> By using basic logic gates and Trainer Kit <b>Level 2:</b> By using Universal logic gates and Trainer Kit				

**Experiment No. 5:** Design and Implementations of combinational logic circuit for specifications

**Level 1: Specifications given in the form of Truth table**

**Level 2: Specification should be extracted from the given scenario**

**Experiment No. 6:** Study of Flip flops

**Experiment No. 7:** Design and Implementations of sequential logic circuit for specifications

**Level 1: Specifications given in the form of Truth table**

**Level 2: Specification should be extracted from the given scenario**

**Experiment No.8:** HDL coding for basic combinational logic circuits

**Level 1: Gate level Modeling**

**Level 2: Behavioral Modeling**

**Experiment No.9:** HDL coding for basic sequential logic circuit

**Level 1: Gate level Modeling**

**Level 2: Behavioral Modeling**

**Targeted Application & Tools that can be used:**

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

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

**Text Book(s):**

1. Mano, M. Morris and Ciletti Michael D., “*Digital Design*”, Pearson Education, 6<sup>th</sup> edition
2. Thomas L. Floyd “*DIGITAL LOGIC DESIGN*”, Pearson Education, fourth edition.

**Reference(s):**

**Reference Book(s):**

- R1. Jain, R. P., “*Modern Digital Electronics*”, McGraw Hill Education (India), 4<sup>th</sup> Edition
- R2. Roth, Charles H., Jr and Kinney Larry L., “*Fundamentals of logic Design*”, Cengage Learning, 7<sup>th</sup> Edition

**Online Resources (e-books, notes, ppts, video lectures etc.): [Book Free Download \(studymaterialz.in\)](#)**

1. **eBook1:** Mano, M. Morris and Ciletti Michael D., “*Digital Design*”, Pearson Education.
2. {[PDF] [Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download](#) }
3. **eBook2:**Floyd “*DIGITAL LOGIC DESIGN*” fourth edition- ePub, eBook- [PDF] [DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org](#).
4. NPTEL Course- [NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits](#)
5. Digital Logic Design PPT [Slide 1 \(iare.ac.in\)](#)
6. Lab Tutorial: [Multisim Tutorial for Digital Circuits - Bing video](#)

[CircuitVerse - Digital Circuit Simulator online](#)

[Learn Logisim ➡ Beginners Tutorial | Easy Explanation! - Bing video](#)

[Digital Design 5: LOGISIM Tutorial & Demo](#)

**7. <https://presiuniv.knimbus.com/user#/home>**

**E-content:**

1. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
2. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)
3. A. Matrosova and V. Provkina, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.
4. A. Matrosova, V. Provkina and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," 2019 IEEE East-West Design & Test Symposium (EWDTS), 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

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

<b>Course Code:</b> <b>CSE 1002</b>	<b>Course Title:</b> Innovation Project-Arduino Using Embedded C  <b>Type of Course:</b> School Core&Practical Only.	<b>L-T-P-C</b>	0-0-4-2
<b>Version No.</b>	1.0		
<b>Course Pre-requisites</b>	<b>NIL</b>		
<b>Anti-requisites</b>	<b>NIL</b>		
<b>Course Description</b>	In this course the students will learn fundamental concepts of ‘C’ and Embedded C, problem solving using C in a systematic way to read and write the C code and to implement them on Arduino prototype board. The course will also demonstrate how to assemble various sensory devices and program them using Arduino platform as a basis. Students will have the opportunity of gaining real-world experience in handling IoT devices involving hardware and software combinations. The course also offers in-depth knowledge of designing, developing, coding and implementing Arduino projects.		
<b>Course Outcomes</b>	<b>On successful completion of this course the students shall be able to:</b> <ol style="list-style-type: none"> <li>1) Acquire the knowledge on Arduino programming language and IDE using Embedded C</li> <li>2) Understand the main features of the Arduino prototype board</li> <li>3) Illustrate the hardware interfacing of the peripherals to Arduino system.</li> <li>4) Demonstrate various projects using Arduino system.</li> </ol>		

<b>Course Content:</b>				
<b>Module 1</b>	Basics of C, Branching and looping	Quiz	Problem Solving	<b>9CLASSES</b>
Topics: Structure of C programs, Variables, Keywords, Datatypes, declaration and Initialization <b>Decision Making and Branching:</b> if, if-else, else-if ladder, switch statement. <b>Decision making and looping:</b> for, while, and do-while statements.				
<b>Module 2</b>	Arrays, functions ,strings	Quiz	Problem Solving	<b>8CLASSES</b>
Topics: <b>Arrays:</b> Introduction ,one dimensional array, two dimensional array, <b>Functions:</b> User defined functions, Categories, searching and sorting <b>Strings:</b> Introduction, string handling functions.				
<b>Module 3</b>	<b>Basic concepts of Arduino</b>	Project Development	System Design Task and Analysis	<b>7 CLASSES</b>
Topics: Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, <b>Various Cloud Platforms.</b>				
<b>Module 4</b>	<b>Sensory Devices</b>	Project Development	Modeling and Simulation task	<b>6CLASSES</b>
Topics: <b>Arduino Sensors:</b> Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor , Connecting Switches and actuators , sensor interface with Arduino. <b>Introduction to 3D Printer:</b> 3D Printer technology and its working Principles, Applications. <b>Introduction to online Simulators:</b> Tinkercad Simulators and Proteus <b>Android/case study</b>				
<b>Targeted Application &amp; Tools that can be used:</b> Making it a reality (Arduino Projects) : Projects will include but not limited to : 1) Intelligent home locking system. 2) Intelligent water level management system. 3) Home automation using RFID. 4) Real time clock-based home automation.				



5) Intelligent Automatic Irrigation System <b>Professionally Used Software: Arduino IDE.</b>	
<b>Project work/Assignment/Quiz:</b>	
<ul style="list-style-type: none"> <li>• Quiz1- Fundamentals of C-Programs,</li> <li>• Quiz2- Basics of Embedded C and Arduino</li> <li>• Project work</li> </ul>	
<b>Text Book(s):</b> 1) E Balagurusamy “ <i>Programming in ANSI C</i> ”, Mc Graw Hill Publications, 7 <sup>th</sup> Edition. 2) Monk Simon “ <i>Programming Arduino: Getting Started with Sketches</i> ”, Mc Graw Hill Publications Second Edition.	
<b>Reference(s):</b> 1) <a href="https://www.tutorialspoint.com/arduino/index.html">https://www.tutorialspoint.com/arduino/index.html</a> . 2) <a href="https://create.arduino.cc/projecthub/projects/tags/sensor">https://create.arduino.cc/projecthub/projects/tags/sensor</a> . 3) <a href="https://3dprinting.com/what-is-3d-printing">https://3dprinting.com/what-is-3d-printing</a> .	
Topics relevant to development of “ Foundation SKILLS”: Basic Concepts of C-Programming. Topics related to development of “Creative Thinking”:	
<b>Evaluation:</b>	Review-1-10%, Review-2-20%, Review-3-20%, online quiz-30%, Project Expo-20%

<b>Course Code:</b> CSE1002	<b>Course Title:</b> Innovative Projects - Arduino using Embedded 'C'	<b>L- T-P- C</b>	0	0	4	2
<b>Version No.</b>	1.0					
<b>Course Pre-requisites</b>	NIL					
<b>Anti-requisites</b>	NIL					
<b>Course Description</b>	This course is designed to provide an in-depth understanding of Arduino microcontrollers and their application in various real time projects involving sensors. Throughout the course, students will learn the fundamentals of Arduino programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Arduino boards, read sensor data, and use it to control various output devices. This course is suitable for beginners who are interested in exploring the world of electronics and developing practical applications using Arduino and sensors.					
<b>Course Objective</b>	The objective of the course is <b>Employability Skills</b> of student by using <b>PARTICIPATIVE LEARNING</b> techniques.					

<b>Course Outcomes</b>	<b>On successful completion of the course the students shall be able to</b> <ol style="list-style-type: none"> <li>1) Explain the main features of the Arduino prototype board</li> <li>2) Demonstrate the hardware interfacing of the peripherals to Arduino system.</li> <li>3) Understand the types of sensors and its functions</li> <li>4) Demonstrate the functioning of live projects carried out using Arduino system.</li> </ol>			
<b>Course Content:</b>				
<b>Module 1</b>	<b>Basic concepts of Arduino</b>	Hands-on	Interfacing Task and Analysis	<b>4 Sessions</b>
<b>Topics:</b> Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.				
<b>Module 2</b>	<b>Sensory Devices</b>	Hands-on	Interfacing Task and Analysis	<b>4 Sessions</b>
Arduino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino. Introduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with Tinkercad Simulator.				
<b>Topics: Types of Arduino boards, sensors, 3D Printer</b>				
<b>Targeted Application &amp; Tools that can be used:</b>  <b>Application Area:</b>  Home Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino and sensors can be applied. The flexibility and affordability of Arduino, combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.				

<b>Professionally Used Software:</b> students can use open SOURCE Softwares Arduino IDE and Tincker CAD
<b>Project work/Assignment:</b>
<p>1. Projects: At the end of the course students will be completing the project work on solving many real time issues.</p> <p>2. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. <a href="#">Presidency University Library Link</a>.</p> <p>3. Presentation: There will be a presentation from interdisciplinary students group, where the students will be given a project on they have to demonstrate the working and discuss the applications for the same</p>
<b>Textbook(s):</b> Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition

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

Course Objective	The objective of the course is to <b>familiarize the learners with the concepts of “Soft Skills” and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.</b>			
Course Out Comes	<b>On successful completion of this course the students shall be able to:</b>  CO1: <b>Recognize</b> significance of soft skills  CO2: <b>Illustrate</b> effective communication while introducing oneself and others  CO3: <b>List</b> techniques of forming healthy habits  CO4: <b>Apply</b> SMART technique to achieve goals and increase productivity			
Course Content:				
Module 1	INTRODUCTION TO SOFT SKILLS		<b>Classroom activity</b>	<b>04 Hours</b>
<b>Topics:</b> Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality				
Module 2	EFFECTIVE COMMUNICATION		<b>Individual Assessment</b>	<b>10 Hours</b>
<b>Topics:</b> Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume Building- Digital, Video, Traditional.				
Module 3	HABIT FORMATION		<b>Worksheets &amp; Assignment</b>	<b>4 Hours</b>
<b>Topics:</b> Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right				
Module 4	Goal setting & Time Management		<b>Goal sheet</b>	<b>8 Hours</b>
A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, Time Management Matrix, steps to managing time through outbound group activity, making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity				
Targeted Application & Tools that can be used: LMS				

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
1) Individual Assessment 2) LMS MCQ
The topics related to Skill Development: Communication and professional grooming, Goal setting and presentation for skill development through participative learning techniques. This is attained through assessment component mentioned in course handout.

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

	4. Compute statistical parameters, correlation and regression, probability and sampling distributions using R software.			
<b>Module 1</b>	<b>Descriptive Statistics</b>	Assignment	Coding needed	<b>10 classes</b>
Introduction to Statistics, Data and statistical thinking, review of basic statistical parameters, Covariance, Correlation, Types of Measures of Correlation - Karl Pearson's Correlation Coefficient, Spearman Rank Correlation, linear regression, Multi linear regression .				
<b>Module 2</b>	<b>Probability</b>			<b>6 classes</b>
Introduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional Probability, Total Probability and Baye's theorem with examples				
<b>Module 3</b>	<b>Random Variables and Probability Distributions</b>		Coding needed	<b>14 classes</b>
Introduction to Random variables, Discrete Random Variables and Continuous Random Variables, Probability Distributions, Probability Mass Function and Probability Density Function, Various Probability distributions, Binomial, <b>Negative Binominal (Self Study)</b> , Poisson, Normal and Exponential distributions				
<b>Module 4</b>	<b>Sampling Theory</b>		Coding needed	<b>15 classes</b>
Introduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard Error. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between Parametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and <b>Difference of Means (Self Study)</b> , Small Sample Tests: Student's t-Test for Single Mean and <b>Difference of Means</b> , F-Test, Chi-Square Test.				
<p><b>Targeted Application &amp; Tools that can be used:</b></p> <p>The objective of the course is to familiarize students with the theoretical concepts of probability and statistics and to equip them with basic statistical tools to tackle engineering and real-life problems.</p> <p>Tools used: R Software / MS-Excel</p>				
<p><b>Text Book</b></p> <p>1. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying E Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, 2016.</p>				

### References

1. James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 2018.
2. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020.
3. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Statistics for Business and Economics, 2019.
4. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2018.
5. Richard A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 2018.
6. Kishor S Trivedi, Probability and Statistics with reliability, Queuing and Computer Science Applications, John Wiley & Sons, 2008.

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

<b>Course Code:</b> CSE2001	<b>Course Title:</b> Data Structures and Algorithms <b>Type of Course:</b> 1] School Core 2] Laboratory integrated	<b>L- T- P- C</b>	<b>3-0-2-4</b>
<b>Version No.</b>	1.0		
<b>Course Pre-requisites</b>	“CSE1001 – Problem Solving Using Java” course		
<b>Anti-requisites</b>	NIL		

<b>Course Description</b>	<p>The purpose of the course is to provide the fundamental concepts of data structures and algorithms, to emphasize the importance of choosing an appropriate data structure and algorithm for program development. The student should have java programming skills, to solve engineering / computational problems.</p> <p>The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.</p> <p>With a good knowledge in the fundamental concepts of data structures and algorithm the student can gain practical experience in implementing them, enabling the student to be an effective designer, developer for new software applications.</p>			
<b>Course Out Comes</b>	<p>On successful completion of this course the students shall be able to:</p> <ol style="list-style-type: none"> <li>1] Implement program for given problems using fundamentals of data structures.</li> <li>2] Apply an appropriate linear data structure for a given scenarios.</li> <li>3] Apply an appropriate non-linear data structure for a given scenarios.</li> <li>4] Analyze complexity of given searching and sorting algorithms.</li> </ol>			
<b>Course Content:</b>				
<b>Module 1</b>	Introduction to Data Structure and Linear data structure – Stacks and Queues (Application)	Assignment	Programming activity	<b>13 Hours</b>
<p>Topics:</p> <p><b>Introduction</b> – Introduction to Data Structures, Types and concept of Arrays.</p> <p><b>Stack</b> - Concepts and representation, Stack operations, stack implementation using array and Applications of Stack.</p> <p><b>Queues</b> - Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.</p>				
<b>Module 2</b>	Linear Data Structure- Linked List (Application)	Assignment	Programming activity	<b>12 Hours</b>
<p>Topics:</p> <p><b>Linked List</b> - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List and Applications of Linked list.</p> <p><b>Recursion</b> - Recursive Definition and Processes and Programming examples.</p>				
<b>Module 3</b>	Non-linear Data Structures- Trees and Graph (Application)	Assignment	Programming activity	<b>10 Hours</b>
<p>Topics:</p> <p><b>Trees</b> - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal and Post-Order traversal.</p> <p><b>Graph</b> - Basic Concept of Graph Theory and its Properties and Representation Of Graphs.</p>				



<b>Module 4</b>	Searching & Sorting Performance Analysis (Comprehension)	Assignment	Programming activity	<b>10 Hours</b>
<p>Topics:  <b>Sorting &amp; Searching</b> - Sequential and Binary Search, Sorting – Selection and Insertion sort.  <b>Performance Analysis</b> - Time and space analysis of algorithms – Average, best and worst case analysis.</p>				
<p><b>List of Laboratory Tasks:</b>  <b>Labsheet -1 [ 4 Practical Sessions]</b>  <b>Experiment No 1:</b>  <b>Level 1:</b> Array and its operations  <b>Experiment No. 2:</b>  <b>Level 1</b> - Stack and its operations with conditions(Exceptions underflow, overflow)  <b>Level 2</b> - Stack application infix to postfix Conversion  <b>Experiment No. 3:</b>  <b>Level 1</b> - Queues and its operations with conditions(Exceptions underflow, overflow)  <b>Level 2</b> - Real time application implementation using queue  <b>Labsheet -2 [ 4 Practical Sessions]</b>  <b>Experiment No. 1:</b>  <b>Level 1</b> - Linked list and its operations.  <b>Level 2</b> - Real time scenario based application using Linked List  <b>Experiment No. 2:</b>  <b>Level 1</b> - Linked list and its operations.  <b>Level 2</b> - Real time scenario based application using Linked List  <b>Labsheet – 3 [ 4 Practical Sessions]</b>  <b>Experiment No. 1:</b>  <b>Level 1</b> - Doubly linked list implementation and its operations  <b>Level 2</b> - Construction of BST  <b>Experiment No. 2:</b>  <b>Level 2</b> - Binary Search Tree Traversal  <b>Experiment No. 3:</b>  <b>Level 1</b> - Construction of Graph  <b>Level 2</b> - Graph application – Breadth first search  <b>Labsheet – 4 [ 3 Practical Sessions]</b>  <b>Experiment No. 1:</b>  <b>Level 1</b> - Implementation of Linear Search  <b>Level 2</b> - Time complexity Estimation of Linear Search  <b>Experiment No. 2:</b>  <b>Level 1</b> - Implementation of Binary Search  <b>Level 2</b> - Time complexity Estimation of Binary Search  <b>Experiment No. 3:</b>  <b>Level 1</b> - Implementation of Sorting – Insertion Sort  <b>Level 2</b> - Time complexity Estimation of Insertion Sort</p>				
<p><b>Targeted Application &amp; Tools that can be used:</b> Application Software and using Eclipse IDE</p>				
<p><b>Project work/Assignment: Mention the Type of Project /Assignment proposed for this course</b></p>				
<p>1] Problem Solving: Choose an appropriate data structure and implementation of programs.</p>				

2] Programming: Implementation of given scenario using Java
<b>Text Book</b> 1] Narasimha Karumanchi, "Data Structures and Algorithms Made Easy in Java", 5 <sup>th</sup> Edition, CareerMonk Publications, 2017.
<b>References</b> 1] Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", 4 <sup>th</sup> Edition, Pearson Educational Limited, 2014 2] Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Java", 6 <sup>th</sup> Edition, John Wiley & Sons, 2014, Inc., ISBN: 978-1-118-77133-4. 3] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3 <sup>rd</sup> Edition, PHI Learning Private Limited, 2014.

<b>Course Code:</b> CSE2067	<b>Course Title: Web Technology</b> <b>Type of Course: Program core</b> <b>Theory &amp; Integrated Laboratory</b>	<b>L- T-P- C</b>	2-0-2-3
<b>Version No.</b>	1.0		
<b>Course Pre-requisites</b>	NIL		
<b>Anti-requisites</b>	NIL		
<b>Course Description</b>	<p>The purpose of the course is to provide a comprehensive introduction to scripting languages that are used for creating web-based applications.</p> <p>The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.</p>		
<b>Course Objective</b>	<p><b>This course is designed to improve the learners' <u>EMPLOYABILITY SKILLS</u> by using <u>EXPERIENTIAL LEARNING</u> techniques.</b></p> <p><b>Please add as per what the course covers in the criteria1 NAAC Template.</b></p>		
<b>Course Outcomes</b>	<p><b>On successful completion of this course the students shall be able to:</b></p> <p><b>CO1:</b> Implement web-based application using client-side scripting languages. <b>(Application level)</b></p> <p><b>CO2:</b> Apply various constructs to enhance the appearance of a website. <b>(Application level)</b></p> <p><b>CO3:</b> Apply server-side scripting languages to develop a web page linked to a database. <b>(Application level)</b></p>		

<b>Course Content:</b>				
<b>Module 1</b>	<b>Introduction to XHTML</b>	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications	<b>10 Classes</b>
<p>Topics:</p> <p>Basics: Web, WWW, Web browsers, Web servers, Internet.</p> <p>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.</p>				
<b>Module 2</b>	<b>Advanced CSS</b>	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages	<b>12 Classes</b>
<p><b>Advanced CSS:</b> Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn.</p> <p>Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks</p> <p><b>XML:</b> Basics, demonstration of applications using XML</p>				
<b>Module 3</b>	<b>PHP – Application Level</b>	Quizzes and assignments	Application of PHP in web designing	<b>14 Classes</b>
<p>Topics:</p> <p><b>PHP:</b> Introduction to server-side Development with PHP, Arrays, and Superglobals, Arrays, \$GET and \$ POST, Super global Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object, Classes and Objects in PHP, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.</p>				
<p><b>List of Laboratory Tasks:</b></p> <p><b>Experiment No. 1: Demonstration of XHTML features</b></p> <p>Level 1: Demonstration of various XHTML Tags (Level 1)  Level 2: Design and develop static web pages for an online Book store (Level 2).</p> <p><b>Experiment No. 2: Application of CSS in web designing</b></p> <p>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.</p> <p><b>Experiment No. 3: Application of PHP in web designing.</b></p>				

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):**

- 1] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 8th Edition, 2015.
- 2] *CSS Notes for Professionals*, ebook available at <https://books.goalkicker.com/CSSBook/> (Retrieved on Jan. 20, 2022)
- 3] Deitel, Deitel, Goldberg, "*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

#### **References**

- 1] Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.
- 2] Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Topics related to development of "FOUNDATION": Web, WWW, Web browsers, Web servers, Internet.

Topics related to development of "EMPLOYABILITY": CSS, PHP.

Topics related to development of "HUMAN VALUES AND PROFESSIONAL ETHICS": Web designing for healthcare.

<b>Course Code:</b> <b>CHE1001</b>	<b>Course Title:</b> Environmental Studies	<b>L- T- P- C</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>
	<b>Type of Course:</b> School Core- Theory and Lab					
<b>Version No.</b>	2.0					

<b>Course Pre-requisites</b>	NIL			
<b>Anti-requisites</b>	NIL			
<b>Course Description</b>	<p>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.</p> <p><b>This course is designed to cater to Environment and Sustainability</b></p>			
<b>Course Objective</b>	<p>The objective of the course is to <b>familiarize the learners with the concepts of “Environmental Science” and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.</b></p>			
<b>Course Outcomes</b>	<p>On successful completion of this course the students shall be able to:</p> <ol style="list-style-type: none"> <li>1) Appreciate the historical context of human interactions with the environment and the need for eco-balance.</li> <li>2) Describe basic knowledge about global climate change with particular reference to the Indian context.</li> <li>3) Understand biodiversity and its conservation</li> <li>4) Develop an understanding on types of pollution and ways to protect the environment</li> <li>5) Learn about various strategies on Global environmental management systems</li> </ol>			
<b>Course Content:</b>				
<b>Module 1</b>	<b>Humans and the Environment</b>	Assignment	Data Collection	<b>01 class</b>
<p><b>Topics:</b> The man-environment interaction: Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment.</p> <p><b>Self-learning topics:</b> Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism.</p>				

<b>Module 2</b>	<b>Natural Resources and Sustainable Development</b>	Assignment		<b>03 Classes</b>
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**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.

<b>Module 3</b>	<b>Environmental Issues: Local, Regional and Global</b>	Case study		<b>02 Classes</b>
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**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

<b>Module 4</b>	<b>Conservation of Biodiversity and Ecosystems</b>	Assignment		<b>02 Classes</b>
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**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.

<b>Module 5</b>	<b>Environmental Pollution and Health</b>	Case study		<b>03 Classes</b>
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**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.

	<b>Module 6</b>	<b>Climate Change: Impacts, Adaptation and Mitigation</b>	Assignment/case		<b>02 Classes</b>
<b>Topics:</b> <b>Understanding climate change:</b> 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					

Course Code: CSE2011	Course Title: Data Communications and Computer Networks Type of Course: Program Core - Theory	L-T-P-C	3	-0	0	3
Version No.	1					
Course Pre-requisites	NIL					
Anti-requisites						
Course Description	This is the first course on data communication and computer networks. This course gives a thorough introduction to all the layers of computer network following the top-down approach. Application, Transport, Network, and data link layer protocols are taught with analysis wherever applicable. All-important concepts required to take up advanced courses and to face placement tests by an undergraduate student will be covered in this course. This course also covers necessary foundational topics pertaining to data communications. This course can be followed up with an advanced computer networks by the student to get a complete understanding of this domain.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques					
Course Outcomes	1. Explain the concepts of Computer Networks and Working Principles of Application Layer and Transport Layer (Comprehension) 2. Apply the Knowledge of IP Addressing and Routing Mechanism in Computer Networks. (Application) 3. Discuss the functionalities of Data Link Layer (Comprehension) 4. Explain the Basic Concepts of Data communication. (Comprehension)					

Course Content:				
Module 1	Overview, Application and Transport Layers.	Assignment	Comprehension	13 Sessions
Introduction: Computer Networks, Topologies, OSI Reference Model, TCP/IP model. Principles of Network Applications, The Web and HTTP, DNS—The Internet's Directory Service, Socket Programming: Creating Network Applications. Introduction and Transport-Layer Services, Connection-less Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.				
Module 2	Network Layer	Assignment	Application	12 Sessions
Overview of Network Layer, Forwarding and Routing, The Data and Control Planes. The Internet Protocol (IP): IPv4, Addressing, IPv6, IPv4 Datagram Format, IPv4 Addressing, Network Address Translation (NAT), IPv6. Introduction Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Intra-AS Routing in the Internet, OSPF Routing Among the ISPs: BGP, Introduction to BGP. ICMP: The Internet Control Message Protocol.				
Module 3	Data Link Layer	Assignment	Comprehension	10 Sessions
Introduction to the Link Layer, The Services Provided by the Link Layer, Error-Detection and -Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols. Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs), DHCP, UDP, IP and Ethernet.				
Module 4	Physical Layer with Data Communication	Assignment	Comprehension	07 Sessions
Data communications: Components, Data Representation, Data Flow, Analog and Digital Signals, Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Transmission Impairment, Data Rate Limits: Noiseless Channel, Nyquist Bit Rate, Noisy Channel: Shannon Capacity, Performance: Bandwidth, Throughput, Latency (Delay), Bandwidth-Delay Product, Parallel/Serial Transmission, Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing.				
Targeted Application & Tools that can be used:  Instant Messaging  Telnet				



File Transfer Protocol
Video Conferencing
Project work/Assignment:
Project Assignment:
Assignment 1: Data Flow Directions
Assignment 2: Types of Topology
Textbooks:
T1. James F. Kurose, Keith W. Ross, "Computer Networking A Top down Approach", 8th Edition, Pearson, 2021.
T2. Behrouz A. Forouzan, "Data Communications and Networking", 6th Edition, Tata McGraw-Hill, 2021.
References:
R1. William Stallings: "Data and Computer Communication", 10th Edition, Pearson Education, 2017.
R2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2012.
Web references:
Digital Learning Resources (Library Resources)
W1. <a href="https://puniversity.informaticsglobal.com/login">https://puniversity.informaticsglobal.com/login</a>
<a href="https://nptel.ac.in/courses/105106053">https://nptel.ac.in/courses/105106053</a>
Topics relevant to "Skill Development":
Virtual Local Area Networks (VLANs), DHCP, UDP, IP and Ethernet for Skill Development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE2009	Course Title: Computer Organization and Architecture	L- T-P- C	3-00	3
Version No.	2.0			
Course Pre-requisites	CSE 2015 Digital Design			
Anti-requisites	NIL			

Course Description	This course introduces the core principles of computer architecture and organization from basic to intermediate level. This theory based course emphasizes on understanding the interaction between computer hardware and software. It equips the students with the intuition behind assembly-level instruction set architectures. It helps the students to interpret the operational concepts of computer technology as well as performance enhancement.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computer Organization and Architecture and attain Skill Development through Participative Learning techniques.			
Course Outcomes	<p>On successful completion of the course the students shall be able to:</p> <p>1] Describe the basic components of a computer, their interconnections, and instruction set architecture [ Comprehension]</p> <p>2] Apply appropriate techniques to carry out selected arithmetic operations</p> <p>3] Explain the organization of memory and processor sub-system</p>			
Course Content:				
Module 1	Basic Structure of computers	Assignment	Data Analysis task	12 Classes
<p>Topics:</p> <p>Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC &amp; CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.</p>				
Module 2	Instruction Set Architecture and Memory Unit	Assignment	Analysis, Data Collection	12 Classes
<p>Topics:</p> <p>Instruction Set Architecture: Addressing Modes, Stacks and Subroutines.</p> <p>Memory System: Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.</p>				
Module 3	Arithmetic and Input/output Design	Case Study	Data analysis task	10 Classes
<p>Topics:</p>				

Arithmetic: Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations.				
Input/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits				
Module 4	BPU and Pipelining	Assignment	Analysis, Data Collection	11 Classes
<p>Topics:</p> <p>Basic Processing Unit: Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization.</p> <p>Pipelining: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>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.</p> <p>Tools:</p> <p>Virtual Lab, IIT KGP</p> <p>Tejas – Java Based Architectural Simulator, IIT Delhi</p>				
<p>Text Book</p> <p>Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Fifth Edition, McGraw-Hill Higher Education, 2016 reprint.</p>				
<p>References</p> <p>William Stallings, “Computer Organization &amp; Architecture – Designing for Performance”, 11th Edition, Pearson Education Inc., 2019</p> <p>David A. Patterson &amp; John L. Hennessy, “Computer Organization and Design MIPS Edition- The Hardware/Software Interface”, 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020.</p> <p>Web References:</p> <p>NPTEL Course on “Computer architecture and organization” IIT Kharagpur By Prof. Indranil Sengupta, Prof. Kamalika Datta. <a href="https://nptel.ac.in/courses/106105163">https://nptel.ac.in/courses/106105163</a></p> <p>NPTEL Course on “Computer Organization”, IIT Madras By Prof. S. Raman. <a href="https://nptel.ac.in/courses/106106092">https://nptel.ac.in/courses/106106092</a></p> <p><a href="https://puniversity.informaticsglobal.com:2229/login.aspx">https://puniversity.informaticsglobal.com:2229/login.aspx</a></p>				

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.
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Course Code: CSE2074	Course Title: Database Management Systems  Type of Course: 1) School Core 2) Laboratory Integrated	L-T-P-C	2 0	- 2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	<p>This course introduces the core principles and techniques required in the design and implementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve the information efficiently. It helps the students to learn and practice data modeling and database designs.</p> <p>The associated laboratory is designed to implement database design using MySQL (My Structured Query Language-Open Source) in information technology applications. All the exercises will focus on the fundamentals for creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database.</p>				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Outcomes:	<p>On successful completion of the course the students shall be able to:</p> <p>1] Understand core concepts of database (Knowledge)</p> <p>2] Apply normalization techniques to refine database schema (Application)</p> <p>3] Develop database with concurrent transactions execution feature (Application)</p>				
Course Content					
Module 1	Introduction to Database and its	Assignment	Problem Solving	6 Classes	

	Conceptual Model (Knowledge)			
<p>Topics:</p> <p>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.</p> <p>Conceptual Data Modelling: Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.</p>				
Module 2	Query Languages (Application)	Assignment	Problem Solving	7 Classes
<p>Topics:</p> <p>Relational Algebra with selection, projection, rename, set operations, cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.</p> <p>MySQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.</p>				
Module 3	Designing and Refining Database Schema (Application)	Assignment	Programming Task	7 Classes
<p>Topics:</p> <p>Schema Design: Problems in schema design, redundancy and anomalies.</p> <p>Schema refinement: Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions.</p>				
Module 4	Transaction Management and Concurrency Control (Application)	Assignment	Problem Solving	6 Classes
<p>Topics:</p> <p>Transaction: Desirable properties (ACID) of Transactions, Simultaneous Transactions and their problems like dirty read, lost update and incorrect summary, Serializability, Conflict Serializability, View Serializability;</p> <p>Concurrency Control: Locking and Time-stamping concurrency schemes.</p>				
List of Laboratory Tasks:				

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

#### Labsheet-1 [3 Practical Sessions]

##### Experiment No 1: [ 1 Session]

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

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

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

##### Experiment No. 2: [2 Sessions]

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

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

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

#### Labsheet-2 [3 Practical Sessions]

##### Experiment No. 3: [ 1 Session]

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

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

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

##### Experiment No. 4: [ 2 Session]

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

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

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

### Labsheet-3 [3 Practical Sessions]

#### Experiment No. 5: [3 sessions]

To study and implement Views, and Procedures in MySQL.

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

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

### Labsheet-4 [3 Practical Sessions]

#### Experiment No. 6: [3 Sessions]

To study and implement Functions, and Triggers in MySQL.

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

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

### Targeted Application & Tools that can be used:

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

Tools/Simulator used: MySQL

### Text Book

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

### References

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

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

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

Course Code: MAT2004	Course Title: Discrete Mathematical Structures  Type of Course:1] School Core		L-T- P- C	3	0	0	3
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.			
<b>Module 3</b>	<b>Relations and Functions</b>		<b>(10 Classes)</b>
<p>Cartesian Products and Relations, Functions, One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.</p> <p>Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders, Lattice, Hasse Diagrams, Equivalence Relations and Partitions.</p>			
<b>Module 4</b>	<b>Recurrence Relations and Generating Functions</b>		<b>(10 Classes)</b>
Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.			
<b>Module 5</b>	<b>Graph Theory &amp; Algorithms on Networks</b>	<b>Assignment</b>	<b>(15 Classes)</b>
<p>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.</p> <p>Tree - Definitions, Properties, and Examples, Routed Trees, Binary search tree, Decision tree, spanning tree: BFS, DFS.</p> <p>Algorithms on Networks - Shortest path algorithm- Dijkstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.</p> <p>Targeted Application &amp; Tools that can be used:</p> <p>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.</p>			
<b>Assignment:</b>			
<p>5. <b>Assignment 1: Logic Equivalences and Predicate calculus.</b></p> <p>6. <b>Assignment 2: Equivalence Relations and Lattices</b></p> <p>7. <b>Assignment 3: Recurrence Relations</b></p>			
<p><b>Text Book</b></p> <p>1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill,s 8th Edition,2019.</p> <p>2. Harary – Graph Theory, Addison-Wesley Publishing Company.</p>			
<p><b>References:</b></p> <p>1. Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall.</p> <p>2. K.D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd.</p> <p>3. Ralph. P. Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia.</p> <p><b>E-resources/ Web links:</b></p> <p>1. <a href="https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BA SED&amp;unique_id=EBSCO95_30102024_54588">https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BA SED&amp;unique_id=EBSCO95_30102024_54588</a></p> <p>2. <a href="https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BA SED&amp;unique_id=EBSCO95_30102024_375">https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BA SED&amp;unique_id=EBSCO95_30102024_375</a></p> <p>3. <a href="https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html">https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html</a></p>			

4.	<a href="https://www.scu.edu.au/study-at-scu/units/math1005/2022/">https://www.scu.edu.au/study-at-scu/units/math1005/2022/</a>
5.	
<b>Topics relevant to SKILL DEVELOPMENT:</b> 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: CSE2027	Course Title: Fundamentals of Data Analytics  Type of Course: Theory only	L- T-P- C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Fundamentals of Data Analytics is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on data analysis to a wide range of applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Fundamentals of Data Analytics and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:  1) Explain different types of data and variables.  2) Interpret data using appropriate statistical methods.  3) Demonstrate the collection, processing and analysis of data for any given application and Illustrate various charts using visualization methods.				

	4) Apply the Data Analysis techniques by MAT Lab			
Course Content:				
Module 1	Introduction to Data Analysis	Assignment	Data Collection , data analysis	6 Sessions
Topics: Introducing Data, overview of data analysis: Data in the Real World, Data vs. Information, The Many “Vs” of Data, Structured Data and Unstructured Data, Types of Data, Data Analysis Defined, Types of Variables, Central Tendency of Data, Scales of Data Sources of Data, Data preparation: Cleaning the data, Removing variables, Data Transformations.				
Module 2	Statistical functions	Assignment	Data analysis	8 Sessions
Topics: Descriptive Statistics, Inferential Statistics (T test, Z test,), Probability Uses In Business and Calculating Probability from a Contingency Tables.				
Module 3	Data Collection, Processing and Analysis	Project based MAT Lab	MAT LAB	6 Sessions
Topics: Collection of Primary Data( Observation Method, Interview Method, Collection of Data through Questionnaires ,Collection of Data through Schedule) Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data ,Difference between Survey and Experiment Processing Operations, correlation.  Introduction: Overview, Classification, Regression, Building a prediction model				
Module 4	Data Visualization and Charting Prediction	Project MAT Lab	Data Collection, visualization and data analysis	6 Sessions
Topics: Types of charts and their significance, Organize data interactively with tables , Visualizing data with charts, Analyzing data with pivot tables, Build presentation ready dashboards and turn real world data into business insights, Tracking trends and making forecasts, Interpretation and report writing				
Module 5	Introduction to MATLAB	Project MAT Lab	Data analysis with optimization	12 Sessions

Topics: Defining Categories of Data, Analyzing Groups within Data, Importing Data from Multiple Files, Review Project ,Images and 3-D Surface Plots, Importing Unstructured Data			
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application Area are</p> <p>Decision making in business, health care, financial sector, Medical diagnosis etc...</p> <p>MAT Lab</p>			
<p>Text Books</p> <p>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.</p> <p>William Menke And Joshua Menke,"Environmental Data Analysis with MAT Lab", Elsevier, 2012.</p> <p><a href="https://matlabacademy.mathworks.com/details/matlab-for-data-processing-and-visualization/mlvi">https://matlabacademy.mathworks.com/details/matlab-for-data-processing-and-visualization/mlvi</a></p>			
<p>References</p> <p>Paul McFedries , "Excel Data Analysis-visual blue print",Wiley 4th Edition September 2019.</p> <p>Gerald Knight, "Analyzing Business Data with Excel",O'Reilly; 1st Edition,13 January 2006.</p> <p><a href="https://people.highline.edu/mgirvin/AllClasses/348/348/AllFilesBI348Analytics.htm">https://people.highline.edu/mgirvin/AllClasses/348/348/AllFilesBI348Analytics.htm</a></p> <p>Hansa Lysander,"Data Analysis and business modelling using Microsoft Excel", PHI, 2017.</p> <p>Web Links:</p> <p><a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p>			
<p>Topics relevant to development of "FOUNDATION SKILLS":</p> <p>Statistical Concepts for data, visualization techniques.</p> <p>Data collection for project based assignments.</p> <p>Inferential Statistics (T test, Z test)</p> <p>Probability Calculation</p> <p>for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</p>			

<b>Course Code:</b> <b>CSE 1003</b>	<b>Course Title: Innovation Project- Raspberry Pi Using Python</b>  <b>Type of Course: School Core &amp; Practical Only.</b>	<b>L- T- P- C</b>	0-0- 4-2
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<b>Version No.</b>	1.0			
<b>Course Pre-requisites</b>	<b>NIL</b>			
<b>Anti-requisites</b>	<b>NIL</b>			
<b>Course Description</b>	The Raspberry Pi is an amazing single board computer (SBC) capable of running Linus and a whole host of applications. Python is a beginner-friendly programming language that is used in schools, web development, scientific research, and in many other industries. This course will enable students in writing own programs with Python to blink lights, respond to button pushes, read sensors, log data on the Raspberry Pi and many more. The course also offers in-depth knowledge of designing, developing, coding and implementing projects using Raspberry Pi.			
<b>Course Outcomes</b>	<b>On successful completion of this course the students shall be able to:</b> <ol style="list-style-type: none"> <li>5) Write a program in Python.</li> <li>6) Explain the main features of the Raspberry Pi board</li> <li>7) Demonstrate the hardware interfacing of the peripherals to Raspberry Pi system.</li> <li>8) Demonstrate the functioning of live various projects carried out using Raspberry Pi system.</li> </ol>			
<b>Course Content:</b>				
<b>Module 1</b>	Basics of Python, functions	Quiz	Problem Solving	<b>4 Lab Sessions</b>
<b>Topics:</b> Introduction, Structure of Python Program, Data Types and Variables, Input and Output, Operators, Importing libraries, Functions, Development Tool. <b>Concepts will be taught by solving problems through programs.</b>				
<b>Module 2</b>	<b>Python Programming</b>	Quiz	Problem Solving	<b>4 Lab Sessions</b>
Control statements, Lists and Dictionaries, Problem solving using Python. <b>Concepts will be taught by solving problems through programs.</b>				
<b>Module 3</b>	<b>Overview of Raspberry Pi</b>	Project Development	System Design Task and Analysis	<b>4 Lab Sessions</b>
<b>Topics:</b> An exploration of GPIO pins, LED and switch control. Installation of libraries, PuTTY SSH. Raspberry Pi to interface with more complicated sensors and actuators like Pi Camera, servo motor ADS51115 through PIP libraries. Arduino with Raspberry-pi				
<b>Module 4</b>	<b>Interaction with API Services</b>	Project Development	Modeling and Simulation task	<b>3 Lab Sessions</b>
<b>Topics:</b> Raspberry Pi interact with online API services through the use of public APIs and SDKs using Firebase, Gspread API. Node-RED – a programming tool for wiring together hardware devices, MQTT. Android/Case study.				
<b>Targeted Application &amp; Tools that can be used:</b>				

<p>Making it a reality (Raspberry Pi Projects) :</p> <p>Projects will include but not limited to :</p> <ol style="list-style-type: none"> <li>1) Intelligent home locking system.</li> <li>2) Intelligent water level management system.</li> <li>3) Home automation using RFID.</li> <li>4) Real time clock-based home automation.</li> <li>5) Intelligent Automatic Irrigation System</li> </ol> <p><b>Professionally Used Software: Raspberry Pi.</b></p>	
<b>Project work/Python Lab Test:</b>	
<p><b>Project work</b></p> <p><b>Python test.</b></p>	
<p><b>Text Book(s):</b></p> <p>1] Ashok Namdev Kamthane, Amit Ashok Kamthane, <i>“Problem Solving and Python Programming”</i>, Mc Graw Hill Education, 2018.</p>	
<p><b>Reference(s):</b></p> <p>4) <a href="https://github.com/thibmaek/awesome-raspberry-pi">https://github.com/thibmaek/awesome-raspberry-pi</a></p> <p>5) <a href="#">MagPi magazine</a></p>	
<p>Topics relevant to development of “Foundation Skills”: Basic Concepts of Python-Programming, and Raspberry Pi.</p> <p>Topics related to development of “Employability Skills”: Problem solving, Creative Thinking, Team work, Prototype Development.</p> <p>Topics related to development of “Entrepreneurship”: Effective Communication, Strategic Thinking, Creative Thinking.</p>	
<b>Evaluation:</b>	Review-1-20cx%, Review-2-25%, Python test-25%, Project Expo-30%
<b>Catalogue prepared by</b>	Dr. M.S Divya Rani Ms. Galiveeti Poornima
<b>Recommended by the Board of Studies on</b>	BOS NO: 12th BOS, held on 04/08/2021
<b>Date of Approval by the Academic Council</b>	Academic Council Meeting No. 16, Dated 23/10/2021

<b>Course Code:</b> MAT2003	<b>Course Title:</b> Numerical Methods for Engineers <b>Type of Course:</b> Theory-	<b>L- T-P- C</b>	1	0	2	2
<b>Version No.</b>	1.0					
<b>Course Pre-requisites</b>	Knowledge of system of equations, differentiation, integration and differential equations.					
<b>Anti-requisites</b>	NIL					

<b>Course Description</b>	The course focuses on formulating and solving problems concerning real-world engineering applications numerically as well as statistically. This course provides an introduction to basic numerical methods to deal with algebraic and transcendental equations, system of equations, interpolation, differentiation and integration. This course also deals with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods.			
Course Objective	The objective of the course is to <b>familiarize the learners with the concepts of “NUMERICAL METHODS FOR ENGINEERS”</b> and attain <b><u>Skill Development</u> Through <u>Problem Solving</u></b>			
<b>Course Out Comes</b>	CO1: Solve algebraic and transcendental equations numerically[Apply] CO2: Adopt numerical techniques to differentiate and integrate functions[Apply] CO3: Apply numerical methods to solve ordinary differential equations.[ Apply]			
<b>Course Content:</b>				
<b>Module 1</b>	<b>Numerical solution of Algebraic and Transcendental Equations</b>	Assignment		<b>15 Sessions</b>
<b>Topics:</b>  Algebraic and Transcendental Equations, Regula - Falsi method, Bisection method, Secant method, Newton-Raphson method, and NR method for non-linear Equations, Fixed-point iteration method.  System of Linear Equations: Introduction, LU decomposition method, Gauss-Jacobi method, Gauss-Seidel iteration method, Largest Eigen value and corresponding Eigen vector by Power method & Jacobi Method				
<b>Module 2</b>	<b>Numerical Interpolation, differentiation, and Integration</b>	Assignment		<b>13 Sessions</b>
<b>Topics:</b>  Numerical Interpolation: Newton's Forward and Backward differences interpolation method, Newton's divided difference method, Lagrange's method, Numerical differentiation. Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's Rule. Area between the two curves.				
<b>Module 3</b>	<b>Numerical solution of ODEs and PDEs</b>	Assignment		<b>17Sessions</b>
<b>Topics:</b>				

Solution of ordinary differential equations: Initial Value problems: Taylor's series method, Picard's method, Euler's Method, Modified Euler's method, Runge-Kutta method, Milne's predictor-corrector formula. Adams -Bashforth method, Boundary value problems – Finite difference methods for ODE. Numerical solution for LCR & damped forced oscillatory equations.

Solution of partial differential equations: Schmidt Explicit Formula for Heat Equation, Crank-Nicolson method. Numerical solution to Wave, Laplace & Heat Equation.

### Text Book

[T1] M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computations, 6th Edition, New age Publishing House, 2015.

[T2] Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons (India), 2014.

### References :

[R1] B.S. Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016.

[R2] B.S. Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers.

[R3] Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., McGraw-Hill Edition, 2015.

[R3] C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill, 2012.

### E-References

1. [https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE\\_BASED&unique\\_id=EBSCO95\\_25769814495](https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_25769814495)

2. [https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE\\_BASED&unique\\_id=EBSCO95\\_25092023\\_8589947451](https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_25092023_8589947451) 3.

3. [https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE\\_BASED&unique\\_id=EBSCO95\\_8589980927](https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_8589980927)

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

<b>Course Code:</b> CSE2007	<b>Course Title:</b> Design and Analysis of Algorithms  <b>Type of Course:</b> Program Core & Theory only	<b>L- T- P- C</b>	3-0-0-3
<b>Version No.</b>	2.1		



<b>Course Pre-requisites</b>	CSE2001, Data Structure and Algorithms			
<b>Anti-requisites</b>	NIL			
<b>Course Description</b>	This intermediate course enables students to design and analyze efficient algorithms to solve problems. This course covers typical design methods such as divide-and-conquer, dynamic programming and greedy method to solve problems. The students shall develop strong analytical skills as part of this course.			
<b>Course Objectives</b>	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.			
<b>Course Outcomes</b>	<p><b>On successful completion of the course the students shall be able to:</b></p> <ol style="list-style-type: none"> <li><b>1] Identify the efficiency of a given algorithm. [Comprehension]</b></li> <li><b>2] Employ divide and conquer approach to solve a problem. [Application]</b></li> <li><b>3] Illustrate dynamic programming approach to solve a given problem. [Application]</b></li> <li><b>4] Solve a problem using the greedy method. [Application]</b></li> <li><b>5] Discuss the techniques to solve a real-world problem based on its complexity classes. [Comprehension]</b></li> </ol>			
<b>Course Content:</b>				
<b>Module 1</b>	Introduction to Algorithms	Assignment	Problem Solving	<b>06 Sessions</b>
<b>Topics:</b> Algorithm Design and efficiency, measuring of running time of algorithms. Insertion sort and merge sort, Asymptotic Growth and Notations. Recurrences--Masters method. <b>Assignment:</b> Comparatively evaluate bubble sort, insertion sort and mergesort.				
<b>Module 2</b>	Review of Searching and Sorting techniques	Assignment	Programming/ Problem Solving	<b>12 Sessions</b>
<b>Topics:</b> <b>Divide and Conquer:</b> Examples. Strassen's Matrix multiplication. <b>Sorting:</b> Quicksort, Heapsort, Lower bound of comparison-based sorting, non-comparison-based sorting: Radix sort. <b>Search:</b> Review of Linear Search and Binary Search, Hashing and hash tables. <b>Assignment:</b> Design and develop an algorithm using Divide and Conquer technique for a given scenario.				
<b>Module 3</b>	Greedy Algorithms	Assignment	Programming/ Problem Solving	<b>09 Sessions</b>

<b>Topics:</b> Introduction, Fractional Knapsack Problem, Minimal Spanning Tree: Prim's Algorithm and Kruskal's Algorithm, Single-source Shortest Path: Dijkstra's Algorithm. Huffman Codes.				
<b>Assignment:</b> Design and Develop a solution to a given scenario using greedy method.				
<b>Module 4</b>	Dynamic Programming	Assignment	Programming/ Problem Solving	<b>09 Sessions</b>
<b>Topics:</b> Introduction with examples, Principles of Memoization, 0-1 Knapsack Problem, Bellman-Ford algorithm, Floyd-Warshall's Algorithms. Optimal Binary Search Trees, Chain Matrix Multiplication.				
<b>Assignment:</b> For a given scenario, attempt the three design paradigms learned so far and argue the best approach to solve the problem				
<b>Module 5</b>	Complexity Classes and Heuristics	Assignment	Programming/ Problem Solving	<b>09 Hours</b>
<b>Topics:</b> Complexity classes: P, NP, and NP-Complete Problems. Backtracking: n-Queens. Branch and bound: Travelling Salesman Problem.				
<b>Assignment:</b> Apply backtracking algorithmic designing technique for solving queen's problems for 4, 8 and 16 inputs.				
<b>Targeted Application &amp; Tools that can be used:</b>  <b>Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.</b>  <b>Professionally Used Software: GCC compiler.</b>				
<b>Project work/Assignment:</b>				
1. <b>Problem Solving: Design of Algorithms and implementation of programs.</b> 2. <b>Programming: Implementation of given scenario using Java.</b>				
<b>Text Book:</b>  T1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ' <i>Introduction to Algorithms</i> ', MIT Press, 2022.  T2. J. Kleinberg and E. Tardos, ' <i>Algorithm Design</i> ', Addison-Wesley, 2005.				
<b>References</b> R1. Anany Levitin, ' <i>Introduction to the Design and Analysis of Algorithms</i> ', Pearson Education, 2003.  R2. Tim Roughgarden, ' <i>Algorithms Illuminated</i> ' (books 1 through 3), Soundlikeyourself Publishing, 2017,18,19 respectively.				

R3. AV Aho, J Hopcroft, JD Ullman, '*The Design and Analysis of Algorithms*', Addison-Wesley, 1974.

<b>Course Code:</b> <b>CSE 2018</b>	<b>Course Title: Theory of Computations</b>  <b>Type of Course: Program Core</b>	<b>L- T-P- C</b>	3-0-0-3
<b>Version No.</b>	1.0		
<b>Course Pre-requisites</b>	NIL		
<b>Anti-requisites</b>	NIL		
<b>Types of Skills</b>	Foundation Skills, Analytical, Logical and Mathematical Thinking		
<b>Course Caters to</b>	Metatheory of Computing		
<b>Course Description</b>	<p>The purpose of Theory of Computation Course is to enable the students to appreciate the study of formal language and the correspondence between language classes and the automata that recognizes. Analytical ability is required for the students to analyze and develop. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The simulation using JFLAP makes the student to visualize the automata construction and string parsing. The project work helps the students to build any context free grammar and Turing Machine for the Language.</p>		
<b>Course Out Comes</b>	<p>On successful completion of the course the students shall be able to:</p> <p>[1] Understand basic concepts of Automata and its types. (Knowledge)</p> <p>[2] Construct Finite Automata with its Simulation. (Application)</p> <p>[3] Distinguish between Regular Grammar and Context Free Grammar. (Comprehensive)</p> <p>[4] Design Push Down Automata. (Application)</p> <p>[5] Implement Turing machine for a Language. (Application)</p>		
<b>Course Content:</b>			
<b>Module 1</b>	Introduction to Automata Theory	Assignment	Data Collection <b>6 Hours</b>

<p>Topics:</p> <p>Introduction to Automata Theory, Applications of Automata Theory, Basic Definitions, Representation of Automata, Language Recognizers, Example for Language Recognizers.</p> <p>(Knowledge)</p>				
<b>Module 2</b>	Finite Automata	Assignment	Simulation	<b>12 Hours</b>
<p>Topics:</p> <p>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 Acceptor, Languages and NFA's, Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata. (Application)</p>				
<b>Module 3</b>	Regular Expressions & Context Free Grammar	Assignment	Programming	<b>8 Hours</b>
<p>Topics:</p> <p>Formal Definition of a Regular Expression, Pumping Lemma, Context Free Grammars- Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Ambiguity in Grammars. (Comprehensive)</p>				
<b>Module 4</b>	Push Down Automata	Assignment	Simulation	<b>7 Hours</b>
<p>Topics:</p> <p>Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Pushdown Automata for Context-Free Languages and Context-Free Grammars for Pushdown Automata, Deterministic Pushdown Automata. (Application)</p>				
<b>Module 5</b>	Turing Machine	Assignment	Programming/Simulation	<b>6 Hours</b>
<p>Topics:</p> <p>Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing Machine. (Application)</p>				
<p><b>Targeted Application &amp; Tools that can be used:</b></p> <p>Targeted Application:</p>				

- [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.

### **Project work/Assignment:**

1. Simulate and verify the string acceptance and rejection using deterministic finite automata / Push down automata / Turing machine for any given regular language or a non-regular language in JFLAP software simulation tool.
2. Write a program to convert non-deterministic finite automata to deterministic finite automata.
3. Write a Java program to verify the given context free grammar is valid not.
4. Write a Java program to validate the given input (check it is valid or not) using Regular Expression.
  - i) IP Address
  - ii) Aadhaar number

### **Text Book**

1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6<sup>th</sup> Edition, 2018.

### **References**

1. Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3<sup>rd</sup> Edition, 2008.
2. Michael Sipser, "Theory of Computation", Cengage India 3<sup>rd</sup> Edition, 2014.

Topics relevant to Development of Foundation Skills:  
Language Recognizers, Basic Concepts of Finite Automata.

Course Code: CSE2010_v02	Course Title: Operating Systems  Type of Course: Program Core and Theory Only	L-T- P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE2009- Computer Organization, Problem solving using C  Students should have basic knowledge on computers, computer software & hardware, and Computer Organization. Prior programming experience in C is recommended.					
Anti-requisites	NIL					
Course Description	This course introduces the concepts of operating system operations, operating system structure and its design and implementation. It covers the classical operating systems internal algorithms such as process scheduling, synchronization, deadlocks detection and recovery and memory management. The course also enhances the problem solving, systems programming ability and case studies.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain Employability through Problem Solving Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamental concepts of operating Systems and case studies. [Knowledge] 2] Demonstrate various CPU scheduling algorithms. .[ Application ] 3] Apply various tools to handle synchronization problems.[Application] 4] Demonstrate deadlock detection and recovery methods [Application ] 5] Illustrate various memory management techniques.[ Application ]					
Course Content:						
Module 1	Introduction to Operating System	Assignment	Programming			9 Hours

<p>Topics:</p> <p>Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system</p>				
Module 2	Process Management	Assignment/Case Study	Programming/Simulation	11 Hours
<p>Topics:</p> <p>Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.</p>				
Module 3	Process Synchronization and Deadlocks	Assignment	Programming	11 Hours
<p>Topics:</p> <p>The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Semaphores, Classic Problems of Synchronization with Semaphore Solution- Producer-Consumer Problem, Reader-Writer problems, Dining Philosopher's Problem, . Introduction to Deadlocks, Necessary conditions for deadlock, Resource allocation Graph, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation, Deadlock detection &amp; Recovery from Deadlock.</p>				
Module 4	Memory Management	Assignment	Programming/Simulation	10 Hours
<p>Topics:</p> <p>Introduction to Memory Management, Basic hardware-Base and Limit Registers, Memory Management Unit(MMU), Dynamic loading and linking, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Virtual Memory and Demand Paging – Page Faults and Page Replacement Algorithms, Copy-on-write, Allocation of Frames, Thrashing</p> <p>Introduction to File system management: File System Interface (access methods, directory structures), File system implementation.</p>				
<p>Targeted Application:</p> <p>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.</p> <p>Software Tools:</p>				

<p>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.</p> <p>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.</p>			
Project work/Assignment			
<p>Demonstrate process concepts in LINUX OS.</p> <p>Simulation of CPU scheduling algorithms.</p> <p>Develop program to demonstrate use of Semaphores in threads.</p> <p>Develop program to demonstrate use of deadlock avoidance algorithms.</p> <p>Develop program to demonstrate use of page replacement algorithms.</p> <p>Simulation of memory allocation strategies [first fit, best fit and worst fit].</p>			
Text Book			
<p>Silberschatz A, Galvin P B and Gagne G , “Silberschatz's Operating System Concepts”, Paperback, Global Edition Wiley, 2019</p>			
References			
<p>Silberschatz A, Galvin P B and Gagne G, “Operating System Concepts”, 10th edition Wiley, 2018.</p> <p>William Stallings, “Operating Systems”, Ninth Edition, By Pearson Paperback ,1 March 2018.</p> <p>Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, “ Cracking the Operating System skills”, Dreamtech, paperback, 2020</p> <p>Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , “Operating Systems: Three Easy Pieces, Amazon digital Services”, September 2018.</p>			
E-resources/Weblinks			
<p><a href="https://www.os-book.com/OS9/">https://www.os-book.com/OS9/</a></p> <p><a href="https://pages.cs.wisc.edu/~remzi/OSTEP/">https://pages.cs.wisc.edu/~remzi/OSTEP/</a></p> <p><a href="https://codex.cs.yale.edu/avi/os-book/OS10/index.html">https://codex.cs.yale.edu/avi/os-book/OS10/index.html</a></p>			

<b>Course Code:</b> CSE 3078	<b>Course Title:</b> Cryptography and Network Security	<b>L-T-P- C</b>	3-0-0-3
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	<b>Type of Course: Program Core &amp; Theory only</b>			
<b>Version No.</b>	1			
<b>Course Pre-requisites</b>	“Data Communications and Computer Networks”.			
<b>Anti-requisites</b>	<b>NIL</b>			
<b>Course Description</b>	<p>The Course covers the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet.</p> <p><b>Topics:</b> The cryptographic tools such as shared key encryption, public key encryption, key exchange, and digital signature are explored. The use and utilization of the internet protocols and applications such as SSL/ TLS, IPSEC, Kerberos, PGP, and S/ MIME, SET are reviewed. System security issues such as viruses, intrusion and firewalls are also explored.</p>			
<b>Course Objective</b>	The objective of the course is <b>SKILL DEVELOPMENT</b> of student by using <b>PARTICIPATIVE LEARNING</b> techniques.			
<b>Course Outcomes</b>	<p>On successful completion of this course the students shall be able to:</p> <p><b>CO1:</b> Identifies the basic concept of Cryptography (<b>Knowledge</b>)</p> <p><b>CO2:</b> Express the different types of Cryptographic Algorithms. (<b>Comprehension</b>)</p> <p><b>CO3:</b> Recognize the Public key Cryptographic Techniques for various applications. (<b>Comprehension</b>)</p> <p><b>CO4:</b> Apply the network security concepts during their implementation of network security application developments. (<b>Application</b>)</p>			
<b>Course Content:</b>				
<b>Module 1</b>	<b>Introduction to Cryptography</b>	Assignment	Identify the Concepts	08 Sessions
<p>Topics:</p> <p>Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active attacks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution Ciphers : Caesar, Mono alphabetic, Polyalphabetic, Play-fair and Hill Cipher, Introduction to Block Cipher and Stream Cipher, Festal Structure.</p>				
<b>Module 2</b>	<b>Private Key Cryptography and Number Theory</b>	Assignment	Analysis of requirement of complexity in cryptography	13 Sessions
<p>Topics:</p> <p>Symmetric Encryption Algorithms : Data Encryption Standard, Introduction to Galois Field, Advanced Encryption Standard, Modular Arithmetic, Prime numbers, Fermat’s little theorem, brief about primality testing and factorization, Discrete Logarithmic Problem,</p>				

Euclidean and Extended Euclidean Algorithm, Euler Totient Function, Chinese Remainder Theorem				
<b>Module 3</b>	<b>Public Key Cryptography and its Applications</b>	Assignment	Recognize the importance of various security concepts to achieve sufficient solutions	10 Sessions
<b>Topics:</b> Overview of Public Key Cryptography, RSA, Diffie - Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Discussion on real time practices of Cryptography.				
<b>Module 4</b>	<b>Network Security</b>	Assignment	Implement the advanced network security algorithms in recent applications.	07 Sessions
<b>Topics:</b> Network Security fundamentals, Network Security applications: Authentication: Kerberos, PKI, Network Security applications: e-mail security: PGP, MIME, Network Security applications: IP Security: IP Sec architecture, Network Security applications: Web Security.				
<b>Targeted Application &amp; Tools that can be used:</b> Students get the knowledge about cryptography techniques followed, the algorithms used for encryption and decryptions & the techniques for authentication and confidentiality of messages.				
<b>Assignment:</b> <b>Assignment 1:</b> Solve the problems of basic encryption techniques. <b>Assignment 2:</b> Solve and analyze the problems on symmetric and asymmetric encryption.				
<b>Textbooks:</b> 1. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall, 8 <sup>th</sup> Edition, 2019. 2. Wade Trappe and Lawrence C Washington, "Introduction to Cryptography with Coding Theory", Pearson, 2020.				
<b>Reference Books:</b> 1. Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill, third edition, 2010. 2. R. Rajaram, "Network Security and Cryptography" SciTech Publication. 3 <sup>rd</sup> Edition, 2014. 3. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 2 <sup>nd</sup> Edition, 2019. 4. Bruce Schneier, "Applied Cryptography", John Wiley and Sons Inc. Second Edition, 2015.				
<b>Web references:</b> 1. <a href="https://onlinecourses.nptel.ac.in/noc22_cs90/preview">https://onlinecourses.nptel.ac.in/noc22_cs90/preview</a>				

2.e-pgpathshala UGC lecture series : E-Series and Self learning Materials. <a href="https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==">https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==</a>
3. <a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=10133&amp;query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=10133&amp;query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security</a>
4. <a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5875&amp;query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5875&amp;query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security</a> .
<b>Topics relevant to “Skill Development”:</b> Symmetric and Asymmetric Encryption Algorithms and its problems.

Course Code: CSE2015	Course Title: Data Analysis and Visualization Type of Course:1] Program core 2] Lab Integrated Course	L- T-P- C	2	0	4	4
Version No.	1.0					
Course Pre-requisites	Python Programming					
Anti-requisites	NIL					
Course Description	<p>The purpose of the course is to instill a strong foundation of scientific process orientation that is the cornerstone of effective data handling, and creative design thinking appended with strong programming skills to create meaningful visualizations of data. The student should have prior knowledge of python programming and basic knowledge of data concepts.</p> <p>The associated laboratory provides an opportunity to strengthen student’s skillset in the arena of Data Preprocessing and Visualization.</p> <p>With a good knowledge in the fundamental concepts of the various libraries for handling and visualizing data the student can gain a stronghold in Data Science enabling the student to be an effective analyst for prospective employers.</p>					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Analysis and Visualization and attain EMPLOYABILITY through Experiential Learning techniques.					
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>Understand the various types of data, apply and evaluate the principles of data visualization.</p> <p>Acquire skills to apply visualization techniques to a problem and its associated dataset.</p>					

	<p>Create interactive visualization for better insight using various visualization tools.</p> <p>Handle data occurring in large volumes</p> <p>Implement the visualization concepts practically using Python</p>			
Course Content:				
Module 1	Introduction to Data Visualization (Comprehension)	Assignment	Programming activity	10 Hours
<p>Topics:</p> <p>Data collection, Data Preparation Basic Models- Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Interacting with Databases, Data Cleaning and Preparation, Handling Missing Data, Data Transformation.</p> <p>Python Libraries: NumPy, pandas, matplotlib, GGplot, Introduction to pandas Data Structures</p>				
Module 2	Data Visualization Techniques (Application)	Assignment	Programming activity	10 Hours
<p>Topics:</p> <p>Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data, Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map.</p>				
Module 3	Visual Analysis of data from various domain (Application)	Assignment	Programming activity	10 Hours
<p>Topics:</p> <p>Time-oriented data visualization – Spatial data visualization, Text data visualization – Multivariate data visualization and case studies, Finance- marketing-insurance-healthcare etc.</p>				
Module 4	Visualization of Streaming Data (Application)	Assignment	Programming activity	10 Hours
<p>Topics:</p>				

Guidelines for designing successful visualizations, Data visualization dos and don'ts, Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.
<p>List of Laboratory Tasks:</p> <p>Labsheet -1 [ 4 Practical Sessions]</p> <p>Working with Numpy Functions and Pandas functions</p> <p>Acquiring and plotting data.</p> <p>Labsheet -2 [ 4 Practical Sessions]</p> <p>Practicals based on Data Cleaning and Preparation</p> <p>Practicals based on Data Wrangling</p> <p>Statistical Analysis – such as Multivariate Analysis, PCA, LDA, Correlation regression and analysis of variance</p> <p>Labsheet – 3 [ 4 Practical Sessions]</p> <p>Practicals based on Data Visualization using matplotlib</p> <p>Visualization of various massive dataset - Finance - Healthcare - Census</p> <p>Labsheet – 4 [ 4 Practical Sessions]</p> <p>Practical based on Time Series Data Analysis-stock market</p> <p>Market-Basket Data analysis-visualization</p> <p>Text visualization using web analytics</p> <p>Labsheet -5 [ 4 Practical Sessions]</p> <p>Financial analysis using Clustering, Histogram and HeatMap</p> <p>Visualization on Streaming dataset (Stock market dataset, weather forecasting)</p>
Targeted Application & Tools that can be used: Anaconda/Google Colab, Google Data Studio, Deep Note
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
<p>Problem Solving: Choose an appropriate set of visualization elements and design for a dashboard.</p> <p>Programming: Implementation of the chosen dashboard</p>

<p>Text Book</p> <p>McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media.</p> <p>Tamara Munzer, Visualization Analysis and Design, CRC Press 2014.</p> <p>Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018</p> <p>Dr. OssamaEmbarak, "Data Analysis andVisualization Using Python", Apress,(2018)</p>
<p>References</p> <p>R1. Dr.Chun-hauh Chen, W.K.Hardle, A.Unwin, Handbook of Data Visualization, Springer publication, 2016.</p> <p>R2. Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020 3. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014.</p> <p>R3. García Salvador, LuengoJulián, &amp; Herrera, F. "Data preprocessing in Data Mining", Springer,(2015)</p> <p>R4. Stephen Few, "Information Dashboard Design: the effective visual communication of data", Oreilly, 2006</p> <p>R5. Belorkar, A, "Interactive Data Visualization with Python" - [S.I.]: Packt Publishing, Second Edition. (2018)</p> <p>Web links</p> <p>R1. <a href="https://pythonprogramming.net/live-graphs-data-visualization-application-dash-python-tutorial/">https://pythonprogramming.net/live-graphs-data-visualization-application-dash-python-tutorial/</a></p> <p>R2. Google Data Analytics Professional Certificate   Coursera</p> <p>R3. Learning Python for Data Analysis and Visualization Ver 1   Udemy</p> <p>R4. Data Science, Analytics and Visualization (DS) Courses   Chaminade University - PROD [Integrated] Catalog</p> <p>R5. Data Visualization Training and Certification Courses   Koenig Solutions (koenig-solutions.com)</p>
<p>Topics relevant to "Employability": Visual Analysis and Streaming of Data for Employability through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.</p>

Course Code: CSE 3001	Course Title: Artificial Intelligence and Machine Learning  Type of Course: Integrated	L-T- P- C	2 -0	2	3
Version No.	2.0				
Course Pre-requisites	CSE1003 Innovation Project - Raspberry Pi Using Python				
Anti-requisites	NIL				
Course Description	<p>This course introduces the basic concepts of artificial intelligence. It introduces students to the basic concepts and techniques of Machine Learning (ML), a subset of Artificial Intelligence (AI), is an important set of techniques and algorithms used for solving several business and social problems. The objective of this course is to discuss machine learning model development using Python.</p> <p>Topics include: Working with Collections and Data Frames; Regression algorithms; Classification algorithms; Optimization techniques – Gradient Descent algorithm, Gradient Descent for simple Linear Regression; Ensemble Learning – Random Forest, Boosting techniques – AdaBoost and Gradient Boosting; Grid Search for optimal parameters; Clustering algorithms; Forecasting with Time-Series data : Auto-Regressive Integrated Moving Average Models, Recommender Systems : Association Rule Mining, Collaborative Filtering, Text Analytics – Sentiment Classification using Naïve Bayesian model.</p>				

Cour se Obj ective	The objective of the course is to familiarize the learners with the concepts of Artificial Intelligence and Machine Learning and attain Skill Development through experiential Learning techniques.			
Cour se Out Com es	<p>On successful completion of the course the students shall be able to:</p> <p>CO1: To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents. [Comprehension]</p> <p>CO2: Produce machine learning models for predictive analytics. [Application]</p> <p>CO3: Apply ensemble learning, optimization and hyper parameter tuning techniques for machine learning algorithms. [Application]</p> <p>CO4: Demonstrate different types of clustering techniques. [Application]</p> <p>CO5: Employ time series forecasting techniques/models for real world problems. [Application]</p>			
Cour se Cont ent:				
Mod ule 1	Introduction to Artificial Intelligence and Knowledge based systems	Assignment	Theory	6 Sessions
<p>Topics:</p> <p>Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agent, Structure of Intelligent agent and its functions, Agents and Environment; Introduction to Knowledge representation, approaches and issues in knowledge representation, Introduction to searching algorithm in AI, Conceptual graphs, Methods for Logic representation(POL, FOL).</p>				
Mod ule 2	Supervised Machine Learning Algorithms	Assignment	Programming activity	16 Sessions
<p>Topics:</p> <p>Introduction to the Machine Learning (ML) Framework, types of ML, types of variables/features used in ML algorithms, Feature engineering-Normalization, One-hot encoding, Simple Linear Regression, Multiple Linear Regression, Validation and Accuracy measures for Regression models. Classification models – Decision Tree algorithms using Entropy and Gini Index as measures of node impurity, model evaluation metrics for</p>				



classification algorithms, Logistic regression, Naïve Bayes Classifiers and Naive Bayes model for sentiment classification – an introduction..				
Module 3	Advanced Machine Learning Concepts	Assignment	Programming activity	14 Sessions
<p>Topics:</p> <p>Nearest Neighbor techniques, Cost functions and Optimization Technique – introduction to Gradient Descent, its applications on Linear Regression. C.Ensemble Learning algorithms – Bagging (Random Forest), Boosting(AdaBoost), XGBoost.</p>				
Module 4	Clustering and Forecasting with Time-Series Data	Assignment	Programming activity	10 Sessions
<p>Topics:</p> <p>Partitioned Clustering – K-means and Hierarchical Clustering techniques, cluster validity measures, Components of Time Series data, Basic Concepts of Forecasting , An introduction to Forecasting from Time Series Models, calculating forecast accuracy, Association Rule Mining, Collaborative Filtering – User based and item based similarity, closed and maximal frequent item sets.</p>				
<p>List of Laboratory Tasks:</p> <p>Lab sheet -1</p> <p>Level 1: A review of Python programming - Introduction to Python Stack for Data Science, Core Python Libraries for data analysis, Anaconda platform and its installation, Executing programs on Jupyter IDE/ Colab.</p> <p>Level2: Programming exercises to revise variables, control statements and collections – lists, list comprehension</p> <p>Lab sheet -2</p> <p>Level 1 - Programming exercises on Tuples</p> <p>Level 2- Nested data structures</p> <p>Lab sheet -3</p> <p>Level 1: Introduction to Numpy, Pandas,</p> <p>Level 2: Scikit-learn and Visualization techniques.</p> <p>Lab sheet -4</p> <p>Level 1 - Dictionaries, dictionary comprehension.</p>				

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

Lab sheet -5

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

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

Lab sheet -6

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

Level 2- Decision Tree Classifier using Entropy.

Lab sheet -7

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

Level 2 - cohen\_kappa\_score.

Lab sheet -8

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

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

Lab sheet -9

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

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

Lab sheet -10

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

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

Lab sheet -1 1

Level 1 – Probability theory(Conditional Probability)

Level 2 - Naïve Bayes Model

Lab sheet -12

Level 1- Models forecasting Applications

Level 2 - Models for Forecasting Time Series data

Lab sheet -13

<p>Level 1- Recommender Systems - Association Rule Mining using Apriori for frequent Itemset Generation.</p> <p>Level 2 - Recommender Systems – user based similarity</p>
<p>Targeted Application &amp; Tools that can be used</p> <p>Use of PowerPoint software for lecture slides and use of Google’s Colab cloud service <a href="https://www.tutorialspoint.com/google_colab/index.html">https://www.tutorialspoint.com/google_colab/index.html</a> for executing and sharing of lab exercises.</p>
<p>Project work/Assignment:</p>
<p>Assignment:</p> <p>Programming: Implementation of given scenario using Python and Colab.</p> <p>Assignment: Learning courses for 4 Hours from the following link <a href="https://learn.datacamp.com/courses?topics=Machine%20Learning">https://learn.datacamp.com/courses?topics=Machine%20Learning</a></p>
<p>Text Book</p> <p>T1. Andreas C Muller, Sarah Guido, “Introduction to Machine Learning with Python :A Guide for Data Scientists”, Oreilly, First Edition, 2016</p> <p>T2. Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, 3rd edition, Upper Saddle River, Prentice Hall.</p>
<p>References</p> <p>R1. Tan P. N., Steinbach M &amp; Kumar V. “Introduction to Data Mining”, Pearson Education, 2016.</p> <p>R2. Giuseppe Bonaccorso, “Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning”, Packt Publishing, 2017.</p> <p>R3. Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning Using Python”, Wiley, First Edition 2019.</p> <p>E-References</p> <p><a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p>
<p>Topics relevant to development of “Skill Development”:</p> <p>Regression Models</p> <p>Decision Tree Classifiers</p> <p>Hyper parameter Tuning methods</p>

<p>Agglomerative Hierarchical clustering</p> <p>Decision tree classifiers</p> <p>for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.</p>
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Course Code: CSE2037	Course Title: Cyber Forensics Type of Course: Program Core	L- T-P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Cryptography and Network Security				
Anti-requisites	NIL				
Course Description	The purpose of this course is to introduce to the students Cyber Forensic concepts. The course is both conceptual and analytical and is understood with various open-source software's. The course develops critical thinking like correctly collect and analyze computer forensic evidence, analyze and validate Forensics Data, study the tools and tactics associated with Cyber Forensics. The course involves quizzes, assignments with various open-source software.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cyber Forensics and attain Skill Development through Experiential Learning techniques.				

Course Outcomes	<p>On successful completion of this course the students shall be able to:</p> <p>(1) understand various digital investigation terminologies and methods (knowledge)</p> <p>(2) understand various file formats (knowledge)</p> <p>(3) Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications (Comprehension)</p> <p>(4) Apply techniques for forensic investigation (Application)</p>			
Course Content:				
Module 1	DIGITAL INVESTIGATION	Quiz	MCQ/Based on Investigation process	No. of Sessions: 09
Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process -Investigative Reconstruction - Modus Operandi, Motive and Technology -Digital Evidence in the Courtroom.				
Module 2	UNDERSTANDING INFORMATION	Quiz	MCQ/Based on file format	No. of Sessions: 09
Methods of storing data: number systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats - Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers - Extraction of forensic artifacts– understanding the dimensions of other latest storage devices – SSD Devices.				
Module 3	COMPUTER BASICS FOR DIGITAL INVESTIGATORS	Assignment	Writing task	No. of Sessions: 09
<p>Computer Forensic Fundamentals - Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology -Steps taken by computer forensic specialists.</p> <p>Information warfare: Arsenal – Surveillance Tools – Hackers and Theft of Components – Contemporary Computer Crime-Identity Theft and Identity Fraud – Organized Crime &amp; Terrorism.</p> <p>Computer forensic cases: Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence –Processing Evidence and Report Preparation – Future Issues.</p> <p>Assignment: Computer Crime</p>				

Module 4	Computer Forensic Evidence and Data Recovery	Assignment	Writing task	No. of Sessions: 09
<p>Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden Data.</p> <p>Data Collection and Data seizure: why collect evidence? - Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody. Reconstructing the Attack.</p> <p>Assignment: Data Recovery</p>				
<p>List of Laboratory Tasks:</p> <p>Case Studies of Opensource Forensic Tools</p> <p>FTK Forensic Tool kit for taking mirror image</p> <p>Disk Forensics-</p> <p>Identify digital evidences</p> <p>Acquire the evidence</p> <p>Authenticate the evidence</p> <p>Preserve the evidence</p> <p>Analyze the evidence</p> <p>Report the findings</p> <p>Network Forensics:</p> <p>Intrusion detection</p> <p>Logging</p> <p>Correlating intrusion detection and logging</p> <p>Device Forensics</p> <p>Mobile phone</p> <p>Digital Music</p> <p>Printer Forensics</p> <p>Scanner Forensics</p> <p>Credit Card Forensics</p> <p>Telecommunications Forensics</p> <p>Forensic Analysis of a Virtual Machine</p> <p>Forensic analysis of Cloud storage and data remnants</p>				

RAM Dumping Tool
<p>Targeted Application &amp; Tools that can be used:</p> <p>FTK Forensic Toolkit</p> <p>Encase</p> <p>Kali Linux- Vinetto, galatta</p> <p>Autopsy – Disk Forensics</p>
<p>Project work/Assignment:</p> <p>Each batch of students (self-selected batch mates) will identify projects based on the content and implement with the most suitable 2 or 3 antecedents.</p>
<p>Textbook(s):</p> <p>John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2019</p>
<p>References</p> <ol style="list-style-type: none"> <li>1. Ravi Kumar &amp; B Jain, 2006, "Cyber Forensics - Concepts and Approaches", icfai university press</li> <li>2. Christof Paar, Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", Springer's, Second Edition, 2010,</li> <li>3. Ali Jahangiri, "Live Hacking: The Ultimate Guide to Hacking Techniques &amp; Countermeasures for Ethical Hackers &amp; IT Security Experts", First edition, 2009</li> <li>4. Computer Forensics: Investigating Network Intrusions and Cyber Crime", Ec-Council Press, 2010.</li> <li>5. C. Altheide &amp; H. Carvey, "Digital Forensics with OpenSource Tools, Syngress", 2011, ISBN: 781597495868., <a href="https://esu.desire2learn.com">https://esu.desire2learn.com</a></li> </ol>
<p>NPTEL: <a href="https://onlinecourses.swayam2.ac.in/cec21_ge10/preview">https://onlinecourses.swayam2.ac.in/cec21_ge10/preview</a></p> <p>Udemy: <a href="https://www.udemy.com/topic/digital-forensics/">https://www.udemy.com/topic/digital-forensics/</a></p> <p>E-book Link(PU):</p> <p>Links</p> <p><a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14073&amp;query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14073&amp;query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC</a></p>
<p>Topics relevant to "Skill Development":</p> <p>Cyber Forensics techniques for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.</p>

<b>Course Code:</b> CSE3342	<b>Course Title:</b> Ethical Hacking <b>Type of Course:</b> Core Subject		<b>L-T- P- C</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>3</b>
<b>Version No.</b>	1.3						
<b>Course Pre-requisites</b>	Basic networking tools knowledge and Cryptography & Network Security						
<b>Anti-requisites</b>	NIL						
<b>Course Description</b>	This course introduces students to a wide range of topics related to ethical hacking. It also provides an in-depth understanding of how to effectively protect computer networks. These topics cover some of the tools and penetration testing methodologies used by ethical hackers and provide a thorough discussion of what and who an ethical hacker is and how important they are in protecting corporate and government data from cyber-attacks						
<b>Course Objective</b>	The objective of the course is to familiarize the learners with the concepts of <b>Ethical Hacking</b> and attain to improve the learners' <b>Employability Skills</b> by using <b>Experiential Learning</b> techniques.						
<b>Course Out Comes</b>	On successful completion of this course the students shall be able to: 1] Extrapolate the importance of ethical hacking. 2] Determine the various techniques for performing reconnaissance 3] Categorize various types of system scanners and their functions. 4] Identify the function of sniff on a network.						
<b>Course Content:</b>							
<b>Module 1</b>	<b>Introduction to Hacking</b>	Assignment		Programming activity	<b>12 Hours</b>		
Topics: Introduction to Hacking-Important Terminologies - Asset - Vulnerability - Penetration Test - Vulnerability Assessments versus Penetration Test - Penetration Testing Methodologies - Categories of Penetration Test. <b>Assignment:</b> Different phase methodologies on penetration testing							
<b>Module 2</b>	<b>Linux Basics</b>	Assignment		Programming activity	<b>10 Hours</b>		
Topics: Major Linux Operating Systems - File Structure inside of Linux - BackTrack - Changing the Default Screen Resolution - Some Unforgettable Basics. <b>Assignment:</b> Penetration testing distribution							
<b>Module 3</b>	<b>Information Gathering Techniques</b>	Assignment		Programming activity	<b>11 Hours</b>		



Topics:  
Sources of Information Gathering - Copying Websites Locally - NeoTrace - Xcode Exploit Scanner - Interacting with DNS Servers - DNS Cache Snooping - DNS Lookup with Fierce - SNMP - SMTP.

**Assignment:**Domain internet groper

<b>Module 4</b>	<b>Target Enumeration and Port Scanning Techniques</b>	Assignment	Programming activity	<b>13 Hours</b>
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Topics:  
Target Enumeration and Port Scanning Techniques - Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - Vulnerability Assessment.

**Assignment:** Demonstrations for port scanning

### List of Laboratory Tasks:

#### Experiments:

1. Command Prompt
2. Wireshark
3. Nmap
4. OWZAP
5. Neotrace
6. NMAP
7. AngryIPScanner
8. Maltigo
9. Readnotify
10. HTTRACK
11. Yougetsignal
12. CAPSA Portable Network Analyzer
13. Samspace
14. Shodan
15. Oputils
16. Brupsuit
17. Zenmap
18. OSINT
19. John the ripper

**Targeted Application & Tools that can be used:** Application Software and open source tools like SQL Injection and NIDS,HIDS.

#### Text Book

- 1.Rafay Baloch, 2014: "Ethical Hacking and Penetration Testing Guide" Apple Academic Press Inc.

#### References

- 1.Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security Testing, Penetration Testing, and Basic Security".
- 2.James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and Network Defense", 2nd Edition, Cengage Learning.

#### E-Resources:

[\(1\) Ethical Hacking in 12 Hours - Full Course - Learn to Hack! - YouTube](#)

**Topics relevant to “EMPLOYABILITY SKILLS”:** CEH Certification

Ethical hacking techniques for **Employability skills** through **Experiential Learning techniques**. This is attained through the assessment component mentioned in course handout.

<b>Course Code:</b> CSE3097	<b>Course Title:</b> Web Security <b>Type of Course:</b> Integrated course	<b>L- T-P- C</b>	2	0	2	3
<b>Version No.</b>		1.0				
<b>Course Pre-requisites</b>		<b>Advanced Computer Networks (CSE3070)</b>				
<b>Anti-requisites</b>		<b>NIL</b>				
<b>Course Description</b>		The purpose of this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web encryption.				
<b>Course Objective</b>		The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.				
<b>Course Outcomes</b>		<b>On successful completion of this course the students shall be able to:</b> <ol style="list-style-type: none"> <li>1. <b>Define</b> the fundamentals of Web applications and validation. (Remember)</li> <li>2. <b>Recognize</b> the significance of password and authentication in web applications. (Understand)</li> <li>3. <b>Explain</b> the importance of session management in web. (Understand)</li> <li>4. <b>Apply</b> web attack techniques to find vulnerabilities in web applications. (Apply)</li> </ol>				
<b>Course Content:</b>						
<b>Module 1</b>	<b>Introduction to Web Security</b>	Quiz	Knowledge			<b>14 Sessions - L[08]+P[06]</b>

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

## List of Laboratory Tasks:

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

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

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

**Level 1: Identification of vulnerabilities**

**Level 2: Apply the concept**

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

#### HTTP and setting up stacks

- i. Create a simple web application that can store information sent to it. For example, you could create a web application that will store to a text file anything provided in a URL parameter
- ii. Write or modify an existing application that legitimately needs access to a sensitive resource ,but uses it at a time when it does not actually need it

#### Various types of databases Access Controls

- i. Role-Based Access Control (RBAC)
- iii. Mandatory Access Control (MAC)

#### Vulnerability: Study and work with KF Sensor

STEP1: Download **KF** Sensor tool Evaluation Setup File from KF Sensor Website.

STEP-2: Install with License Agreement and appropriate directory path.

STEP-3: Reboot the Computer now. The KF Sensor automatically starts during Windows boot.

STEP-4: Click Next to setup wizard.

STEP-5: Select all port classes to include and Click Next.

STEP-6: "Send the email and Send from email", enter the ID and Click Next.

STEP-7: Select the options such as Denial of Service[DOS], Port Activity, Proxy Emulsion, Network Port Analyzer, Click Next.

STEP-8: Select Install as System service and Click Next.

**Level 1: Identification of vulnerabilities**

**Level 2: Apply the concept**

### **3. Study of web authoring tools (any 2-3 tools)**

- i. Study and work with Net Stumbler tool
- ii. Study and work with Snort
- iii. Study and work with Nmap

**Level 1: Install the tools required**

**Level 2: Apply the concept**

### **4. Testing web applications**

**Study and work with Word press tool**

- i. Create an Online Community website and test the website
- ii. Showcase Your Work Online and test its worth
- iii. Create a Local Business Website and test the website.

**Level 1: Define the test cases**

**Level 2: Apply the concept to test the web application**

### **5. SQL injection and prevention**

From the given data set ,

- i. Put limits on all result sets
- ii. Cleanse and Validate Freeform User Input
- iii. Remove Freeform User Input When Possible
- iv. Validate Data Prior to Processing
- v. Ensure Errors are Not User-Facing
- vi. Use Stored Procedures to Abstract Business Logic and Control parameters
- vii. Use LIKE Operators Carefully

	<ul style="list-style-type: none"> <li>viii. Limit Use of xp_cmdshell and Other Extended Stored Procedures</li> <li>ix. Perform Penetration Tests</li> <li>x. Code Review</li> <li>xi. Minimizing the Impact of SQL Injection</li> <li>xii. Principle of Least Privilege &amp; Login Security</li> <li>xiii. Secure Linked Servers and Data Sources</li> </ul> <p><b>Level 1: Recognize and acquire the data</b></p> <p><b>Level 2: Apply the concept</b></p> <p><b>6. Cross site request forgery attack lab</b></p> <p>With the usage of Virtual Machines</p> <ul style="list-style-type: none"> <li>i. Configure the Virtual Machines:</li> <li>ii. Observing HTTP Request in Victim VM</li> <li>iii. CSRF Attack using GET Request</li> <li>iv. CSRF Attack using POST Request</li> <li>v. Implementing a countermeasure</li> </ul> <p><b>Level 1: Identify and acquire the data</b></p> <p><b>Level 2: Apply the concept</b></p> <p><b>7. Web tracking</b></p> <p>Tracking the Web based scenario by</p> <ul style="list-style-type: none"> <li>• Environment Configuration</li> <li>• clear history and cookies</li> <li>• open a new private window in Firefox</li> </ul> <p>Task 1: Understand the basic working of the web tracking</p> <p>Task 2: Importance of cookie in Web tracking</p> <p>Task 3: Tracked user interests and data</p> <p>Task 4: How ads are displayed in a website</p> <p>Task 5: Tracking in a Private browser window</p> <p>Task 6: Real world tracking</p> <p>Task 7: Countermeasures</p> <p><b>Level 1: Identify and acquire the data logs</b></p> <p><b>Level 2: Apply the concept</b></p>
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	<p><b>Targeted Application &amp; Tools that can be used:</b></p> <ol style="list-style-type: none"> <li>(1) Word press tool can be used for building websites with possible vulnerabilities.</li> <li>(2) Tools such as Nmap and Nessus can be used for web attack demonstration.</li> <li>(3) KF Sensor advanced 'honeypot' intrusion and insider threat detection system for Windows networks</li> <li>(4) Snort can be used for network intrusion detection system and intrusion prevention system</li> <li>(5) Net Stumbler tool for Windows that facilitates detection of Wireless LANs using the 802.11b, 802.11a and 802.11g WLAN standards.</li> </ol>
	<p><b>Textbook(s):</b></p> <p>T1. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook", Willey Publishing Inc. ,2008</p>
	<p><b>References:</b></p> <p>R1. B. Sullivan, V. Liu, and M. Howard, "Web Application Security", A B Guide. New York: McGraw-Hill Education, 2011.</p> <p>R2. <i>Web Application Security: Exploitation and Countermeasure for Modern Web Applications</i>, by Andrew Hoffman.</p> <p><b>E-book Links</b></p> <p>T1: <a href="https://www.oreilly.com/library/view/web-application-security/9780071776165/">https://www.oreilly.com/library/view/web-application-security/9780071776165/</a></p> <p>T2: <a href="https://www.oreilly.com/library/view/web-application-security/9781492053101/">https://www.oreilly.com/library/view/web-application-security/9781492053101/</a></p> <p><b>Web links-</b></p> <ol style="list-style-type: none"> <li>1. NPTEL course : Introduction to Information Security I, IIT Madras <a href="https://nptel.ac.in/courses/106106129">https://nptel.ac.in/courses/106106129</a></li> <li>2. Coursera Link : <a href="https://www.coursera.org/learn/security-and-authentication">https://www.coursera.org/learn/security-and-authentication</a></li> </ol> <p><b>Topics related to development of "Skills":</b> Web technology fundamentals, web security measures and webvulnerability/attacks.</p> <p><b>Topics related to development of "Experimental Learning":</b> Writing different web exploits to demonstrate vulnerabilities in web applications.</p>

Course Code: CSE2040	Course Title: Cyber threats for IOT and Cloud  Type of Course:1] Program Core 2] Theory Only	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Cyber Security, Information Security and Networks				
Anti-requisites	NIL				
Course Description	Objective of the course is to understand the most important cyber threats for IOT and Cloud. Cyber attackers discover new possibilities in the areas of Internet of Things and cloud services. It mainly focuses on multiple security challenges facing the IoT and cloud computing especially concerns surrounding privacy and cyber security threats of the users and the how can the cyber risks relating to them be mitigated.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Cyber threats for IOT and Cloud and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  Understand the different types of cyber threats for IOT and cloud  Develop a deeper understanding and familiarity with various types of cyber-attacks, cybercrimes, vulnerabilities and remedies thereto.  Plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets.				
Course Content:					



Module 1	Introduction to IOT and Cloud computing	Assignment	Programming Task	12 Sessions
<p>Topics</p> <p>What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, IoT Challenges, IOT Architecture and protocols, Various platforms for IoT, Real-Time examples of IoT, Overview of IoT components and IoT communication Technologies. Introduction to Cloud Computing, The Vision of Cloud Computing, Defining a Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Distributed Systems, Virtualization, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies.</p> <p>Assignment:</p>				
Module 2	Cyber Threats	Assignment	Programming Task	8 Sessions
<p>Topics:</p> <p>What are Cyber Security Threats? Common Sources of Cyber Threats, Types of Cyber security Threats-Malware attacks, Social Engineering attacks, Supply chain attacks, Man-in-the middle Attack, Threat Detection Tools, Cyber Defense for Individuals.</p> <p>Assignment:</p>				
Module 3	Cyber Threats in Internet of Things	Assignment	Programming/Data analysis task	10 Sessions
<p>Topics:</p> <p>IoT threats and vulnerabilities- IoT attack surface, Attack surface areas of the IoT, Types of IoT security threats-Botnets, Denial of service, Man-in-the-Middle, Identity and data theft, Social engineering, Advanced persistent threats, Ransomware, Remote recording, How does the IoT influence security?, Best practices to reduce risks and prevent threats. Security guidelines for IoT. Managing IoT Security Threats.</p> <p>Assignment:</p>				
References				

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

Course Code: CSE3145	Course Title: Intrusion Detection and Prevention System	L- T-P- C	3-0	0	3
	Type of Course:1] Program Core 2] Theory Only				
Version No.	1.0				
Course Pre-requisites	Fundamental knowledge in Operating Systems, Information Security and Networks				
Anti-requisites	NIL				
Course Description	Objective of the course is to Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems and Analyze intrusion detection alerts and logs to distinguish attack types from false alarms.				

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Intrusion Detection and Prevention System and attain Skill Development through Participative Learning techniques.			
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Understand about the intruders.</p> <p>Define intrusion detection and prevention policies</p> <p>Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets.</p> <p>Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.</p>			
Course Content:				
Module 1	Introduction to Intrusion Detection and Prevention System	Assignment	Programming Task	10 Sessions
<p>Topics</p> <p>Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anomaly detection – specification based detection – hybrid detection. Internal and external threats to data, Need and types of IDS, Information sources, Host based information sources, Network based information sources.</p> <p>Assignment: Demonstrating the skills to capture and analyze network packets using network packet analyzer.</p>				
Module 2	Intrusion Prevention System	Assignment	Programming Task	10 Sessions
<p>Topics:</p> <p>Intrusion Prevention Systems, Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis, techniques, Responses, requirement of responses, Types of responses, mapping responses to policy Vulnerability analysis, credential analysis, non-credential analysis. Architecture models of IDs and IPs.</p> <p>Assignment: Applying Intrusion detection in security applications.</p>				
Topics:				

<p>Tool Selection and Acquisition Process – Bro Intrusion Detection – Prelude Intrusion Detection – Cisco Security IDS – Snort Intrusion Detection – NFR security. Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes</p> <p>Assignment: Demonstrate the working with Snort Rules, Rule Headers, Rule Options and The Snort Configuration File.</p>					
<p>References</p> <p>R1. Rafeeq Rehman : “ Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID,” 1st Edition, Prentice Hall , 2003.</p> <p>R2. Christopher Kruegel, Fredrik Valeur, Giovanni Vigna: “Intrusion Detection and Correlation Challenges and Solutions”, 1st Edition, Springer, 2005.</p> <p>R3. Paul E. Proctor, “The Practical Intrusion Detection Handbook “,Prentice Hall , 2001.</p> <p>Weblinks:</p> <p><a href="https://www.youtube.com/watch?v=RYB4cG8G2xo">https://www.youtube.com/watch?v=RYB4cG8G2xo</a></p> <p><a href="https://www.coursera.org/lecture/detecting-cyber-attacks/intrusion-detection-systems-UeDqJ">https://www.coursera.org/lecture/detecting-cyber-attacks/intrusion-detection-systems-UeDqJ</a></p>					
<p>Topics relevant to “SKILL DEVELOPMENT”: Agent development for intrusion detection for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</p>					

Course Code: CSE 3035	Course Title: R Programming For Data Science Type of Course: Integrated	L- T-P- C	1 -0	4	3
Version No.	1				
Course Pre-requisites	NIL				

Anti-requisites	NIL			
Course Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of R Programming For Data Science and attain Skill Development through Experiential Learning techniques.			
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>Apply basic R functions pertaining to fundamental data analysis. [Application]</p> <p>Interpret data using appropriate statistical methods [Application]</p> <p>Demonstrate the decision trees concept with the given dataset. [Application]</p> <p>Demonstrate the Mining concepts for both Data and Text. [Application]</p>			
Course Content:				
Module 1	Introduction	Assignment	Data Collection/Interpretation	6 Sessions
<p>Topics:</p> <p>Introduction to R, Overview of data analysis, Working with directory in R, Loading and handling data in R, Data Visualization with ggplot2, Data Transformation with dplyr.</p>				
Module 2	Exploratory Data Analysis	Coding Assignment	Case Study	11 Sessions
<p>Topics:</p> <p>Exploring a new dataset, Anomalies in numerical data, Visualizing relations between variables, Assumptions of Linear Regression, Validating Linear Assumption, Missing Values, Covariation, Patterns and Models, ggplot2 Calls.</p>				
Module 3	Regression Analysis	Coding Assignment	Project	12 Sessions
<p>Topics:</p> <p>Introduction, Types of Regression Analysis Models, Linear Regression, Simple Linear Regression, Non-Linear Regression, Regression Analysis with Multiple Variables, Cross Validation, Principal Component Analysis, Factor Analysis.</p>				

Module 4	Classification	Quiz	Project	8 Sessions
<p>Topics:</p> <p>Introduction, Different types of Classification, Logistic Regression, Support Vector Machines, K-Nearest Neighbors, Naïve Bayes Classifier, Decision Tree Classification, Random Forest Classification, Evaluation.</p>				
<p>List of Laboratory Tasks:</p> <ol style="list-style-type: none"> <li>1. Using with and without R objects on console</li> <li>2. Using mathematical functions on console</li> <li>3. Write an R script, to create R objects for calculator</li> <li>4. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars &amp; cars datasets.</li> <li>5. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location. b. Reading Excel data sheet in R</li> <li>6. Find the data distributions using box and scatter plot.</li> <li>7. Find the outliers using plot.</li> <li>8. Plot the histogram, bar chart and pie chart on sample data</li> <li>9. Find the correlation matrix.</li> <li>10. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data</li> <li>11. Create a regression model for a given dataset</li> <li>12. Install relevant package for classification.</li> <li>13. Choose classifier for classification problem. c. Evaluate the performance of classifier.</li> <li>14. Install relevant package for classification.</li> <li>15. Choose classifier for classification problem. c. Evaluate the performance of classifier.</li> </ol>				
<p>Targeted Application &amp; Tools that can be used</p> <p>Tools: RStudio / Google Colab</p>				
<p>Project work/Assignment:</p>				
<p>Assignment:</p> <p>During the course, students would need to do coding assignments to learn to train and use different models. Sample coding assignments include:</p> <p>Analysis of Sales Report of a Clothes Manufacturing Outlet.</p> <p>Comcast Telecom Consumer Complaints.</p> <p>Web Data Analysis</p>				
<p>Text Book</p>				

T1	Hadley Wickham and Garrett Grolemund, "R for Data Science", O'reilly, 2017.
References	
R1	Dr. Bharati Motwani, "Data Analytics using R", Wiley, 2019.
Web resources:	
<a href="https://www.geeksforgeeks.org/r-programming-for-data-science/">https://www.geeksforgeeks.org/r-programming-for-data-science/</a>	
<a href="https://r4ds.had.co.nz/">https://r4ds.had.co.nz/</a>	
Topics relevant to "SKILL DEVELOPMENT": Regression model, classifier for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.	

Course Code: CSE 2014	Course Title: Software Engineering Type of Course: School Core [Theory Only]	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	<p>The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles.</p> <p>The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development.</p> <p>The course covers software quality, configuration management and maintenance.</p>				
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	<p>On successful completion of this course the students shall be able to:</p> <p>1] Describe the Software Engineering principles, ethics and process models(Knowledge)</p> <p>2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension)</p> <p>3] Understand the Agile Principles(Knowledge)</p> <p>4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)</p>				
Module 1	Introduction to Software Engineering and Process Models  (Knowledge level)	Quiz			09 Hours
Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle					
Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.					
Module 2	Software Requirements, Analysis and Design	Assignment	Development of SRS documents for a given scenario		11 Hours



	(Comprehension level)			
<p>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.</p> <p>Design: Design concepts, Architectural design, Component based design, User interface design.</p>				
Module 3	Agile Principles & Devops  (Knowledge level)	Quiz		09 Hours
<p>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.</p> <p>Devops: Introduction, definition, history, tools.</p>				
Module 4	Software Testing and Maintenance  (Application Level)	Assignment	Apply the testing concepts using Programing	12 Hours
<p>Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.</p> <p>Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).</p> <p>Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.</p>				
Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools				
<p>Text Book</p> <p>1] Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 2017.</p> <p>2] Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 2018.</p>				
<p>References</p> <p>Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2015.</p> <p>Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.</p> <p>Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002</p>				

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

Course Code: CSE 3002	Course Title: Big Data Technologies  Type of Course: Program Core  Theory and Lab Integrated Course	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	CSE2012-Database Management System, CSE1001- Problem solving using Java.				
Anti-requisites	NIL				
Course Description	<p>The purpose of the course is to provide the fundamentals of Big data technology, to emphasize the importance of choosing suitable tools for processing and analyzing big data to gain insights.</p> <p>The student should have knowledge and skill to select and use most appropriate big data tools to solve business problems.</p> <p>The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.</p> <p>With a good knowledge in the fundamentals of Big data technology the student can gain practical experience in implementing them, enabling the student to be an effective solution provider for applications that involve huge volume of data.</p>				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Big Data Technologies and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Outcomes	<p>On successful completion of the course the students shall be able to:</p> <p>Apply Map-Reduce programming on the given datasets to extract required insights. (Application).</p> <p>Employ appropriate Hadoop Ecosystem tools such as scoop, Hbase, Hive, to perform data analytics for a given problem. (Application).</p> <p>Use Spark tool to analyze the given dataset for a given problem. (Application).</p>				

Course Content:				
Module 1	Introduction to Hadoop	Programming Assignment	Data Collection and Analysis	10 Classes
<p>Introduction to Big Data and its importance: Basics of Distributed File System, Four Vs, Drivers for Big data, Big data applications, Structured, unstructured, semi-structured and quasi structured data. Big data Challenges-Traditional versus big data approach, The Big Data Technology Landscape: No-SQL.</p> <p>The Hadoop: History of Hadoop-Hadoop use cases, The Design of HDFS, Blocks and replication management, Rack awareness, HDFS architecture, HDFS Federation, Name node and data node, Anatomy of File write. Anatomy of File read, Hadoop Map Reduce paradigm, Map and reduce tasks, Job Tracker and task tracker, Map reduce execution pipeline, Key value pair, Shuffle and sort, Combiner and Partitioner, APIs used to Write/Read files into/from Hadoop, Need for Flume and Sqoop.</p> <p>Anatomy of a YARN: Hadoop 2.0 Features, Name Node High Availability, YARN Architecture, Introduction to Schedulers, YARN scheduler policies, FIFO, Fair And Capacity scheduler.</p>				
Module 2	Hadoop Ecosystem Tools	Programming Assignment	Data Collection and Analysis	8 Classes
<p>Introduction to SQOOP: SQOOP features, Sqoop Architecture, Sqoop Import All Tables, Sqoop Export All Tables, Sqoop Connectors, Sqoop Import from MySQL to HDFS, Sqoop vs flume.</p> <p>Hive: Apache Hive with Hive Installation, Hive Data Types, Hive Table partitioning, Hive DDL commands, Hive DML commands, and Hive sort by vs. order by, Hive Joining tables, Hive bucketing.</p> <p>Hbase: Introduction to HBase and its working architecture- Commands for creation and listing of tables- disabled and is disabled of table - enable and is enabled of table- describing and dropping of table-Put and Get command - delete and delete all command- commands for scan, count, truncate of tables.</p>				
Module 3	Spark	Programming Assignment	Data analysis	8 Classes
<p>Introduction to Apache Spark A unified Spark, Who uses Spark and for what?, A Brief History of Spark, Spark version and releases, Storage layers for Spark. Programming with RDDs: RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. Spark SQL: Linking with Spark SQL, Using Spark SQL in Applications, Loading and Saving Data, JDBC/ODBC Server, User-defined functions, Spark SQL Performance.</p> <p>Scala: The Basics, Control Structures and functions, Working with arrays, Maps and Tuples.</p>				
<p>List of Laboratory Tasks:</p> <p>1. Level 1: To install the Hadoop in pseudo cluster mode.</p>				

Level 1: HDFS Shell Commands – Files and Folders.

Level 2: HDFS Shell Commands – Management.

2. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

Level 1: Find the number of occurrence of each word appearing in the input file(s)

Level 2: Performing a Map Reduce Job for word search count (look for specific keywords in a file).

3. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with Map Reduce, since it is record-oriented. Data available at: <https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all>.

Level 1: Find average, max and min temperature for each year in NCDC data set?

Level 2: Programming assignment to analyze the social media data for business analytics.

4. Level 1: Finding out Number of Products Sold in Each Country using map reduce with sample

dataset

Level 2: Find matrix multiplication using map reduce

5. Level 1: Installation of Hive, working on basic hive commands. (Create, Alter and Drop tables)

Level 2: Apply Hive commands to student database/employee database.

6. Level 1: Working on advance hive commands. (Static Partitioning & Dynamic partitioning)

Level 2: Continue the previous experiment, select and apply suitable partitioning technique.

7. Level 1: Working on advance hive commands-2. (Bucketing)

Level 2: Continue the previous experiment, apply bucketing technique to bring out the difference between partitioning and bucketing.

8. Level 1: Installing Ecosystem tools such as Scoop, Hbase.

Level 2: Scoop – Move Data into Hadoop.

9. Level 1: Working on basic Hbase commands (General commands, DDL Commands)

Level 2: Apply Hbase commands on Insurance database/employee dataset.

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

Level 2: Continue the previous experiment to demonstrate CRUD operations.

11. Level 1: Install, Deploy & configure Apache Spark.

Level 2: Using RDD and FlatMap count how many times each word appears in a file and

write out a list of words whose count is strictly greater than 4 using Spark

12. Level 1: Write a program in Apache spark to count the occurrences words in a given text file

and display only those words starting with 'a' in ascending order of count.

Level 2: Apache access logs are responsible for recording data for all web page requests

processed by the Apache server. An access log record written in the Common Log

Format will look something like this: 127.0.0.1 - Scott [10/Dec/2019:13:55:36

0700] "GET /server-status HTTP/1.1" 200 2326 Where, HTTP 200 status response

code indicates that the request has succeeded. Write a program to read the records of

access log file log.txt and display the number of successful requests using Spark.

13. Level 1: Chess king moves horizontally, vertically or diagonally to any adjacent cell. Given

two different cells of the chessboard, determine whether a king can go from the first

cell to the second in one move.

Write a scala program that receives input of four numbers from 1 to 8, each

the last	specifying the column and row number, first two - for the first cell, and then
from the	two - for the second cell. The program should output YES if a king can go
	first cell to the second in one move, or NO otherwise.
of	Level 2: Data analytics using Apache Spark on Amazon food dataset, find all the pairs
	items frequently reviewed together.
	Write a single Spark application that:
	Transposes the original Amazon food dataset, obtaining a Pair RDD of the type:
	Counts the frequencies of all the pairs of products reviewed together;
	Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.
Targeted Application & Tools that can be used:	
Business Analytical Applications	
Social media Data Analysis	
Predictive Analytics	
Tools: Hadoop Framework tools like map reduce, Hive, Hbase, Scoop, Spark.	
Text Book	
Seema Acharya, Subhashini Chellappan. 2015. Big Data and Analytics. Wiley Publication.	
Matei Zaharia, Bill Chambers. 2018. SPARK: The Definitive Guide. Oreilly.	
References	
Tom White. 2016. Hadoop: The Definitive Guide. O'Reilley.	
Cay S. Horstmann. 2017. Scala for the Impatient. Wesley.	
Topics relevant to development of "Skill Development": Real time application development using Hadoop Ecosystem tools through Experiential Learning as mentioned in the course handout.	

Course Code: CSE3125/CSE265	Course Title: Service Oriented Architecture	L-T-P-C	3 -0	0	3
	Type of Course: Program Core				
Version No.	2.0				
Course Pre-requisites	CSE207-Data Base Management System, CSE264 -Web Technology				
Anti-requisites	NIL				
Course Description	The study of the course is to enable the students to understand the different architectural styles and XML based web applications which is required to explore the basics of service-oriented Architecture(SOA) in two approaches i.e. Web Services (WS) and Representational State Transfer (REST) architecture.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Service Oriented Architecture and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to:  1.Discuss the XML Fundamentals and to manipulate the data using XML. [Comprehension]  2.Define the key principles of SOA [Knowledge]  3.Discuss the web services technology elements for realizing SOA[Comprehension]  4. Illustrate the various Web Service Standards[Application]				
Course Content:					
Version No.	2.0				
Module 1	Introduction to XML	Assignment	Programming Task	08 Sessions	
Topics: XML document structure ,Well formed and valid documents ,Namespaces – DTD – xml Schema – X-Files,Parsing XML – using DOM, SAX – XML Transformation and XSL Formatting – Modelling Databases in XML.					
Module 2	Service Oriented Architecture	Assignment	Architectural study	10 Sessions	
Topics: Types of Architecture,Objectives of Software architecture,SOA Planning and analysis,Architecture patterns and styles ,Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA ,Security and implementation					

,Principles of Service orientation ,Service Layers, Application development process,SOA methodology for Enterprise.				
Module 3	Web Services	Quiz	Data patterns	08 Sessions
Topics: Service Descriptions – WSDL – Messaging with SOAP – Service Discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography – WS Transactions.				
Module 4	Building SOA based Applications	Quiz	Security aspects	11 Sessions
Topics: Business Process Design,Business case for SOA, Stake holder objectives, Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines – Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security , Tools available for implementing SOA, SOA Security, approach for enterprise wide SOA implementation,Trends in SOA,Technologies in Relation to SOA, Advances in SOA, SOA Support in J2EE.				
Targeted Application & Tools that can be used:  Basic HTML and XML				
Textbook(s):  Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2016.  <a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6532">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6532</a>  Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2013  <a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6645">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6645</a>				
References  Frank P.Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002 <a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6647">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6647</a>  Eric Newcomer, Greg Lomow, “Understanding SOA with Web Services”, Pearson Education, 2005 <a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6619">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6619</a>				



Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.

<http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5906>

James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew, "Java Web Services Architecture", Morgan Kaufmann Publishers, 2003.

<https://www.elsevier.com/books/java-web-services-architecture/mcgovern/978-1-55860-900-6>

#### Web Resources:

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

<https://www.coursera.org/learn/service-oriented-architecture>

3. <https://nptel.ac.in/courses/soa>

Topics relevant to "SKILL DEVELOPMENT": Based on an understanding of architectural styles, understanding web applications based on XML, review architectures for web applications, Service-Oriented Architecture (SOA) in two approaches: Web Services (WS\*) and Representational State Transfer (REST) architecture for Skill Development through Participative Learning techniques. This is attained through the Presentation as mentioned in the assessment component.

Course Code: CSE 3010	Course Title: Deep Learning Techniques  Type of Course: Program Core Theory	L-T-P- C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	Data Mining and Machine Learning fundamentals Basic working knowledge of Statistics and Probability Familiarity with programming languages and hands on coding				
Anti-requisites	NIL				

Course Description	The course introduces the core intuitions behind Deep Learning, an advanced branch of Machine Learning involved in the development and application of Artificial Neural Networks that function by simulating the working principle of human brain. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. The course emphasizes on understanding the implementation and application of deep neural networks in various prominent problem domains like speech recognition, sentiment analysis, recommendations, and computer vision etc. The course facilitates the students to interpret and appreciate the successful application of deep neural nets in various prediction and classification tasks of ML.			
Course 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.			
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Apply basic concepts of Deep Learning to develop feed forward models(Knowledge)</p> <p>Apply Supervised and Unsupervised Deep Learning techniques to build effective models for prediction or classification tasks(Comprehension)</p> <p>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)</p> <p>Analyze performance of implemented Deep Neural models(Application)</p>			
Course Content:				
Module 1	Introduction to Deep Learning	Assignment	Programming	10 Sessions
<p>Topics:</p> <p>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.</p>				
Module 2	Improving Deep Neural Networks	Assignment	Programming	8 Sessions
<p>Topics:</p> <p>Initialization, Overfitting and Underfitting, Regularization and Optimization, Dropout, Batch Normalization, Artificial Neural network.</p>				
Module 3	Deep Supervised Learning Models	Assignment	Programming	10 Sessions

<p>Topics:</p> <p>Convolutional neural network, Deep learning in Sequential Data, RNN &amp; LSTM, GRU, Deep Models in Pattern Recognition.</p>				
Module 4	Deep Unsupervised Learning	Assignment	Programming	10 Sessions
<p>Topics:</p> <p>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.</p>				
<p>Targeted Application &amp; Tools that can be used: Google collab</p> <p>Professionally used software : Anaconda, Spider.</p>				
<p>Text Book</p> <p>T1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017</p>				
<p>References</p> <p>R 1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Inderscience, 2nd Edition. 2013</p> <p>R2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4, Academic Press, 2015</p> <p>R3. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence, 2013</p> <p>R4. Bishop, C. M. Neural Networks for Pattern Recognition, Oxford University Press, 2008.</p>				
<p>Weblinks:</p> <p>W1: pu.informatics.global, <a href="https://sm-nitk.vlabs.ac.in/">https://sm-nitk.vlabs.ac.in/</a></p>				
<p>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.</p>				

Course Code: CSE 313	Course Title: Storage Area Networks Type of Course: Theory Only Course	L- T-P- C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	Basics of information storage				
Anti-requisites					
Course Description	The course aims to equip students with basic introduction to Storage Area Networks, including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center and basic Disaster Recovery principles.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Storage Area Networks and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  CO1 Identify key challenges in managing information and analyze different storage networking technologies. [Understanding]  CO2 Explain physical and logical components of a storage infrastructure of RAID, and intelligent storage systems. [Comprehension]  CO3 Describe Object and Content addressed storage and storage virtualization. [Comprehension]  CO4 Articulate business continuity solutions—backup and archive for managing fixed content. [Application]				
Course Content:					
Module 1	Storage System: Introduction to Information Storage	Assignment	Data Collection/Interpretation	10 Sessions	
Topics:  Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Data Proliferation					
Module 2	Data Protection – RAID, Intelligent Storage Systems	Case studies / Case let	Case studies / Case let	08 Sessions	

<p>Topics: RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID vs SSD, Types of RAID Storage for Databases in Public Cloud</p> <p>Intelligent Storage Systems: Components of an Intelligent Storage System, Types of Intelligent Storage Systems, Optimal architectures for intelligent storage systems</p>				
Module 3	Object-Based and Unified Storage	Quiz	Case studies / Case let	08 Sessions
<p>Topics: Object-Based Storage Architecture: Components of OSD, Object Storage and Retrieval in OSD, Benefits of Object-Based Storage, Content-Addressed Storage.</p> <p>Virtualization in SAN: types of storage virtualization, Benefits of virtualization</p>				
Module 4	Backup and Archive, Replication	Quiz	Case studies / Case let	10 Sessions
<p>Backup Purpose, Backup Considerations, Backup Granularity, Data Recovery Services, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments.</p> <p>Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas.</p> <p>Remote Replication: Modes of Remote Replication, Remote Replication Technologies.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Architecture based environment</p>				
<p>Text Book</p> <p>T1. G. Somasundaram, Alok Shrivastava. "Information Storage and Management", EMC Education Services, Wiley India. 2nd Edition.2012.</p>				
<p>References</p> <p>R1. Ulf Troppens, Rainer Erkens and Wolfgang Muller. "Storage Networks Explained", Wiley India. 2nd Edition.2015.</p> <p>R2. Rebert Spalding. "Storage Networks The Complete Reference", Tata McGraw Hill, Indian Edition.2017.</p> <p>R3. Richard Barker and Paul Massiglia. "Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs", Wiley. 1stEdition.2008.</p> <p>E-Resource:</p> <p><a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p>				

R3 Web resources: Students may find articles and significance of SAN at <https://www.ibm.com/topics/storage-area-network> and EMC2 and may refer an eBook on “Storage Area Network Essentials” A Complete Guide to Understanding and Implementing SANs by Richard Barker, Paul Massiglia

<https://presiuniv.knimbus.com/user#/searchresult>

Topics relevant to “EMPLOYABILITY SKILLS”: Data Protection – RAID for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2051	Course Title: Information Retrieval  Type of Course: Theory Only Course	L- T-P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Basic Knowledge in Data Structures and algorithms and probability and statistics, background in machine learning				
Anti-requisites	NIL				
Course Description	The course studies the theory, design and implementation of Text- based information systems. The Information Retrieval core concepts of the course include statistical characteristics of text, representation of information needs and documents. Topics Include Several important retrieval models (Basic IR Models, Boolean Model, TF-IDF (Term Frequency/Inverse Document Frequency) Weighting, Vector Model, Probabilistic Model, Latent Semantic Indexing Model, Neural Network Model). Retrieval Evaluation, Retrieval Metrics, Text Classification and Clustering algorithms, Web Retrieval and Crawling. Recommender Systems: Basics of Content-based Recommender Systems, Content-based Filtering, Collaborative Filtering, Matrix factorization models and neighborhood models.				
Course Objective	The objective of the course is to familiarize the learners with the concepts Information Retrieval and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  CO1: Define basic concepts of information Retrieval. [Knowledge]  CO2: Evaluate the effectiveness and efficiency of different information retrieval methods. [Application]  CO3: Explain different indexing methodology requirements and the concept of web retrieval and crawling. [Comprehension]  CO4: Classify different recommender system and its aspect. [Comprehension]				
Course Content:					
Module 1	Introduction to Information Retrieval	Assignment	Data collection	7	Sessions
Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes					
Module 2	Modeling and Retrieval Evaluation	Assignment	Problem solving	10	Sessions

Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.				
Module 3	Indexing & Web-Retrieval	Term paper/Assignment	Data analysis	8 Sessions
Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing. The Web – Search Engine Architectures – Cluster based Architecture - Search Engine Ranking – Link based Ranking – Simple Ranking Functions, Evaluations — Search Engine Ranking – Applications of a Web Crawler.				
Module 4	Recommender System	Term paper/Assignment	Problem solving	8 Sessions
Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models.				
Targeted Application & Tools that can be used:				
Information Retrieval System, Collaborative Filtering System, Feedback System, Evaluation Metrics				
Assignment:				
Group assignment, Quiz				
Text Book				
T1 Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —" Modern Information Retrieval: The Concepts and Technology behind Search", Third Edition, ACM Press Books, 2018. Link: <a href="https://people.ischool.berkeley.edu/~hearst/irbook/">https://people.ischool.berkeley.edu/~hearst/irbook/</a>				
T2 Ricci, F, Rokach, L. Shapira, B.Kantor, —"Recommender Systems Handbook", Fourth Edition, 2018.				
References				
R1 Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —"Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2017.				
R2 Jian-Yun Nie Morgan & Claypool –" Cross-Language Information Retrieval", Publisher series 2011.				
R3 Stefan M. Rüger Morgan & Claypool – "Multimedia Information Retrieval", Publisher series 2014.				
R4 B. Liu, Springer, - "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data", Second Edition, 2013.				
R5 C. Manning, P. Raghavan, and H. Schütze, —"Introduction to Information Retrieval", Cambridge University Press, 2015. Link: <a href="https://nlp.stanford.edu/IR-book/">https://nlp.stanford.edu/IR-book/</a>				



Web Based Resources and E-books: <a href="https://puniversity.informaticsglobal.com/login">https://puniversity.informaticsglobal.com/login</a>
Topics relevant to the development of SKILLS: Recommendation Techniques, Content-based Filtering for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE324	Course Title: Internet and Web Technologies Type of Course: Integrated	L- T- P- C	1 -0	4	3
Version No.	1				
Course Pre-requisites	nil				
Anti-requisites	nil				
Course Description	The purpose of the course is to provide a comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Internet and Web Technologies and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  Implement web-based application using markup languages. [Application]  Illustrate the use of various constructs to enhance the appearance of a website. [Application]  Apply server-side scripting languages for web page design and link to a database. [Application]				
Course Content:	Module: 1: [20 Hrs - L[10] + T[10]] [Application]  Module: 2: Advanced CSS [16 Hrs – L[8] + T[8]] [Application]  XML: Basics, demonstration of applications using XML  Module 3: PHP [20 Hrs – L[10] + T[10]] [Application]  PHP: Introduction to server-side Development with PHP, Arrays, and Superglobals, Arrays, \$_GET and \$_POST, Super global Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object,				

	Classes and Objects in PHP, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP			
Module 1	Introduction to XHTML	Assignment	Data Collection/Interpretation	16 Sessions
<p>Topics:</p> <p>Basics: Web, WWW, Web browsers, Web servers, Internet.</p> <p>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</p>				
Module 2	Advanced CSS	Experiment	Case studies / Case let	20 Sessions
<p>Topics:</p> <p>Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks</p>				
Module 3	PHP	Quiz	Case studies / Case let	20 Sessions
<p>Topics:</p> <p>Introduction to server-side Development with PHP, Arrays, and Superglobals, Arrays, \$GET and \$ POST, Super global Arrays, \$_SERVER Array, \$_Files Array, Reading/Writing Files, PHP Classes and Objects, Object, Classes and Objects in PHP, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP</p>				
<p>List of Laboratory Tasks:</p> <p>HTML with tables</p> <p>HTML with frames</p> <p>Html with form</p> <p>Web site with links</p> <p>Website with advanced CSS</p> <p>WAMP installation &amp; introduction</p> <p>PHP for website</p> <p>Form validation</p> <p>PHP and MySQL for website</p>				
Targeted Application & Tools that can be used				

Notepad++
WAMP
Project work/Assignment:
Assignment: Mini Project on development of a Website
Text Book
<p>T1 Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition, 2015.</p> <p>T2. CSS Notes for Professionals, ebook available at <a href="https://books.goalkicker.com/CSSBook/">https://books.goalkicker.com/CSSBook/</a> (Retrieved on Jan. 20, 2022)</p> <p>T3. Deitel, Deitel, Goldberg, "Internet &amp; World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.</p>
References
<p>R1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education India, 1st. Edition. 2016.</p> <p>R2. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition, 2016.</p> <p>R3 Web resources:</p> <p>W1. Journal resources</p> <p>Pallavi Yadav, Paras Nath Barwal, "Designing Responsive Websites Using HTML And CSS" INTERNATIONAL JOURNAL OF SCIENTIFIC &amp; TECHNOLOGY RESEARCH VOLUME 3, ISSUE 11, NOVEMBER 2014, ISSN 2277-8616</p> <p>Thomas H. Park, Brian Dorn, Andrea Forte, "An Analysis of HTML and CSS Syntax Errors in a Web Development Course" ACM Transactions on Computing Education Volume 15 Issue 1 March 2015 Article No. 4pp 1–21, <a href="https://doi.org/10.1145/2700514">https://doi.org/10.1145/2700514</a></p> <p>Thomas H. Park, Ankur Saxena, Swathi Jagannath, Susan Wiedenbeck, Andrea Forte, "Towards a taxonomy of errors in HTML and CSS" ACM Transactions on Computing Education, Pages 75–82, <a href="https://doi.org/10.1145/2493394.2493405">https://doi.org/10.1145/2493394.2493405</a></p> <p>A. Veglis; M. Leclercq; V. Quema; J.-B. Stefani, "PHP and SQL made simple", Published in: IEEE Distributed Systems Online (Volume: 6, Issue: 8, August 2005) DOI: 10.1109/MDSO.2005.42</p> <p>W2. Course NPTEL / Swayam Link : <a href="https://nptel.ac.in/courses/106105084">https://nptel.ac.in/courses/106105084</a></p> <p>W3. Coursera Link : <a href="https://www.coursera.org/learn/html-css-javascript-for-web-developers">https://www.coursera.org/learn/html-css-javascript-for-web-developers</a></p> <p>W4. PU Library Link : <a href="https://puniversity.informaticsglobal.com/login">https://puniversity.informaticsglobal.com/login</a></p> <p>Or</p>

: <http://182.72.188.193/>

Topics relevant to development of “Skill Development”: Form Design and Validation for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE219	Course Title: Big Data Analytics	L- T- P- C	1	0	4	3
	Type of Course: Laboratory Integrated					
Version No.	2.0					
Course Pre-requisites	DDL, DML of SQL Queries and Creation of Class & object, interface, reading & writing a file, control statements in java programming.					
Anti-requisites	NIL					
Course Description	This course is designed to provide the fundamental knowledge to equip students being able to handle real world big data problems including the three key resources of Big Data: people, organizations, and sensor. With the advancement of IT storage, processing, computation and sensing technologies, big data has become a novel norm of life.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Big Data Analytics and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques					
Course Out Comes	On successful completion of the course the students shall be able to:  1: Describe the fundamental concepts of big data analytics (Knowledge)  2: Apply Map-Reduce programming on the given datasets to extract required insights. (Application).  3: Employ appropriate Hadoop Ecosystem tools such as Hive, Hbase to perform data analytics for a given problem (Application)  4: Use Spark and nosql tool to analyse the given dataset for a given problem. (Application).					
Course Content:						
Module 1	Introduction to Big data Analytics	Assignment	Case study on Real time applications	10 Sessions		
Introduction to Big Data: Basics of Distributed File System, Four Vs, Drivers for Big data, Big data applications, Structured, unstructured, semi-structured and quasi structured data. Big data Challenges-Traditional versus big data approach.						
The Hadoop: History of Hadoop-Hadoop use cases, The Design of HDFS, Blocks and replication management, Rack awareness, HDFS architecture, HDFS Federation, Name node and data node, Anatomy of File write, Anatomy of File read. Role of Data Scientist - Role of Data Analyst – Data Analytics in Product development - Business Intelligence vs Data analytics - Real time Business Analytical ProcessCase studies related to big data applications						

Module 2	Hadoop MapReduce Framework	Assignment	Installation of multimode cluster	10 Sessions
MapReduce : Overview and Need of Distributed processing for big data- Introduction to hadoop framework and MapReduce programming - HDFS design and its goals - Master-Slave Architecture of hadoop – Working with hadoop daemons-Installation of hadoop single node cluster and multi node clusters - Working with MapReduce programming.				
Module 3	Hive and Hbase Analytical tools	Term paper/Assignment	Hive joins	10 Sessions
<p>Hive : Apache Hive with Hive Installation, Hive Data Types, Hive Table partitioning, Hive DDL commands, Hive DML commands, and Hive sort by vs. order by, Hive Joining tables, Hive bucketing.</p> <p>Hbase : Introduction to HBase and its working architecture- Commands for creation and listing of tables- disabled and is disabled of table - enable and is enabled of table- describing and dropping of table-Put and Get command - delete and delete all command- commands for scan, count, truncate of tables.</p>				
Module 4	Data Analytics with Spark	Term paper/Assignment	Spark RDD	10 Sessions
<p>Spark: Spark: Apache Spark's Philosophy, History of Spark, Running Spark, A Gentle Introduction to Spark, Spark's Basic Architecture, Spark Applications, DataFrames, Partitions, Transformations, Lazy Evaluation, Actions, Spark UI, An End-to-End Example, Integration of Hive and spark.</p> <p>Nosql: Mongo DB: Introduction ,Features ,Data types , Mongo DB Query language , CRUD operations ,Arrays , Functions: Count ,Sort , Limit , Skip , Aggregate , Cursors – Indexes , Mongo Import , Mongo Export.</p>				
<p>List of Laboratory Tasks</p> <p>Introduction to Hadoop Ecosystem tools</p> <p>Introduction to Hadoop distributed file System.</p> <p>Installation of Hadoop single node cluster using Ubuntu operating system.</p> <p>Working with Hadoop Commands</p> <p>Introduction to Mapreduce framework</p> <p>Word Count analysis using sample data set (MapReduce)</p> <p>Stock analysis using sample data set (MapReduce)</p> <p>Web log analysis using sample data set (MapReduce)</p> <p>Temperature analysis using sample data set .(MapReduce)</p> <p>Working on basic hive commands</p>				

<p>Working on basic hbase commands</p> <p>Install, Deploy &amp; configure Apache Spark</p> <p>Word count analysis using RDD and FlatMap</p> <p>Working with MongoDB using restaurant data.</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Apache Hadoop-</p> <p>HDFS – for data storage</p> <p>Map reduce – Mapping and reducing.</p> <p>Hive – Structured data,HQI</p> <p>Hbase, MongoDB – No SQL</p> <p>Apache Spark – SCALA LANGUAGE</p>
<p>Text Book</p> <p>Big Data and Analytics- Seema Acharya, Subhashini Chellappan-2019, 2nd Edition, Wiley Publication.</p> <p>Analytics in a Big data world- Bart Baesens- 2nd Edition, Wiley Publication. 2018</p>
<p>Reference</p> <p>Big data Analytics, Radha Shankarmani and vijayalakshmi second edition wiley publication 2016</p> <p>Big Data, Anil Maheshwari , McGraw Hill education 2019</p> <p>Hadoop: The Definitive Guide, Tom White , 3rd Edition, O'reilly. 2016</p> <p>E-Resources</p> <p>1.<a href="https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=1223875&amp;site=ehost-live&amp;ebv=EB&amp;ppid=pp_xiii">https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=1223875&amp;site=ehost-live&amp;ebv=EB&amp;ppid=pp_xiii</a></p> <p>2.<a href="https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=2706929&amp;site=ehost-live">https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=2706929&amp;site=ehost-live</a></p>
<p>Topics relevant to SKILL DEVELOPMENT: Hadoop ecosystem tools, HDFS, Mapreduce, Hive, Hbase, MongoDB,NoSQL, Spark for Skill Development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.</p>

Course Code: CSE3123	Course Title: Search Engine Optimization  Type of Course: Program Core & Theory Only	L- T- P- C	3 - 0 0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Objective of this course is to make students learn the basics of Search Engine and develop ability to optimize the searching based on the key words so that the business can be improved. The search engine optimization is the skill of improving a website to upsurge its visibility when people search for products or services. The more visible a website has on search engines, the more likely it is that brand captures business. The students should have prior knowledge of WWW to pursue the Course. After successful completion of the Course, the students would acquire knowledge to comprehend the Search Engine Optimization algorithms, SEO tools and Reporting methods to analyze the web sites.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Search Engine Optimization and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  Outline the basic concepts of SEO (Knowledge)  Discuss the content necessary for On-page & Off-Page SEO (Comprehension)  Illustrate Technical SEO (Application)  Analyse the Report of SEO to measure the performance ( Analysis)				
Course Content:					
Module 1	Introduction to SEO				10 Sessions
Topics:					



Search Engine – works- SEO vs SEM- need – history- works- Googlebot (Google Crawler)- Types of SEO technique- Search Engine Algorithm- Google Algorithm- Key word search- Types of key words- Competition analysis- Page ranking technology				
Module 2	On-Page and Off-Page SEO	Assignment		12 Sessions
<p>Topics:</p> <p>Introduction to On-Page SEO, Basics of website designing/development, HTML Basics for SEO, Meta Tag, Title Tag, Image Tag and H Tag Optimization- Link building- Optimizing SEO content- Key word search and Analysis.</p> <p>Introduction to Off-Page optimization- Local marketing of website as per the location- Page ranking- Building back links- Type of links – Natural Link, manually built link &amp; Self-created link- White hat, grey hat and Black hat SEO- Social Media optimization technique.</p>				
Module 3	Technical SEO			10 Sessions
Basics of Technical SEO- Crawling and Indexing- HTML Sitemap vs. XML Sitemap, The robots.txt File protocol, Overcoming Error codes, Technical Analysis connected with Redirection, Broken Links - Redirects, Best Practices, Analysis of Crawl Errors				
Module 4	SEO Reporting	Assignment		08 Sessions
Website position analysis in various search engine- Analyzing performance of the website using Google analytics- Goals and conversion- Tracking and report- Reports submission- Securing Ranks.				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Applications: Online Business models such as e-Commerce, Digital Marketing, Health Care</p> <p>Professionally used software – Google Analytics</p>				
<p>Text Book</p> <p>T1 - "Search engine optimization all-in-one for dummies", Clay, B ,3rd ed., John Wiley &amp; Sons, Inc., 2015.</p> <p>T2 -"Google AdWords: A beginner's guide to Google. Use Analytics, SEO, and AdWords. Become an influencer on social media", Wally Bax , Notion Press Media Pvt Ltd., 2022.</p>				
<p>References</p> <p>R1 – "Introduction to search engine optimization: A guide for absolute beginners", Kelsey, T, Apress. (2017).</p> <p>R2 - "Step By Step Guide to SEO", Upendra Rana, Ocean Books Pvt Ltd.R-Tech Offset Printers, 2018.</p>				

<p>R3 - "Search Engine Optimization (SEO).Grow the Audience", Clark, Hack Book Works, 2022.</p> <p>Weblinks:</p> <p>W1: <a href="https://puniversity.informaticsglobal.com/login">https://puniversity.informaticsglobal.com/login</a></p> <p>W2:<a href="https://essentials.ebsco.com/search?query=Search+Engine+Optimization">https://essentials.ebsco.com/search?query=Search+Engine+Optimization</a></p>
<p>Topics relevant to "SKILL DEVELOPMENT": Development basic using HTML and Search engine optimization tools for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</p>

Course Code: CSE2050	Course Title: System Software  Type of Course: Theory Only	L-T-P-C	3-0	0	3
Version No.	1.1				
Course Pre-requisites	Students are expected to be familiar with the basics of DataStructure, Programming Language Java Basics, J2EE and should have a knowledge on DBMS.				
Anti-requisites	NIL				
Course Description	This course is introduced to have an understanding of foundations of design of assemblers, loaders, linkers, and macro processors, The design and implementation of various types of system software and relationship between machine architecture and system software. Use andimplimentation of assemblers, macros, loaders, compilers, and operating systems. To Introduce formal systems and their application to programming languages, including topics such as Different System Software– Assembler, Assembler design options, macro processors, Device drivers.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of System Software and attain SKILL DEVELOPMENT through Participative Learning techniques.				

Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>CO1 : Distinguish different software into different categories.</p> <p>CO2 : Design, analyze and implement one pass, two pass or multi pass assembler</p> <p>CO3 : Design, analyze and implement loader and linker.</p> <p>CO4 : Design, analyze and implement macro processors</p> <p>CO5 : Critique the features of modern editing /debugging tools.</p>			
Course Content:				
Module 1	Introduction to System Software	Assignment	Analysis	10 Sessions

Course Code:	Course Title: Firewall and Internet security	L- T-P- C	2 -0	2	3
CSE 2058	Type of Course: Integrated				
Version No.	1				
Course Pre-requisites	Computer Networks				
Anti-requisites					
Course Description	<p>This course provides an in-depth study of various network attacks techniques and methods to defend against them. A number of threats and vulnerabilities of the Internet will be covered, including various vulnerabilities of TCP/IP protocols, denial of service (DOS), attacks on routing, attacks on DNS servers, TCP session hijacking, and so on. This course will also cover defending mechanisms, including intrusion detection, firewalls, tracing the source of attacks, anonymous communication, IPsec, virtual private network, and PKI. To make it easy for students to understand these attacks, basics of the TCP/IP protocols will also be covered in the course.</p>				
Course Objective	<p>The objective of the course is to familiarize the learners with the concepts of Firewall and Internet security and attain Skill Development through Problem Solving Methodologies.</p>				

Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>To identify elements of firewall design, types of security threats and responses to security attacks.</p> <p>Examine security incident postmortem reporting and ongoing network security activities.</p> <p>Construct code for authentication algorithms.</p> <p>Develop a signature scheme using Digital signature standard.</p> <p>Demonstrate the network security system using open source tools</p>			
Course Content:				
Module 1	Introduction to Firewall	Assignment	Data Collection/Interpretation	12 Sessions
Introduction of Firewall in computer network, Categories of firewall, How firewall works, Types of firewall, Firewall location and Configuration, Firewall Policies, Firewall Biasing, Network Architecture, Net masks, Packet filters, Stateful firewalls, Resources				
Module 2	Computer security	Case studies / Case let	Case studies / Case let	12 Sessions
Topics: Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH)				
Module 3	Network Security	Quiz	Case studies / Case let	10 Sessions
Topics: Overview of Network Security: Elements of Network Security , Classification of Network Attacks , Security Methods , Symmetric-Key Cryptography : Data Encryption Standard (DES), Advanced Encryption Standard (AES) , Public-Key Cryptography : RSA Algorithm , Diffie-Hellman Key-Exchange Protocol , Authentication : Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures.				
Module 4	Cyber laws and Compliance Standards	Quiz	Case studies / Case let	11 Sessions
<p>Topics:</p> <p>Kerberos: Working , ASS, TGS, SS-Internet security protocols-AH, ESP, Models-Transport and tunnel-Email security, Public key Infrastructure, Certificates, certificates authority. Cyber Crime: Introduction, Hacking, Digital forgery, Cyber Stalking, Identify theft and Fraud, Cyber terrorism, Cyber defamation, Crime against individual, Government, Property.</p>				

#### List of Laboratory Tasks:

Perform encryption, decryption using the following substitution techniques

(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher

Perform encryption and decryption using following transposition techniques

i) Rail fence ii) row & Column Transformation

Apply DES algorithm for practical applications.

Apply AES algorithm for practical applications.

Implement RSA Algorithm using HTML and JavaScript

Implement the Diffie-Hellman Key Exchange algorithm for a given problem.

Calculate the message digest of a text using the SHA-1 algorithm.

Implement the SIGNATURE SCHEME – Digital Signature Standard.

Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.

Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool

Defeating Malware

i) Building Trojans ii) Rootkit Hunter

#### Targeted Application & Tools that can be used

#### Text Book

T1 : Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition

T2: James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017

#### References

R1: Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson Edition

R2: Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

#### Web resources:

<https://networklessons.com/cisco/asa-firewall>

<https://www.udemy.com/course/cisco-asa-firewall-lab-guide>

<https://geekflare.com/learn-network-security>

Topics relevant to development of “Skill Development”: AES, Network Security for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE 2059	Course Title: MOBILE NETWORKING 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	Objective of this course is to make students understand basics of various techniques in mobile Networks/Adhoc Networks and New technology of Wireless Broadband Networks				
Course Objective	The objective of the course is to familiarize the learners with the concepts of MOBILE NETWORKING and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  1] Understand basics of Routing and protocols in Adhoc and Sensor Networks.  2] Learn Wireless Broadband Networks Technology Overview, Platforms and Standards.  3] Learn management, testing and troubleshooting in Wireless Broadband Networks working principles of wireless LAN, its standards.  4] Learn latest wireless networks.				
Course Content:					
Module 1	AD HOC NETWORKS	Quiz	Case studies / Case let	8 Sessions	
Topics:					

<p>Characteristics and Applications of Ad hoc Networks, Routing – Need for routing and routing classifications, Table Driven Routing Protocols, Source Initiated On-Demand Routing Protocols., Hybrid Protocols – Zone Routing, Fisheye Routing, LANMAR for MANET with group mobility, Location Added Routing, Distance Routing Effects, Microdiscovery and Power Aware Routing.</p>				
Module 2	SENSOR NETWORKS	Quiz	Case studies / Case let	8 Sessions
<p>Topics:</p> <p>Wireless Sensor Networks, DARPA Efforts, Classification, Fundamentals of MAC, Flat routing – Directed Diffusion, SPIN, COGUR, Hierarchical Routing, Cluster base routing, Scalable Coordination, LEACH, TEEN, APTEEN and Adapting to the dynamic nature of Wireless Sensor Networks.</p>				
Module 3	WIRELESS BROADBAND NETWORKS TECHNOLOGY	Quiz	Case studies / Case let	8 Sessions
<p>Topics:</p> <p>Overview, Platforms and Standards</p> <p>Wireless broadband fundamentals and Fixed Wireless Broadband Systems, Platforms-Enhanced Copper, Fibre Optic and HFC, 3G Cellular, Satellites, ATM and Relay Technologies, HiperLAN2 Standard, Global 3G CDMA Standard, CDMA Harmonization G3G Proposal for Protocol Layers.</p>				
Module 4	MANAGING WIRELESS NETWORKS AND TESTING	Quiz	Case studies / Case let	8 Sessions
<p>Managing Wireless Broadband Operations Management of LMDS Systems and their Application, Principles of operations Management, LMDS Versus Other Access technologies, Applications, Testing Wireless Satellite Networks and Fixed Wireless Broadband Networks.</p>				
Module 5	ADVANCED WIRELESS NETWORKS	Quiz	Case studies / Case let	8 Sessions
<p>Wireless. Broadband Network Applications: Teleservices Model and Adaptive QoS Parameters, Modeling of Wireless. Broadband Applications, Multicomponent Model, Residential High speed Internet Wireless Broadband Satellite Systems, Next Generation Wireless Broadband Networks – 3G, Harmonized 3G, 3G CDMA, Smart Phones and 3G Evolution.</p>				
<p>List of Laboratory Tasks:</p> <p>Test the different sections of mobile phone. (such as ringer section, dialer section, receiver section and transmitter section).</p>				

<p>Perform the process of call connection and call release of cellular Mobile system.</p> <p>Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyze the performance.</p> <p>Configure Wi-Fi setting in mobile devices using mobile tethering to connect two devices such as mobile phone to mobile phone, mobile phone to laptop.</p> <p>Apply RFID technology for real life applications using RFID kit.</p> <p>Establish seamless wireless connectivity using multiple access point</p>
<p>Targeted Application &amp; Tools that can be used</p> <p>MATLAB and Simulink</p>
<p>Project work/Assignment:</p>
<p>Assignment:</p>
<p>Text Book</p> <p>T1. Joh R. Vacca, "Wireless Broadband Networks Handbook 3G, LMDS and Wireless Internet" Tata McGraw-Hill, 2001 (Unit III Chapter – 1, 2, 5; Unit IV Chapter 22, 23, 24, Unit V Chapter 25, 26 and 28)</p> <p>T2. D.P. Agrawal and Qing-An zeng, "Introduction to Wireless and Mobile Systems" Thomson Learning, 2003. [Unit I, Chapter 13.1 to 13.7.7, Unit 2 13.7.8 to 13.9]</p>
<p>References</p> <p>R1. Martyn Mallick, Mobile and Wireless Design Essentials, Wiley, 2003.</p> <p>R2. Kavesh Pahlavan and Prashant Krishnamurty - "Principles of Wireless Networks – A unified Approach, Pearson Education, 2002.</p> <p>E book link R1. <a href="https://www.youtube.com/watch?v=H7tGiGjL9bA">https://www.youtube.com/watch?v=H7tGiGjL9bA</a></p> <p>E book link R2. <a href="https://nptel.ac.in/courses/106106167">https://nptel.ac.in/courses/106106167</a></p> <p><a href="https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=2233842&amp;site=ehost-live">https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=2233842&amp;site=ehost-live</a></p> <p><a href="https://nptel.ac.in/courses/106102064">https://nptel.ac.in/courses/106102064</a></p>
<p>Topics relevant to "SKILL DEVELOPMET": Wireless and Cellular networks for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.</p>



Course Code: CSE 3132	Course Title: Network Management Systems Type of Course: Theory Only Course	L-T- P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	To understand the principles of network management, different standards and protocols used in managing complex networks and the Automation of network management operations and making use of readily available network management systems.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Network Management Systems and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  1]Acquire the knowledge about network management standards (OSI and TCP/IP).  2]Acquire the knowledge about various network management tools and the skill to use them in monitoring a network.  3]Analyze the challenges faced by Network managers.  4]Evaluate various commercial network management systems and open network management systems.  5]Analyze and interpret the data provided by an NMS and take suitable actions.				
Course Content:					
Module 1	DATA COMMUNICATION AND NETWORK MANAGEMENT	Assignment	Data Collection/Interpretation	12 Sessions	
Topics:  OVERVIEW : Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.					
Module 2	Simple Network Management Protocol	Case studies / Case let	Case studies / Case let	12 Sessions	

<p>Topics:</p> <p>SNMPV1 NETWORK MANAGEMENT MANAGED NETWORK: Organization and Information Models MANAGED NETWORK: Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.</p> <p>SNMPV1 NETWORK MANAGEMENT: Communication and Functional Models The SNMP Communication Model, Functional model. SNMP MANAGEMENT: SNMPv2 Major Changes in SNMPv2, SNMPv2 System architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.</p>				
Module 3	Remote Monitoring	Quiz	Case studies / Case let	14 Sessions
<p>Topics:</p> <p>RMON : What is Remote Monitoring? ,RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON</p> <p>TELECOMMUNICATIONS MANAGEMENT NETWORK: Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, Implementation Issues.</p>				
Module 4	NETWORK MANAGEMENT TOOLS AND SYSTEMS	Quiz	Case studies / Case let	14 Sessions
<p>Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management, Enterprise Management Solutions.</p>				
Module 5	WEB-BASED MANAGEMENT	Quiz	Case studies / Case let	14 Sessions
<p>NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network , Future Directions. Case Studies.</p>				
<p>Targeted Application &amp; Tools that can be used: Kiwi CatTools, SolarWinds Network Configuration Manager.</p>				
<p>Project work/Assignment:</p>				
<p>Assignment: Simulation of NMS using any of the tools mentioned above.</p>				
<p>Text Book</p> <p>T1. Mani Subrahmanian, "Network Management Principles and Practice", 2nd Edition, Pearson Education, 2010.</p>				

## References

R1. Morris, "Network management", 1st Edition, Pearson Education, 2008.

R2. Mark Burges, "Principles of Network System Administration", 1st Edition, Wiley DreamTech, 2008.

E book link R1.

[https://documentation.solarwinds.com/en/success\\_center/kct/content/kct\\_documentation.htm](https://documentation.solarwinds.com/en/success_center/kct/content/kct_documentation.htm)

E book link R2. <https://documentation.solarwinds.com/>

E book link R3. [https://www.youtube.com/watch?v=liBB\\_Q7Go5k](https://www.youtube.com/watch?v=liBB_Q7Go5k)

NPTEL Course: [https://onlinecourses.nptel.ac.in/noc22\\_cs98/course](https://onlinecourses.nptel.ac.in/noc22_cs98/course)

Topics relevant to "SKILL DEVELOPMENT": Telephony network management and SNMPV1 for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2057	Course Title: Cloud computing and Virtualization Type of Course : Theory	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Basics of Distributed Computing, Service Oriented Architecture				
Anti-requisites	nil				
Course Description	<p>This Course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. Cloud Computing has emerged in recent years as a new paradigm for hosting and delivering services over the Internet. The students can explore various Cloud Computing terminology, principles and applications. Understanding different views of the Cloud Computing such as theoretical, technical and commercial aspects.</p> <p>Topics include: Evolution of cloud computing and its services available today, Introduction, Architecture of cloud computing, Infrastructure, platform, software, Types of cloud, Business models, cloud services, Collaborating using cloud services, Virtualization for cloud, Security, Standards and Applications.</p>				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cloud computing and Virtualization and attain Employability through Participative Learning techniques.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Describe fundamentals of cloud computing, virtualization and cloud computing services.</p> <p>Discuss high-throughput and data-intensive computing.</p> <p>Explain security and standards in cloud computing.</p> <p>Demonstrate the installation and configuration of virtual machine.</p>				
Course Content:					
Module 1			10 Sessions		
Introduction to Cloud and Virtualization					
Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Virtualization, Characteristics of Virtualized Environments Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Technology Examples, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, Economics of Cloud					

Module 2	10 Sessions
High Throughput and Data Intensive Computing: Task computing, MPI applications, Task based programming, Introduction to DIC, Technologies for DIC, Aneka Map Reduce Programming	
Module 3	09 Sessions
Cloud Security and Standards : Cloud Security Challenges, Software-as-a-Service Security, Application standards, Client standards, Infrastructure and Service standards.	
Module 4	09 Sessions
Cloud Platforms, Advances in cloud: introduction to Amazon Web Services: Introduction to Google App Engine, Introduction to Microsoft Azure.	
Media Clouds - Security Clouds - Computing Clouds - Mobile Clouds – Federated Clouds – Hybrid Cloud	
Text Book	
John Rittinghouse and James Ransome, “Cloud Computing, Implementation, Management and Security”, CRC Press.	
Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education.	
References	
David E.Y. Sarna, “Implementing and Developing Cloud Applications”, CRC Press.	
Anthony T Velte, Toby J Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGraw-Hill.	
Web resources: <a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a>	
Topics relevant to “EMPLOYABILITY SKILLS”:	
<p>Aws, Azure, APIs, Aneka Cloud Platform, EC2, Installation of VM Workstation, Infrastructure Security Challenges for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout..</p>	

Course Code: CSE3143	Course Title: Infrastructure Management Type of Course : Theory	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Basic Knowledge on Linux and Information Management				
Anti-requisites	NIL				
Course Description	The course will employ a research, reporting and presentation approach using the latest ICT tools to examine and critically analyze a combination of the technical and management issues in contemporary infrastructure management, with a focus on business alignment. IT infrastructure Management evaluates new ICTs and case studies in the context of enterprise architecture. It is suitable for combinations of students in information technology, business administration and electronic commerce.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Infrastructure Management and attain Employability through Participative Learning techniques.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Describe the business value and processes of ICT services in an organization and apply that knowledge and skill with initiative to a workplace scenario.</p> <p>Investigate, critically analyze and evaluate the impact of new and current ICT services to an organization.</p> <p>Describe how effective IT Infrastructure Management requires strategic planning with alignment from both the IT and business perspectives in an organization.</p> <p>Demonstrate the technical and communications skills that contribute to the operation of ICT services in an organization.</p>				
Course Content:					
Module 1			10 Sessions		
Introduction to Infrastructure management					
Definitions, Infrastructure, management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business.					

Module 2	10 Sessions
<b>Managing Infrastructure</b> Factors to consider in designing IT organizations and IT infrastructure, determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).	
Module 3	09 Sessions
<b>Security Concerns</b> Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management. Introduction to Storage, Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, Disaster Recovery, Hierarchical space management, Database & Application protection, Bare machine recovery, Data retention. Service-level management, financial management and costing, IT services continuity management, Capacity management, Availability management.	
Module 4	09 Sessions
<b>Configuration Management</b> Configuration Management, Service desk, Incident management, Problem management, Change management, Release management.	
<b>Text Book</b> Rich Schiesser, IT Systems Management.	
<b>References</b> E Turban, E Mclean and James Wetherbe, —Information Technology for Management Kenneth C Laudon, Jane P Laudon, —Management Information Systems Roger S Pressman, —Software Engineering: A Practitioner 's Approach James A O 'Brien, —Management Information Systems Walker Royce, — Software Project Management: A Unified Framework  <b>Web resources:</b> 1 . <a href="http://pu.informatics.global">http://pu.informatics.global</a> <a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a>	
<b>Topics relevant to “EMPLOYABILITY SKILLS”:</b> Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout..	

Course Code: CSE2034	Course Title: Edge Computing  Type of Course: Theory Only Course Discipline Elective	L-T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Distributed Systems and Algorithms				
Anti-requisites	Nil				
Course Description	In this course, we will study significant tools and applications that comprise today's cloud computing platform, with a special focus on using the cloud for big data applications. The course covers various topics such as the evolution of computing industry, cloud computing basics and edge computing. The course provides information on the different types of edge compute deployments, different types of edge compute services (such as CDN Edge, IOT Edge, and Multi-access Edge (MEC)). The course also educates the students on the different vendor platforms, software services, standard bodies and open source communities available for edge computing. Students will also create a research project of their choosing.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Edge Computing and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:  CO1 Understand the principles, architectures of edge computing (Knowledge)  CO2 Describe IoT Architecture and Core IoT Modules (Comprehension)  CO3 Summarize edge to Cloud Protocols (Comprehension)  CO4 Describe Edge computing with RaspberryPi (Comprehension)				
Course Content:					



Module 1	IoT and Edge Computing Definition and Use Cases	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	9 Sessions
<p>Topics:</p> <p>Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.</p>				
Module 2	IoT Architecture and Core IoT Modules	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	9 Sessions
<p>Topics: A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.</p>				
Module 3	RaspberryPi	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	10 Sessions
<p>Topics: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image &amp; Video Processing using Pi.</p>				
Module 4	Edge to Cloud Protocols	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	7 Sessions
<p>Topics: Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.</p>				
Module 5	Edge computing with	Term paper/Assignment/Case Study	Programming/Simulation/Data Collection/any other such associated activity	7 Sessions

	RaspberryPi			
Topics: Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application : Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking.</p> <p>Tools :Eclipse ioFog : An integrated development environment built by the Eclipse Foundation, backed by IBM. Eclipse ioFog is the organization's open-source edge computing platform.</p>				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Exploring topics such as developing scalable architectures, moving from closed systems to open systems, and ethical issues rising from data sensing, addresses both the challenges and opportunities of Edge computing presents. Students can harness federating Edge resources, middleware design issues, data management and predictive analysis, smart transportation and surveillance applications, and more. A coordinated and integrated solutions can be provided by thorough knowledge of the foundations, applications, and issues that are central to Edge computing.				
<p>Text Book</p> <p>IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806</p> <p>2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.</p>				
Topics relevant to "EMPLOYABILITY SKILLS": Implementation of Microcomputer RaspberryPi and device Interfacing for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

Course Code: CSE 3090	Course Title: 5G Networking	L- T-P- C	3 -0	0	3
Type of Course:	Theory Only Course				
Version No.	1				
Course Pre-requisites	Digital communications, Mobile Communication Systems, Wireless Networks				
Anti-requisites	Nil				
Course Description	The aim of this course is to let the students understand that air Interface is one of the most important elements that differentiate between 2G, 3G, 4G and 5G. While 3G was CDMA based, 4G was OFDMA based; this course reveals the contents of air interface for 5G. While 4G brought in a deluge of infotainment services, 5G aims to provide extremely low delay services, great service in crowd, enhanced mobile broadband (virtual reality being made real), ultra-reliable and secure connectivity, ubiquitous QoS, and highly energy efficient networks.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of 5G Networking and attain Employability through Participative Learning techniques				
Course Out Comes	On successful completion of the course the students shall be able to:  Explain the channel models of 5G and the use cases for 5G.  Analyze use of MIMO in 5G and its techniques.  Understand device to device (D2D) communication and standardization.  Illustrate the in-depth functioning of 5G radio access technologies and security issues in 5G.				
Course Content:					
Module 1	5G channel modelling and use cases	Assignment	Data Collection/Interpretation	10 Sessions	
Topics: 5G channel modelling and use cases, Modeling requirements and scenarios, Channel model requirements, Propagation scenarios, Relaying multi-hop and cooperative communications: Principles of relaying, fundamentals of relaying, Cognitive radio: Architecture, spectrum sensing, Software Defined Radio (SDR), Multiple-input multiple-output (MIMO) systems, Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems. Diversity, exploiting multipath diversity, Transmit diversity, Space-time codes.					
Module 2	The 5G architecture	Case studies / Case let	Case studies / Case let	8 Sessions	

Topics: Introduction, NFV and SDN, Basics about RAN architecture, High-level requirements for the 5G architecture, Functional architecture and 5G flexibility, Functional split criteria, Functional split alternatives, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G Requirements, Enhanced Multi-RAT coordination features, Physical architecture and 5G deployment.				
Module 3	Device-to-device (D2D) communications	Quiz	Case studies / Case let	10 Sessions
Topics: D2D: from 4G to 5G, D2D standardization: 4G LTE D2D, D2D in 5G: research challenges, Radio resource management for mobile broadband D2D, RRM techniques for mobile broadband D2D, RRM and system design for D2D, 5G D2D RRM concept: an example, Multi-hop D2D communications for proximity and emergency, services, National security and public safety requirements in 3GPP and METIS, Device discovery without and with network assistance.				
Module 4	The 5G radio-access technologies	Quiz	Case studies / Case let	8 Sessions
Topics: Access design principles for multi-user communications, Orthogonal multiple-access systems, Spread spectrum multiple access systems, Capacity limits of multiple-access methods, Sparse code multiple access (SCMA), Interleave division multiple access (IDMA), Radio access for dense deployments, OFDM numerology for small-cell deployments, Small-cell sub-frame structure, Radio access for V2X communication, Medium access control for nodes on the move, Radio access for massive machine type communication.				
Targeted Application & Tools that can be used:				
Project work/Assignment:				
Assignment: Quiz				
Text Book				
T1 : Afif Osseiran, Jose F. Monserrat, Patrick Marsch, 5G Mobile and Wireless Communications Technology, Cambridge University Press Second Edition, 2015.				
T2 : Erik Dahlman, Stefan Parkvall, Johan Sko'ld, 5G NR: The Next Generation Wireless Access Technology, Elsevier First Edition, 2016.				
References				
R1 : Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, Wiley First Edition 2015				
E book link R1: <a href="https://www.wiley.com/en-in/Fundamentals+of+5G+Mobile+Networks-p-9781118867525">https://www.wiley.com/en-in/Fundamentals+of+5G+Mobile+Networks-p-9781118867525</a>				

<p>Web resources:</p> <p><a href="https://nptel.ac.in/courses/108/105/108105134/">https://nptel.ac.in/courses/108/105/108105134/</a></p> <p><a href="https://www.udemy.com/course/5g-mobile-networksmorden-wireless-communication-technology/">https://www.udemy.com/course/5g-mobile-networksmorden-wireless-communication-technology/</a></p> <p><a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p>
<p>Topics relevant to “EMPLOYABILITY SKILLS”: D2D: from 4G to 5G, D2D standardization: 4G LTE D2D for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</p>

Course Code: CSE3068	Course Title: Advance Database Management System Type of Course: Integrated	L- T-P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Basics about DBMS MYSQL software tool usage				
Anti-requisites	Nil				
Course Description	This course covers advanced aspects of database management including normalization and renormalizations, query optimization, distributed databases, data warehousing, and big data. There is extensive coverage and hands on work with SQL, and database instance tuning. Course covers various modern database architectures including relational, key value, object relational and document store models as well as various approaches to scale out, integrate and implement database systems through replication and cloud based instances. Students learn about unstructured "big data" architectures and databases, and gain hands-on experience with Spark and MongoDB.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Advance Database Management System and attain Employability through Experiential Learning techniques				

Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <ol style="list-style-type: none"> <li>1. Select the appropriate high-performance database like parallel and distributed database</li> <li>2. Infer and represent the real-world data using object-oriented database</li> <li>3. Interpret rule set in the database to implement data warehousing of mining</li> </ol>			
Course Content:				
Module 1	Review of Relational Data Model and Relational Database Constraints:	Assignment	Data Collection/Interpretation	15 Sessions
<p>Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations.</p> <p>Object and Object-Relational Databases: Overview of Object Database Concepts, Object Database Extensions to SQL, The ODMG Object Model and the Object Definition Language ODL, Object Database Conceptual Design, The Object Query Language OQL, Overview of the C++ Language Binding in the ODMG Standard.</p>				
Module 2	Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures:	Assignment	Case studies / Case let	15 Sessions
<p>Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk Operations on Files, Files of Unordered Records (Heap Files), Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures.</p> <p>Distributed Database Concepts: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control and Recovery in Distributed Databases, Overview of Transaction Management in Distributed Databases, Query Processing and Optimization in Distributed Databases, Types of Distributed Database Systems, Distributed Database Architectures, Distributed Catalogue Management</p>				
Module 3	NOSQL Databases and Big Data Storage Systems	Assignment	Case studies / Case let	15 Sessions

<p>Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. Big Data Technologies Based on MapReduce and Hadoop: What Is Big Data? Introduction to MapReduce and Hadoop, Hadoop Distributed File System (HDFS), MapReduce: Additional Details Hadoop v2 alias YARN, General Discussion</p>
<p>List of Laboratory Tasks:</p> <p>Lab sheet -1 [ 2 Practical Sessions]</p> <p>Experiment No 1:</p> <p>Level 1 – Study and Configure Hadoop for Big Data</p> <p>Lab sheet – 2 [2Practical Sessions]</p> <p>Experiment No. 2:</p> <p>Level 1– Study of NoSQL Databases such as Hive/Hbase/Cassandra/DynamoD</p> <p>Level 2 - Design Data Model using NoSQL Databases such as Hive/Hbase/Cassandra/DynamoDB</p> <p>Lab sheet – 3 [ 2 Practical Sessions]</p> <p>Experiment No. 1:</p> <p>Level 1 - Implement any one Partitioning technique in Parallel Databases</p> <p>Level 2 – Implement Two Phase commit protocol in Distributed Databases</p> <p>Lab sheet – 4 [ 2 Practical Sessions]</p> <p>Experiment No. 1:</p> <p>Level 1 - Design Persistent Objects using JDO and implement min 10 queries on objects using JDOQL in ObjectDB NOSQL DATABASE</p> <p>Level 2 - Design database schemas and implement min 10 queries using Hive/ Hbase/ Cassandra column based databases</p> <p>Lab sheet -5 [2 Practical Sessions]</p> <p>Experiment No. 1:</p> <p>Level 1 - Design database schemas and implement min 10 queries using DynamoDBkeyValue based databases</p> <p>Level 2 – Design and Implement social web mining application using NoSQL databases, machine learning algorithm, Hadoop and Java/.Net</p>
<p>Targeted Application &amp; Tools that can be used</p> <p>MangoDB</p>

Project work/Assignment:
Assignment: CASE STUDY OF TRADITIONAL RDBMS AND NOSQL DATABASE SYSTEM and submit the report
Text Book 1. Elmasri R and Navathe S B, "Fundamentals of Database System", 7th Edition, Pearson Publication, 2017.
References 1. Hector Garcia Molina, Jeffery D Ullman, JennifferWidom, "Database systems: The Complete Book", 2nd edition, Pearson Publication,2013. 2.AviSilberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2019.  <a href="https://www.classcentral.com/course/youtube-sql-tutorial-for-beginners-in-hindi-dbms-tutorial-sql-full-course-in-hindi-great-learning-99143/classroom">https://www.classcentral.com/course/youtube-sql-tutorial-for-beginners-in-hindi-dbms-tutorial-sql-full-course-in-hindi-great-learning-99143/classroom</a> <a href="https://www.udemy.com/course/sql-for-beginners-course/">https://www.udemy.com/course/sql-for-beginners-course/</a> <a href="https://onlinecourses.nptel.ac.in/noc22_cs51/preview">https://onlinecourses.nptel.ac.in/noc22_cs51/preview</a> <a href="https://www.coursera.org/learn/database-management">https://www.coursera.org/learn/database-management</a> <a href="https://www.youtube.com/watch?v=HXV3zeQKqGY">https://www.youtube.com/watch?v=HXV3zeQKqGY</a>  PU Library Link : <a href="https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&amp;curPage=0&amp;layout=grid&amp;sortFieldId=none&amp;topresult=false&amp;content=*cloud*">https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&amp;curPage=0&amp;layout=grid&amp;sortFieldId=none&amp;topresult=false&amp;content=*cloud*</a>
Topics relevant to "EMPLOYABILITY SKILLS": Distributed Database for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.



Course Code: CSE 3015	Course Title: ADVANCED NATURAL LANGUAGE PROCESSING Type of Course: Integrated	L- T-P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	CSE 3014 – Fundamentals of Natural Language Processing				
Anti-requisites					
Course Description	<p>This course is an advanced course for Natural Language Processing. As a part of the course, students will be introduced to solving multiple problems in natural language processing, such as sentiment analysis, machine translation, cognitive natural language processing, etc.</p> <p>Topics include: Machine translation, Text summarization, Sentiment analysis, Cognitive NLP, Gaze behaviour, Evaluation Metrics, etc.</p>				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Advanced Natural Language Processing and attain Employability through Experiential Learning techniques.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Understand how to solve different problems in natural language processing. [Comprehension]</p> <p>Solve natural language generation problems such as machine translation and text summarization. [Application]</p> <p>Perform sentiment analysis on reviews to discern the stance of the writer. [Application]</p> <p>Use public gaze behaviour data to improve the performance of different NLP systems. [Application]</p>				
Course Content:					
Module 1	Pre-trained Language Models				4 Sessions
Topics: Introduction to Pre-Trained Language Models. BERT. Multi-lingual variants of BERT. Introduction to NLTK and Huggingface Transformers.					
Module 2	Machine Translation and Text Summarization				7 Sessions
Topics: Introduction to machine translation – source and target languages. Pivot-based machine translation. Using Transformers for machine translation. Monolingual machine translation examples. Machine translation evaluation metrics – BLEU. Implementation of BLEU score calculation using NLTK in Python. Other MT metrics – METEOR, TER, etc.					

Text summarization – definition. Types of summarizations – Extractive and Abstractive Summarization. Summarization evaluation metrics – ROUGE score.				
Module 3	Sentiment Analysis			6 Sessions
Topics: Introduction to Sentiment Analysis. Solving sentiment analysis using text classification. Classification of sentiment analysis based on different levels – polarity-based and intensity-based. Challenges in sentiment analysis – sarcasm, thwarting, negations. Case studies in sentiment analysis – Reviewer rating prediction, short-text classifications, etc.				
Module 4	Cognitive NLP Using Gaze Behaviour			7 Sessions
Topics: Eye-Mind Hypothesis and gaze behaviour terminology. Using gaze behaviour for prediction of translation complexity, sentiment analysis complexity, sarcasm understandability, text complexity, text quality prediction, etc. Challenges with recording gaze behaviour at run time. Comparison of gaze behaviour across different people – normalization and binning. Gaze behaviour datasets. Mitigation of recording gaze behaviour at run time using type aggregation.				
<p>List of Laboratory Tasks:</p> <p>Familiarization with Python. Using Python to read text files, basic tokenization and other preprocessing.</p> <p>Introduction to NLTK and Huggingface Transformers in Python.</p> <p>Using Huggingface Transformers to create a simple MT application.</p> <p>Implementation of pivot-based machine translation using Huggingface Transformers.</p> <p>Calculation of BLEU using NLTK – difference between sentence_bleu and corpus_bleu methods.</p> <p>Implementation of extractive summarization.</p> <p>Polarity classification of text using VADER.</p> <p>Intensity prediction of text using Weighted Normalized Polarity Intensity.</p> <p>Estimating gaze behaviour for a user using normalization and binning</p> <p>Calculating gaze behaviour for a text based on type aggregation in multiple languages.</p> <p>Complex word identification using gaze behaviour.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Google Colab</p> <p>Python IDE (Eg. PyCharm)</p> <p>Huggingface Transformers</p>				

NLTK
Project work/Assignment:
Assignment: Students will have to do a course group assignment over the course of the semester. The assignment topics can be taken from Modules 2 or 3 as per the instructor-in-charge.
Text Books  T1 Daniel Jurafsky, and James Martin. "Speech and Language Processing" (3rd edition draft, 2022).  T2 Abhijit Mishra, and Pushpak Bhattacharyya. "Cognitively Inspired Natural Language Processing: An Investigation Based on Eye Tracking". Springer, Singapore. 2018.
References  R1 Steven Bird, Ewan Klein, and Edward Loper. "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit". O'Reilly Publishers. 2009.  R2 Chris Manning, and Heinrich Schutze. "Foundations of Statistical Natural Language Processing". MIT Press. 1999.  E book link R1: <a href="https://www.nltk.org/book/">https://www.nltk.org/book/</a> E book link R2: <a href="https://nlp.stanford.edu/fsnlp/">https://nlp.stanford.edu/fsnlp/</a> R3 Web resources: <a href="http://pu.informatics.global">http://pu.informatics.global</a>
Topics relevant to "EMPLOYABILITY SKILLS": Calculation of BLEU and ROUGE scores using NLTK , Estimating gaze behaviour through type aggregation, Using Hugging face Transformers for machine translation for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3038	Course Title: Applied Data Science with Python  Type of Course: Program Core	L-T-P-C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Fundamentals of Python concepts				
Anti-requisites	NIL				
Course Description	The aim of the course is to give complete overview of Python’s data analytics tools and techniques. Learning python is a crucial skill for many data science roles, and this course helps to understand and develop feature engineering. With a blended learning approach, Python for data science along with concepts like data wrangling, mathematical computing, and more can be learnt.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Applied Data Science and attain Employability through Experiential Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to:  Understand Numpy and Matrix Operations [Knowledge]  Analyze the need for data preprocessing and visualization techniques. [Comprehensive]  Demonstrate the performance of different supervised learning algorithms like decision Tree, Random Forest, Linear Regression, Logistic Regression etc. [Application]  Apply unsupervised learning algorithms like K-Means, K-Medoids etc for grouping the given data. [Applicaion]				
Course Content:					
Module 1	Introduction to Data Science, Python Data Structures, Python Numpy Package	Quiz	Knowledge based quiz	No. of sessions:8	
Data Science - Need, Applications, Difference between data analysis and data analytics. Python- Variables, data types, control structures, Operators, Simple operations, Array and its operations, Numpy operations, Matrix and its operations					
Module 2	Data preparation and preprocessing using Pandas dataframe, Exploratory Data	Assignment	Data Visualization	No. of sessions:10	

	Analysis, Data Visualization			
Dealing missing values, Normalization, statistical description about the data, Accessing the data, Summary of the data, Relationship between the data, Data Visualization using matplotlib				
Module 3	Supervised Learning Algorithms	Design an algorithm using Example	Random Forest	No. of sessions:10
Decision Tree Algorithm, ID3 Classifier, Random Forest, Classifier Accuracy, Linear Prediction, Logistic Regression – Case study				
Module 4	Unsupervised Learning Algorithms	Case Study	Conduct a case study on how data sets can be gathered and implemented in real time application.	No. of sessions:10
Various distance Function, Dissimilarity between the mixed types of data, K-Means Algorithm, K- Medoids Algorithm -Case Study				
List of Laboratory Tasks: Introduction to R tool for data analytics science Basic Statistics and Visualization in R K-means Clustering Association Rules Linear Regression Logistic Regression Naive Bayesian Classifier Decision Trees Simulate Principal component analysis Simulate Singular Value Decomposition				
Targeted Application & Tools that can be used: IBM SPSS Julia and Jupyter Notebook Matplotlib				
Project work/Assignment:				
Design forest fire and wildfire prediction system.				

Driver Drowsiness Detection System with OpenCV & Keras Credit Card Fraud Detection using Python.
Textbook(s): Applied Data Science with Python and Jupyter-Alex Galea, Packt Publishing, October 2018 Data Visualization in Python with Pandas and Matplotlib Paperback –David Landup, June 16, 2021
References: 1. Data Science with Python and Dask- Jesse Daniel, 1st Edition, July 30, 2019 Weblinks: Udemy: <a href="https://www.udemy.com/course/applied-data-science-with-python-specialization-mhm/">https://www.udemy.com/course/applied-data-science-with-python-specialization-mhm/</a> NPTEL online course : <a href="https://nptel.ac.in/courses/106106179">https://nptel.ac.in/courses/106106179</a> <a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a>
Topics relevant to “EMPLOYABILITY SKILLS”: Data Science, Decision Tree Algorithm for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3017	Course Title: Autonomous Navigation and Vehicles Type of Course: Theory	L- T-P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Real-time embedded programming Optimal estimation and control Linear algebra				
Anti-requisites	NIL				
Course Description	Overview of technologies vehicles including sensors, sensing algorithms, machine learning, localization, mapping, object detection, tracking, communication and security. Hands-on implementation of robotic sensing and navigation algorithms on both simulated and physical mobile platforms. This course covers the mathematical foundations and state-of-the-art implementations of algorithms for vision-based navigation of autonomous vehicles (e.g., mobile robots, self-driving cars, drones). It culminates in a critical review of recent advances in the field and a team project aimed at advancing the state-of-the-art.  Topics include: Autonomous driving technologies overview, Object Recognition and Tracking, Localization with GNSS, Visual Odometry,				

	Perceptions In Autonomous driving, Deep learning in Autonomous Driving Perception, Prediction and Routing, Decision planning and control	
Course Objective	The objective of the course is to familiarize the learners with the concepts of Autonomous Navigation and Vehicles and attain Employability through Participative Learning techniques.	
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>CO1. Understand the Autonomous system's and its requirements. Explain algorithm, sensing, object recognition and tracking of an Autonomous system [Understand]</p> <p>CO2. Do the error analysis of Localization systems and use the tools and techniques [Application]</p> <p>CO3. Explain, plan and control the traffic behavior, and shall be able to do lane level routing and create simple algorithms [Understand]</p> <p>CO4. Explain Plan and control motion, choose proper client systems for automotive vehicles and understand the cloud platform. [Understand]</p>	
Course Content:		
Module 1		12 Sessions
Introduction to autonomous driving: Autonomous driving technologies overview, autonomous driving algorithms: Sensing, Perception. Object Recognition and Tracking: Autonomous driving client system, driving cloud platform, Robot Operating System, HD Map Production, Deep learning Model Training, Localization with GNSS: GNSS overview, GNSS error analysis, satellite based augmentation systems, real time kinematic and differential GPS, precise point positioning, Visual Odometry: Stereo Visual Odometry, Monocular Visual Odometry, Visual Inertial Odometry, Dead Reckoning and Wheel Odometry.		
Module 2		8 Sessions
Perceptions In Autonomous driving: Introduction, Datasets, Detection, Segmentation, Stereo, Optical flow and Scene flow. Deep learning in Autonomous Driving Perception: Convolutional Neural Networks, Detection, Semantic segmentation, Stereo and optical flow.		
Module 3		10 Sessions
Prediction and Routing: Planning and control overview, Traffic prediction: Behaviour prediction as classification, Vehicle trajectory generation, Lane level routing: Constructing a weighted directed graph for routing, typical routing algorithms, routing graph cost.		
Module 4		08 Sessions

Decision planning and control: Behavioral decisions, Motion planning, Feedback control Reinforcement Learning Based Planning and Control, Client systems for Autonomous Driving: Operating systems and computing platform Cloud platform for Autonomous driving: Introduction, infrastructure, simulation.
Text Book  T1: Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc, Creating Autonomous Vehicle Systems Morgan & Claypool Publishers 1st Edition, 2018  T2: Ronald K. Jurgen Autonomous Vehicles for Safer Driving SAE International Edition, 2013
References  R1. Hod Lipson, Melba Kurman Driverless: Intelligent Cars and the Road ahead MIT Press. 1st Edition, 2016  R2. Markus Maurer, J. Christian Gerdes, Barbara Lenz Autonomous Driving: Technical, Legal and Social Aspects 1st Edition, 2016  R3. Hannah YeeFen Lim, Autonomous Vehicles and the Law: Technology, Algorithms and Ethics ,Edward Elgar Publishing. 1st Edition, 2018  Web resources: <a href="http://pu.informatics.global">http://pu.informatics.global</a>
Topics relevant to “EMPLOYABILITY SKILLS”: Autonomous driving for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.



Course Code: CSE3021	Course Title: BLOCKCHAIN FOR PUBLIC SECTOR	L-T-P-C	3 -0	0	3
	Type of Course: Theory				
Version No.	1.0				
Course Pre-requisites	Foundations of Blockchain Technology				
Anti-requisites	NIL				
Course Description	Blockchain Technology is being increasingly employed in the public sector, specifically where trustworthiness and security are of importance. This course discusses about the blockchain technology and its potential applications, emerging technologies and their role in the implementation of blockchain technologies in the digital government and the public sector particularly in Smart City, Electronic Health Care monitoring and Digital Certificates. It also analyses effects, impacts, and outcomes from the implementation of blockchain technologies in the public sector in the selected case studies.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Blockchain For Public Sector and attain Employability through Participative Learning techniques..				
Course Out Comes	On successful completion of the course the students shall be able to:  1] Understand the Standards and Protocols of Blockchain and data management in the public sector [COMPREHENSION]  2] Apply Artificial intelligence and machine learning approaches for implementation of Smart cities using blockchain architecture [APPLICATION]  3] Discuss about Electronic Healthcare Records Monitoring using Blockchain Technology [ COMPREHENSION]  4] Describe the Blockchain Technology use cases in Indian and Foreign Countries [KNOWLEDGE]				
Course Content:					
Module 1	Blockchain in Government and the Public Sector	Quiz	Data Collection	9 Sessions	
Blockchain in Government and the Public Sector use cases – Benefits – Standards and Protocols of Blockchain - data management in the public sector - Building networked public					

services - Understanding and addressing risks and challenges. Blockchain Applications to Public Sector Governance.

Case Study – Keyless Signature Infrastructure (KSI)

Module 2	Blockchain in Smart City Applications	Assignment	Data Collection	9 Sessions
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The Application of Blockchain Technology to Smart City Infrastructure - Artificial intelligence and machine learning approaches for smart transportation in smart cities using blockchain architecture - Blockchain architecture for intelligent water management system in smart cities - Blockchain-based energy-efficient smart green city in IoT environments - Citizen e-governance using blockchain - Cloud/edge computing for smart cities.

Module 3	Blockchain in Healthcare	Case Study	Data Collection	9 Sessions
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Blockchain in Healthcare Applications – Use cases - Blockchain and Data Security – Blockchain Medical Records - Healthcare Blockchain Use Case: Supply Chain Transparency – Electronic Health Records, A novel Blockchain-based Access Control Manager to Electronic Health Records.

Case Study – Avaneer Health, MEDICALCHAIN, BurstIQ, Guardtime

Module 4	Implementation of Blockchain in Indian System and Foreign Countries	Case Study	Data Collection	9 Sessions
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Implementation of Blockchain in India - land registration - Blockchain Fit Assessment: Digital certificates, SuperCert: Anti certificates fraud identity intelligence blockchain solution for educational certificates.

Case study- Implementation of Blockchain in Foreign Countries - Vehicle Wallet – BenBen – Project Ubin

Targeted Application & Tools that can be used:

Remix IDE - Solidity Programming

Project Work / Assignment / Case Study

Assignment 1: Blockchain architecture for intelligent water management system in smart cities.

Case Study: Blockchain-based health care monitoring for privacy preservation of COVID-19 medical records.

Case Study: Implementation of Blockchain in Government of Estonia - Digital Certification by DNV GL.

#### Text Books

Saravanan Krishnan, Valentina Emilia Balas, Raghvendra Kumar, "Blockchain for Smart Cities", Elsevier, 2021.

<https://doi.org/10.1016/C2020-0-01958-4>

Christopher G. Reddick, Manuel Pedro Rodríguez-Bolívar, Hans Jochen Scholl, "Blockchain and the Public Sector Theories, Reforms, and Case Studies", Stanford University Press, 2021.

Blockchain and the Public Sector: Theories, Reforms, and Case Studies (Public Administration and Information Technology Book 36) eBook : Reddick, Christopher G., Rodríguez-Bolívar, Manuel Pedro, Scholl, Hans Jochen: Amazon.in: Kindle Store

#### References

Sheikh Mohammad Idrees, Parul Agarwal, M. Afshar Alam, "Blockchain for Healthcare Systems: Challenges, Privacy, and Securing of Data", CRC Press, 2021 .

[https://books.google.co.in/books/about/Blockchain\\_for\\_Healthcare\\_Systems.html?id=hiU7EAAAQBAJ&redir\\_esc=y](https://books.google.co.in/books/about/Blockchain_for_Healthcare_Systems.html?id=hiU7EAAAQBAJ&redir_esc=y)

#### Web Resources:

<https://link.springer.com/book/10.1007/978-3-030-55746-1>

<https://consensus.net/blockchain-use-cases/government-and-the-public-sector/>

<https://www.oecd.org/gov/innovative-government/oecd-guide-to-blockchain-technology-and-its-use-in-the-public-sector.htm>

<https://www2.deloitte.com/in/en/pages/public-sector/articles/blockchain-in-public-sector.html>

<https://www.ibm.com/in-en/blockchain/industries/government>

<https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/using-blockchain-to-improve-data-management-in-the-public-sector>

<https://www.frontiersin.org/articles/10.3389/fbloc.2022.869665/full>

<https://www.settlemint.com/government-blockchain-use-cases/>

<https://stlpartners.com/articles/digital-health/5-blockchain-healthcare-use-cases/>

<https://www.oecd.org/finance/Opportunities-and-Challenges-of-Blockchain-Technologies-in-Health-Care.pdf>

<a href="https://builtin.com/blockchain/blockchain-healthcare-applications-companies">https://builtin.com/blockchain/blockchain-healthcare-applications-companies</a> <a href="https://www.hhs.gov/sites/default/files/blockchain-for-healthcare-tlpwhite.pdf">https://www.hhs.gov/sites/default/files/blockchain-for-healthcare-tlpwhite.pdf</a> <a href="https://healthitanalytics.com/features/3-use-cases-for-blockchain-in-healthcare">https://healthitanalytics.com/features/3-use-cases-for-blockchain-in-healthcare</a> <a href="https://www2.deloitte.com/us/en/pages/public-sector/articles/blockchain-opportunities-for-health-care.html">https://www2.deloitte.com/us/en/pages/public-sector/articles/blockchain-opportunities-for-health-care.html</a> <a href="https://www.niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf">https://www.niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf</a> <a href="https://www.bigchaindb.com/usecases/government/benben/">https://www.bigchaindb.com/usecases/government/benben/</a>
Topics relevant to “EMPLOYABILITY SKILLS”: Keyless Signature Infrastructure for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3044	Course Title: BUILD AND RELEASE MANAGEMENT Type of Course: Theory Only Course	L- T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	CSE 2014 – Software Engineering				
Anti-requisites	-				
Course Description	Build and Release management course guides the software development efforts from planning to deployment, resulting in better customer satisfaction with the end product. The benefits of Build and release is essential to high-performing software development and delivery. Build and release enhanced by safely testing features in production environments, gathering valuable feedback and releasing new and improved features continuously. In this course, Students will learn about the benefits of using a release management process to manage and improve the development of a software build. This course covers the key concepts and principles that apply to release management, as well as common considerations and potential challenges to be aware of.				
Course Objective	The objective of the course is to familiarize the learners with the concepts Of Build And Release Management and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  Learn about the common Infrastructure build servers, scalability and availability  Understand the Continuous Integration and Deployment (CI/CD)				

	Implement Automated, build, Installations and deployments and release			
Course Content:				
Module 1	UNDERSTANDING COMMON AGILE PRACTICES IN DEVOPS	Assignment	Data Collection/Interpretation	12 Sessions
<p>Topics:</p> <p>Introduction to Product Management, Product Design and Requirement gathering, Product Design Challenges, UX Design, Product Development Methodologies, Product Marketing and Presentation, Traditional Software Development Methodologies, Problem/issues with traditional approach, Agile Development, Agile Manifesto, Scrum Model, Agile Estimations and Planning, Soft skills in agile</p> <p>Kanban - What is Kanban, Understanding the Principle of Kanban, Value System of Kanban, WIP Limits, Classes of Service in Kanban, Sample Kanban Boards (Proto Kanban) , How to read a Kanban Board, Meetings in Kanban System, Extreme Programming.</p>				
Module 2	CODE DESIGN	Case studies / Case let	Case studies / Case let	12 Sessions
<p>Topics:</p> <p>Good design is good design regardless of paradigm, Fundamental characteristics of good design: modular, loosely coupled, etc., Using design to simplify code structure, how programming languages are designed to support good code design, best practices of design in OO program development, First Fundamental OO principle: Interface and implementation design, Second Fundamental OO Principle: Recursive design, Design Patterns: reusing best practices., SOLID Design Principles</p>				
Module 3	TESTING AND DEBUGGING	Quiz	Case studies / Case let	14 Sessions
<p>Topics:</p> <p>TESTING AND DEBUGGING</p> <p>Planning for errors and exceptions, Basic test-driven development: writing tests first, How TDD improves the quality of the resulting code, automating testing: using Junit, etc, Avoiding creeping errors.</p> <p>REFACTORING: IMPROVING STRUCTURE</p> <p>Code smells: symptoms of poorly designed code, Refactoring: changing code structure without changing functionality, Using TDD for controlled code changes, the refactoring process, using refactoring to make better code faster, Collective Code Ownership</p>				

<p>Targeted Application &amp; Tools that can be used:</p> <p>Common frameworks and code architectures: Spring, Hibernate, Microservices, Spring Boot.</p> <p>IDEs: Eclipse, Visual Studio, IntelliJ</p>
<p>Project work/Assignment:</p>
<p>Assignment:</p> <p>Each student have to submit assignment as 4 to 5 pages report on Agile Frameworks and tools</p>
<p>Text Book</p> <p>T1.Eric Breachner, “Agile Project Management with Kanban”, 1st Edition, 2019, MSPress Publishers.</p> <p>T2. Peter Measey and Radtac, “Agile Foundations: Principles, Practices and Frameworks”, Whitshire publishers, 2015.</p>
<p>References</p> <p>R1. Dave Howard, “IT Release Management: Hands on Guide”, CRC Press , 2016.</p> <p>R2. Lyssa Adkins, “Coaching Agile teams”, Addison-wesley publications, 2012.</p> <p>E book link R1: <a href="https://download.manageengine.com/academy/it-release-management-e-book.pdf">https://download.manageengine.com/academy/it-release-management-e-book.pdf</a></p> <p>E book link R2: <a href="https://www.smartsheet.com/release-management-process">https://www.smartsheet.com/release-management-process</a></p> <p>R3 Web resources:</p> <p><a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p> <p><a href="https://www.youtube.com/watch?v=dvFQrsY_tKg">https://www.youtube.com/watch?v=dvFQrsY_tKg</a></p> <p><a href="https://www.youtube.com/watch?v=vlsLxaY4P7M">https://www.youtube.com/watch?v=vlsLxaY4P7M</a></p>
<p>Topics relevant to “EMPLOYABILITY SKILLS”: Build and release management Process, Frameworks and tools for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</p>

Course Code: CSE2025	Course Title: Business Continuity and Risk Analysis Type of Course: Theory	L- T-P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Through the study of incident response and contingency planning, including incident response plans, disaster recovery plans, and business continuity plans, this course aims to help students comprehend the principles of risk management.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Business Continuity and Risk Analysis and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  Describe concepts of risk management [Knowledge]  Define and be able to discuss incident response options [Comprehension]  Design an incident response plan for sustained organizational operations [Comprehension]  Discuss and recommend contingency strategies, including data backup and recovery and alternate site selection for business resumption planning. [Knowledge]				
Course Content:					
Module 1 Sources of disaster and types of disasters			10 Sessions		
Disaster Recovery Operational cycle of disaster recovery, disaster recovery cost, incidents that requires disaster recovery plans, evaluating disaster recovery - methods, team, phases, objectives, checklist. Best practices for disaster recovery - Business continuity - Business continuity vs. disaster recovery					
Module 2 Business continuity management:			10 Sessions		
Introduction - Elements of business continuity management. Business continuity plan – Business continuity planning and strategies - BCP standards and guidelines - BCP Project Organization - Crisis communication plan - Emergency response plan - Contingency planning					

Module 3 Managing, assessing and evaluating risks:	09 Sessions
Importance of risk management - Risk management methodology - Attack methods and Countermeasures - Cost benefits analysis of risk management - Risk assessment responsibilities - Responsibilities of security professional - Information system auditing and monitoring – Verification tools and techniques.	
Module 4 Risk control policies and Counter measures	09 Sessions
Introduction - Counter measures - Risk control policy development factors-Development of information assurance principles and practices - Laws and procedures in information assurance policy implementation, Security test and evaluation, Automated security tools, Cost benefit analysis, Developing a risk assessment methodology, Security requirements, Information categorization, Risk management methodologies to develop life cycle management policies and procedures, Education, training and awareness. Policy development Information security policy, change control policies, system acquisition policies and procedures, Risk analysis policies and General risk control policies.	
<p>Text Book</p> <p>John W. Rittinghouse and James F. Ransome, Business Continuity and Disaster Recovery for Info Sec Managers. Elsevier: Elsevier Digital Press, 2005. (ISBN: 978-0-52-119019-0 )</p> <p>EC Council Press. Disaster Recovery, 1st Ed. Course Technology, 2011. (ISBN: 978-1-55558-339-2 )</p>	
<p>References</p> <p>ISO 27001:2013 A specification for an information security management system</p> <p>David Alexander, Amanda Finch, David Sutton, Andy Taylor. Information Security Management Principles, 2nd Ed. BCS Shop, 2013. (ISBN: 9781780171753)</p> <p>Mark Talabis, Jason Martin. Information Security Risk Assessment Toolkit Practical Assessments through Data Collection and Data Analysis. Syngress Imprint, 2013. (ISBN: 978-1-59-749735-0).</p> <p>Web resources: <a href="http://pu.informatics.global">http://pu.informatics.global</a></p>	
Topics relevant to “EMPLOYABILITY SKILLS”: Business continuity vs. disaster recovery , risk management, Storage disaster recovery services tools, Verification tools and techniques for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.	



Course Code: CSE3088	Course Title: Business Intelligence and Analytics  Type of Course: Theory	L-T-P-C	3 -0	0	3
Version No.	1.1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Business Intelligence (BI) refers to technologies, applications, and practices for the collection, integration, analysis, and presentation of business information. The purpose of business intelligence is to support better business decision making. This course provides an overview of the technology of BI and the application of BI to an organization's strategies and goals.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Business Intelligence and Analytics and attain Employability through Problem Solving Methodologies.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Introduce the concepts and components of Business Intelligence (BI) [Knowledge]</p> <p>Evaluate the technologies that make up BI (data warehousing, OLAP) [COMPREHENSION]</p> <p>Define how BI will help an organization and whether it will helpful [COMPREHENSION]</p> <p>Identify the technological architecture that makes up BI systems [COMPREHENSION]</p>				
Course Content:					
Module 1	Basics of Insights	Assignment	Programming Task	10 Sessions	
<p>Topics:</p> <p>The importance of data in the information age – the data value chain – tools for generating insights – job roles available in the data insights market</p>					

Module 2	Basics Statistics: Foundation of Quantitative Insights	Assignment		12 Sessions
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<p>Topics:</p> <p>Basic statistics – Variables - Measures of central tendency - Measures of dispersion - Normal distribution and histograms - The empirical rule - Covariance and correlation</p>				
Module 3	Data Visualization	Assignment		10 Sessions
<p>Topics:</p> <p>Data visualisation and Anscombe's Quartet - Data cleaning using SAS Data Studio - Bar and Pie Charts</p>				
Module 4	Advanced charts and dashboards			13 Sessions
<p>Topics:</p> <p>Multi variation correlation matrix and bar and line chart - SAS Visual Analytics filtering and controls - KPIs and targeted bar charts - Dashboard theory – Demand forecasting - Linear regression analysis – Forecasting - Forecasting and smoothing methods</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Professionally used software</p>				
<p>Project work/Assignment:</p>				
<p>Text Book</p> <p>Business Intelligence Guidebook: From Data Integration to Analytics 1st Edition, Kindle Edition.</p> <p>Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications (Addison-Wesley Information Technology Series) 1st Edition, Kindle Edition</p>				
<p>References</p> <p>Successful Business Intelligence, Second Edition: Unlock the Value of BI &amp; Big Data 2nd Edition, Kindle Edition</p> <p>Weblinks:</p> <p>W1: <a href="https://www.coursera.org/learn/business-intelligence-data-analytics#">https://www.coursera.org/learn/business-intelligence-data-analytics#</a></p> <p>W2: <a href="https://onlinecourses.nptel.ac.in/noc20_mg11/preview">https://onlinecourses.nptel.ac.in/noc20_mg11/preview</a></p>				
<p>Topics relevant to “EMPLOYABILITY SKILLS”: information age , data value chain for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</p>				

Course Code: CSE 3127	Course Title: Cloud Application Development  Type of Course: Theory Only	L-T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Cloud Computing Basics				
Anti-requisites	NIL				
Course Description	The Cloud Application Development Foundations Specialization program will teach students the tools and technologies that successful software developers use to build, deploy, test, run, and manage Cloud Native applications – putting them in an advantageous position to begin a new career in a highly in-demand area. The course will provide the students' knowledge on cloud computing and related concepts, cloud services, applications developments of Amazon web services, Cloud architecture and programming model, map reducing in cloud, virtualization, applying virtualization, Cloud Resource Management and Scheduling, Cloud Security issues.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cloud Application Development and attain Employability through Participative Learning techniques.				
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>Understand the Define cloud computing and related concepts and Memorize the Cloud architecture and programming model. [Comprehension]</p> <p>Identify compute intensive model and data intensive model and Understand the Cloud Resource Management and Scheduling. [Comprehension]</p> <p>Understand the Cloud Security issues and Identify the how standards deal with cloud services and virtualization. [Application]</p> <p>Understand the cloud resource virtualization and Identify the application virtualization, applying virtualization. [Application]</p> <p>Understand compliance for the cloud provider vs compliance for the customer. [Comprehension]</p>				
Course Content:					
Module 1	INTRODUCTION AND CLOUD	Assignment	Knowledge, Quizzes	No. of	

	APPLICATION DEVELOPMENT			Classes:8
<p>Topics:</p> <p>Introduction: Definition, Characteristics, Benefits, challenges of cloud computing, cloud models: service IaaS(infrastructure as service),PaaS(platform as a service),SaaS(software as a service), deployment models-public, private, hybrid, community; Types of cloud computing: Grid computing utility computing, cluster; computing Cloud services: Amazon, Google, Azure, online services, open source private clouds, SLA; Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development.</p> <p>Assignment: Types of cloud and their comparisons.</p>				
Module 2	CLOUD ARCHITECTURE, PROGRAMMING MODEL	Assignment	Knowledge, Quizzes	No. of Classes:7
<p>Topics:</p> <p>Cloud Architecture, programming model: NIST reference architecture, architectural styles of cloud applications, single, multi, hybrid cloud site, redundant, non-redundant, 3 tier, multi-tier architectures; Programming model: Compute and data intensive.</p> <p>Assignment: Cloud Architecture, architectural styles of cloud applications.</p>				
Module 3	CLOUD RESOURCE VIRTUALIZATION	Case Study	Application, Quizzes	No. of Classes:8
<p>Topics:</p> <p>Cloud resource virtualization: Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, Full vs Para - virtualization, virtual machine monitor/hypervisor.</p> <p>Virtual machine basics, taxonomy of virtual machines, process vs system virtual machines.</p> <p>Case Study: Cloud resource virtualization: Basics of virtualization, types of virtualization techniques.</p>				
Module 4	CLOUD RESOURCE MANAGEMENT AND SCHEDULING	Case study	Application, Quizzes	No. of Classes:9
<p>Topics:</p> <p>Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, resource bundling, combinatorial, fair queuing, start time fair queuing, borrowed virtual time, cloud scheduling subject to deadlines, scheduling map reduce applications subject to deadlines, resource management and application scaling.</p> <p>Case Study: Cloud Resource Management and Scheduling.</p>				

Module 5	CLOUD RESOURCE MANAGEMENT AND SCHEDULING	Case study	Application, Quizzes	No. of Classes:8
Topics:				
Cloud Security: Risks, privacy and privacy impacts assessments; Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities; Virtualization system-specific attacks: Technologies for virtualization-based security enhancement, legal.				
Case Study: Cloud Security: Risks, privacy and privacy impacts assessments.				
Targeted Application & Tools that can be used:				
Public cloud platforms like AWS, GCP and Azure.				
Project work/Assignment:				
Create an Amazon EC2 Instance (Linux) or use equivalent other cloud platform such as Google Cloud or Azure to create a virtual machine service.				
Create an Amazon S3 Bucket or use equivalent other cloud platform such as Google Cloud or Azure to create a storage service.				
Create a static website in AWS using S3 and cloud front.				
Textbook(s):				
Dan Marinescu, "Cloud Computing: Theory and Practicell", M K Publishers, 1st Edition, 2013,				
Kai Hwang, Jack Dongarra, Geoffrey Fox," Distributed and Cloud Computing, From Parallel Processing to the Internet of Thingsll", M K Publishers, 1st Edition, 2011.				
References				
Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw Hill, 1st Edition, 2009.				
Arshdeep Bahga, "Cloud Computing: A Hands on Approach", Vijay Madisetti Universities Publications, 1 st Edition, 2013.				
Web Resources and Research Articles:				
<a href="https://www.oracle.com/in/cloud/application-development">https://www.oracle.com/in/cloud/application-development</a>				
<a href="http://computingcareers.acm.org/?page_id=12">http://computingcareers.acm.org/?page_id=12</a>				
<a href="http://en.wikibooks.org/wiki/cloud_application">http://en.wikibooks.org/wiki/cloud application</a>				
<a href="http://www.acadmix.com/eBooks_Download">http://www.acadmix.com/eBooks_Download</a>				
<a href="http://www.ibm.com">http://www.ibm.com</a>				

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

Topics relevant to “EMPLOYABILITY SKILLS”: EC2 for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3095	Course Title: Cloud Security Type of Course: Theory	L-T- P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Cloud Computing and Services (CSE322)				
Anti-requisites	NIL				
Course Description	This course provides ground-up coverage on the high-level concepts of cloud landscape, architectural principles, and techniques. It describes the Cloud security architecture and explores the guiding security for Infrastructure and Softwares.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cloud Security and attain Employability through Participative Learning techniques.				
Course Outcomes	<p>On successful completion of this course the students shall be able to:</p> <p>Describe fundamentals of cloud computing [Knowledge].</p> <p>Explain cloud computing security architecture and associated challenges [Comprehension].</p> <p>Discuss cloud computing software security essentials [Comprehension].</p> <p>Apply infrastructure security and data security in cloud computing environment. [Application].</p>				
Course Content:					
Module 1:	Fundamentals of Cloud Computing	Quiz	Knowledge based Quiz	10 Sessions	
Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.					
Module 2:	Cloud Security Challenges and Cloud Security Architecture	Quiz	Comprehension based Quiz	10 Sessions	
Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security.					





Course Code: CSE3103	Course Title: Cognitive Science & Analytics  Type of Course:	L-T-P-C	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course is an introduction to computational theories of human cognition. Drawing on formal models from classic and contemporary artificial intelligence, it will explore fundamental issues in human knowledge representation, inductive learning and reasoning. What are the forms that our knowledge of the world takes? What are the inductive principles that allow us to acquire new knowledge from the interaction of prior knowledge with observed data? What kinds of data must be available to human learners, and what kinds of innate knowledge (if any) must they have?					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cognitive Science & Analytics and attain Employability through Participative Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to:  Introduce the concepts and components of Cognitive Science  Evaluate the technologies that make up Cognitive Science .  Define how CS will help an organization and whether it will helpful  Identify the technological architecture that makes up this systems					
Course Content:						
Module 1	Introduction	Assignment	Programming Task	12 Sessions		
Topics:  Cognition Process, Cognitive Psychology, Cognitive Science; Foundations of Cognitive Science, Cognitive Science and Multi-disciplinary; Machines and Minds; Laws thoughts to binary logic; Classical Cognitive Science; Connectionist Cognitive Science; Mind body Problem; Turing Response to Mind Body Problem; Pinker, Penerose and Searle"s Responses to Mind Body Problem; Representational Theory of Mind; Theories of Mental Representation: Minimal Analysis of mental representation, Resemblance theories of						

<p>mental representation, Casual covariation theories of mental representation, internal roles theories of mental representation</p>				
Module 2	Precursors of Cognitive Science	Assignment		10 Sessions
<p>Topics:</p> <p>Behaviorism; Theory of Computation and Algorithms; Algorithms and Turing Machines; Marr's Three Level of Computation; Linguistics and Formal Language; Information Processing Models in Psychology</p>				
Module 3	Psychological Perspective of Cognition	Assignment		10 Sessions
<p>Topics:</p> <p>Cognitive Models of Memory, Atkinson-Shiffrin's Model, Tulving's Model, Mental Imagery, Kosslyn's View, Moyer's View, Peterson's View, Cognitive Maps, Problem Understanding, States of Cognition, Cognition in AI</p>				
Module 4	Cognitive System and analytics			13 Sessions
<p>Topics:</p> <p>Cognitive System; Architecture for intelligent agents; Modularity of Mind; Modularity Hypothesis; The ACT-R/PM architecture</p> <p>Data Analytics overview, Importance of DA, Types of DA, Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Benefits of DA, Data Visualization for Decision Making, Data types, Measure of central tendency, Measures of Dispersion</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Professionally used software</p>				
<p>Project work/Assignment:</p>				
<p>Text Book</p> <p>1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, Cambridge University Press</p> <p>2. Michael R. W. Dawson , Mind, Body, World: Foundations of Cognitive Science, UBC Press</p>				

References	
1. Daniel Kolak, William Hirstein, Peter Mandik, Jonathan Waskan, Cognitive Science, An Introduction to Mind and Brain, Routledge Taylor and Francis Group	
2. Amit Konar – Artificial Intelligence and Soft computing: Behavioral and Cognitive Modeling of the Human Brain, CRC Press	
Weblinks:	
W1: Top Cognitive Science Courses - Learn Cognitive Science Online   Coursera	
W2: Introduction to Cognitive Psychology - Course (nptel.ac.in)	
Topics relevant to “EMPLOYABILITY SKILLS”: Cognitive System for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Shine V Joseph
Recommended by the Board of Studies on	BOS NO: 16th BOS, held on 25/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 3/8/2022

Course Code: CSE3022	Course Title: Cryptocurrency Technology Type of Course: Theory Only Course	L- T-P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Basics of cryptography and Blockchain				
Anti-requisites					
Course Description	<p>The course is designed to provide an introductory understanding of decentralized digital currencies (cryptocurrencies) such as bitcoin, a basic understanding of its underlying technology 'Blockchain' and why this new and innovative technology is so important, since it has the potential to disrupt a number of industries in the immediate near future.</p> <p>In particular, the course will survey the theory and principles by which cryptocurrencies operate, practical examples of basic cryptocurrency transactions, the likely interaction of cryptocurrencies with the banking, financial, legal and regulatory systems, and how cryptocurrencies could be viewed within a framework of innovation and development.</p>				
Course Objective					

	The objective of the course is to familiarize the learners with the concepts of Cryptocurrency Technology and attain Employability through Participative Learning techniques.			
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Understand the technology components of blockchain-based digital currencies. [Comprehensive]</p> <p>Explain the transactions from a digital currency wallet. [Comprehensive]</p> <p>Understand alternatives to bitcoin, such as alt-coins, Ethereum and Bitcoin Cash. [Comprehensive]</p> <p>Use cryptocurrencies in the context of disruptive innovations [Application]</p>			
Course Content:				
Module 1	Introduction to Cryptography	Assignment	Data Interpretation	8 Sessions
<p>Topics: Cryptography, Digital Signatures, Cryptographic Hash Functions.</p> <p>Cryptographic Data Structures: Hash Pointers, Append-Only Ledgers (BlockChains), Merkle Trees.</p>				
Module 2	Bitcoin's Protocol	Assignment	Data Interpretation	10 Sessions
<p>Topics: Bitcoin's Protocol Keys as Identities, Simple Cryptocurrencies, Decentralization through Distributed Consensus, Incentives, Proof of Work (Mining), Application-Specific Integrated Circuit (ASIC) Mining and ASIC-resistant Mining, Virtual Mining (Peer coin).</p>				
Module 3	Bitcoin Engineering	Quiz	Questions Set	10 Sessions
<p>Topics: Engineering Details, Bitcoin Blocks, Hot and Cold Storage, Splitting and Sharing Keys, Proof of Reserve Proof of Liabilities.</p> <p>Anonymity, Pseudonymity, Unlinkability: Statistical Attacks (Transaction Graph Analysis), Network-layer De-anonymization, Chaum's Blind Signatures, Single Mix and Mix Chains, Decentralized Mixing, Zero-Knowledge Proof Cryptocurrencies.</p>				
Module 4	Cryptocurrency Technologies	Quiz	Questions Set	10 Sessions
<p>Topics: Cryptocurrency Technologies, Smart Property, Efficient micro-payments, Coupling Transactions and Payment (Interdependent Transactions,) Public Randomness Source, Prediction Markets, Escrow transactions, Green addresses, Auctions and Markets, Multi-party Lotteries.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>A cryptocurrency is a digital or virtual currency, it is secured by cryptography which makes it impossible to simulate or double-spend. Many cryptocurrencies are decentralized networks based on blockchain technology. Cryptocurrency caters to the promise of making the easier transaction of funds directly between two groups or parties without the need for</p>				

any third party like bank or credit card company. Applications are Money transfer, Smart contracts, Internet of Things (IoT), Personal identity security, Healthcare, Logistics. Tools: Messari, Glass node, Lunar Crush, Coin Metrics, Coin Market Cal.
Project work/Assignment:
<p>Assignment:</p> <p>Beyond a method for payment, what are other functions of cryptocurrencies?</p> <p>How are cryptocurrency transactions recorded?</p> <p>What are the top cryptocurrencies?</p> <p>What is the market capitalization of all cryptocurrencies and which ones make up largest % of that capitalization?</p> <p>Explain briefly efficient micro-payments</p>
<p>Text Books:</p> <p>T1. Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.</p> <p>T2. Schar, Fabian, and Aleksander Berentsen. Bitcoin, Blockchain, and Cryptoassets: A Comprehensive Introduction. MIT press, 2020.</p> <p>T3. Karame, Ghassan O., and Elli Androulaki. Bitcoin and blockchain security. Artech House, 2016.</p>
<p>References:</p> <p>R1. Antonopoulos, Andreas M., and Gavin Wood. Mastering ethereum: building smart contracts and dapps. O'reilly Media, 2018.</p> <p>R2. Antonopoulos, Andreas M. Mastering Bitcoin: unlocking digital cryptocurrencies. "O'Reilly Media, Inc.", 2014.</p> <p>R3. Day, Mark Stuart. Bits to bitcoin: how our digital stuff works. MIT Press, 2018.</p> <p>E book link R1: <a href="http://fincen.gov/statutes_regs/guidance/html/FIN-2013-G001.html">http://fincen.gov/statutes_regs/guidance/html/FIN-2013-G001.html</a></p> <p>E book link R2: <a href="http://www.scribd.com/doc/212058352/Bit-Coin">http://www.scribd.com/doc/212058352/Bit-Coin</a></p> <p>R Web resources:</p> <p>H W1. <a href="http://www.usv.com/posts/bitcoin-as-protocol">http://www.usv.com/posts/bitcoin-as-protocol</a></p> <p>W2. <a href="http://startupboy.com/2013/11/07/bitcoin-the-internet-of-money/">http://startupboy.com/2013/11/07/bitcoin-the-internet-of-money/</a></p> <p>W3. <a href="http://startupboy.com/2014/03/09/the-bitcoin-model-for-crowdfunding/">http://startupboy.com/2014/03/09/the-bitcoin-model-for-crowdfunding/</a></p> <p>W3. <a href="http://www.hmrc.gov.uk/briefs/vat/brief0914.html">http://www.hmrc.gov.uk/briefs/vat/brief0914.html</a></p>

Topics relevant to “EMPLOYABILITY SKILLS”: Cryptography, Digital Signatures, Hash Pointers, BlockChains, ASIC-resistant Mining, Hot and Cold Storage, Transaction Graph Analysis, Zero-Knowledge Proof Cryptocurrencies, Escrow transactions, Multi-party Lotteries.

for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3096	Course Title: Cyber Digital Twin Type of Course: Theory Only Course	L- T-P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	CSE2013				
Anti-requisites	NIL				
Course Description	This course is designed to improve the learners ‘Skill Development’ by using modeling, optimizing, and risk management approach. The course objective is to get familiar with the Cyber digital twin-working principal, Development considerations, Data-Modelling Environment, Digital Twin Optimization, Risk Management and Applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cyber Digital Twin and attain Employability through Participative Learning techniques.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Understand the basic concepts of Cyber Digital twin, and its working principle. [KNOWLEDGE]</p> <p>Explain Data modeling and development consideration in digital twin model for cloud and IoT technology.[COMPREHENSION]</p> <p>Observe digital twin-human behavior modeling in digital twin-optimization [COMPREHENSION]</p> <p>Show Risk Assessment-Digital twin reference model-Implementation. [APPLICATION]</p> <p>Apply Digital twin in various area like Manufacturing, Automotive and Healthcare.[APPLICATION]</p>				
Course Content:					
Module 1	Introduction	Assignment	Theory	No. of Classes:09	

Introduction- Cyber Digital twin-definition-uses and benefits-need for digital twin-working principal Technology Digital thread-digital shadow-building blocks of digital twin-digital twin technology drivers and enablers.				
Module 2	Data Modelling Environment	Assignment	Theory	No. of Classes:10
Types of digital twin-Based on Product and Process-Based on Functionality-Based on Maturity. Development considerations-Overview of Data-Modelling Environment. Modelling-model and data management-Managing data-implementing the model- Cloud and IOT technologies.				
Module 3	Digital Twin Optimization	Assignment	Theory	No. of Classes:10
Cyber range vs digital twin-human behavior modeling in digital twin-optimization using digital twin-digital twin and cyber security-Techniques. Technologies-Industrial IOT and Digital Twin-simulation and digital twin-Machine learning and digital twin-virtual reality and digital twin-cloud technology and digital twin.				
Module 4	Risk Management and Applications	Assignment	Case Study	No. of Classes:10
Digital twin and Risk Assessment-Digital twin reference model-Implementation-Development of risk assessment plan-Development of communication and control system-Development of digital twin tools-Integration-platform validation-Difficulties-Practical implications. Applications: Digital Twin in Manufacturing-Digital Twin in Automotive-Digital Twin in Healthcare-Digital Twin in Utilities-Digital Twin in Construction				
Targeted Application & Tools that can be used:  Ansys Twin Builder is a powerful solution for building, validation and deploying simulation-based systems and digital twins: Build, validate, and deploy digital twins. Digital twin models integrate real-world data. Increase efficiency with digital twins.				
Project work/Assignment:				
Project Assignment:				
Text Book  Clint Bodungen, Bryan Singer, Aaron Shbeeb, Kyle Wilhoit, and Stephen Hilt," Hacking Exposed Industrial Control Systems: ICS and SCADA Security Secrets & Solutions", 1st Edition, ISBN: 978-1259589713.  Eric D. Knapp and Raj Samani," Applied Cyber Security and the Smart Grid: Implementing Security Controls into the Modern Power Infrastructure ", 1st Edition. Kevin Mitnick," The Art of Invisibility", 2017.				
References				

Michael E. AuerKalyan Ram B. Digital,” Cyber-physical System and Digital Twins - Part of the Lecture Notes in Networks and Systems book series”.

Nassim Khaed, Bibin Pattel and Affan Siddiqui,” Development and Deployment on the Cloud”, Elsevier, 2020.

Weblinks:

[https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-live%26ebv%3dEB%26ppid%3dpp\\_xiii](https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-live%26ebv%3dEB%26ppid%3dpp_xiii)

<https://www.udemy.com/course/digital-twin-a-comprehensive-overview/>

Topics relevant to “EMPLOYABILITY SKILLS”:Digital thread-digital shadow-building blocks of digital twin, Digital Twin in Manufacturing-Digital Twin in Automotive, Cyber range vs digital twin-human behavior modeling in digital twin-optimization for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3094	Course Title: Cyber Security  Type of Course:1] Discipline Elective  2] Theory Only	L- T-P- C	3 -0	0	3
Version No.	1.1				
Course Pre-requisites	Fundamental knowledge in Information Security and Networks				
Anti-requisites	NIL				
Course Description	<p>This is a foundation program geared towards generating and enhancing awareness about cyber security challenges and the concept of Cyber Security and Cyber Ethics among the stakeholders to help them become responsible Cyber Citizens and participate safely and securely in the rapidly evolving information-age society.</p> <p>The important topics include: Network Security model, attacks, malware, firewall, IT act and Cyber forensics</p>				



Course Objectives	The objective of the course is to familiarize the learners with the concepts of Cyber Security and attain Employability through Participative Learning techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe the basic concept of Cyber Security [Knowledge] 2) Classify different types of attacks for a scenario [Comprehension] 3) Prepare a mitigation policy for security threat [Comprehension] 4) Demonstrate Cyber Security tools [Application]			
Course Content:				
Module 1	Introduction to Cyber Security	Quiz	Knowledge	10 Sessions
Topics History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Guidelines to choose web browsers, Securing web browser, Antivirus, Email security, Guidelines for setting up a Secure password, Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques .				
Module 2	Security in Networks	Assignment	Comprehension	10 Sessions
Topics: Security in Networks – Concepts, threats in Network, website vulnerabilities, man in the middle attack, denial of Service attack, distributed denial of service attack, Firewalls – introduction and design, types of firewalls, personal firewalls, Program Security – non malicious program errors, malicious program flaws, virus and other malicious code, prevention of virus infection. Assignment: Program Security – non malicious program errors.				
Module 3	Smartphone Security	Assignment	Comprehension	12 Sessions
Topics: Introduction to mobile phones, Smartphone Security, Android Security, IOS Security, Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance, Guidelines for social media security, Tips and best practices for safer Social Networking, Basic				

Security for Windows, User Account Password Assignment: Social Media Security				
Module 4	Ethical Issues in Cyber Security	Assignment	Programming/Data analysis task	9 Sessions
<p>Legal and ethical issues in Cyber Security – protecting program and data, copyright, patents and trade secrets, IT Act, EDP audit, Overview of CISA, Privacy in computing, Cyber Forensic Tools – types and categories, Cyber forensic suite. Forensic tools: types, categories, open source proprietary</p> <p>Assignment: Cyber Forensic Tools</p>				
<p>Textbooks</p> <p>T1. Charles P. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education, 5th Edition, 2012</p> <p>T2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley &amp; Sons, 2018 .</p> <p>T3. Dejeu and Murugan, “Cyber Forensics”, Oxford University Press, 2018.</p>				
<p>References</p> <p>R1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th Ed, Pearson Education, 2015.</p> <p>R2. Behrouz A Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, Mc Graw Hill Publication, ISBN 13: 978-93-392-2094-5. 2008.</p> <p>Web links:</p> <p>W1. <a href="https://www.youtube.com/watch?v=RYB4cG8G2xo">https://www.youtube.com/watch?v=RYB4cG8G2xo</a></p> <p>W2. <a href="https://www.coursera.org/lecture/detecting-cyber-attacks/Cyber%20Security-UeDqJ">https://www.coursera.org/lecture/detecting-cyber-attacks/Cyber Security-UeDqJ</a> , <a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p>				
<p>Topics relevant to “EMPLOYABILITY SKILLS”: Mobile Security for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</p>				



Course Code: CSE2023	Course Title: Data Warehousing and its Applications Type of Course: Theory	L- T-P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	Basics of data mining & Python				
Course Description	The Objective of this course is to create a trove of historical data that can be retrieved and analyzed to provide useful insight into the organization's operations. A data warehouse is a vital component of business intelligence. This course will introduce basic concepts of data warehousing, architecture, design principles, building data warehouse, data mining techniques and major application areas of data warehouse.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Warehousing and its Applications and attain Employability through Participative Learning techniques.				
Course Outcomes	On completion of this course, the students will be able to Describe data warehousing architecture and considerations to build data warehouse. [Knowledge] Discuss different multidimensional data models for data warehouse. [Comprehension] Apply various techniques to build data warehouse [Application] Apply different data mining techniques to mine insights [Application]				
Course Content:					
Module 1	Introduction To Data Warehousing	Assignment/Quiz	Benefits of data warehousing	8	Session
Topics: The need for data warehousing, paradigm shift, data warehouse definition and characteristics, Data warehouse architecture, sourcing, acquisition, cleanup and transformation, metadata, access tools, data marts, data warehouse administration and management, building a data warehouse: business consideration, technical consideration, design consideration, implementation consideration, integrated solutions, benefits of data warehousing. Data Warehouse Architecture: Two and Three tier Data Warehouse architecture. Assignment: Benefits of data warehousing					

Module 2	Data Warehouse modelling	Assignment/Quiz	Data cube	12 Session
<p>Topics:</p> <p>Data cube: A multidimensional data model, stars, snowflakes, and fact constellations: schemas for multidimensional data models, dimensions: the role of concept hierarchies, measures: their categorization and computation, typical OLAP operations, efficient data cube computation, the compute cube operator and the curse of dimensionality, partial materialization: selected computation of cuboids, indexing olap data: bitmap index and join index.</p> <p>Assignment: Data cube</p>				
Module 3	8	Case Study	Data Warehouse design principles	12 Session
<p>Topics:</p> <p>Building a data warehouse: Introduction, Critical Success Factors, Requirement Analysis, Planning for the data Warehouse-The data Warehouse design stage, Building and implementing data marts. Building data warehouses, Backup and Recovery, Establish the data quality framework, Operating the Warehouse, Recipe for a successful warehouse, Data warehouse pitfalls.</p> <p>Assignment: Data Warehouse design principles</p>				
Module 4	Introduction to Data Mining	Case Study	Data Mining Techniques	8 Session
<p>Topics:</p> <p>Introduction to Data mining, KDD versus data mining, data mining techniques, tools and applications. Mining complex data objects, Spatial databases, Multimedia databases, Time series and Sequence data; mining Text Databases and mining Word Wide Web. Applications of data warehousing across different industries- Retail industry, Manufacturing and distribution, Bank, insurance company, Government agencies etc</p> <p>Assignment: Data Mining Techniques</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application Area includes Ecommerce, retail, manufacturing industry, government agencies, Finance, banking etc</p> <p>Professionally Used Software: Microsoft Azure Synapse SQL, IBM DB2 warehouse, Terradata vantage, SAP data warehouse cloud, Google Bigtable, google sheets, BigQuery, MongoDB, MarkLogic, Talend, Informatica, Arm Treasure data, Micro focus vertica, Cloudera Enterprise data platform.</p> <p>Assignment:</p>				

<p>1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .</p>
<p>2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.</p>
<p>Text Book(s):</p> <p>T1. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining &amp; OLAP", McGraw Hill, 2016</p> <p>T2. Jiawei Han, Micheline Kamber, Jian Pei, "Data-Mining.-Concepts-and-Techniques ", The-Morgan-Kaufmann, 3rd-Edition-Morgan-Kaufmann, 2015</p>
<p>Reference(s):</p> <p>R1. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", Pearson, 2016</p> <p>R2. Tan P. N, Steinbach M and Kumar V, "Introduction to Data Mining", Pearson Education, 2016</p> <p>Web Based Resources and E-books:</p> <p>W1. NPTEL Course on "Business Analytics &amp; Data Mining Modeling Using R", Prof. Gaurav Dixit.</p> <p><a href="https://onlinecourses.nptel.ac.in/noc22_mg67/preview">https://onlinecourses.nptel.ac.in/noc22_mg67/preview</a></p> <p>W2. NPTEL Course on "Data Mining", Mr. L. Abraham David</p> <p><a href="https://onlinecourses.swayam2.ac.in/cec22_cs06/preview">https://onlinecourses.swayam2.ac.in/cec22_cs06/preview</a></p> <p>W3. Coursera course on "Data Warehousing for Business Intelligence Specialization", Michael Mannino, Jahangir Karimi</p> <p><a href="https://www.coursera.org/specializations/data-warehousing">https://www.coursera.org/specializations/data-warehousing</a></p> <p>W4. Journal on "Data Mining and Knowledge Discovery"</p> <p><a href="https://www.springer.com/journal/10618/">https://www.springer.com/journal/10618/</a></p> <p><a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p>
<p>Topics relevant to "EMPLOYABILITY SKILLS": Building a data warehouse, data mining tools, for developing Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.</p>

Course Code:	Course Title: Digital Health and Imaging	L- T-P- C	3 -0	0	3
CSE3018	Type of Course: Program Core& Theory Only				
Version No.	1.0				
Course Pre-requisites	CSE3008: Machine Learning Techniques				
Anti-requisites	-				
Course Description	This course will give an overview of digital health and its impact on healthcare, Image enhancement techniques, filtering, and restoration. Medical Imaging, health informatics, Health data analytics and predictive modeling.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of : Digital Health and Imaging and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:  1.Understand the role of digital health’s impact in ethical and legal considerations. [Understand]  2. Apply Machine learning techniques for medical image analysis. [Application]  3. Apply Computer-aided detection and diagnosis in medical imaging. [Application]  4. Apply Health data analytics and predictive modeling. [Application]				
Course Content:					
Module 1	Introduction to Digital Health and Digital Image	Assignment	Theory	L : 8	
Introduction to Digital Health  Overview of digital health and its impact on healthcare, Introduction to telemedicine, wearables, and health monitoring devices, Ethical and legal considerations in digital health.  Digital Image Processing Fundamentals:  Digital image representation and properties, Image enhancement techniques, Image filtering and restoration, Image segmentation and feature extraction					

Module 2	Medical Imaging Modalities	Assignment	Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions	L: 10
<p>Medical Imaging Modalities: Principles and applications of various medical imaging modalities. X-ray imaging, computed tomography (CT), and magnetic resonance imaging (MRI) , Ultrasound imaging and nuclear medicine imaging, Imaging modalities for specific healthcare domains (e.g., radiology, cardiology)</p>				
Module 3	Image Analysis in Healthcare	Assignment /Quiz	Researching and reviewing academic papers or industry publications on specific AI applications	L:12
<p>Image registration and fusion techniques, Quantitative image analysis for disease diagnosis and treatment planning, Computer-aided detection and diagnosis in medical imaging, Machine learning in medical image analysis.</p> <p>Health Informatics and Electronic Health Records, Introduction to health informatics and electronic health records (EHR), EHR systems and interoperability, Data privacy, security, and regulatory considerations in health informatics.</p>				
Module 4	Digital Health Applications and Innovations	Assignment	Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.	L: 10
<p>Mobile health (mHealth) applications and remote patient monitoring, Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health. Emerging technologies and trends in digital health.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Applications: Quantitative image analysis for disease diagnosis, Mobile health (mHealth)</p> <p>Tools: TensorFlow, PyTorch, Computer-aided detection</p>				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				



Assignments can involve researching and reviewing academic papers or industry publications on specific AI applications in engineering / Students may be given programming assignments to implement AI algorithms / Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions / Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.
<p>Text Book</p> <p>"Digital Health: Scaling Healthcare to the World" by Paul Sonnier-2020</p> <p>Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods</p> <p>"Biomedical Signal and Image Processing" by Kayvan Najarian and Robert Splinter</p>
<p>References</p> <p>Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley , 2021..</p> <p>"Introduction to Health Informatics" by Mark S. Braunstein</p> <p><a href="https://talentsprint.com/course/ai-digital-health">https://talentsprint.com/course/ai-digital-health</a></p> <p><a href="https://www.udemy.com/topic/medical-imaging/">https://www.udemy.com/topic/medical-imaging/</a></p>
Topics relevant to "EMPLOYABILITY SKILLS": Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3101	Course Title: Digital Watermarking and Steganography Type of Course: Theory Only	L-T-P-C	3 -0	0	3
Version No.	1.1				
Course Pre-requisites	Fundamental knowledge in Operating Systems, Cryptography & Network Security and Computer Networks				
Anti-requisites	NIL				
Course Description	The purpose of this course is to enable the students to Comprehend the need for Digital Watermarking and Steganography and to develop the basic abilities of design and use Digital Watermarking and Steganography-information hiding technique. The course is both conceptual in nature and needs fair knowledge of Mathematical and computing. The course develops critical thinking and analytical skills. The course also enhances the abilities through assignments.				

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Digital Watermarking and Steganography and attain Employability through Participative Learning techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: Discuss the Introduction of Digital Watermarking Classify the various Digital Watermarking techniques. Explain the Fundamentals of Steganography. Summarize the Steganographic Techniques.			
Course Content:				
Module 1	Introduction to digital watermarking	Assignment	Programming Task	7 Sessions
Topics Introduction to Digital Watermarking, Digital Steganography differences, brief History, Watermarking Applications, Classification in Digital Water Marking- Classification based on Characteristics, Classification based on Applications.				
Module 2	Types and tools of digital watermarking	Assignment	Programming Task	14 Sessions
Topics: Digital Watermarking Fundamentals, Least Significant bit substitution, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform, Random Sequence Generation, Chaotic Map, Error Detection Code. Spatial domain watermarking, frequency Domain watermarking, Fragile Watermark, Robust Water Mark, Watermarking attacks and Tools, Image processing techniques, Water Mark (software Analysis).				
Module 3	Introduction to Steganography	Assignment	Programming/Data analysis task	8 Sessions
Topics: Steganography, Watermarking vs Steganography, Need for Steganography, Application of Steganography, Methods of Hiding, properties of Steganography, Performance measure of				

Steganography Approaches, Mathematical Notation and Terminology, Steganography Software (S-tools, StegoDos, EzStezo, JSteg, Jpeg,).				
Module 4	Techniques of Steganography	Assignment	Programming/Data analysis task	7 Sessions
Substitution Systems and Bit-plane Tools- Least Significant Bit Substitution, Pseudorandom Permutations, Image Downgrading and Covert Channels, Practical Approach towards Steganography, Embedding of a secret Message.				
Textbooks  T1. Frank Y Shih. Digital Water marking and Steganography Fundamentals and Techniques, 2017, CRC Press, second edition.  T2. Jsjit. S. Suri Shivendra Shivani, Suneeth Agarwal, Handbook on Image based Security Techniques, CRC Press, 2018.				
References  R1. Abid Yahya, Steganography Techniques for Digital Images, Springer, 2019.  Weblinks:  W1. Digital Watermarking   ScienceDirect (informaticsglobal.com) W2. Digital Watermarking and Steganography   ScienceDirect (informaticsglobal.com)				
Topics relevant to “EMPLOYABILITY SKILLS”: Building a data warehouse, data mining tools, for developing Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.				

Course Code: CSE3136	Course Title:E – Business and Marketing Analytics  Type of Course: Discipline Theory	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Basic Communication skills General Knowledge in information technology Basic knowledge about online business				
Anti-requisites	Nil				
Course Description	The course intends to provide the basis of electronic business applications. This course will help the students understand the dynamics of E – Business and demonstrate the ability to identify, describe and apply the essential current practices in the contemporary scenario and provides a conceptual understanding of how marketing decisions are aided by analytics.				
Course Out Comes	At the end of the course, the student shall be able to:  CO 1: Describe the fundamentals of E – Business(Knowledge) CO 2: Discuss the various E – Business models (Comprehension) CO 3: Identify how to manage E – Business (Comprehension) CO4: Describe the basics of marketing analytics for decision making (Knowledge)				
Course Objective:	The objective of the course is to familiarize the learners with the concepts of E – Business and Marketing Analytics and attain Employability through Participative Learning techniques.				
Module 1	Introduction to Electronic Business	Case study	Case study on Types of Networking for E-Business	6 Sessions	
Electronic Business: Overview, Definitions, Advantages & Disadvantages of E - Business, History of Electronic Business, Threats of E – Business, Types of E – Business and related Industries, E – Business Technology: Different Types of Networking for E-Business, Internet, Intranet, EDI Systems, Development of the Internet, Advantages of Internet, E-Business Infrastructure: An Overview, Hardware, Server Operating System, Software, Network Website, Roadmap of E – Business in India					

Module 2	E-business Markets and Models	Case study	Case study on One-to-One Marketing and E – Governance	7 Sessions
E-business Markets and Models: Introduction, E-business Environment, E – Marketplaces, E – Business Markets, Types of E – Business Models: Model based on Transaction Type, Model based on Transaction Party – B2B, B2C, C2B, C2C, E-commerce Sales Life Cycle (ESLC) Model, E – Marketing: Key Issues, Introduction, The Scope of E – Marketing, Internet Marketing Techniques, E – Marketing Plan, The Marketing Mix, Branding, Online Advertising, Targeting Online Customers, One-to-One Marketing, E – Governance				
Module 3	The Management of E – Business:	Group Discussion	Group Discussion on E – Payment Mechanism	10 Sessions
Managing Knowledge, Managing Applications Systems for E – Business, Management Skills for E – Business, Comparison between Conventional Design and E – Organisation, Supply Chain Management (SCM), Customer Relationship Management, E – Payment Mechanism: Payment through Card System, E – Cheque, E – Cash, E – Payment Threats & Protections.				
Module 4	Introduction to Marketing Analytics	Assignment	E-resource Review	8 Sessions
Marketing analytics-data for marketing analytics-Exploratory data analysis-descriptive analysis-predictiveanalytics-prescriptive analytics-Customer analytics-benefits-Segmentation analytics-applications of cluster analysis				
<b>DELIVERY PROCEDURE (PEDAGOGY):</b>  Self-learning: An Overview, Hardware, Server Operating System, Software, Network Website, Roadmap of E – Business in India  Experiential Learning: Case Studies on E-business  Participative learning: Group discussion on E-Payment Mechanism				
<b>Textbook</b>  T1- Colin Combe, Introduction to E-business Management and Strategy, Elsevier Ltd,1st edition,2006  T2- Gupta, Seema. Marketing Analytics,1st Edition,Wiley,1st October 2021.				
<b>References</b>  R1: Tokuro Matsuo and Ricardo Colomo-Palacios , Electronic Business and Marketing: NewTrends on its Process and Applications, Springer,2015.  R2: Joseph, P.T, E-COMMERCE AN INDIAN PERSPECTIVE (2e), New Delhi Prentice-Hall of India,2019  R3: Chaffey, E-Business and E-Commerce Management: Strategy, Implementation and Practice, 5e, Pearson Education India,2013				

<p>R4: Kenneth C. Laudon and Carol Guercio Traver, E-Commerce, Pearson Education, 2017</p> <p>R5. Winston, Wayne, Marketing Analytics: Data –driven techniques with Microsoft Excel, Wiley, 2014.</p> <p>R6. Grigsby, Mike, Marketing analytics: A practical guide to improving consumer insights using data techniques. Kogan Page, 2022.</p>
<p>Project /Assignment :Case study on Legal and Regulatory Environment for E - Business</p>
<p>PU E-Resource Links:</p> <p>1. Ng, E. (2005), "An empirical framework developed for selecting B2B e-business models: the case of Australian agribusiness firms", Journal of Business &amp; Industrial Marketing, Vol. 20 No. 4/5, pp. 218-225.</p> <p>Link: <a href="https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/08858620510603891/full/html">https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/08858620510603891/full/html</a></p> <p>PU1:: <a href="https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/17505930710734125/full/htm">https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/17505930710734125/full/htm</a></p> <p>PU2: <a href="https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/JCM-02-2019-3080/full/pdf?title=the-internet-of-everything-implications-of-marketing-analytics-from-a-consumer-policy-perspective">https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/JCM-02-2019-3080/full/pdf?title=the-internet-of-everything-implications-of-marketing-analytics-from-a-consumer-policy-perspective</a></p>
<p>NPTEL Videos:</p> <p><a href="https://www.digimat.in/nptel/courses/video/110105083/L01.html">https://www.digimat.in/nptel/courses/video/110105083/L01.html</a></p> <p><a href="https://www.digimat.in/nptel/courses/video/110105083/L60.html">https://www.digimat.in/nptel/courses/video/110105083/L60.html</a></p> <p><a href="http://www.digimat.in/nptel/courses/video/110105083/L22.html">http://www.digimat.in/nptel/courses/video/110105083/L22.html</a></p> <p><a href="https://onlinecourses.nptel.ac.in/noc20_mg30/preview">https://onlinecourses.nptel.ac.in/noc20_mg30/preview</a> (Sessions on Marketing Analytics)</p>
<p>Web Based Resources:</p> <p>W1. <a href="https://hbr.org/2018/05/why-marketing-analytics-hasnt-lived-up-to-its-promise">https://hbr.org/2018/05/why-marketing-analytics-hasnt-lived-up-to-its-promise</a></p> <p>W2. <a href="https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Deloitte-Analytics/dttl-analytics-us-da-pricinganalytics3minguide.pdf">https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Deloitte-Analytics/dttl-analytics-us-da-pricinganalytics3minguide.pdf</a></p> <p>W3. <a href="https://hbr.org/2010/11/using-customer-journey-maps-to-improve-customer-satisfaction">https://hbr.org/2010/11/using-customer-journey-maps-to-improve-customer-satisfaction</a></p> <p>W4. <a href="https://www.zoho.com/subscriptions/guides/what-is-customer-lifetime-val">https://www.zoho.com/subscriptions/guides/what-is-customer-lifetime-val</a></p> <p>W5. <a href="https://www.mediassociates.com/wp-content/uploads/2018/12/Mediassociates-whitepaper-Predictive-Analytics_2018.pdf">https://www.mediassociates.com/wp-content/uploads/2018/12/Mediassociates-whitepaper-Predictive-Analytics_2018.pdf</a></p>
<p>Topics relevant to “EMPLOYABILITY SKILLS”: Managing Knowledge, Managing Applications Systems for E – Business, Management Skills for E – Business, Comparison between Conventional Design and E – Organisation, for developing Employability Skills through Participative learning Techniques. This is attained through assessment component mentioned in course handout.</p>

Course Code: CSE3024	Course Title: Emerging Areas in Blockchain Type of Course: Theory Only Course	L- T-P- C	3-0	0	3
Version No.	1				
Course Pre-requisites	Basic concepts in networking. Cryptography Techniques Data Structures and Algorithms Introduction to Programming				
Anti-requisites					
Course Description	This course will be on the fundamentals of Blockchain and Blockchain Technology. The most well-known example of Blockchain Technology in wide use today is as the storage and transaction mechanism for the cryptocurrency Bitcoin. We will use historical examples, key concepts, key challenges, and their proposed (and implemented) solutions to help explain Blockchain Fundamentals. A key focus for the class will be on the decisions between challenge and implementation. This 'design' process can take a very long time, and the design and research process that ultimately led to a 'successful' implementation for a cryptocurrency took decades. Bitcoin represents an elegant technical solution to a series of long posed problems and partial solutions.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Emerging Areas in Blockchain and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: CO1: To understand the mechanism of Blockchain and Cryptocurrency. CO2: To understand the functionality of current implementation of blockchain technology. CO3: To explore the applications of Blockchain to cryptocurrencies and understanding limitations of current Blockchain.				
Course Content:					
Module 1	Blockchain: A new perspective in cyber technology	Assignment	Data Interpretation	8 Sessions	
Topics: 1. Introduction, Blockchain architecture, Blockchain concepts ,Consensus algorithms, Blockchain validity, Blockchain attacks, Merkle trees					

Module 2	Blockchain-enabled cyber-physical systems	Assignment	Data Interpretation	10 Sessions
Topics: Background of CPS, Background of blockchain, Blockchain-enabled cyber-physical systems, Characteristics of blockchain-enabled CPS systems, Challenges in blockchain-enabled CPS systems				
Module 3	Blockchain for intrusion detection systems	Quiz	Questions Set	10 Sessions
Topics: . Intrusion detection system, About blockchain, Host-based intrusion detection system, Blockchain-based intrusion detection, Collaborative intrusion detection system, Applications of IDS: Snort, Limitations Comparison with firewalls				
Module 4	Blockchain for digital rights management	Quiz	Questions Set	10 Sessions
Topics: Introduction, Illustrations, DRM requirement, Parts of a traditional DRM, Compatibility of blockchain for DRM, Various cryptographic hash functions in blockchain, Methodologies and technology in use, Effects and applications of using blockchain in DRM, Methodologies for coupling DRM with blockchain, Advantages of integrating blockchain with digital content, Limitation of blockchain in DRM,				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Blockchain has so many applications in every sector you can imagine such as healthcare, finance, government, identity, etc. And that's not including its most popular application which is Bitcoin.</p> <p>Tools: Geth, Solc, Remix IDE, Truffle</p>				
Project work/Assignment:				
Assignment:				
<p>T1.Blockchain Technology for Emerging Applications, A Comprehensive Approach</p> <p>1st Edition - May 21, 2022, SK Hafizul Islam, Arup Kumar Pal, Debabrata Samanta, Siddhartha Bhattacharyya</p>				
References				



R1. Applications of Blockchain Technology in Business Challenges and Opportunities ,  
Mohsen Attaran, Angappa Gunasekaran · Springer International Publishing 2019

E book link R1: <https://www.blockchain-council.org/e-books/>

E book link R2: <https://101blockchains.com/ebooks/blockchain-for-enterprise/>

R3 Web resources:

H W1. <https://www.coursera.org/specializations/blockchain>.

W2. <https://nptel.ac.in/courses/106105184/>

W3. [https://swayam.gov.in/nd1\\_noc20\\_cs01/preview](https://swayam.gov.in/nd1_noc20_cs01/preview)

Topics relevant to development of “EMPLOYABILITY SKILLS”: Byzantine  
Generals, Public-Key Cryptography, Bitcoin Blockchain, Incentive Model, Ethereum  
Structure, Ethereum Blockchain, for developing Employability Skills through Participative  
learning techniques. This is attained through assessment components mentioned in course  
handout.

Course Code: CSE 3108	Course Title: Expert Systems Course type : Theory Only	L- T-P- C	3-0	0	3
Version No.	1.0				
Course Pre- requisites	“CSE 3108 – Expert systems” course				
Anti-requisites	NIL				
Course Description	The purpose of this course is to present the concepts of intelligent agents, searching, knowledge and reasoning, planning, learning and expert systems, to study the idea of intelligent agents and search methods, to study about representing knowledge, to study the reasoning and decision making in uncertain world, to construct plans and methods for generating knowledge, to study the concepts of expert systems.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Expert Systems and attain Employability through Participative Learning techniques .				

Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>CO1: Describe the modern view of AI as the study of agents that receive percepts from the Environment and perform actions.</p> <p>CO2: Demonstrate awareness of informed search and exploration methods.</p> <p>CO3: Explain about AI techniques for knowledge representation, planning and uncertainty Management.</p> <p>CO4: Develop knowledge of decision making and learning methods.</p>			
Course Content:				
Module 1	Introduction	Assignment	Theory	9 Hours
<p>Topics:</p> <p>Introduction to AI: Intelligent agents – Perception –</p> <p>Natural language processing – Problem – Solving agents – Searching for solutions: Uniformed search strategies – Informed search strategies.</p>				
Module 2	Knowledge and Reasoning	Assignment	Theory	9 Hours
<p>Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents: Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic.</p>				
Module 3	Uncertain knowledge and Reasoning	Assignment	Theory	8 Hours
<p>Uncertainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye's rule – Probabilistic reasoning – Making simple decisions.</p>				
Module 4	Planning and Learning	Assignment	Theory	9 Hours
<p>Planning: Planning problem – Partial order planning – Planning and acting in non-deterministic domains –</p> <p>Learning: Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning – Passive and active.</p>				

Module 5 Systems	Expert Assignment 10hrs	Theory
Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN.		
Targeted Application & Tools that can be used:		
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course		
Text Book		
Stuart Russel and Peter Norvig, 'Artificial Intelligence A Modern Approach', Second Edition, Pearson Education, 2003 / PHI.		
2. Donald A.Waterman, 'A Guide to Expert Systems', Pearson Education.		
References		
1. George F.Luger, 'Artificial Intelligence – Structures and Strategies for Complex Problem Solving', Fourth Edition, Pearson Education, 2002.		
2. Elain Rich and Kevin Knight, 'Artificial Intelligence', Second Edition Tata McGraw Hill, 1995.		
3. Janakiraman, K.Sarukesi, 'Foundations of Artificial Intelligence and Expert Systems', Macmillan Series in Computer Science.		
4. W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2003.		
Links :		
pu.informatics.global, <a href="https://sm-nitk.vlabs.ac.in/">https://sm-nitk.vlabs.ac.in/</a>		
Topics relevant to “EMPLOYABILITY SKILLS”: Optimal and imperfect decisions, Logical agents, for developing Employability Skills through Participative Learning Techniques. This is attained through Review of digital/e resource as mentioned in course handout.		

Course Code: CSE 3025	Course Title: Industry Use Cases using Blockchain Type of Course: Theory Only	L-T-P-C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	Data structures, Distributed Systems, Cryptography				
Anti-requisites	NIL				
Course Description	The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Blockchain have now spread from cryptocurrencies to various other domains, including business process management, smart contracts, IoT and so on. This course is a joint venture from academia and industry, where the target is to cover both the conceptual as well as application aspects of Blockchain. This includes the fundamental design and architectural primitives of Blockchain, the system and the security aspects, along with various use cases from different application domains.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of : Industry Use Cases using Blockchain and attain Employability through Participative Learning techniques.				
Course Out Comes	Describe what the Blockchain does  Evaluate if Blockchains are useful for a particular application  Demonstrate the application of hashing and public key cryptography in protecting the blockchain  Explain the elements of trust in a Blockchain: validation, verification, and consensus.  Develop smart contracts in Ethereum framework.				
Course Content:					
Version No.	1.0				
Module 1	Introduction to Blockchain	Assignment	Knowledge, Quizzes	No. of Classes:9	
Topics:					

Basic ideas behind blockchain, how it is changing the landscape of digitalization, Bitcoin eco system -,peer - to - peer permission less network addresses in bitcoin. Transactions : syntax , structures, and validation , Blocks - structure, Merkle tree and validation, Cryptographic Hash Functions, Hash Pointers and Data Structures, Mining : target/difficulty, hash rates, consensus, forking.

Assignment: Blockchain Architecture and Components in the blockchain.

Module 2	Tiers of Blockchain Technology	Assignment	Application, Quizzes	No. of Classes:8
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Topics:

Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains. Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles, Introduction to Bitcoin Blockchain, task of Bitcoin miners, Mining Hardware, Bitcoin network, Limitations and improvements.

Assignment: Bitcoin Blockchain and use cases.

Module 3	Cryptographic Applications in Blockchain	Case Study	Application, Quizzes	No. of Classes:10
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Topics:

Wallets - hash functions - public key cryptography - elliptic curve cryptography - digital signatures Introduction to Aneka, Framework overview, Anatomy of the Aneka container, Building Aneka clouds, Cloud programming, and management.

Case Study: Use of Cryptography in Blockchain.

Module 4	Types of Consensus Algorithms	Case study	Application, Quizzes	No. of Classes:10
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Topics:

Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposit-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Smart Contracts- Objectives and

<p>principles for the design of Blockchain systems, Understanding Ethereum, Ethereum Basics , Writing smart contracts using Ethereum, issues and Needs of Blockchain, Benefits and Challenges of Blockchain Implementation</p> <p>Case Study: Blockchain Use Case: Supply Chain Management, Smart Health Care, Transportation</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Private Blockchain, Health sector, Finance, Supply Chain Management</p> <p>Ethereum, Hyper ledger</p>
<p>Project work/Assignment:</p>
<p>Defend your blockchain analysis of real world systems and present relevant findings and arguments in a structured logical and compelling manner.</p> <p>9. Determine real world challenges that blockchain technologies may assist (or explain why not) in solving.</p>
<p>Textbook(s):</p> <p>Blockchain and Distributed Ledger Technology Use Cases: Applications and Lessons Learned Treiblmaier, Horst, and Trevor Clohessy ,1st ed. 2020 Edition, Kindle Edition</p> <p>Ritesh Modi, Solidity Programming Essentials : A beginner's guide to build smart contracts for Ethereum and blockchain, Packt Publishing Limited, 2018.</p>
<p>References:</p> <p>R1. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, 2016 .</p> <p>R2. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017.</p> <p>R3: Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014</p>
<p>Web Resources and Research Articles:</p>

<https://www.coursera.org/specializations/blockchain>.

<https://nptel.ac.in/courses/106105184/>

Introduction to Blockchain Technology and Applications:

[https://swayam.gov.in/nd1\\_noc20\\_cs01/preview](https://swayam.gov.in/nd1_noc20_cs01/preview)

<https://www.edx.org/course/blockchain-and-fintech-basics-applications-andlimitations>

Topics relevant to “EMPLOYABILITY SKILLS”: Hashing , public key cryptography, public and private blockchain, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2060	Course Title: Information Security and Management Type of Course: Theory Only Course	L- T-P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Data Communication and Computer Networks, Information Security, Database Management Systems and Concepts of cryptography.				
Anti-requisites					
Course Description	The course explores information security through some introductory material and helps gain an appreciation of the scope and context of information security. It includes a brief introduction to cryptography, security management, network and computer security. It allows a student to begin a fascinating journey into the study of information security and develop an appreciation of some key security concepts. The course concludes with a discussion of a simple model of the information security in industry and explores skills, knowledge and roles required for employability. A student will be able to determine and analyze potential career opportunities in this profession.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Information Security and Management and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  Describe the basic concept of information security. (Knowledge)  Explain the concepts and methods of cryptography. (Comprehension)				

	Demonstrate the aspects of risk management. (Application)			
Course Content:				
Module 1	Information Security Management:	Assignment	Data Collection/Interpretation	10 Sessions
Topics: Information Security Overview, Threat and Attack Vectors, Types of Attacks, Common Vulnerabilities and Exposure (CVE), Security Attacks, Fundamentals of Information Security, Computer Security Concerns, Information Security Measures.				
Module 2	Fundamentals of Information Security and Data Leakage	Case studies / Case let	Case studies / Case let	13 Sessions
Topics: Key Elements of Networks, Logical Elements of Networks, Critical Information Characteristics, Information States. What is Data Leakage and Statistics, Data Leakage Threats, Reducing the Risk of Data Loss, Key Performance Indicators (KPI), Database Security.				
Module 3	Information Security Policies and Management	Case studies / Case let	Case studies / Case let	14 Sessions
Topics: Information Security Policies-Necessity-Key Elements and Characteristics, Security Policy Implementation, Configuration, Security Standards-Guidelines and Frameworks, Security Roles and Responsibilities, Accountability, Roles and Responsibilities of Information Security Management, Team Responding to Emergency Situation- Risk Analysis Process.				
<p>Targeted Application &amp; Tools that can be used:</p> <p>An ISMS is a systematic approach to managing sensitive company information so that it remains secure. It includes people, processes and IT systems by applying a risk management process.</p> <p>It can help small, medium and large businesses in any sector keep information assets secure.</p> <p>The ISO 27000 family of standards helps organizations keep information assets secure.</p>				



<p>Using this family of standards will help your organization manage the security of assets such as financial information, intellectual property, employee details or information entrusted to you by third parties.</p> <p>ISO/IEC 27001 is the best-known standard in the family providing requirements for an information security management system (ISMS).</p>
Project work/Assignment:
Assignment:
<p>Text Book</p> <p>T1 Management of Information Security by Michael E.Whilman and Herbert J.Mattord</p> <p>T2 Information Security: The Complete Reference, Second Edition, 2nd Edition. by Mark Rhodes-Ousley. Released April 2013. Publisher(s): McGraw-Hill.</p> <p>.</p>
<p>References</p> <p>R1 Title, Cryptography &amp; Network Security (Sie) 2E. Author, Forouzan. Publisher, McGraw-Hill Education (India) Pvt Limited.</p> <p>R2 Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices. Nina Godbole.</p> <p>E book link R1: <a href="http://www.iso.org/iso/home/standards/management-standards/iso27001.html">http://www.iso.org/iso/home/standards/management-standards/iso27001.html</a></p> <p>E book link R2: <a href="http://csrc.nist.gov/publications/nistpubs/800-55-Rev1/SP800-55-rev1.pdf">http://csrc.nist.gov/publications/nistpubs/800-55-Rev1/SP800-55-rev1.pdf</a></p> <p>WEBLINKS: <a href="http://pu.informatics.global">pu.informatics.global</a> , <a href="https://sm-nitk.vlabs.ac.in">https://sm-nitk.vlabs.ac.in</a>.</p>
<p>Topics relevant to development of “SKILL DEVELOPMENT”: Security Policy Implementation, Security Roles, for development of Skill Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.</p>

Course Code: CSE3086	Course Title: Information Theory and Coding	L-T-P-C	3-0	0	0
	Type of Course: Theory Only				
Version No.	1.1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	<p>Information Theory is the science for measuring, preserving, transmitting, and estimating information in random data. It was initially proposed by Shannon as a mathematical theory of communication more than five decades ago. It provides the fundamental limits of performance for transmission of messages generated by a random source over a noisy communication channel. On the one hand, Information Theory has been the driving force behind the revolution in digital communication and has led to various practical data compression and error correcting codes that meet the fundamental theoretical limits of performance. On the other hand, over the years, techniques and concepts from Information Theory have found applications well beyond communication theory. In this course, we will introduce the basic notions and results of Information Theory, keeping in mind both its fundamental role in communication theory and its varied applications beyond communication theory. This course, and the follow-up advanced courses to be offered in the future, will be of interest to students from various backgrounds.</p>				
Course Objective	<p>The objective of the course is to familiarize the learners with the concepts of Information Theory and Coding and attain Employability through Problem Solving Methodologies.</p>				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Calculate the entropy of Zero memory; Analyze Markov sources and Apply the properties of Entropy for a given source statistic.</p> <p>For the given source message, Determine the code words and Calculate coding efficiency using Shannon, Shannon-Fano, Huffman and Arithmetic coding algorithm for memoryless sources given the source statistics and LZ algorithm for sources with memory.</p> <p>Determine and Analyze the channel entropies, mutual information and the channel capacities for Discrete Memoryless Channels for the given channel diagram or channel matrix and to Discuss Shannon Hartley Law and Shannon's limit.</p> <p>For the given <math>(n, k)</math> Linear Block Codes and Binary Cyclic Codes Determine the code words, syndrome, error detecting &amp; correcting</p>				

	<p>capability of the code and the corrected received vector; Design a single error correcting Linear Block Code for the given message length.</p> <p>Evaluate the code words for a given <math>(n, k, m)</math> convolution encoder and Use Sequential search and Viterbi algorithm to decode the information from the given received vector and Discuss BCH, RS, Golay, shortened cyclic, burst error correcting, Burst and Random error correcting codes and Turbo codes.</p>	
Course Content:		
Module 1	Information Theory	8 Sessions
<p>Topics:</p> <p>Introduction, Measure of information, Average information content (entropy) of symbols in long independent sequences, Information rate, Properties of entropy, Extension of discrete memory less (zero-memory) sources, Average information content (entropy) of symbols in long dependent sequences, Mark off statistical model for information source, Entropy and information rate of Mark off sources.</p>		
Module 2	Source Coding	8 Sessions
<p>Topics:</p> <p>Properties of codes- Block codes, on-singular codes, Uniquely decodable codes. Instantaneous codes and Optimal codes, Prefix of a code, Test for instantaneous property, Construction of Instantaneous code, Decision tree, Kraft's inequality, Source coding theorem (Shannon's Noiseless coding theorem), Shannon's encoding algorithm, Shannon Fano Algorithm, Huffman minimum redundancy code (binary, ternary and quaternary), Code efficiency and redundancy, Extended Huffman Coding, Arithmetic Codes, Lempel – Ziv Algorithm.</p>		
Module 3	Channels and Mutual Information	8 Sessions
<p>Topics:</p> <p>Introduction, Discrete communication channels, Representation of a channel, Probability relations- Apriori, Posteriori entropy, Equivocation, Mutual information, Properties, Rate of information transmission over a discrete channel, Capacity of a discrete memoryless channel, Shannon's theorem on channel capacity (Shannon's second theorem), Special channels- Symmetric, Binary symmetric, Binary erasure, Noiseless, Deterministic and cascaded channels, Estimation of channel capacity by Muroga's method, Continuous channels, Shannon-Hartley theorem and its implications, Shannon's limit, Rate Distortion Theory.</p>		
Module 4	Linear Block Codes	8 Sessions
<p>Topics:</p> <p>Introduction to Fields and Vector Spaces, Types of errors, Examples, Methods of controlling errors, Types of codes, Linear Block Codes- Matrix description, Encoding circuit, Syndrome and error detection, Syndrome circuit, hamming weight, hamming distance, Minimum distance of a block code error detection and correction capabilities of a</p>		

linear block code, Single error-correcting Hamming codes, Table lookup decoding using standard array, General decoder for a linear block code. Binary cyclic codes: Algebraic structures of cyclic codes, Encoding using (n-k) bit shift register, Syndrome calculation.
<p>Text Book</p> <p>T1- K. Sam Shanmugham, "Digital and Analog Communication Systems", John Wiley Publications, 1996.</p> <p>T2- Simon Haykin, "Digital Communications", John Wiley Publications, 2003.</p> <p>T3-. Shu Lin, Daniel J. Costello, "Error Control Coding", Pearson / Prentice Hall, 2nd Edition, 2004.</p>
<p>References</p> <p>R1-Muralidhar Kulkarni and K. S. Shivaprakash, "Information Theory and Coding", Wiley (India), 2015.</p> <p>R2-Glover and Grant, "Digital Communications", Pearson 2nd Edition, 2008.</p> <p>R3-Abramson, "Information Theory &amp; Coding", McGraw-Hill, 1963.</p> <p>Weblinks: <a href="http://pu.informatics.global">pu.informatics.global</a>.</p>
Topics relevant to development of "EMPLOYABILITY SKILL": Algebraic structures of cyclic codes, Encoding using (n-k) bit shift register, Syndrome calculation, for developing Employability Skills through Problem Solving Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE305	Course Title: Parallel Computing Type of Course: Theory Only	L-T- P- C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	Computer Organization and Architecture, Algorithms and Operating Systems, Some Networking concepts				
Anti-requisites	NIL				
Course Description	This is an introductory course to Parallel Computing. The purpose of this Course is to understand the motivation for Parallel Computing and the concept of Parallel Computing. It also exposes the various Models of Parallel Computers and their interconnections and how computations can be performed using Parallel Algorithms and Parallel Programming Models like OpenMP and MPI.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Parallel Computing and attain Employability through Problem Solving techniques				

Course Out Comes	On successful completion of this course the students shall be able to: Classify Parallel Systems Employ a Parallel Algorithm for the given Problem Demonstrate the usage of Parallel Programming Tools			
Course Content:				
Module 1	Motivation, History & Scope of Parallel Computing, Concurrency	Assignment	Write about parallel computing application areas	7 Sessions
Topics: The significance of parallel computing, Motivating parallelism, scope and applications, types of computing – concurrent, parallel and distributed computing; Types of Parallel Systems: Shared Memory Systems and Distributed Memory Systems; Parallelism in uniprocessor systems – Implicit parallelism - pipelining and superscalar execution, Parallel processing mechanisms, Parallel Computer structures – pipeline computers, array processors, multiprocessor systems				
Module 2	Parallel Hardware	Assignment	Programming activity using OpenMP	10 Sessions
Flynn's Classification – SIMD , MIMD, interconnection networks, Performance evaluation criteria, The Effect of Granularity on Performance, Message-Passing Programming, Send and Receive Operations, Interconnection networks, Shared memory interconnects: Bus, Crossbar; Distributed Memory Model, Basic communication operations-One to all Broadcast and All to one Reductions, Ring, Mesh, Hypercube				
Module 3	Parallel Software, I/O, Performance, Parallel Algorithm Design	Case Study	Application of Foster's design methodology to Boundary Value problem	10 Sessions
Introduction to Decomposition, tasks and dependency graphs; granularity, concurrency and task interaction; Processes and mapping; processes versus processors; Decomposition techniques – recursive decomposition, data decomposition, exploratory decomposition, speculative decomposition, hybrid decomposition; Characteristics of tasks and interactions; Parallel algorithm models – data parallel, task graph, work pool, master slave, producer-consumer, hybrid models				
Module 4	Parallel Programming	Assignment	Programming activity using MPI	10 Sessions
Modelling parallel computation: Multiprocessor Models- Random-Access Machine, The Local-Memory Machine, The Memory-Module Machine, Parallel Programming Models: Shared Memory Model, Shared programming model with OpenMP, Message Passing				

Models, Message passing interface, MPI_init, MPI_Comm_rank, MPI_finalize, Running MPI Programs, collective Communication
Targeted Application & Tools that can be used: OpenMP programming
<p>Text Book</p> <p>T. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, “Introduction to Parallel Computing”, 2nd edition. Noida, India: Pearson Education, Ltd., 2003.</p> <p>Web Links:</p> <p>Technology Enabled Learning - NPTEL offers as Course on “Introduction to Parallel Programming in OpenMP” by Yogish Sabharwal, IIT, Delhi.</p> <p><a href="https://swayam.gov.in/nd1_noc19_cs45/preview">https://swayam.gov.in/nd1_noc19_cs45/preview</a> Students can enroll for the course that starts on 26th Aug – 20th Sep, 2019.</p> <p><a href="https://nptel.ac.in/courses/105105157">https://nptel.ac.in/courses/105105157</a></p> <p><a href="https://puniversity.informaticsglobal.com:2229/login.aspx">https://puniversity.informaticsglobal.com:2229/login.aspx</a></p>
<p>References</p> <p>Michael J Quinn, “Parallel computing: Theory and Practice”, 2nd edition. New Delhi, India: Tata MacGraw Hill Education Private Limited, 2002.</p> <p>Michael J Quinn, “Parallel Programming in C with MPI and OPENMP”, Indian edition. Chennai, India: Tata MacGraw Hill Education (India) Private Limited, 2004.</p> <p>Kai Hwang, Faye A. Briggs, “Computer Architecture and Parallel Processing”, Indian edition, New Delhi, India: MacGraw Hill Education (India) Private Limited, 2012</p> <p>Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, Burlington, USA, 2011.</p> <p>V.Rajaraman, C. Siva Ram Murthy, "Parallel Computers: Architecture and Programming", 2nd edition, PHI Learning Private Limited, Delhi, India, 2016.</p>
Topics relevant to “EMPLOYABILITY SKILLS”: Shared Memory Systems and Distributed Memory Systems, Data Parallelism, Functional Parallelism, Pipelining, Flynn’s Classification, SIMD systems, MIMD systems, for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE3033	Course Title: INFORMATION VISUALIZATION  Type of Course: Integrated	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Basic Programming Concepts.				
Anti-requisites	NIL				
Course Description	This course offers foundational principles, methods, and techniques of visualization to enable creation of effective information representations suitable for exploration and discovery. Covers the design and evaluation process of visualization creation, visual representations of data, relevant principles of human vision and perception, and basic interactivity principles.				
Course Objective	The objective of the course is to familiarize the learners with the concepts Of Information Visualization and attain Employability through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to  CO 1: Choose appropriate visualization methods for a given data type.  CO 2: Implement interactive visualization interface for different types of data such as time oriented, textual, and spatial.  CO 3: Design an effective visualization using design and human perception principles.				
Course Content:					
Module 1	Data Visualization & Techniques	Quiz	Data Collection/Interpretation	08 Sessions	
Topics:  Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Human Visual Perception, Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data.					
Module 2	Visual Analysis of data from various domains	Assignment	Programming	09 Sessions	
Topics:  Time-oriented data visualization – Spatial data visualization and case studies, Text data visualization – Multivariate data visualization, and case studies,					
Module 3	Designing Effective Dashboard	Assignment	Programming	09 Sessions	

	and Visual Story Telling			
<p>Topics:</p> <p>Guidelines for designing successful visualizations, Data visualization dos and don'ts, Dashboard Design principles, Effective Dashboard Display Media, Dashboard creation using visualization tools for the use cases: Finance- marketing-insurance-healthcare etc.</p>				
List of Laboratory Tasks:				
<p>Targeted Application &amp; Tools that can be used</p> <p>Targeted application: Business intelligence tools.</p> <p>Tools: Tableau, Google data studio, Openheatmap</p>				
Project work/Assignment:				
Assignment: Programming				
<p>Text Book</p> <p>T1 Tamara Munzer, "Visualization Analysis and Design", CRC Press, 2018.</p> <p>T2 Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", CRC Press, Second Edition, 2015.</p>				
<p>References</p> <p>R1 Stephen Few, "Now You See It", Analytics Press, 2019. .</p> <p>R2 Stephen Few, "Information Dashboard Design: the effective visual communication of data", Oreilly, 2016.</p> <p>Web resources: <a href="https://www.coursera.org/specializations/information-visualization">https://www.coursera.org/specializations/information-visualization</a> , <a href="https://presiuniv.knimbus.com">https://presiuniv.knimbus.com</a></p>				
<p>Topics relevant to development of "EMPLOYABILITY SKILLS": Human Visual Perception, Effective Dashboard Display, for development of Employability Skills through Experiential Learning techniques. This is attained through assessment component as mentioned in course handout.</p>				



Course Code: CSE3102	Course Title: Malware Analysis Type of Course:Discipline Elective in Cyber Security Basket	L- T-P- C	3	-0	0	3
Version No.	1.0					
Course Pre-requisites	Should Have the knowledge of Cryptography and Network Security					
Anti-requisites	NIL					
Course Description	The purpose of the course is to explore malware analysis tools and techniques in depth. Understanding the capabilities of malware is critical to an organization's ability to derive threat intelligence, respond to information security incidents, and fortify defenses. This course builds a strong foundation for reverse-engineering malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger, and other tools useful for turning malware inside-out.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Malware Analysis and attain Employability through Participative Learning techniques.					
Course OutComes	On successful completion of this course the students shall be able to:  Understanding the nature of malware, its capabilities, and how it is combated through detection and classification.  Apply the methodologies and tools to perform static and dynamic analysis on unknown executables.  Analyze scientific and logical limitations on society's ability to combat malware..  Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti analysis techniques in future malware samples.					
Course Content:						
Module 1	Introduction to MALWARE ANALYSIS		Assignment	Programming activity	12 Hours	
Topics:  Introduction to malware, OS security concepts, malware threats, evolution of malware, malware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.  Assignment: Brief study on types of spyware						

Module 2	Static Analysis		Assignment	Programming activity	11 Hours
<p>Topics:</p> <p>X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture</p> <p>Assignment: Static analysis on malware (PeStudio &amp; ProcMon)</p>					
Module 3	Dynamic Analysis		Assignment	Programming activity	11 Hours
<p>Topics:</p> <p>Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark</p> <p>Assignment: Demonstration of wireshark</p>					
Module 4	Malware Functionality and Detection Techniques		Assignment	Programming activity	12 Hours
<p>Topics:</p> <p>Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.</p> <p>Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences</p> <p>Assignment: Packet malware signature</p>					
Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)					
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course					
Any appropriate tool can be given to demonstrate.					

<p>Text Book</p> <p>Michael Sikorski and Andrew Honig, 2012: “ Practical Malware Analysis”, No Starch Press.</p> <p>E-Resources</p> <p>W1. <a href="https://www.geeksforgeeks.org/introduction-to-malware-analysis/">https://www.geeksforgeeks.org/introduction-to-malware-analysis/</a></p> <p>W2. <a href="https://ine.com/learning/courses/malware-analysis">https://ine.com/learning/courses/malware-analysis</a></p> <p>W3: <a href="https://sm-nitk.vlabs.ac.in/">https://sm-nitk.vlabs.ac.in/</a></p>
<p>References</p> <p>Jamie Butler and Greg Hoglund, 2005: “Rootkits: Subverting the Windows Kernel”, Addison-Wesley.</p> <p>Dang, Gazet and Bachaalany, 2014: “Practical Reverse Engineering”,Wiley.</p> <p>Reverend Bill Blunden, 2012: “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System” Second Edition,Jones&amp; Bartlett.</p>
<p>Topics relevant to “EMPLOYABILITY SKILLS”: X86 Architecture, Packet Sniffing, Wireshark, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.</p>

Course Code: CSE3129	Course Title: Middleware Technologies		3 -0	0	3
	Type of Course: Program Core Theory Based Course	L- T- P- C			
Version No.	1.0				
Course Pre-requisites	Familiarity with basics of Internet technologies would be essential.				
Anti-requisites	NIL				

Course Description	The main objective of the course is to create a practical, wide-ranging discussion on Middleware Technologies to help students understand what is going on so they can pick out the real issues from the imaginary issues and start building complex distributed systems with confidence.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Middleware Technologies and attain Employability through Participative Learning techniques.			
Course Outcomes	<p>At the end of the course the student will be able to</p> <p>Learn how to use Middleware to Build Distributed Applications</p> <p>Implement Business Processes</p> <p>Learn about Middleware Technologies</p> <p>Implement Business Processes</p> <p>Learn application design and IT architecture</p>			
Course Content:				
Module 1		Case studies		9 Hours
<p>Topics:</p> <p>Moving to e-business, what is IT architecture? Why is this different from what we did before? Rewrite or evolve? Who develops the architecture? Early days, Preliminaries, Remote procedure calls, Remote database, Distributed transaction processing, Message queuing, Message queuing versus distributed transaction processing, what happened to all this technology? OBJECTS, COMPONENTS, AND THE WEB: Using object middleware, Transactional component middleware, COM, EJB, Final comments on TCM, Internet Applications. WEB SERVICES: Service concepts, Web services, and Using Web services: A pragmatic approach.</p>				
Module 2		Case studies		9 Hours
<p>Topics:</p> <p>Middleware elements, the communications link, the middleware protocol, the programmatic interface, Data presentation, Server control, Naming and directory services, Security, System management, Comments on Web services, Vendor architectures, Vendor platform architectures, Vendor distributed architectures, Using vendor architectures, Positioning, Strawman for user target architecture, Marketing, Implicit architectures, Middleware interoperability.</p>				
Module 3		Quiz		9 Hours
<p>Topics:</p> <p>What is middleware for? Support for business processes, Information retrieval, Collaboration, Tiers, The presentation tier, The processing tier, The data tier, Services versus tiers, Architectural choices, Middleware bus architectures, Hub architectures, Web services architectures, Loosely coupled versus tightly coupled.</p>				

Module 4		Case studies		9 Hours
<p>Topics:</p> <p>What is a process? Business processes, Information and processes, Architecture process patterns, Clarification and analysis, Error Handling, Timing, Migration, Flexibility.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>To design and develop distributed application.</p>				
<p>Project work/Assignment:</p>				
<p>Project Assignment: NIL</p> <p>Assignment 1: Paper Review of distributed application using web services</p>				
<p>Text Books</p> <p>Chris Britton and Peter Eye, "IT Architectures and Middleware: Strategies for Building Large, Integrated Systems", 2nd Edition, Pearson Education, 2004.</p>				
<p>References</p> <p>1. Qusay H. Mahmoud, "Middleware for Communications", 1st Edition, John Wiley and Sons, 2004. 2. Michah Lerner, "Middleware Networks: Concept, Design and Deployment of Internet Infrastructure", 1st Edition, Kluwer Academic Publishers, 2000.</p>				
<p>Topics relevant to "EMPLOYABILITY SKILLS": Middleware Protocol, Architecture process patterns, for developing Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.</p>				

Course Code: CSE3009	Course Title: Optimization Techniques for Machine Learning  Type of Course: Discipline Elective in Artificial Intelligence and Machine Learning Basket  Theory	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	CSE3008 Machine Learning Techniques				
Anti-requisites	NIL				
Course Description	<p>This course introduces a range of machine learning models and optimization tools that are used to apply these models in practice. Course will introduce what lies behind the optimization tools often used as a black box as well as an understanding of the trade-offs of numerical accuracy and theoretical and empirical complexity.</p> <p>For the students with some optimization background this course will introduce a variety of applications arising in machine learning and statistics as well as novel optimization methods targeting these applications.</p>				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Optimization Techniques for Machine Learning and attain Employability through Problem Solving Methodologies.				
Course Outcomes	<p>On successful completion of this course the students shall be able to:</p> <p>Describe fundamentals of Machine learning [Knowledge].</p> <p>Explain Machine learning models [Comprehension].</p> <p>Discuss Convex optimization models [Comprehension].</p> <p>Apply Methods for convex optimization [Application].</p>				
Course Content:					
Module 1:	Fundamentals of Machine learning	Quiz	Knowledge based Quiz	8 Sessions	
Topics: Machine learning paradigm, empirical risk minimization, structural risk minimization, learning guarantees, introduction of VC-dimension.					
Module 2:	Machine learning models	Quiz	Comprehension based Quiz	10 Sessions	

Topics: logistic regression, support vector machines, sparse regression, low dimensional embedding, low rank matrix factorization, sparse PCA, multiple kernel learning.				
Module 3	Convex optimization models	Assignment	Batch-wise Assignments	9 Sessions
Topics: linear optimization, convex quadratic optimization, second order cone optimization, semidefinite optimization, convex composite optimization				
Module 4:	Methods for convex optimization	Assignment and Presentation	Batch-wise Assignment and Presentations	11 Sessions
Topics: gradient descent, Newton method, interior point methods, active set, prox methods, accelerated gradient methods, coordinate descent, cutting planes, stochastic gradient.				
Targeted Application & Tools that can be used: Use of Matlab tool				
Project work/Assignment: Survey on Methods for convex optimization				
Text Book  T1. Charu C. Aggarwal, “ Linear Algebra and Optimization for Machine Learning”, Springer, 2020.  T2. Sra Suvrit, Nowozin Sebastian, and Wright Stephen J, “Optimization for Machine Learning”, The MIT Press, 2012.				
References  R1. Guanghui Lan, “First-order and Stochastic Optimization Methods for Machine Learning”, Springer Cham, 2020.  Web References  W1. <a href="https://sm-nitk.vlabs.ac.in/">https://sm-nitk.vlabs.ac.in/</a>  W2. <a href="https://nptel.ac.in/courses/">https://nptel.ac.in/courses/</a>				
Topics related to development of “EMPLOYABILITY SKILL”: Convex optimization models and Methods for convex optimization, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.				

Course Code: CSE3063	Course Title: Privacy and Security in IoT Type of Course: Program Core & Theory only	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	[1] The primary prerequisite is a working knowledge of basic algebraic number theory, which includes number fields, rings of integers, factorization of ideals into primes  [2] A working knowledge of basic algebraic number theory.  [3] Basic concepts of cryptography like encryption decryption, Signature generation and verifications.				
Anti-requisites	NIL				
Course Description	The purpose of this course is to enable the students to appreciate the need for cryptography and to identify the applications of cryptography in Internet of Things (IoT). The course is both conceptual and analytical in nature and needs fair knowledge of mathematics and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in IoT and attain Skill Development through Problem Solving Methodologies.				
Course Outcomes	On successful completion of this course the students shall be able to:  Explain benefits of modern cryptographic algorithms  Apply the Elliptic curve Diffie Hellman and digital signature algorithms to encrypt-decrypt , generate and verify the signatures  Estimate the performance of ECC with other traditional cryptography algorithms.				
Course Content:					
Module 1	Introduction to Elliptic Curves	Quiz	Comprehension based Quizzes and assignments;		15 Classes
Topics:  Elliptic Curve Cryptosystems (ECC): Introduction to ECC, Method of Diophantus, Elliptic curves in Cryptography, Discrete Logarithms in Finite Fields, Elliptic Curve on a finite set of Integers, Definition of Elliptic curves,General form of a EC, Weierstrass Equation, Points on the Elliptic Curve (EC),The Abelian Group, Operations on ECC- Point addition, Point doubling.					



Module 2	Elliptic Curve Cryptosystems	Quizzes and assignments	Comprehension based Quizzes and assignments;	15 Classes
<p>Topics:</p> <p>Elliptic Curve Cryptosystems (ECC): Public-Key Cryptosystems, Public-Key Cryptography, What Is Elliptic Curve Cryptography (ECC)?, Using Elliptic Curves In Cryptography, Generic Procedures of ECC, Example – Elliptic Curve Cryptosystem Analog to El Gamal, Diffie-Hellman (DH) Key Exchange, ECC Diffie-Hellman, Example – Elliptic Curve Diffie-Hellman Exchange, Elliptic Curve Digital Signature Algorithm (ECDSA) Why use ECC?, Security of ECC, Applications of ECC, Benefits of ECC.</p>				
Module 3	IIOT Protocols	Assignment and Lab projects with presentation	Project implementations in software, batch wise presentations	10 Classes
<p>Topics:</p> <p>IoT Communication model and Protocols :</p> <p>Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (COAP), Advanced Message Queuing Protocol (AMQP), Extensible Messaging and Presence Protocol (XMPP), Introduction, Principle of RFID, Components of an RFID system.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application areas are to secure crypto currency- Bitcoin, Ethereum and Ripple using ECC in key agreement, digital signatures.</p> <p>Professionally Used Software: elliptic2</p> <p style="text-align: center;">: <a href="https://www.graui.de/code/elliptic2/">https://www.graui.de/code/elliptic2/</a></p>				
<p>Project work/Assignment:</p> <p>Each batch of students (self-selected batch mates) will identify projects from searching on Google, and implement with the most suitable 2 or 3 NIST /SECP curves</p> <p>Project Assignment:</p> <p>Assignment: 1] Collect the running time of ECC on different standard NIST curves.</p> <p>Assignment 2: Prepare a compressive report on the efficiency of NIST Vs SECP curves.</p>				
<p>Textbook(s):</p> <p>I. Blake, G. Seroussi, N. Smart, Elliptic Curves in Cryptography , Cambridge University 2020</p> <p>Arshdeep Bagha, Vijay Madiseti, “Internet of Things - A hands on approach”, Universities Press, 2021.</p>				

References
Joseph H Silver man The Arithmetic of Elliptic Curves: Springer; 2nd Edition April 2016
Darrel Hankerson, Scott Vanstone, Alfred J. Menezes Guide to Elliptic Curve Cryptography Springer 2018
Topics related to development of “SKILL DEVELOPMENT”: IOT Protocols, Elliptic Curve Cryptosystem, for Skill Development through Participative Learning Techniques. This is attained through assessment components as mentioned in the course handout.

Course Code: CSE2038	Course Title: Privacy and Security in Online Social Media  Type of Course: Program Core & Theory Only	L-T-P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Basic of Network security and cryptography.					
Anti-requisites	NIL					
Course Description	Objective of this course is to make students learn the basics of privacy and security in online social media and develop ability to understand the importance of privacy in anyone's life and their consequences if it is in peril. This course is both conceptual and analytical in nature that would help the student to predict the effects of any activity on Social Media. The students should have prior knowledge of some Social media platforms. After successful completion of the Course, the students would acquire knowledge to protect themselves from the online data theft on social media from attacker.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in Online Social Media and attain Employability through Participative Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to:  1] Recognize the significance of the Privacy and how to protect it [Knowledge]  2] Summarize the privacy and security Encryption for Peer to Peer Social Networks. [Comprehension]					

	3] Understand the function of stealing Reality and K-Anonymity. [Knowledge]  4]Use the Link Reconstruction attack in privacy Social Networks. [Application]			
Course Content:				
Module 1	ANALYSIS OF PRIVACY IN SOCIAL NETWORKS	Assignment	Knowledge	8 Sessions
Topics:  Three-Layered Framework-Characteristics Used to Analyze Social Web Privacy-Privacy Issues Related to Social Web Users-Privacy Issues Related to Service Providers-Security and Privacy for Digital Facets-Identifiable Facets-Private Facets.  Assignment: Find real world problems and suggest solutions.				
Module 2	ENCRYPTION FOR PEER-TO-PEER SOCIAL NETWORKS	Assignment	Comprehension	8 Sessions
Topics:  Essential Criteria for the P2P Encryption Systems-Existing P2P OSN Architectures-Evaluations of Existing Encryption Schemes Based on Our Criteria-Broadcast Encryption-Predicate Encryption.  Assignment: - Survey of Unethical Behavior and Influencing factors.				
Module 3	STEALING REALITY AND K-ANONYMITY	Quiz	Comprehension	11 Sessions
Topics:  Stealing Reality- Social Attack Model- Social Learnability- k-Anonymity- k-Degree Anonymity- k-Neighborhood  Anonymity- k- Automorphism- k-Isomorphism-L-diversity- Attack Model and Privacy Guarantee- Insights from an $\ell$ -Diversified Graph.				
Module 4	PRIVACY IN SOCIAL NETWORKS- LINKS RECONSTRUCTION ATTACK	Assignment/Case study	Application	11 Sessions
Privacy in Social Networks- Link Prediction- Feature Extraction- Communities Datasets-Electronic Currencies- Anonymity- The Bit coin System- The Transaction Network- The User Network- Anonymity Analysis- Integrating Off-Network Information. Use Case and the Threat Model- Use Case for Private Record Linkage- Use Case for Privacy-Preserving Record Linkage-				

Assignment: - The Bit coin Faucet- Voluntary Disclosures- TCP/IP Layer Information- Context Discovery- Flow and Temporal Analyses.
<p>Text Book / References</p> <p>T1. Yaniv Altshuler, Yuval Elovici, Armin B. Cremers Nadav Aharony, Alex Pentland,” Security and Privacy in Social Networks”, Springer Publisher,2012,1st Edition</p> <p>Online Resources: -</p> <p>W1:  <a href="https://presiuniv.knimbus.com/user#/searchresult?searchId=Privacy%20and%20Security%20in%20Online%20Social%20Media%20&amp;curPage=0&amp;layout=list&amp;sortFieldId=none&amp;topresult=false">https://presiuniv.knimbus.com/user#/searchresult?searchId=Privacy%20and%20Security%20in%20Online%20Social%20Media%20&amp;curPage=0&amp;layout=list&amp;sortFieldId=none&amp;topresult=false</a></p> <p>W2: <a href="https://onlinecourses.nptel.ac.in/noc21_cs28/preview">https://onlinecourses.nptel.ac.in/noc21_cs28/preview</a></p> <p>Topics relevant to “EMPLOYABILITY SKILLS”: Link Prediction, features extraction, for developing Employability Skills through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.</p>

Course Code: CSE 2028	Course Title: Software Project Management Type of Course: Theory Only Course	L- T- P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Basics of Programming				
Anti-requisites					
Course Description	Effective software project management is crucial to the success of any software development or maintenance project. The roles and responsibilities of the project manager is numerous and varied. However, at the broad level, these can be classified in to the project planning and monitoring and control activities. Project planning involves making cost, effort, and duration estimation and preparing various types of plans such as schedule, configuration management, risk management, quality management. Staffing plan etc. The monitoring and control activities encompass keeping track of progress and removing bottlenecks using techniques such as PERT, GANTT, and also effective risk management, team building etc.				

Course Objective	The objective of the course is to familiarize the learners with the concepts of Software Project Management and attain Employability through Participative Learning techniques.			
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Understand the different project contexts and appropriate management strategy.</p> <p>Practice the role of professional ethics in successful software development.</p> <p>Identify the key phases of project management.</p> <p>Determine an appropriate project management approach through an evaluation of the business context and scope of the project.</p>			
Course Content:				
Module 1	Conventional & Modern Software Management	Assignment	Case studies	9 Sessions
<p>Topics:</p> <p>Waterfall Model, Conventional Software Management Performance; Evolution of Software Economics - Software economics, Pragmatic software cost estimation, Reducing software product size, Improving software processes. Principles of Conventional Software Engineering, Principles of Modern Software Management, Transitioning to an interactive Process.</p>				
Module 2	Software Management Process Framework	Case studies / Case let	Case studies	9 Sessions
<p>Topics:</p> <p>Life cycle phases, The artifact sets, Management artifacts, Engineering artifacts, Pragmatic artifacts; ModelBased Software Architectures - A management perspective and A technical perspective.</p>				
Module 3	Project Organization and Planning	Quiz	Case studies	10 Sessions
<p>Topics:</p> <p>Work breakdown structures, Planning guidelines, The cost and schedule estimating process, The iteration planning process, Pragmatic planning, Line-of-Business organizations, Project organizations, Evolution of organizations; Process automation - Automation building blocks, The project environment.</p>				

Module 4	Project Control and Process Instrumentation	Quiz	Case studies	10 Sessions
<p>Topics:</p> <p>PROJECT CONTROL AND PROCESS INSTRUMENTATION :The Seven-Core metrics, Management indicators, Quality indicators, Life-Cycle expectations, Pragmatic software metrics, Metrics automation, Modern project profiles, Next generation software economics, Modern process transitions.</p>				
Targeted Application & Tools that can be used:				
Project work/Assignment:				
Assignment:				
<p>Text Book</p> <p>T1. Walker Royce, "Software Project Management : A unified Framework", 1st Edition, Pearson Education, 2021</p>				
<p>References</p> <p>R1. Bob Hughes and Mike Cotterell, "Software Project Management", 3rd Edition, Tata McGraw Hill Edition, 2005.</p> <p>R2. Joel Henry, "Software Project Management", 1st Edition, Pearson Education, 2006.</p> <p>E book link T1:</p> <p><a href="https://www.edutechlearners.com/download/Software%20Project%20Management.pdf">https://www.edutechlearners.com/download/Software%20Project%20Management.pdf</a></p> <p>Web resources: <a href="https://onlinecourses.nptel.ac.in/noc19_cs70/preview">https://onlinecourses.nptel.ac.in/noc19_cs70/preview</a> Library resources: <a href="https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&amp;curPage=0&amp;layout=grid&amp;sortFieldId=doc_title_str&amp;topresult=false&amp;content=*software%20project%20management*&amp;sub_category_name=Computer%20Science%20and%20IT">https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&amp;curPage=0&amp;layout=grid&amp;sortFieldId=doc_title_str&amp;topresult=false&amp;content=*software%20project%20management*&amp;sub_category_name=Computer%20Science%20and%20IT</a></p>				
Topics relevant to development of "EMPLOYABILITY SKILLS": Life cycle Phases, Seven Core Metrics, for development of Employability Skills through the Participative Learning Techniques. This is attained through the assessment components mentioned in the course handout.				

Course Code: CSE250	Course Title: System Administration and IT Infrastructure  Type of Course:  Theory & Integrated Laboratory	L-T-P-C	2 -0	4	4
Version No.	1.0				
Course Pre-requisites	[1] Preliminary knowledge on cloud computing and services-CSE 233				
Anti-requisites	Nil				
Course Description	The main goal of this course is to study the fundamentals of system administration and infrastructure services such as Managing Operating system, Upgrading, installing, and configuring application software and computer hardware, Creating and managing system permissions and user accounts, performing regular security tests and security monitoring, Maintaining networks and network file systems. The course aims to introduce the popular cloud infrastructure services such as managing cloud resources, virtual machine usage and storage management. The student will also learn how to manage and configure servers and way of using industry tools to manage computers, user information, and user productivity. Finally, the student will learn how to recover your organization's IT infrastructure in the event of a disaster.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of System Administration and IT Infrastructure and attain Employability through Experiential Learning techniques .				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Demonstrate the knowledge of different directory services and how a centralized system admin can support different parts of IT Infrastructure.</p> <p>Apply the concepts of system administration to real life scenarios.</p> <p>Understand the working of user Management and Directory management commands.</p> <p>Demonstrate the knowledge of cloud infrastructure services.</p> <p>Identify appropriate methods of system recovery and back-up.</p>				
Course Content:					

MODULE 1	Introduction to System Administration	Quiz	Programming/ Problem Solving	05 Hours
<p>Topics:</p> <p>Define System Administration, Basics of system administration, organizational policies, IT infrastructure services, user and hardware provisioning, routine maintenance, troubleshooting, and managing potential issues. [Blooms 'level selected: Comprehension]</p>				
Module 2	Network and Infrastructure Services	Lab evaluation	Programming/ Problem Solving	06 Hours
<p>Topics:</p> <p>Introduction to network and infrastructure services, what IT infrastructure services are and what their role is in system administration, server operating systems, virtualization, network services, DNS for web services, and how to troubleshoot network services, introduction to system administration tasks. [ Blooms 'level selected: Comprehension]</p>				
Module 3	Software and Platform Services	Lab evaluation	Programming/Problem Solving	07 Hours
<p>Topics:</p> <p>Explore software and platform services, types of software and platform services such as configure email services, security services, file services, print services, and platform services. Explore the ways to troubleshoot platform services and common issues to look out for. To setup and manage the IT infrastructure services to help a business stay productive, keep information secure, and deliver applications to its users. [ Blooms 'level selected: Application]</p>				
Module 4	Directory Services	Lab evaluation/ Assignment	Programming/Problem Solving	07 Hours
<p>Topics:</p> <p>Learn about directory services -two of the most popular directory services, Active Directory and OpenLDAP, work in action. Explore the concept of centralized management and support in SysAdmins to maintain and support all the different parts of an IT infrastructure, how to add users, passwords, and use group policies in Active Directory and OpenLDAP. Introduction to RAID storage, Need of RAID storage, Types of Raid Storage in the cloud. [ Blooms 'level selected: Application]</p>				
Module 5	Data Recovery & Backups	Assignment	Programming /Problem Solving	05 Hours
<p>Topics:</p> <p>Data recovery and backups, Backup and recovery of data, explore common corporate practices like designing a disaster recovery plan and writing post-mortem documentation. Study the trade-offs between on-site and off-site backups, understand the value and importance of backup and recovery testing, know different options for data backup and</p>				



understand the purpose and contents of a disaster recovery plan. An introduction to edge computing- A new revolution in cloud computing. [ Blooms 'level selected: Comprehension]

List of Laboratory Tasks:

Experiment No 1: Demonstrate basic Commands, Visual Interface (Vi Editor), User and Group Administration. [6 hours: Application Level]

Level 1: Demonstrate Linux basic commands.

Experiment No. 2: Demonstrate the use of permissions, access control list, change ownership of files and directories, using simple Filters, advanced Filters. [ 4 hours: Application Level]

Level 1: Work with basic file permissions, access control list.

Experiment No. 3: Demonstrate the working of User Management, Directory management commands, Start-up & Shutdown scripts, Process management commands and their execution. [ 4 hours: Application Level]

Level 1: Understand use of User Management, Directory management commands.

Experiment No. 4: Demonstrate the working of Firewall configuration in Linux, Study of Important LINUX Services. [ 4 hours: Application Level]

Level 1: Understand use of Firewall configuration in Linux, Study of Important LINUX Services.

Experiment No. 5: Practicing of some sample Shell Script programs. [ 6 hours: Application Level]

Level 1: Working with shell script programs.

Experiment No. 6: Create an Amazon EC2 Instance (Linux) or use equivalent other cloud platform such as Google Cloud or Azure to create a virtual machine service. [ 8 hours: Application Level]

Level 1: Explore cloud infrastructure service.

Experiment No. 7: Create an Amazon S3 Bucket or use equivalent other cloud platform such as Google Cloud or Azure to create a storage service. [ 8 hours: Application Level]

Level 1: Explore cloud infrastructure service.

Experiment No.8: Configuring a Static Website with S3 and CloudFront. [ 6 hours: Application Level]

Level 1: Explore cloud infrastructure service.

Experiment No.9: Demonstrate the use of S3 Bucket Policies and Conditions to Restrict Specific Permissions. [ 8 hours: Application Level]

Level 1: Explore cloud infrastructure service.

Experiment No.10: Working with AWS Backup Services. [ 6 hours: Application Level]					
Level 1: Explore cloud infrastructure service.					
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application Area is to understand and apply concept of system administration and infrastructure services.</p> <p>Tools/Simulator used: Linux operating system, AWS cloud service subscription or equivalent cloud platform subscription.</p>					
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course					
<p>Problem Solving: Understanding different system administration services.</p> <p>Programming: Implementation of different cloud infrastructure services.</p>					
<p>Text Book</p> <p>AEleen Frisch, "Essential System Administration", Published by O'Reilly Media, 3rd Edition, 2014.</p> <p>Donald Coffelt, Chris Hendrickson, "Fundamentals of Infrastructure Management", Donald Coffelt and Chris Hendrickson, 2017.</p>					
<p>References:</p> <p>1. Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup, "The Practice of System and Network Administration", McGraw Hill Education, Pearson Education, Second Edition, 2022.</p> <p>2. IBM Information Infrastructure Solutions Handbook, June 2010, © Copyright International Business Machines Corporation.</p> <p>3. Hideo Nakamura, Kotaro Nagasawa, Kazuaki Hiraishi, Atsushi Hasegawa, KE Seetha Ram, Chul Ju Kim, and Kai Xu, "PRINCIPLES OF INFRASTRUCTURE-Case Studies and Best Practices", Mitsubishi Research Institute, Inc., 2019.</p>					
Topics relevant to "EMPLOYABILITY SKILLS": Demonstrate the use of permissions, access control list, change ownership of files and directories, using simple Filters for developing Employability Skills through Experiential Learning techniques. This is attained through the assessment component as mentioned in the course handout.					

Course Code:	Course Title: Network Programming	L-T-P-	0 -0	4	2
CSE257	Type of Course: Laboratory only	C			

Version No.	2.0
Course Pre-requisites	C language
Anti-requisites	NIL
Course Description	Network Programming intends to explore the opportunities for developing, maintaining and supporting distributed and network applications. The Course covers the basics of computer networks to designing and implementing networks.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Network Programming and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques
Course Outcomes	<p>On successful completion of this laboratory based course the students will be able to:</p> <ul style="list-style-type: none"> <li>Outline the basic network troubleshooting commands in windows/Linux.</li> <li>Configure various networks using cisco packet tracer tool.</li> <li>Demonstrate the working of client-server TCP/IP socket programming.</li> <li>Demonstrate the usage of Wireshark tool in networking.</li> <li>Simulate networking scenarios using NS2 simulator.</li> </ul>
Course Content:	
<p>List of Laboratory Tasks</p> <p>Task 1: Troubleshoot using network DOS command</p> <p>Task 2: Demonstration of Cisco Packet Tracer Tool</p> <p>2.1: Introduction to Cisco Packet Tracer</p> <p>2.2: User interface and simulation view</p> <p>2.3: Configure user name and password for the three modes in router</p> <p>2.4: Configure the DHCP Server using 2 wireless router</p> <p>2.5: Configure the TELNET Service for 2 different network</p> <p>2.6: Demonstrate the static routing with multiple networks using serial port and interface</p> <p>2.7: Demonstrate the RIP routing with multiple networks using serial port and interface</p> <p>2.8: Configure the Static and dynamic NAT for private network</p> <p>Task 3: Demonstrate the working of client-server TCP/IP socket programming</p>	

Task 4: Demonstrate the Wireshark tool Usage
Task 5: Demonstration of Network Simulator Version 2
<p>Targeted Application &amp; Tools that can be used:</p> <p>Simulate networking scenarios using Cisco Packet Tracer.</p> <p>Demonstrate the usage of Wireshark tool in networking.</p> <p>Practice the simulation-based network performance evaluation techniques using NS2.</p>
<p>Textbooks:</p> <p>1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2017.</p>
<p>References</p> <p>R1. "Network Simulation Lab Manual" Presidency University.</p> <p>E-Resource</p> <p>18 Most Popular Network Simulation Software Tools in 2022 (networkstraining.com)</p> <p>Virtual Labs (vlab.co.in)</p> <p>NPTEL course- Computer Networks and Internet Protocol - Course (nptel.ac.in)</p> <p>By Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty   IIT Kharagpur</p> <p><a href="https://puniversity.informaticsglobal.com/login">https://puniversity.informaticsglobal.com/login</a> Or <a href="http://182.72.188.193/">http://182.72.188.193/</a></p>
<p>Topics relevant to "SKILL DEVELOPMENT": Troubleshoot using network DOS command, Demonstration of Cisco Packet Tracer Tool for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.</p>

Course Code: CSE465	Course Title: Reinforcement Learning  Type of Course: Theory Only	L-T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Knowledge of programming in Python is required.				

	<p>Knowledge of probabilities/statistics, calculus and linear algebra is required.</p> <p>Machine learning background, as provided for example by COMP-551 or COMP-652 is required.</p>			
Anti-requisites	NIL			
Course Description	<p>The goal of this class is to provide an introduction to reinforcement learning, a very active research sub-field of machine learning. Reinforcement learning is concerned with building programs that learn how to predict and act in a stochastic environment, based on past experience. Applications of reinforcement learning range from classical control problems, such as power plant optimization or dynamical system control, to game playing, inventory control, and many other fields. Notably, reinforcement learning has also produced very compelling models of animal and human learning. During this course, we will study theoretical properties and practical applications of reinforcement learning. We will follow the second edition of the classic textbook by Sutton &amp; Barto (available online for free, or from MIT Press), and supplement it as needed with papers and other materials.</p>			
Course Objective	<p>The objective of the course is to familiarize the learners with the concepts of Reinforcement Learning and attain Skill Development through Problem Solving Methodologies.</p>			
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Knowledge of basic and advanced reinforcement learning techniques.</p> <p>Identification of suitable learning tasks to which these learning techniques can be applied.</p> <p>Appreciation of some of the current limitations of reinforcement learning techniques.</p> <p>Formulation of decision problems, set up and run computational experiments, evaluation of results from experiments.</p>			
Course Content:				
Module 1	Introduction	Assignment	Programming	No. of Classes:10
<p>Topics:</p> <p>Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning.</p> <p>Probability Primer</p> <p>Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.</p>				
Module 2	Markov Decision Process	Assignment	Programming	No. of Classes:10

<p>Topics:</p> <p>Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.</p>				
Module 3	Prediction and Control by Dynamic Programming	Assignment	Programming	No. of Classes:10
<p>Topics:</p> <p>Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions</p> <p>Monte Carlo Methods for Model Free Prediction and Control</p> <p>Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.</p>				
Module 4	TD Methods and Policy Gradients	Assignment	Programming	No. of Classes:10
<p>Topics:</p> <p>Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(<math>\lambda</math>), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.</p> <p>Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>While Convolution Neural Network (CNN) and Recurrent Neural Network (RNN) are becoming more important for businesses due to their applications in Computer Vision (CV) and Natural Language Processing (NLP), Reinforcement Learning (RL) as a framework for computational neuroscience to model decision making process seems to be undervalued. Besides, there seems to be very little resources detailing how RL is applied in different industries. Despite the criticisms about RL's weaknesses, RL should never be neglected in the space of corporate research given its huge potentials in assisting decision making.</p> <p>Tools: Torch, Google Colaboratory, Spider, Jupiter Notebook</p>				
Project work/Assignment:				
<p>This part is written for general readers. At the same time, it will be of greater value for readers with some knowledge about RL.</p> <p>Resources management in computer clusters</p> <p>Designing algorithms to allocate limited resources to different tasks is challenging and requires human-generated heuristics. The paper "Resource Management with Deep</p>				

Reinforcement Learning” [2] showed how to use RL to automatically learn to allocate and schedule computer resources to waiting jobs, with the objective to minimize the average job slowdown.

State space was formulated as the current resources allocation and the resources profile of jobs. For action space, they used a trick to allow the agent to choose more than one action at each time step. Reward was the sum of  $(-1/\text{duration of the job})$  over all the jobs in the system. Then they combined REINFORCE algorithm and baseline value to calculate the policy gradients and find the best policy parameters that give the probability distribution of actions to minimize the objective.

#### Traffic Light Control

Researchers tried to design a traffic light controller to solve the congestion problem. Tested only on simulated environment though, their methods showed superior results than traditional methods and shed a light on the potential uses of multi-agent RL in designing traffic system.

Five agents were put in the five-intersection traffic network, with a RL agent at the central intersection to control traffic signalling. The state was defined as eight-dimensional vector with each element representing the relative traffic flow of each lane. Eight choices were available to the agent, each representing a phase combination, and the reward function was defined as reduction in delay compared with previous time step. The authors used DQN to learn the Q value of the {state, action} pairs.

#### Robotics

There are tremendous works on applying RL in Robotics. Readers are referred to for a survey of RL in Robotics. In particular, trained a robot to learn policies to map raw video images to robot’s actions. The RGB images were fed to a CNN and outputs were the motor torques. The RL component was the guided policy search to generate training data that came from its own state distribution.

#### Web System Configuration

There are more than 100 configurable parameters in a web system and the process of tuning the parameters requires a skilled operator and numerous trial-and-error tests. The paper “A Reinforcement Learning Approach to Online Web System Auto-configuration” showed the first attempt in the domain on how to do autonomic reconfiguration of parameters in multi-tier web systems in VM-based dynamic environments.

The reconfiguration process can be formulated as a finite MDP. The state space was the system configuration, action space was {increase, decrease, keep} for each parameter, and reward was defined as the difference between the given targeted response time and measured response time. The authors used the model-free Q-learning algorithm to do the task.

#### Text Book

"Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, 2nd Edition

<p>"Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, Alberto Leon-Garcia</p> <p>"Machine Learning: A Probabilistic Perspective", Kevin P. Murphy</p>
<p>References</p> <p>Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019.</p> <p>Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).</p> <p>Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012):</p>
<p>E-Resources</p> <p>NPTEL course – <a href="https://onlinecourses.nptel.ac.in/noc19_cs55/preview">https://onlinecourses.nptel.ac.in/noc19_cs55/preview</a></p> <p><a href="https://archive.nptel.ac.in/courses/106/106/106106143/">https://archive.nptel.ac.in/courses/106/106/106106143/</a></p> <p><a href="https://www.digimat.in/nptel/courses/video/106106143/L35.html">https://www.digimat.in/nptel/courses/video/106106143/L35.html</a></p>
<p>Topics relevant to “SKILL DEVELOPMENT”: Real time Data Analysis using Reinforcement learning for Skill Development through Problem Solving techniques. This is attained through assessment component mentioned in course handout.</p>



Course Code: PIP103	Course Title: Professional Practice– II Type of Course: NTCC	L- T-P- C	-	-	-	15
Version No.	1.0					
Course Pre-requisites	Knowledge and Skills related to all the courses studied in previous semesters.					
Anti-requisites	NIL					
Course Description	<p>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 interpersonal 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.</p>					
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	<p>On successful completion of this course the students shall be able to:</p> <p>Identify the engineering problems related to local, regional, national or global needs.</p> <p>Apply appropriate techniques or modern tools for solving the intended problem.</p> <p>Design the experiments as per the standards and specifications.</p> <p>Interpret the events and results for meaningful conclusions.</p> <p>Appraise project findings and communicate effectively through scholarly publications.</p>					

Course Code: CSE3066	Course Title: Mobile Application for IoT  Type of Course: Program Core& Theory Only	L-T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Mobile Application is the essential part for IoT infrastructure, which helps in understanding the architectural overview of IOT. The purpose of this course is to expose the students to understand the IoT Reference Architecture and Real World Design Constraints along with various IOT protocols. This course is both conceptual and analytical in nature that would help the student to predict the effects of forces and its motion while carrying out creative design functions.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mobile and Application for IoT and attain Skill Development through Participative Learning techniques.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>Able to understand the application areas of IOT</p> <p>Able to realize the revolution of Internet in Mobile Devices, Cloud &amp; Sensor Networks</p> <p>Able to understand building blocks of Internet of Things and characteristics.</p> <p>Learn about android application development</p>				
Course Content:					
Module 1	Overview	Assignment	Programming Task		9 Sessions

<p>Topics:</p> <p>IoT-An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management</p> <p>Assignment: Case study on Business processes in IoT.</p>				
Module 2	Basic Design	Assignment	Data Collection/Excel	10 Sessions
<p>Topics:</p> <p>Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability.</p> <p>Assignment: Recent trends In mobile application development</p>				
Module 3	IOT mobile apps	Assignment	Programming/Data analysis task	9 Sessions
<p>Topics:</p> <p>IoT Mobile App Development Trends In 2020 - Role of Mobile Apps in revolutionizing the world of IoT - UX / UI design for IoT Mobile apps - challenges of UX/UI design for IoT applications - practice tips on design for IoT mobile apps IoT App Design Solutions</p> <p>Assignment: Challenges faced during mobile application development</p>				
Module 4	TECHNOLOGY I- ANDROID	Assignment	Programming/Data analysis task	10 Sessions
<p>Topics:</p> <p>Introduction Establishing the development environment Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment Interaction with server side applications Using Google Maps, GPS and Wifi Integration with social media applications.</p>				
<p>Targeted Protocols &amp; Tools that can be used:</p> <p>Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread</p>				

Text Book	
T1: "From machine to machine to the internet of things: Introduction to the new age of intelligence", 1st edition, Academic press, 2014.	
T2: Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012	
References	
R1: Bernd Scholz- -3-642-19156-5 e-ISBN 978-3- 642-19157-2, Springer	
R2: Andrea Goldsmith, "Android in practice," Cambridge University Press, 2005	
Weblinks:	
W1: <a href="https://relevant.software/blog/mobile-iot-apps/">https://relevant.software/blog/mobile-iot-apps/</a>	
W2: <a href="https://medium.com/@its.mattfitzgerald/top-14-iot-mobile-app-development-trends-to-expect-in-2020-7fd7718155dc">https://medium.com/@its.mattfitzgerald/top-14-iot-mobile-app-development-trends-to-expect-in-2020-7fd7718155dc</a>	
W3: <a href="https://puniversity.informaticsglobal.com/login?url=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-%2520live%26ebv%3dEB%26ppid%3dpp_xiii">https://puniversity.informaticsglobal.com/login?url=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-%2520live%26ebv%3dEB%26ppid%3dpp_xiii</a>	
Topics relevant to "SKILL DEVELOPMENT":	
Wifi integration and social media analysis for developing Skill Development through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.	
Catalogue prepared by	Ms. Suma N G
Recommended by the Board of Studies on	BOS NO: 1st, BOS held on 22/12/22 PU/AC-20.3/SOCSE01/CIT/2020-24
Date of Approval by the Academic Council	Academic Council Meeting No.20, Dated 15/02/23

Course Code: CSE3055	Course Title: Wireless communication in IOT  Type of Course: Program Core& Theory Only	L-T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Wireless communication system is the essential part for IoT infrastructure, which acts as the bridge for dual directional communication for data collection and control message delivery. The purpose of this course is to expose the students to understand the fundamentals of wireless network and problems related to real-world scenarios. This course is both conceptual and analytical in nature.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Wireless communication in IOT and attain Skill Development through Participative Learning techniques.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>To understand the fundamentals of wireless networks</p> <p>Analyze the standards of IoT which employed for wireless networks</p> <p>Explain the use of various wireless technologies in IoT</p> <p>Design and develop various applications of IoT</p>				
Course Content:					

Module 1	Cellular standards	Assignment	Programming Task	9 Sessions
Topics: Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells, Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE, UMTS), Mobile IP, WCDMA				

Assignment: Case study on generation cellular systems.				
Module 2	Radio Frequency (RF) Fundamentals	Assignment	Data Collection/Excel	10 Sessions
Topics: Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards, Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements, Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM. Assignment: Determination of RF and Microwave spectral Analysis				
Module 3	WLAN: Wi-Fi Organizations and Standards	Assignment	Programming/Data analysis task	9 Sessions
Topics: IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards, 802.11-2007, 802.11a/b/g, 802.11e/h/l, 802.11n Assignment: Protocols on WLAN connectivity				
Module 4	Wi-Fi Hardware & Software	Assignment	Programming/Data analysis task	10 Sessions
Topics:				

Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, Direct-connect Aps, Distributed connect Aps, PoE Infrastructure, Endpoint, Client hardware and software, Wi-Fi Applications
<p>Targeted Protocols &amp; Tools that can be used:</p> <p>Bluetooth, ZigBee, LoRa, NBloT, WiFi, and Thread</p>
<p>Text Book</p> <p>T1: Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd.</p> <p>T2: Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd.</p>
<p>References</p> <p>R1:Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi 4. R2:Wilson , “Sensor Technology hand book,” Elsevier publications 2005. 5.</p> <p>R3: Andrea Goldsmith, “Wireless Communications,” Cambridge University Press, 2005</p> <p>Weblinks:</p> <p>W1: <a href="https://pianalytix.com/wireless-communication-protocols-in-iot/">https://pianalytix.com/wireless-communication-protocols-in-iot/</a></p> <p>W2: <a href="https://behrtech.com/blog/6-leading-types-of-iot-wireless-tech-and-their-best-use-cases/">https://behrtech.com/blog/6-leading-types-of-iot-wireless-tech-and-their-best-use-cases/</a></p>
<p>Topics relevant to “SKILL DEVELOPMENT”:</p> <p>GSM, CDMA for developing Skill Development through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.</p>

Course Code: CSE 3053	Course Title: Big Data Analytics for IoT  Type of Course: Program Core Theory with embedded lab	L- T-P- C	1 -0	4	3
Version No.	1.0				
Course Pre-requisites					
Anti-requisites	NIL				
Course Description	The course covers basic concepts for IOT Analytics, collection of data for IOT, Integration of IOT with Cloud, Big Data Environments. Students can learn about applying geospatial analytics and applying machine learning to the IOT data. The course also covers the organization of the IOT data, cost benefits of using IOT and review of IOT in various sectors.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Big Data Analytics for IoT and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Outcomes	On successful completion of the course the students shall be able to:  CO1: Demonstrate IOT Data Analytics and machine learning application in IOT (Apply)  CO2: Apply appropriate Hadoop Ecosystem tools to perform data analytics for a given problem (Apply)  CO3: Examine concepts of cloud based IOT, Big data and IOT (Apply)  CO4: Illustrate techniques and strategies for data collection and Geospatial Analytics to IOT Data (Apply)				
Course Content:					
Module 1	IOT Analytics	Assignment		5 sessions	
Introduction – IOT Data, Challenges of IOT analytics Applications – IOT analytics Lifecycle and Techniques. IOT Cloud and Big Data Integration – Cloud based IOT platform – Data Analytics for IOT, IOT devices in different domains. IOT Analytics for the Cloud.					
Module 2	Hadoop Ecosystem Tools			5 sessions	
Introduction – Big Data and Big Data Analytics – Hadoop Ecosystem – Hadoop Distributed File System (HDFS) – MapReduce – YARN Architecture – PIG Architecture – Apache HIVE – Mahout – Apache Spark – Apache HBase –Apache Zookeeper.					



Module 3	Overview of AWS and Thingworx	Assignment		5 sessions
AWS overview - AWS key services for IOT analytics. Thingworx overview. Creating an AWS Cloud Analytics environment.				
Module 4	Geospatial Analytics to IOT Data	Case Study	Data Collection and Analysis	
Strategies and Techniques in Data collection: Designing data processing for analytics – Applying big data to storage for Geospatial.				
<p>List of Practical Tasks:</p> <p>Experiment 1:[Module 1]</p> <p>Level 1: Installation of Raspbian OS,working basic commands on raspberry pi</p> <p>Level 2: Demonstrate to obtain the temperature using DHT22 sensors .</p> <p>Experiment 2: [Module 1]</p> <p>Level 1: Design and Simulate the RADAR SYSTEM Using Arduino and display on the serial monitor using ultrasonic sensor/PIR WITH &amp;WITH OUT BUZZER/Servo motor</p> <p>Level 2: using a raspberry pi to Demonstrate to find the distance using ultrasonic sensor hc- sr04</p> <p>Experiment 3: [Module 1]</p> <p>Level 1 : using a raspberry pi Set the connections of healthcare sensors</p> <p>Level 2: using a raspberry pi to Demonstrate to find the ECG, Temperature, etc using Healthcare sensors</p> <p>Experiment 4: [Module 2]</p> <p>Level 1: Hadoop Single node cluster installation on ubuntu</p> <p>Level 2: Hadoop Multiple node cluster installation, windows installation</p> <p>Experiment 5: [Module 2]</p> <p>Level 1: Basic hadoop commands and Word count analysis for given dataset</p> <p>Level 2: Analysis on particular matching word on huge dataset</p> <p>Experiment 6: [Module 2]</p> <p>Level 1: Basic hadoop commands and Stock analysis on given dataset</p> <p>Level 2: Analysis with max, min, average functions on particular field with missing values</p>				

<p>Experiment 7: [Module 2]</p> <p>Level 1: Basic hadoop commands and Temperature analysis on given dataset</p> <p>Level 2: Analysis with max, min, average functions on particular field with missing values</p> <p>Experiment 8: [Module 3]</p> <p>Level 1: Working on hive commands</p> <p>Level 2: Apply bucketing technique to bring out the difference between partitioning and bucketing</p> <p>Experiment 9: [Module 3]</p> <p>Level 1: Working on Hbase commands .</p> <p>Level 2: Apply Hbase commands on Insurance database/employee dataset.</p> <p>Experiment 10: [Module 3]</p> <p>Level 1: Installation of spark and word count analysis</p> <p>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</p> <p>Experiment 11: [Module 4]</p> <p>Level 1: Temperature Data stored in cloud through IoT devices</p> <p>Level 2: Retrieve the data set for cloud and Apply data analytics techniques</p> <p>Experiment 12: [Module 4]</p> <p>Level 1: Healthcare Data stored through IoT sensors in Cloud</p> <p>Level 2: Retrieve the data set for cloud and Apply data analytics techniques</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Hadoop ecosystem tools, Thingworx , AWS Cloud</p>
<p>Project work/Assignment:</p>
<p>Student will be asked to carry out a mini project integrating IoT &amp; data Analytics.</p>
<p>Text Book</p> <p>T1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley., 2nd Edition, 2019.</p> <p>T2. Analytics for the Internet of things,Andrew Minter. Packt publishing, 1st Edition,2017.</p> <p>T3. Big Data and the Internet of Things, Robert Stackowiak, Art Licht, Venu Mantha and Louis Nagode, Apress, 2nd Edition, 2020</p>

References
R1. IOT and Analytics in Agriculture.,Prasant Kumar Pattnaik, Raghvendra Kumar, Souvik Pal, S. N. Panda. Springer, First Edition, 2020.
R2. Building blocks for IOT Analytics. Internet-of-Things Analytics. John Soldatos (Editor). River Publisher Series in Signal Image and Speech Processing.2020
(iii) web resources
W1. NPTEL: <a href="https://onlinecourses.nptel.ac.in/noc20_cs92/preview">https://onlinecourses.nptel.ac.in/noc20_cs92/preview</a>
W2. Coursera: <a href="https://www.coursera.org/learn/big-data-introduction">https://www.coursera.org/learn/big-data-introduction</a>
W3. EDX: <a href="https://www.edx.org/course/big-data-fundamentals">https://www.edx.org/course/big-data-fundamentals</a>
W4. E-book Link : <a href="https://www.wiley.com/en-us/Internet+of+Things+and+Data+Analytics+Handbook">https://www.wiley.com/en-us/Internet+of+Things+and+Data+Analytics+Handbook</a> -p-9781119173625
<a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a>
Topics relevant to “SKILL DEVELOPMENT”: Organize IOT data – Linked analytics datasets – Managing data lakes for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2032	Course Title: Introduction to Fog Computing Type of Course:1] Discipline Elective 2] Lab Integrated Course	L- P- T- C	3	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The course will provide a solid base for understanding the challenges and problems underlying the design and development of fog computing systems and applications. Thus, this course will teach how to specify, design, program, analyze and implement such systems and applications. Fog computing is a decentralized computing infrastructure in which data, compute, storage and applications are located somewhere between the data source and the cloud. Like edge computing, fog computing brings the advantages and power of the cloud closer to where data is created and acted upon. Many people use the terms fog computing and edge computing interchangeably because both involve bringing intelligence and processing closer to where the data is created. This is often done to improve efficiency, though it might also be done for security and compliance reasons.				

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Introduction to Fog Computing and attain SKILL DEVELOPMENT through Problem Solving techniques.			
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>Understand the basic principles and concepts of fog computing systems and their relation to other models such as Cloud Computing and Near-Far computing.</p> <p>Understand the challenges of developing fog based applications and middleware, and the possible solutions.</p> <p>Specifically, understand the issues mostly related to fog computing, namely: introduction to the fog programming model and related models, security, offloading, Software Defined Network, load balancing, communication, containers and orchestration, application areas.</p> <p>Able to decide which is the best approach for a particular problem regarding the design and development of a fog computing system.</p> <p>Able to design and implement an application using containers.</p> <p>Able to measure and analyze the performance of a fog computing application.</p>			
Course Content:				
Module 1	INTRODUCTION TO FOG COMPUTING	Assignment	Programming activity	11 Sessions
<p>Topics:</p> <p>Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing, Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT , FOG, CloudBenefits.</p>				
Module 2	ARCHITECTURE	Assignment	Programming activity	10 Sessions
<p>Topics:</p> <p>Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.</p>				

Module 3	FOG PROTOCOLS AND COMMUNICATION TECHNOLOGIES	Assignment	Programming activity	10 Sessions
<p>Topics:</p> <p>Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing protocols, Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range</p>				
Module 4	MANAGEMENT AND ORCHESTRATION	Assignment	Programming activity	11 Sessions
<p>Topics:</p> <p>Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background , Network Slicing in 5G , Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog , Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds , IoT Integration , Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics: Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.</p>				
Module 5	FOG COMPUTING REQUIREMENTS WHEN APPLIED TO IOT	Assignment	Programming activity	11 Sessions
<p>Topics:</p> <p>Fog computing requirements when applied to IoT: Scalability,Interoperability,Fog-IoT: architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, DataManagement,filtering,EventManager,DeviceManagement,cloudification,virtualization, security and privacy issues. Integrating IoT,Fog, Cloud Infrastructures: Methodology , Integrated C2F2T Literature by Modeling Technique re by Use-Case Scenarios , Integrated C2F2T Literature by Metrics.</p>				
<p>Targeted Application &amp; Tools that can be used: Case Study: Wind Farm - Smart Traffic Light System, Wearable Sensing Devices, Wearable Event Device ,Wearable System, Demonstrations , Post Application Example . . Event Applications Example.</p>				
<p>Text Book</p> <p>Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya.</p> <p>Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by RajkumarBuyya and Satish Narayana Srirama.</p> <p>Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things Paperback by SudipMisra , Subhadeep Sarkar , Subarna Chatterjee.</p> <p>Web Links:</p>				

Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya.

Fog Computing | Wiley Online Books

Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by RajkumarBuyya and Satish Narayana Srirama.

Fog and Edge Computing: Principles and Paradigms | Wiley

Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things Paperback by SudipMisra , Subhadeep Sarkar , Subarna Chatterjee.

Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of (routledge.com)

#### References

FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, —Fog Computing and Its Role in the Internet of ThingsII, MCC'12, August 17, 2012, Helsinki, Finland. Copyright 2012 ACM 978- 1-4503-1519-7/12/08... \$15.00.

Shanhe Yi, Cheng Li, Qun Li, —A Survey of Fog Computing: Concepts, Applications and IssuesII, Mobidata'15, ACM 978-1-4503-3524-9/15/06, DOI: 10.1145/2757384.2757397, June 21, 2015, Hangzhou, China..

Amir M. Rahmani ,PasiLiljeberg, Preden, Axel Jantsch, —Fog Computing in the Internet of Things - Intelligence at the Edgell, Springer International Publishing, 2018.

Ivan Stojmenovic, Sheng Wen, “The Fog Computing Paradigm: Scenarios andSecurity Issues”, Proceedings, Federated Conference on Computer Science and Information Systems, pp. 1–8, 2014

Fog Computing: Helping the Internet of Things Realize its Potential Amir VahidDastjerdi and RajkumarBuyya, University of Melbourne.

Multi-Dimensional payment Plan in Fog Computing with Moral Hazar,YanruZhang,Nguyen H. Tran,DusitNiyato, and Zhu Han,IEEE,2016

#### Topics relevant to “SKILL DEVELOPMENT”:

Fog Computing requirements for SKILL DEVELOPMENT through Problem Solving Techniques. This is attained through the assessment component mentioned in course handout.

Course Code: CSE3046	Course Title:  DevOps Tools And Internals Type of Course:  Theory & Integrated Laboratory	L-T-P-C P-C	2-0	2	3
Version No.	1.2				
Course Pre-requisites	Fundamentals of Devops				
Anti-requisites	NIL				
Course Description	<p>This course is designed to offer profound perceptions and knowledge in various tools like Git, Ansible, Selenium and Jenkins. With the proficient learning of DevOps course, a student will be able to work in all the above tools and become a trained practitioner in the integration and monitoring of software.</p> <p>DevOps Tool is an application that helps the software development process to industrialize. It mainly focuses on communication and collaboration between product management, software development, and operations professionals. The objective of this course is to discuss and implement the various tools usage and internals practically.</p>				
Course Objective	The objective of the course is to familiarize the learners with the concepts of DevOps Tools And Internals and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>1] Apply the features and common Git workflow. [Application]</p> <p>2] Practice the filters and plugins to populate, manipulate, and manage data used by Ansible Playbooks. [Application]</p> <p>3] Compute the features of selenium IDE. [Application]</p> <p>4] Interpret the installation and features of Jenkins and build jobs. [Application]</p>				
Course Content:					
Module 1		Quiz	Quiz on Git commands		5L +4P

	Git			Classes
<p>Topics:</p> <p>Introduction to Git, Features of Git, Benefits, Workflow, Git vs GitHub, Installation of Git on Windows/Linux and Environment set up, All Git Commands-Working with local and remote repositories, Running first Git command, Fundamentals of Repository structure and file status life cycle, Working locally with staging, unstaging and commit.</p>				
Module 2	Containerization Using Docker	Quiz	Quiz on Ansible tool usage	5L +4P Classes
<p>Topics:</p> <p>Docker Life Cycle,Docker Installation, Docker Operations,Docker Concepts - Registry, Repository, Tag, Image and Containers, Create A Docker Hub Account, Docker Images and Containers, Pushing Docker To Container Hub, Docker File.</p>				
Module 3	Ansible	Assignment	Assignments on Selenium tool usage and test case	5L +4P Classes
<p>Topics:</p> <p>Ansible Workflow, Architecture, Installation in Linux/Windows, ad-hoc Commands, Playbooks, Tower, Roles, Variables open link, Tags, Galaxy, Commands Cheat Sheets, Modules, Shell, Templates, YAML, Inventory, Debug, Apt, Lineinfile, Copy, Command, File, Vault, Windows, Yum, AWX, Unarchive, Ansible Pip</p>				
Module 4	Jenkins	Assignment	Assignments on Jenkins tool usage and Build jobs	5L +4P Classes
<p>Topics:</p> <p>Introduction To Continuous Integration, Jenkins Architecture, Managing Nodes On Jenkins, Jenkins Master Node Connection, Jenkins Integration With Devops Tools, Understanding CI/CD Pipelines, Creating A CI/CD Pipeline</p>				
<p>List of Laboratory Tasks:</p> <p>Git</p> <p>1. Level 1: Installation of Git on windows</p>				



Level 2: Git commands-Local repositories

Level 2: Git commands-Remote repositories

2. How Git can handle automatically file modifications when they are not related to the same lines of text.

Level 1: You are in a new repository located in C:\Repos\Exercises\Ch2-1.

Level 1: You have a master branch with two previous commits: the first commit with a file1.txt file and the second commit with a file2.txt file.

Level 2: After the second commit, you created a new branch called File2Split. You realized that file2.txt is too big, and you want to split its content by creating a new file2a.txt file. Do it, and then commit the modifications.

3. How to resolve conflicts when Git cannot merge files automatically.

Level 1: You are in the same repository used earlier, C:\Repos\Exercises\Ch2-1. On the master branch, you add the file3.txt file and commit it.

Level 2: Then, you realize that it is better to create a new branch to work on file3.txt, so you create the File3Work branch. You move in this branch, and you start to work on it, committing modifications.

Level 2: The day after, you accidentally move to the master branch and make some modifications on the file3.txt file, committing it. 5. Then, you try to merge it.

4. Level 1: Installation of Ansible

Level 2: Create a basic inventory file

Level 2: Running your first Ad-Hoc Ansible command.

Ansible

5. Ansible Archive

Level 1: Compressing the Directory with TAR and tar and gz

Level 1: Compress the file – Default File Compress format and Remove the Source files after archiving

Level 2: Create a ZIP file archive – File and Directory

Level 2: Create a BZIP archive – File and Directory

6. A Quick Syntax of Ansible Shell module – ADHOC

Level 1: A Quick Syntax of Ansible Shell module in a Playbook

Level 1: Ansible Shell Examples

Level 2: Execute a Single Command with Ansible Shell

Level 2: Execute a Command with Pipe and Redirection

7. Level 1: Run playbook

Level 2: Create the file on the target machines or servers as mentioned in the inventory file and the webserver's group, save the below code with .yml extension and run the playbook.

Level 2: Create multiple directories. To create multiple directories with one single task you can use the loop with `_items` statement. So when you run the below playbook it is interpreted as 3 different tasks.

## Selenium

8. Level 1: Selenium IDE Download and Install

Level 2: Selenium IDE - First Test Case, Login Test and command usage

9. Level 1: Write a script to open google.co.in using chrome browser (ChromeDriver).

Level 2: Write a script to open google.com and verify that title is Google and also verify that it is redirected to google.co.in.

10. Level 1: Write a script to open google.co.in using internet explorer (InternetExplorerDriver).

Level 2: Write a script to create browser instance based on browser name.

11. Level 1: Write a script to close all the browsers without using `quit()` method.

Level 2: Write a script to search for specified option in the listbox

## Jenkins

12. Level 1:

Environment Setup

Level 2:

Jenkins downloading and installation

13. Level 1:

<p>Setup a Jenkins Job with Apache Ant Build Tool</p> <p>Setup a Jenkins Job with Apache Maven</p> <p>Level 2 :</p> <p>Setup a Jenkins Job with Batch Script.</p> <p>14. Level 1: Add a Linux Node (Also Check SSH Slaves plugin plugins)</p> <p>Level 1: Add a Windows Node</p> <p>Level 2: Assign a Java Based Job to Linux and Build it</p> <p>Level 2: Assign a MSBuild Based to Windows and Build it</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Tracking changes in the source code and source code management</p> <p>Automates web browsers</p> <p>Configuration Management and IT automation.</p> <p>Integration of Individual Jobs and Effortless Auditing</p> <p>Tools: Git, Ansible, Selenium and Jenkins</p>
<p>Project work/Assignment: Mention the Type of Project /Assignment proposed for this course</p>
<p>Each batch of students (self-selected batch mates) will identify projects from searching on Google and implement with the most suitable 2 or 3 antecedents.</p>
<p>Text Book</p> <p>Craig Berg, “DevOps For Beginners: A Complete Guide to DevOps Best Practices (Including How You Can Create World-Class Agility, Reliability, And Security In Technology Organizations With DevOps) (Code tutorials)”, Paperback – June 12, 2020.</p> <p>Ferdinando Santacroce, “Git Essentials”, Packt Publishing, April 2015, ISBN: 9781785287909</p> <p>John Ferguson Smart. “Jenkins: The Definitive Guide”, O'Reilly Media, Inc., July 2011, ISBN: 9781449305352</p>
<p>References</p> <p>Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, Leanpub, August 5, 2020</p> <p>Unmesh Gundecha, Carl Cocchiario, “Learn Selenium”, Packt Publishing, July 2019, ISBN: 9781838983048</p> <p>Gaurav Agarwal, “Modern DevOps Practices: Implement and secure DevOps in the public cloud with cutting-edge tools, tips, tricks, and techniques”, July 2021.</p>

<p>Mikael Krief, “Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps”, October 2019</p> <p>Weblinks:</p> <p><a href="https://git-scm.com/book/en/v2">https://git-scm.com/book/en/v2</a></p> <p><a href="https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner">https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner</a></p> <p><a href="https://www.javatpoint.com/selenium-tutorial">https://www.javatpoint.com/selenium-tutorial</a></p> <p><a href="https://www.javatpoint.com/ansible">https://www.javatpoint.com/ansible</a></p> <p><a href="https://www.tutorialspoint.com/jenkins/jenkins_managing_plugins.htm">https://www.tutorialspoint.com/jenkins/jenkins_managing_plugins.htm</a></p> <p><a href="https://nptel.ac.in/courses/128106012">https://nptel.ac.in/courses/128106012</a></p>
<p>Topics relevant to “SKILL DEVELOPMENT”: Git&amp;Junit, Ansible, Selenium, Jenkins for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.</p>

Course Code: CSE3045	Course Title: Development Automation Type of Course: Elective in Devops Basket Theory & Integrated Laboratory	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	Scripting Language Knowledge, Linux Fundamentals				
Course Description	The Objective of this course is to give a strong foundation of the Development Automation. DevOps refers to the integration of an organization’s development (dev) and operations (ops) teams. It encompasses an organization’s culture, processes, and philosophies. DevOps tools enable faster development cycles and higher software quality. DevOps speeds delivery of higher quality software by combining and automating the work of software development and IT operations teams.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Development Automation and attain SKILL DEVELOPMENT through Experiential Learning techniques.				
Course Outcomes	On successful completion of the course, the students shall be able to Understand the automated software delivery and deployment process[ Knowledge]				

	Analyze the various automation scenarios .[Comprehension] Demonstrate the interaction with linux environment[Application] Implement scripts[ Application] Implement makefiles to automate tasks[Application]			
Course Content:				
Module 1	Introduction to Automation	Assignment/Quiz	Fully Automated Software delivery process	06 Session
<p>Topics: The Software Delivery Pipeline, Overview of the Continuous Delivery Pipeline, Fully Automated</p> <p>Software Delivery Process, The Build Process, Automated build, Automated Test, Automated Deployment, Benefits of Automated Deployment, Automated Deployment and DevOps Adoption, Automated Deployment and DevOps Adoption, Overview of Rapid Application Development (RAD), Phases in RAD, Essential Aspects of RAD, Code generation, Categories of Code Generators, Common.</p> <p>Assignment: The build process</p>				
Module 2	Advantages of Automation	Case study	Automation scenarios	06 Session
<p>Topics: Advantages of Automation, Automation Scenarios, Archiving Logs, Auto-Discard Old Archives, MySQL (RDBMS) Backups, Email Web Server Summary, Ensure Web Server is Running, User Command</p> <p>Validation, Disk Usage Alarm, Sending Files to Recycle Bin, Restoring Files from Recycle Bin, Logging</p> <p>Delete Actions, File Formatter, Decrypting Files, Bulk File Downloader, System Information, Install</p> <p>LAMP Stack, Get NIC's IP, Scenarios Where Automation Prevents Errors .</p> <p>Assignment: Email web server summary</p>				
Module 3	Interacting with Linux Environment	Case study	Linux File system	06 Session

<p>Topics: The Linux System, Linux File System, Partitions, Common System Directories, Shell, User Groups and Permissions, User Accounts, The passwd File, Creating User Accounts, File Ownership, File Permissions, Working with Bash, Shell Features</p> <p>Assignment: Linux File System</p>				
Module 4	Scripting Development Tasks	Case study	Linux commands	06 Session
<p>Topics: Writing Automation Scripts, Task Scheduling Using Cron, Basic Linux Commands, Best Practices for Scripting, Make use of Shell's Built-In Options, Naming Conventions, Annotations Make the Logic Clean, Command Substitution, Always Begin with a Shebang, Variable Substitution, Conditionals, Regular Expressions.</p> <p>Assignment: Shell's built-in options</p>				
Module 5	"Make" and "Makefiles"	Case study	Makefile arguments and source code creation	06 Session
<p>Topics: Why "Make"? Why not Others?, Why not use "Bash Script" instead of "Makefile"?, features of "Make", Various versions and Variants of "Make", Structure of a "Makefile", What is a Rule?, Structure of a "Makefile" Rule, Targets, Some Special Built-in Target Names, Automatic Variables, Suffix Rules,</p> <p>Pattern Rules, The "Make" command, "Make" arguments, recursive makefile, Building Binary from Source Code, Conditionals in "Makefile", Best Practices in writing "Makefiles".</p> <p>Assignment: Best practices in writing Makefiles</p>				
<p>List of Laboratory Tasks:</p> <p>Experiment No 1: Working with Basic Linux Commands, make use of shells built in options, naming conventions,</p> <p>Level 1: basic linux commands</p> <p>Level 2: Advanced linux commands</p> <p>Experiment No 2: Working with Linux File System, Partitions, Common System Directories</p> <p>Level 1: Simple commands for exploring partitions, common system directories</p>				

Level 2: configuring linux system

Experiment No 3: Working with writing automation scripts

Level 1: Simple automation scripts

Level 2: Complicated automation scripts

Experiment No 4: Working with variable substitution, conditionals, regular expressions

Level 1: Simple regular expressions, conditionals

Level 2: Advanced regular expressions, conditionals

Experiment No 5: creation of makefile , Structure of makefile

Level 1: Simple makefile creation

Level 2: Advanced program on makefile

Experiment No 6: Working with automatic variables, pattern rules , make command

Level 1: Basic pattern rules, make command

Level 2: Advanced pattern rules

Experiment No 7: Building binary from source code

Level 1: basic binary from source code

Level 2: Advanced binary from source code

Experiment No 8: Working with Conditionals in “Makefile”, Best Practices in writing “Makefiles

Level 1: Basic conditionals in makefile

Level 2: Advanced conditions and best practices in writing makefiles

Targeted Application & Tools that can be used:

Application Area includes Online Financial Trading Company, Network Cycling, Car manufacturing industries, Airlines industries, GM Financial, Bug Reduction. Companies like Amazon, Target, Esty, Netflix, Google, Walmart use Devops in their day to day processes to increase efficiency and improve delivery time.

Professionally Used Software: Red hat Linux Operating system, GIT

Besides these software tools Visual studio code also used

Project work/Assignment:

1. Case Studies: At the end of the course students will be given a real-world scenario for any application on automating software development and deployment process, automation scenarios, working with linux environment using script and makefile.

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

3. Presentation: There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

Text Book(s):

- a. Running Linux – Book by Matthias Kalle Dalheimer, Matt Welsh
- b. Mastering Linux Shell Scripting – Book by Andrew Mallett .

Reference(s):

Reference Book(s):

- 1. DevOps Handbook: How to Create World-Class Agility, Reliability and Security in Technology Organizations – IT Revolution Press; Illustrated edition (October 6, 2016), Gene Kim, Jez Humble, Patrick Debois, John Allspaw and John Willis
- 2. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale 1st Edition, O'Reilly Media; 1st edition (May 30, 2016), Jennifer davis, Ryn daneils

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

Coursera:

- 1. DevOps on AWS | Coursera
- 2. DevOps, Cloud, and Agile Foundations | Coursera
- 3. Introduction to DevOps | Coursera



<p>E-books :</p> <p>1. <a href="https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=1223875&amp;site=ehost-live&amp;ebv=EB&amp;ppid=pp_xiii">https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=1223875&amp;site=ehost-live&amp;ebv=EB&amp;ppid=pp_xiii</a></p> <p>2. <a href="https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=2706929&amp;site=ehost-live">https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&amp;db=nlebk&amp;AN=2706929&amp;site=ehost-live</a></p>
<p>Topics relevant to “SKILL DEVELOPMENT”:</p> <p>Simple automation Scripts, Linux commands for SKILL DEVELOPMENT through Experiential Learning Techniques. This is attained through the assessment component mentioned in the course handout.</p>

Course Code: CSE 3043	Course Title:  Automated Test Management  Type of Course: Integrated	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Introductory course on Software Engineering.				
Anti-requisites	NA				
Course Description	This course is intended for understanding the principles of automation and the application of tools for the analysis and testing of software. The automated analysis encompasses both approaches to automatically generate a very large number of tests to check whether programs meet requirements, and also means by which it is possible to prove that software meets requirements and that it is free from certain commonly-occurring defects, such as divide-by-zero, overflow/underflow, deadlock, race-condition freedom, buffer/array overflow, uncaught exceptions, and several other commonly-occurring bugs that can lead to program failures or security problems. The learner will become familiar with the fundamental theory and applications of such approaches, and apply a variety of automated analysis techniques on example programs.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Automated Test Management and attain SKILL DEVELOPMENT through Experiential Learning techniques.				

Course Out Comes	On successful completion of the course the students shall be able to: Understand testing in DevOps. Learn its approaches to testing. Understand to design test cases.			
Course Content:				
Module 1		CA1	Lab Experiments	10 Sessions
Topics: Seven Principles - SDLC vs STLC - Testing Life Cycle - Usability Testing - Functional Testing - End to End Testing - Compatibility Testing - GUI Testing - API testing.				
Module 2		CA2	Lab Experiments	10 Sessions
Topics: Usability Testing - Functional Testing - End to End Testing - Compatibility Testing - GUI Testing - API testing.				
Module 3		CA3	Lab Experiments	10 Sessions
Topics:Manual Testing - Automation Testing - Unit Testing - Integration Testing - Smoke-Sanity Testing - Regression Testing , Reasons for Automated Testing: Controlling Costs, Application Coverage, Scalability, Repeatability.				
Module 4		CA4	Lab Experiments	10 Sessions
Topics :Test Scenario - Test Case Design - Test Basis - Traceability Matrix				
Module 5		CA4	Lab Experiments	8 Sessions
Topics : ESTIMATION TECHNIQUES :Estimating automation - Test Plan Document - Bug Life Cycle				
List of Laboratory Tasks: Introduction and installation of DevOps. SDLC, STLC, GUI and API testing modules. Unit Testing and Integration testing modules. Creating test scenarios. Bug Life Cycle				
Targeted Application & Tools that can be used DevOps				

Project work/Assignment:
Assignment: CA1, CA2, CA3, CA4
Text Book T1.Flexible Test Automation - by Vitaliano Inglese, Pasquale Arpaia T2.Experiences of Test Automation: Case Studies of Software Test Automation - by Mark Fewster, Dorothy Graham
References  Web resources: W1. <a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a>
Topics relevant to "SKILL DEVELOPMENT": Unit testing, Functional testing for Skill Development through Experiential Learning Techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3040	Course Title: Agile Structures and Frameworks Type of Course: School Core	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Software Engineering				
Anti-requisites	NIL				
Course Description	<p>This course imparts knowledge to students in the basic concepts of Agile Software Process, methodology and its development</p> <p>The objective of this course is to provide the fundamentals concepts of Agile and its Significance.</p> <p>This course covers the Agile and its methodologies.</p> <p>The objective of the course is to understand the Agility and Assurance.</p>				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Agile Structures and Frameworks and attain Skill Development through Participative Learning techniques.				
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>1] Understand the basic concepts of Agile Software Process. (Knowledge level)</p> <p>2] Comprehend the various Agile Methodologies. (Comprehension level)</p> <p>3] Develop Agile Software Process. (Knowledge level)</p> <p>4] Apply principles of Agile Testing. (Application level)</p>				
Module 1	Introduction	Assignment	Agile Estimation		08 Sessions
Introduction to Agile technology, Iterative and Evolutionary Methods, Agile – Agile Development. Agile Values, Agile Principles, Compare and Contrast the agile with traditional methods. Agile Benefits. Agile Estimation Techniques. Case Study					
Module 2	Agile and Its Significance	Assignment	Comparison of Agile technologies with traditional methods		09 Sessions
Agile Story : Evolutionary delivery ,Scrum Demo, Planning game, Sprint back log, adaptive planning. Agile Motivation – Problems With The Waterfall - Research Evidence. Scrum : Method Overview ,Life cycle phases and Work product roles and practices.					
Module 3	Agile methodology		Case Study		12 Sessions

Extreme Programming: Method Overview ,Life cycle phases and Work product roles and practices. Unified process : Method Overview ,Life cycle phases and Work product roles and practices. EVO : Method Overview ,Life cycle phases and Work product roles and practices. Case Study.				
Module 4	Agility and Quality Assurance	Assignment	Apply the testing concepts using Programing	09 Sessions
Agile product development – Agile Metrics – Feature Driven Development (FDD). Agile approach to Quality Assurance. Test Driven Development – Agile approach in Global Software Development. Agile Technology Tools.				
Targeted Application & Tools that can be used: JIRA				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
<p>Agile Estimation</p> <p>Comparison of Agile technologies with traditional methods</p> <p>Case Study: Student group must collaborate and report together along with assigned batch members. Collect the requirements from the client and adopt the suitable agile practice method for your project</p> <p>Installation and features of JIRA tool.</p>				
<p>Text Book</p> <p>1] Craig Larman, “Agile and Iterative Development – A Manager’s Guide”, Pearson Education – 2006</p> <p>2] Edward Scatter “Brilliant Agile Project Management: A Practical Guide to Using Agile, Scrum and Kanban, 2015</p>				
<p>References</p> <p>1] Chetankumar Patel, Muthu Ramachandran, Story Card Maturity Model (SMM): A Process Improvement Framework for Agile Requirements Engineering Practices, Journal of Software, Academy Publishers, Vol 4, No 5 (2009), 422-435, Jul 2009.</p> <p>2] Hazza&amp; Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer 2009</p> <p>3]Kevin C. Desouza, Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007.</p> <p>Web resources:</p> <p><a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a></p>				
Topics relevant to "SKILL DEVELOPMENT":				

Agile Estimation techniques for skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 2014	Course Title: Software Engineering Type of Course: School Core [Theory Only]	L-T- P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	<p>The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles.</p> <p>The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development.</p> <p>The course covers software quality, configuration management and maintenance.</p>				
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	<p>On successful completion of this course the students shall be able to:</p> <p>1] Describe the Software Engineering principles, ethics and process models(Knowledge)</p> <p>2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension)</p> <p>3] Understand the Agile Principles(Knowledge)</p> <p>4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)</p>				
Module 1	Introduction to Software Engineering and Process Models	Quiz			09 Hours

	(Knowledge level)			
<p>Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle</p> <p>Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.</p>				
Module 2	Software Requirements, Analysis and Design (Comprehension level)	Assignment	Development of SRS documents for a given scenario	11 Hours
<p>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.</p> <p>Design: Design concepts, Architectural design, Component based design, User interface design.</p>				
Module 3	Agile Principles & Devops (Knowledge level)	Quiz		09 Hours
<p>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.</p> <p>Devops: Introduction, definition, history, tools.</p>				
Module 4	Software Testing and Maintenance (Application Level)	Assignment	Apply the testing concepts using Programing	12 Hours
<p>Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.</p> <p>Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).</p> <p>Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.</p>				
Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools				
Text Book				
1] Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, VII Edition, McGraw-Hill, 2017.				

2] Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 2018.
<p>References</p> <p>Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2015.</p> <p>Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.</p> <p>Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002</p>
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: CSE3034	Course Title: BIG DATA SECURITY AND PRIVACY  Type of Course: Elective in Big Data Basket  Theory	L-T-P-C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	CSE219 Big Data Analytics				
Anti-requisites	NIL				
Course Description	The purpose of this course is to sensitize security in Big Data environments. This course will discover cryptographic principles, mechanisms to manage access controls in Big Data system. This course teaches the principles and practices of big data for improving the privacy and the security of computing systems. Big data is being applied in areas where there is great commercial advantage to be had, and consequently, attacks and failures have become a serious concern. It delves into a set of techniques for defending big data techniques against breaching of bigdata (the privacy aspect) and against malicious attacks (the security aspect).				
Course Objective	The objective of the course is to familiarize the learners with the concepts of BIG DATA SECURITY AND PRIVACY and attain Skill Development through Participative Learning techniques.				



Course Outcomes	<p>On successful completion of this course the students shall be able to:</p> <p>Define cryptographic principles and mechanisms to manage access controls in Big Data system.[Knowledge]</p> <p>Explain security risks and challenges for Big Data system.[Knowledge]</p> <p>Recognize all security related issues in big data systems .[Comprehension]</p> <p>Apply Kerberos configuration for Hadoop ecosystem components.[Application]</p>			
Course Content:				
Module 1	Big Data Privacy, Ethics And Security	Assignment/Quiz	Big data security-organizational security	08 classes
<p>Topics:</p> <p>Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self regulating? – Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security.</p> <p>Assignment: Big data security-organizational security</p>				
Module 2	Security, Compliance, Auditing, And Protection	Assignment	communication protocols for each of the Hadoop ecosystem components	08 classes
<p>Topics:</p> <p>Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems.</p> <p>Assignment: communication protocols for each of the Hadoop ecosystem components</p>				
Module 3	Hadoop Security Design, Hadoop Ecosystem Security	Case study	Kerberos configuration for ecosystem tools	08 classes
<p>Topics:</p> <p>Kerberos – Default Hadoop Model without security - Hadoop Kerberos Security Implementation &amp; Configuration. Configuring Kerberos for Hadoop ecosystem components – Pig, Hive, Oozie, Flume, HBase, Sqoop.</p> <p>Assignment: Kerberos configuration for Hadoop ecosystem tools</p>				
Module 4	Data Security & Event Logging	Case study	Event monitoring in Hadoop cluster	08 classes

<p>Topics:</p> <p>Integrating Hadoop with Enterprise Security Systems - Securing Sensitive Data in Hadoop – SIEM system – Setting up audit logging in hadoop cluster</p> <p>Assignment: Event monitoring in Hadoop cluster</p>
<p>Assignment:</p> <p>1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .</p> <p>2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.</p>
<p>Text Book(s):</p> <p>Sudeesh Narayanan, “Securing Hadoop”, Packt Publishing, 2013.</p> <p>Ben Spivey, Joey Echeverria, “Hadoop Security Protecting Your Big Data Problem”, O'Reilly Media, 2015.</p>
<p>Reference(s):</p> <p>Reference Book(s):</p> <p>1. Mark Van Rijmenam, “Think Bigger: Developing a Successful Big Data Strategy for Your Business”, Amazon, 1 edition, 2014.</p> <p>2. Frank Ohlhorst John Wiley &amp; Sons, “Big Data Analytics: Turning Big Data into Big Money”, John Wiley &amp; Sons, 2013.</p> <p>3. SherifSakr, “Large Scale and Big Data: Processing and Management”, CRC Press, 2014.</p> <p>Online Resources (e-books, notes, ppts, video lectures etc.):</p> <p>Top Tips for Securing Big Data Environments:</p> <p>e-book (<a href="http://www.ibmbigdatahub.com/whitepaper/top-tips-securing-big-data-environments-ebook">http://www.ibmbigdatahub.com/whitepaper/top-tips-securing-big-data-environments-ebook</a>)</p> <p><a href="http://www.dataguise.com/?q=securing-hadoop-discovering-and-securing-sensitive-datahadoop-data-stores">http://www.dataguise.com/?q=securing-hadoop-discovering-and-securing-sensitive-datahadoop-data-stores</a></p> <p>Gazzang for Hadoop</p> <p><a href="http://www.cloudera.com/content/cloudera/en/solutions/enterprisesolutions/security-for-hadoop.html">http://www.cloudera.com/content/cloudera/en/solutions/enterprisesolutions/security-for-hadoop.html</a></p> <p>eCryptfs for Hadoop <a href="https://launchpad.net/ecryptfs">https://launchpad.net/ecryptfs</a>.</p> <p>Project Rhino - <a href="https://github.com/intel-hadoop/project-rhino">https://github.com/intel-hadoop/project-rhino</a> .</p> <p>Weblinks:</p>

[https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp\\_xiii](https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii)

<https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live>

Topics relevant to “SKILL DEVELOPMENT”: Configuring Kerberos for Hadoop ecosystem components – Pig, Hive, Oozie, Flume for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3032	Course Title: Streaming Data Analytics Type of Course: Program Core Theory and Lab Integrated Course	L-T-P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	CSE3032 -Big Data Analytics				
Anti-requisites	NIL				
Course Description	<p>The purpose of the course is to introduce theoretical foundations, algorithms, methodologies, and applications of streaming data. It also provides practical knowledge for handling and analyzing streaming data.</p> <p>The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.</p> <p>With good knowledge of the fundamentals of streaming analytics, the student can gain practical experience in implementing them, enabling the student to be an effective solution provider for applications that involve huge volume of streaming data.</p>				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Streaming Data Analytics as mentioned above and attain Skill Development through experiential Learning techniques.				
Course Outcomes	<p>On successful completion of the course the students shall be able to:</p> <p>Recognize the characteristics of data streams that make it useful to solve real-world problems.</p>				

	Identify and apply appropriate algorithms for analyzing the data streams for a variety of problems.  Implement different algorithms for analyzing the data streams.			
Course Content:				
Module 1	Introduction to Data Streams	Programming Assignment	Streaming methods	8 Classes
Introduction to Data Streams: Data Stream Models, Research Issues in Data Streams Management Systems, Knowledge Discovery from Data Streams, Basic Streaming Methods: Counting the Number of Occurrence of the Elements in a Stream, Counting the Number of Distinct Values in a Stream, Bounds of Random Variables, Poisson Processes, Sliding Windows.				
Module 2	Decision Trees and Clustering from Data Streams	Programming Assignment	Streaming Data Collection and Analysis	10 Classes
Decision Trees and Clustering from Data Streams: Introduction, The Very Fast Decision Tree Algorithm, Extensions to the Basic Algorithm: Processing Continuous Attributes, Functional Tree Leaves, Clustering Examples: Partitioning Clustering, Hierarchical Clustering, Micro Clustering, Grid Clustering .				
Module 3	Frequent Pattern Mining	Programming Assignment	Streaming Data analysis	8 Classes
Frequent Pattern Mining: Introduction to Frequent Itemset Mining: The FP-growth Algorithm, Summarizing Itemsets, Heavy Hitters, Mining Frequent Itemsets from Data Streams: Landmark Windows, Mining Recent Frequent Itemsets, Frequent Itemsets at Multiple Time Granularities, Sequence Pattern Mining				
Module4				7 classes
Evaluating Streaming Algorithms Evaluation Issues, Design of Evaluation Experiments, Evaluation Metrics, Error Estimators using a Single Algorithm and a Single Dataset, Comparative Assessment, The 0-1 loss function, Evaluation Methodology in Non-Stationary Environments, The Page-Hinkley Algorithm				
List of Laboratory Tasks:  1.Level 1: Exploring stream processing engine STORM  Level 2: Exploring stream processing engine STREAM				

<p>2. Implementation of decision tree algorithms</p> <p>Level 1: Implementation of VFDT decision tree algorithm</p> <p>Level 2: Implementation of CVFDT decision tree algorithm</p> <p>3. Implementation of partitioning clustering on stream.</p> <p>Level 1: Implementation of partitioning clustering The Leader Algorithm.</p> <p>Level 2: Implementation of Single Pass k-Means partitioning Clustering Algorithm.</p> <p>4. Implementation of micro clustering on stream.</p> <p>Level 1: Implementation of Fractal Clustering algorithm Initialization phase</p> <p>Level 2: Implementation of Fractal Clustering algorithm Incremental phase</p> <p>5. Level 1: Implementation of The ODAC Global Algorithm.</p> <p>Level 2: Implementation of The ODAC: The TestSplit Algorithm</p> <p>6. Level 1 Implementation of the Apriori algorithm to find frequent itemsets</p> <p>Level 2: Implementation of the Apriori algorithm to find association rules</p> <p>7. Level 1: Frequent Itemsets mining of data streams using Lossy Counting algorithm</p> <p>Level 2: Reservoir Sampling for Sequential Pattern Mining over Data Streams.</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Apache Spark</p> <p>Social media Data Analysis</p> <p>Predictive Analytics</p>
<p>Project work/Assignment:</p>
<p>Students will be asked to develop a mini-project for streaming Data Analysis on streaming data.</p>
<p>Text Book</p> <p>Joao Gama, "Knowledge Discovery from Data Streams", CRC Press, 2018.</p>
<p>References</p> <p>David Luckham, "The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems", Addison Wesley, 2016.</p>

Charu C. Aggarwal, "Data Streams: Models And Algorithms", Kluwer Academic Publishers, 2017.

Weblinks:

<http://www.liaad.up.pt/area/jgama/DataStreamsCRC.pdf>

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

Topics relevant to "SKILL DEVELOPMENT":

Streaming data analysis of twitter data using Apache Spark for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: PG COURSE: CSE 2024	Course Title:NoSQL Databases Type of Course:Program Core Theory and Laboratory Integrated	L-T-P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	CSE2074-DBMS				
Anti-requisites	NIL				
Course Description	Introduction to non-relational (NoSQL) data models, such as Key-Value, Document, Column, Graph and Object-Oriented database models. Advantages and disadvantages of the different data architecture patterns will be discussed. Hands-on experience with a representative sample of open-source NoSQL databases will be provided. The rapid and efficient processing of data sets with a focus on performance, reliability, and agility will be covered.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of NoSQL Databases and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  1. Understand history, fundamentals, characteristics, and main benefits of NoSQL databases. [Knowledge]  2. Comprehend different types of NoSQL databases through case studies. [Comprehension]				

	3. Design different types of NoSQL databases, add content, and try queries on them. [Comprehension]			
Course Content:				
Module 1	NoSQL Database Architectures	Assignment	Knowledge	No. of Classes:6
<p>Topics: Transactions: Concurrency and Integration, ACID, NoSQL emergence and its main features, BASE for reliable database transactions, Achieving horizontal scalability with data base sharding, Brewers CAP theorem.</p> <p>Main Data models of NoSQL: Document Data Model, Key-Value Data Model, Columnar Data Model, Graph Data Model.</p>				
Module 2	Document data model	Assignment	Analysis	No. of Classes:6
<p>Topics: Characteristics of Document Data Model, Collection, Naming, CRUD Operation, Querying, Indexing, Replication, Sharding, Consistency, Update Consistency, Read Consistency, Relaxing Consistency, Capped Collection.</p>				
Module 3	Document Data Model Hands on: Mongo DB/Cassandra	Assignment	Programming (Embedded Lab)	No. of Classes:7
<p>Topics: Install, Perform CRUD (create, read, update and delete) Operations, Aggregations, Data Models, Transactions, Indexes, Security, Replication and Sharding.</p>				
Module 4	Basics of Columnar and Graph Data Models	Assignment	Comprehend	No. of Classes:7
<p>Topics:</p> <p>Columnar Data Model: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes, Indexing, Adaptive Indexing and Database Cracking.</p> <p>Graph Data Model: Comparison of Relational and Graph Modeling, Property Graph Model</p> <p>Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank-Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution.</p>				
<p>Learn MongoDB/Cassandra by doing the following</p> <p>Master the art of queries, CRUD, schema design, and data aggregation</p> <p>Understand scalability using sharding and replication</p> <p>Write code, build real-world projects and learn hands-on with Cloud Labs</p>				

<p>List of Lab Experiments</p> <p>Lab Experiments are to be conducted on the following topics</p> <p>Topic 1: Install MongoDB</p> <p>Topic 2: Do lab experiment to perform CRUD (create, read, update and delete).</p> <p>Topic 2: Demonstrate Aggregations in NoSQL with a real-life application.</p> <p>Topic 3: Demonstrate different aspect of transactions in NoSQL by taking suitable problem.</p> <p>Topic 5: Show making indexes in NoSQL with a suitable application.</p> <p>Topic 6: Illustrate security features of NoSQL with a suitable problem.</p> <p>Topic 6: Explain Sharding concept practically through a suitable example.</p>
<p>Targeted Applications(few are as given below):</p> <p>1.Content Management systems are pretty common. All the comments on posts on social media are contained in a separate database. In MongoDB, a model has been designed to store such comments and is known as “MetaData and Asset Management”.</p> <p>2.MongoDB is widely used for storing product information and details by finance and e-commerce companies. You can even store the product catalogue of your brand in it.</p> <p>3. MongoDB can also be used to store and model machine-generated data. For this, you can learn the “Storing Log data” document. This is known as operational intelligence.</p>
<p>List of MongoDB Tools</p> <p>MongoDB Compass.</p> <p>Mongo Management Studio.</p> <p>MongoJS Query Analyzer.</p> <p>Nucleon Database Master.</p> <p>NoSQLBooster.</p> <p>Studio 3T.</p> <p>MongoDB Spark Connector.</p> <p>MongoDB Charts.</p>
<p>Project work/Assignment: Mention the Type of Project /Assignment proposed for this course</p>
<p>Project Works:</p> <p>1. Create a database that stores road cars. Cars have a manufacturer, a type. Each car has a maximum performance and a maximum torque value. Do the following: Test Cassandras replication schema and Consistency models.</p>



2. Shopping Mall case study using cassandra, where we have many customers ordering items from the mall and we have suppliers who deliver them their ordered items.					
Text Books					
Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2019					
<a href="https://bigdata-ir.com/wp-content/uploads/2017/04/NoSQL-Distilled.pdf">https://bigdata-ir.com/wp-content/uploads/2017/04/NoSQL-Distilled.pdf</a>					
Bradshaw & Chodorow. MongoDB: The Definitive Guide: Powerful and Scalable Data Storage, 3rd ed., O'Reilly, 2019					
<a href="https://www.oreilly.com/library/view/mongodb-the-definitive/9781491954454/">https://www.oreilly.com/library/view/mongodb-the-definitive/9781491954454/</a>					
References					
Pivert. NoSQL Data Models: Trends and Challenges, 1st ed. Wiley, 2018					
<a href="https://www.perlego.com/book/995563/nosql-data-models-trends-and-challenges-pdf">https://www.perlego.com/book/995563/nosql-data-models-trends-and-challenges-pdf</a>					
Amit Phaltankar, Juned Ahsan, Michael Harrison, Liviu Nedov, MongoDB Fundamentals A hands-on guide to using MongoDB and Atlas in the real world: 1st edition, Packt publications, 2020					
<a href="https://www.perlego.com/book/2059687/mongodb-fundamentals-a-handson-guide-to-using-mongodb-and-atlas-in-the-real-world-pdf">https://www.perlego.com/book/2059687/mongodb-fundamentals-a-handson-guide-to-using-mongodb-and-atlas-in-the-real-world-pdf</a>					
More than 25% of changes are made from the earlier version. Changes are highlighted in bold.					
Topics relevant to "SKILL DEVELOPMENT": Usage of un-structured data for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.					

Course Code: CSE 3028	Course Title: Blockchain security and performances  Type of Course: Program Core Theory and Laboratory Integrated	L-T-P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	Blockchain Technology and Applications				

Anti-requisites	NIL			
Course Description	<p>The purpose of this course is to introduce the students to security and privacy techniques in blockchain based systems. The course provides a comprehensive understanding of blockchain security, risks, methods, and best practices. The course develops critical thinking skills by augmenting the student's ability to tackle security related issues of blockchain</p> <p>The associated laboratory provides an opportunity to validate the concepts taught as well as enhances the ability to visualize the real-world problems in order to provide a solution using various tools and techniques.</p>			
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>CO1:Comprehend security and performance perspective of blockchain technology.</p> <p>CO2: Apply cryptographic techniques to enhance security in blockchain based systems</p> <p>CO3: Implement secure transaction models.</p> <p>CO4: Apply security techniques to blockchain systems that provide solutions to some real world problems</p>			
Course Outcome	The objective of the course is to familiarize the learners with the concepts of CSE3028_BLOCKCHAIN SECURITY & PERFORMANCE and attain Employability through Experiential Learning techniques.			
Course Content:				
Module 1	Fundamentals of Privacy And Security Techniques In Blockchain	Assignment	Programming	9 Sessions
Introduction to Blockchain Technology, Cyber Security Threats and incidents on blockchain networks, Categorization of blockchain threats and vulnerabilities: Client vulnerabilities, Consensus Mechanism vulnerabilities, Mining Pool vulnerabilities, Network vulnerabilities, Smart Contract vulnerabilities; Privacy and security techniques: Mixing, Anonymous Signatures, Homomorphic Encryption, Attribute-Based Encryption, Secure Multi-Party Computation, Non-Interactive Zero-Knowledge (NIZK) Proof, TEE Based Smart Contracts, Game-Based Smart Contracts.				
Module 2	Cryptography	Assignment	Programming	12 sessions
Cryptography, Public Key Cryptography and Cryptocurrency, Private Keys, Generating a Private Key from a Random Number, Public Keys, Elliptic Curve Cryptography, Elliptic Curve Arithmetic Operations, Generating a Public Key, Elliptic Curve Libraries,				

Cryptographic Hash Functions, Ethereum's Cryptographic Hash Function: Keccak-256, Ethereum Address and Formats, Inter Exchange Client Address Protocol				
Module 3	Transaction Model	Assignment	Programming	9 sessions
Topics: Blockchain Level Transaction Models : UTXO, Account-Based Online Transaction Model, CAP Properties in Blockchain, Security and Privacy Requirements of Online Transactions, Basic Security Properties: Consistency, Tamper-Resistance, Resistance to DDoS attacks, Resistance to Double-Spending attacks, Resistance to the Consensus attacks, Pseudonymity; Additional Security and Privacy Properties of Blockchain: Unlinkability, Confidentiality of Transactions and Data Privacy, Consensus Algorithms, BFT based Consensus Algorithms, Sleepy Consensus, Proof of Elapsed Time, Proof of Authority, Proof of Reputation, Comparison of Consensus Algorithms				
List of Laboratory Tasks:				
Targeted Application & Tools that can be used:				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
<p>After completion of each module a programming based Assignment/Assessment will be conducted.</p> <p>On completion of Module 3, student will be asked to develop a Project.</p>				
Textbook(s): T1.Antonopoulos, Andreas M., and Gavin Wood. Mastering ethereum: building smart contracts and dapps. O'reilly Media, 2018. T2.Howard E. Poston, Blockchain Security from the Bottom Up: Securing and Preventing Attacks on Cryptocurrencies, Decentralized Applications, NFTs, and Smart Contracts, John Wiley & Sons, 2022.				

## References

R1.Parisi, Alessandro. Securing Blockchain Networks like Ethereum and Hyperledger Fabric: Learn advanced security configurations and design principles to safeguard Blockchain networks. Packt Publishing Ltd, 2020.

Web Based Resources and E-books:

Digital Learning Resources (Library Resources)

W1: NPTEL : <https://nptel.ac.in/courses/106/104/106104220/#>

W2: UDEMY : <https://www.udemy.com/course/build-your-blockchain-az/>

W3 : Book

[https://www.google.co.in/books/edition/Blockchain\\_By\\_Example/ci59DwAAQBAJ?hl=en&gbpv=1](https://www.google.co.in/books/edition/Blockchain_By_Example/ci59DwAAQBAJ?hl=en&gbpv=1)

W4 : Book

<https://www.insiderintelligence.com/insights/blockchain-technology-applications-use-cases/>

W6: <https://www.analyticsinsight.net/real-world-applications-of-blockchain-technologies/>

W7:PU Library Link : <https://puniversity.informaticsglobal.com/login> Or : <http://182.72.188.193/>

Topics relevant to “SKILL DEVELOPMENT”: Real time data analysis used for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:CSE3023	CourseTitle:Distributed Ledger Technology TypeofCourse:Discipline Elective	L-T-P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	Foundations of Blockchain Technology				
Anti-requisites	NIL				

CourseDescription	<p>The purpose of the course is to provide the fundamental concepts of distributed ledger technologies as well as to explore various aspects of distributed ledger techniques like Ethereum, Hyper ledger and smart contract.</p> <p>With a good knowledge in the fundamental concepts of block chain and distributed ledger technologies, the student can gain practical experience in implementing them, enabling the student to be an effective chain code creator.</p>			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Distributed Ledger Technology and attain Skill Development through Experiential Learning techniques.			
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>Understand and explore the working of distributed ledger technology (Knowledge)</p> <p>Understand the working of Smart Contracts (Knowledge)</p> <p>Apply the learning of solidity and de-centralized apps on Ethereum (Application).</p>			
Course Content:				
Version No.	1.0			
Module 1	Introduction to Distributed Ledger Technologies	Assignment	Data Collection	No. of Sessions: 09
<p>Topics:</p> <p>What is Distributed Ledger Technology (DLT) and How Does it work? Key Features of DLT, Distributed Nature of the Ledger, Consensus Mechanism, Open/Permissionless Distributed Ledgers : Bitcoin , Ethereum ; Permissioned Distributed Ledgers :, Ripple, Fabric (Hyperledger Project) , Corda, Key Advantages of DLT, Challenges and Risks related to DLT, Applications of DLT.</p> <p>Assignment: Permissionless Distributed Ledgers/ Permissioned Distributed Ledgers</p>				
Module 2	Introduction to Hyperledger	Assignment	Writing Task	No. of Sessions: 09
<p>Topics:</p> <p>What is Hyperledger? Hyper ledger frameworks, Hyperledger Fabric- Components design, principles of Hyperledger design, reference architecture, run time architecture, the journey of sample transaction, Hyperledger Composer.</p>				

Assignment: Hyperledger Fabric Design				
Module 3	Designing a Data and Transaction Model	Assignment	Programming Task	No. of Sessions: 10
<p>Topics:</p> <p>Starting the chaincode development, Compiling and running chaincode, Installing and instantiating chaincode, Invoking chaincode, Creating a chaincode, The chaincode interface, setting up chaincode file, Access control – ABAC- Registering a user, Enrolling a user, Retrieving user identities and attributes in chaincode, Implementing chaincode functions, Defining chaincode assets, Coding chaincode functions Creating an asset, Testing.</p> <p>Assignment: Creating Chaincode and interfacing among them.</p>				
Module 4	Applications of DLT	Case Study	Discussion	No. of Sessions: 08
<p>Topics:</p> <p>Applications: Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.</p> <p>Case study: Managing the Metal and Mining Industry's Supply Chain with Hyperledger Fabric</p>				

<p>List of Laboratory Tasks:</p> <p>Level 1: Create a Simple Blockchain in any suitable programming language.</p> <p>Level 2: Create a complex Blockchain in any suitable programming language</p> <p>Level 1: Deposit oneEther in your MetaMask accounts.</p> <p>Level 2: Deposit 10 Ether in your MetaMask accounts</p> <p>Level 1: Create Single account.</p> <p>Level 2: Create multiple accounts and make a transaction between these accounts</p> <p>Level 1: Test any one property of cryptographic hashing</p> <p>Level 2: Test all the properties of cryptographic hashing</p> <p>Level 1: Add a transaction to a blockchain</p> <p>Level 2: Add multiple transaction to a blockchain</p> <p>Level 1: Create a new file 'WorkingWithVariables.sol' in Solidity</p> <p>Level 2: Program to write a solidity program with required variables</p> <p>Level 1: Create a new file 'SendMoney.sol' in solidity</p> <p>Level 2: Create new transaction with signing</p> <p>Level 1: Single Error Handling using solidity</p> <p>Level 2: Complex exception Handling using solidity</p> <p>Level 1: Use Geth to Implement Private Ethereum Block Chain.</p> <p>Level 2: Use Geth to Implement public Ethereum Block Chain.</p> <p>Level 1: Build Hyperledger Fabric Client Application.</p> <p>Level 2: Build Hyperledger Fabric Server/network Application.</p> <p>Level 1: Build Hyperledger Fabric with Smart Contract.</p> <p>Level 2: Case study on Hyperledger Fabric</p> <p>Level 1: Create Case study of Block Chain being used in illegal activities in real world.</p> <p>Level 2: Using Golang to develop Block Chain Application</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Meta mask, Docker and Docker compose, Go Programming language</p>
<p>Project work/Assignment:</p>
<p>Topics:</p> <p>Permissioned Distributed Ledgers</p> <p>Chaincode- Creation and interface</p>

Textbook(s):
T1. Nitin Gaur, Hands-on blockchain with Hyperledger_ Building decentralized applications with Hyperledger Fabric and Composer, Packt,2020.
References
R1. Andreas M. Antonopoulos, “Mastering Bitcoin- Programming” - The Open Blockchain,Oreilly,2017
R2. hyperledger-fabricdocs Documentation, Release Master, 2021.
R3. D. Drescher, Blockchain Basics. Apress, 2017.
R4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
Other Resources
Distributed Ledger Technology (DLT) and Blockchain, Fintech
NPTEL online course : <a href="https://nptel.ac.in/courses/106/104/106104220/">https://nptel.ac.in/courses/106/104/106104220/</a>
Udemy: <a href="https://www.udemy.com/course/build-your-blockchain-az/">https://www.udemy.com/course/build-your-blockchain-az/</a>
EDUXLABS Online training : <a href="https://eduxlabs.com/courses/blockchain-technologytraining/?tab=tab-curriculum">https://eduxlabs.com/courses/blockchain-technologytraining/?tab=tab-curriculum</a>
E-Book Links:
T1. <a href="https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EXc_hRKtg1dOu6GuNvv0MZMBQ_Zo0lpNJyXsJ4lANfcJdQ?e=YAvywC">https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EXc_hRKtg1dOu6GuNvv0MZMBQ_Zo0lpNJyXsJ4lANfcJdQ?e=YAvywC</a>
R1. <a href="https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EUMg4-zAc3dGgl1RWeDDJR8B4SCqMMeO0llzun51qbDITw?e=ObRwKr">https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EUMg4-zAc3dGgl1RWeDDJR8B4SCqMMeO0llzun51qbDITw?e=ObRwKr</a>
R2. <a href="https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EWrs6M9zaYpJhvf9RI2jRaUB9PIJhXmQfZC5vdg284oVlg?e=aD9RgX">https://presidencyuniversityin-my.sharepoint.com/:b:/g/personal/sampath_ak_presidencyuniversity_in/EWrs6M9zaYpJhvf9RI2jRaUB9PIJhXmQfZC5vdg284oVlg?e=aD9RgX</a>
Topics relevant to “Skill Development”: Applications of DLT is used for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.



Course Code: CSE 3020	Course Title: Smart Contract and Solidity Type of Course: Integrated	L-T- P- C	2 -0	2	3
Version No.	1				
Course Pre-requisites	Basics of Mathematics and any Programming Language				
Anti-requisites	NONE				
Course Description	Solidity is an object-oriented, high-level language for implementing smart contracts. Smart contracts are programs which govern the behaviour of accounts within the Ethereum state. Solidity is a curly-bracket language designed to target the Ethereum Virtual Machine (EVM). It is influenced by C++, Python and JavaScript. The Ethereum Virtual Machine (EVM) and assembly (low level language), events and logging blockchain emissions, send vs transfer methods, scoping and more				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Smart Contract and Solidity and attain EMPLOYABILITY through Experiential Learning Techniques..				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>CO 1 :Understand the fundamentals of computational Element of the Blockchain Technology</p> <p>C.O 2: Implementuser-defined operations of arbitrary complexity that are not possible through plain cryptocurrency protocols</p> <p>C.O 3: Exhibitbest practices for designing solutions with smart contracts using Solidity and Remix IDE</p>				
Course Content:	<p>Module: 1: Introduction to Smart Contract[14 Hrs - L[14] + T[00]] [Knowledge]</p> <p>A Simple Smart Contract, Blockchain Basics, The Ethereum Virtual Machine, Versioning, Remix, npm / Node.js, Docker, Binary Packages, Building from Source, CMake options.</p> <p>Module: 2: Solidity in Depth [22 Hrs – L[08] + T[02] + P[12]] [Application]</p> <p>Layout of a Solidity Source File, Structure of a Contract, Types, Units and Globally Available Variables, Expressions and Control Structures, Contracts, Solidity Assembly, Miscellaneous, Solidity v0.5.0 Breaking Changes</p> <p>Module 3: Contract Metadata &amp; Contract ABI Specification</p> <p>[22 Hrs – L[08] + T[02] + P[12]] [Comprehension]]</p> <p>Encoding of the Metadata Hash in the Bytecode, Usage for Automatic Interface Generation and NatSpec, Usage for Source Code Verification,</p>				

	Basic Design, Function Selector, Argument Encoding, Types, Design Criteria for the Encoding, Formal Specification of the Encoding, Function Selector and Argument Encoding, Examples, Use of Dynamic Types, Events, JSON, Strict Encoding Mode, Non-standard Packed Mode			
Module 1	Introduction to Smart Contract	TEST-1	Fundamentals of Smart Contract and Solidity	12Sessions
Topics:				
Module 2	Solidity in Depth	TEST-1	Case studies / Case let	12 Sessions
Topics:				
Module 3	Contract Metadata & Contract ABI Specification	Endterm lab Exam	Implementing Applications	14 Sessions
Topics:				
List of Laboratory Tasks:  Develop a complex voting application Build blind auction App Create safe remote purchase Develop micropayment channel Creating Decentralized Apps with Solidity Store Patient Health Records using Solidity Implement Supply Chain Management App using Solidity				
Targeted Application & Tools that can be used  NetBeans				

Project work/Assignment:
Assignment: Quiz and Group Project
Text Book T1 Solidity Smart Contracts: Build DApps In Ethereum Blockchain- Rangel Stoilov T2 Mastering Blockchain Programming with Solidity- Jitendra Chittoda .
References R1 Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and blockchain  R2 Hands-On Smart Contract Development with Solidity and Ethereum: From Fundamentals to Deployment- Book by David H. Hoover, Kevin Solorio, and Randall Kanna  E book link R1: NA  E book link R2: NA  R3 Web resources: Udemy course – <a href="https://www.udemy.com/course/the-complete-solidity-course-blockchain-zero-to-expert/">https://www.udemy.com/course/the-complete-solidity-course-blockchain-zero-to-expert/</a> Co Coursera Course ---- <a href="https://www.coursera.org/learn/smarter-contracts/">https://www.coursera.org/learn/smarter-contracts/</a>
Topics relevant to “SKILL DEVELOPMENT”: Encoding of the Metadata Hash in the Bytecode, Usage for Automatic Interface Generation and NatSpec, Usage for Source Code Verification, Basic Design, Function Selector, Argument Encoding, Types, Design Criteria for the Encoding, Formal Specification of the Encoding, Function Selector and Argument Encoding for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3020	CourseTitle:Blockchain Technology and Applications TypeofCourse:ProgramCore	L-T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Fundamentals of Blockchain Technology				
Anti-requisites	NIL				
CourseDescription	The purpose of the course is to provide an introduction to Blockchain technology with specific focus on industrial applicationslike Blockchain in Financial system, trade/supply chain management, agriculture industry, Healthcare sectors and Insurance system. With the knowledge of blockchain technology, Students will learn how these system are built, how to interact with them.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Blockchain Technology and Applications and attain Skill Development through Participative Learning techniques.				
Course OutComes	Onsuccessfulcompletionofthiscoursethestudentsshallbeableto:  Understand the concepts of Blockchain technology (Knowledge).  Explain the methods for verification and validation of Bitcoin transactions (Comprehension).  Explore the use the Ethereum programming (Application).  Illustrate the role ofblockchain in various domain (Comprehension).				
CourseContent:					
Module 1	Introduction to Blockchain	Quiz	Knowledge based quiz on Cryptographic Hash Functions	No.of Classes:8	
Topics: Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Online Wallets and Exchanges, Payment Services, Transaction Fees, Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures.					
Module 2	Bitcoin	Assignment	Bitcoin mining pools	No.of Classes:10	
Bitcoin Mechanics: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements.					

Bitcoin mining: The task of Bitcoin miners, Mining Hardware, Energy consumption, Mining pools, Mining incentives and strategies.				
Module 3	Ethereum	Create a smart contract using solidity language	Components of Ethereum Ecosystem	No.of Classes:10
The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.				
Module 4	Blockchains in Business	Case Study	Conduct a case study on how BaaS is adopted in industries.	No.of Classes:10
Topics: Blockchain in Supply Chain - Blockchain in Manufacturing - Blockchain in Automobiles - Blockchain in Healthcare- Blockchain in Financial Industry				
List of Laboratory Tasks: NA				
Targeted Application & Tools that can be used:  Ethereum Remix online& Ganache  Solidity programming language				
Project work/Assignment:				
Calculate the 'number of ethers' for the transaction of gas limit for the scenario in which the sender sets the gas limit to 50,000 and a gas price to 20 gwei.  Represent the EthereumMerkley Tree for the given list of Transactions.  Create Survey report of various types of Blockchain and its real time use cases.				
Textbook(s):  BellajBadr, Richard Horrocks, Xun (Brian) Wu, "BlockchainBy Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.				

<p>References:</p> <p>Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained”, 2nd Edition, Packt Publishing Ltd, March 2018.</p> <p>Weblinks:</p> <p>Udemy: <a href="https://www.udemy.com/course/build-your-blockchain-az/">https://www.udemy.com/course/build-your-blockchain-az/</a></p> <p>NPTel online course : <a href="https://nptel.ac.in/courses/106/104/106104220/#">https://nptel.ac.in/courses/106/104/106104220/#</a></p> <p>Textbook(s):</p> <p>BellajBadr, Richard Horrocks, Xun (Brian) Wu, “BlockchainBy Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger”, Packt Publishing Limited, 2018.</p> <p><a href="https://www.google.co.in/books/edition/Blockchain_By_Example/ci59DwAAQBAJ?hl=en&amp;gbpv=1">https://www.google.co.in/books/edition/Blockchain_By_Example/ci59DwAAQBAJ?hl=en&amp;gbpv=1</a></p> <p>Topics relevant to “SKILL DEVELOPMENT”: Ethereum, Blockchain in Manufacturing for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</p>
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Course Code:CSE2019	CourseTitle: Foundations of Blockchain Technology TypeofCourse:ProgramCore& Theory only	L-T-P-C	3 -0	0	3
Version No.	1.1				
Course Pre-requisites	Networks				
Anti-requisites	NIL				
CourseDescription	<p>The purpose of the course is to provide the fundamental knowledge onBlockchain technologyand explore various aspects of Blockchain technology like types of Blockchain, Bitcoin and EthereumBlockchain platform.</p> <p>With a good knowledge of block chain technology, the student can understand the mechanism of Bitcoin and able to write simple smart contracts</p>				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Foundations of Blockchain Technology and attain Skill Development through Participative Learning techniques.				

Course Outcomes	<p>On successful completion of this course the student shall be able to:</p> <p>Understand the concepts of an emerging blockchain technology (Knowledge).</p> <p>Infer the knowledge about consensus protocols (comprehension).</p> <p>Explore Bitcoin payment methods (comprehension).</p> <p>Develop simple smart contract (comprehension).</p>			
Course Content:				
Module 1	Blockchain Basics	Quiz	Knowledge based quiz on distributed ledger	10 Sessions
<p>Topics: The history of Blockchain: Blockchain, Generic elements of a blockchain, Benefits and limitations of Blockchain, Tiers of Blockchain technology, Features of Blockchain.</p> <p>Types of Blockchain: Distributed ledgers, Public Blockchain, private Blockchain, shared ledger.</p> <p>Quiz: Knowledge based quiz on distributed ledger</p>				
Module 2	Distributed Consensus	Assignment	PoW	08 Sessions
<p>Topics: Consensus: Consensus mechanism, Types of consensus mechanisms, Consensus in Blockchain.</p> <p>Assignment: Write an assignment on PoW consensus mechanism</p>				
Module 3	Introducing Bitcoin	Case study	Bitcoin network wallets	10 Sessions
<p>Topics: Bitcoin definition, Digital keys and addresses, Transactions, mining, Bitcoin network wallets, Bitcoin payments.</p> <p>Case Study: Conduct a study about hot bitcoin wallets</p>				
Module 4	Smart contracts	Case study	how to execute smart contract	10 Sessions

<p>Topics:History, Definition, Introduction to Ethereum,Ethereum network,Components of Ethereum ecosystem, Smart contracts.</p> <p>Case Study: Create a simple smart contract for User identity management using Solidity language and show how to execute.</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Ethereum Remix</p> <p>MetaMask</p> <p>Truffle</p> <p>Ganache</p>
<p>Textbook</p> <p>T1.Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained”, 2nd Edition, Packt Publishing Ltd, March 2018.</p> <p>Weblinks:Mastering Blockchain - Google Books</p>
<p>References</p> <p>R1.Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015.</p> <p>R2.Blockchain by Melanie Swa, O’Reilly .</p> <p>Weblinks:</p> <p>Blockchain A-Z™: Learn How To Build Your First Blockchain   Udemy</p> <p><a href="https://www.coursera.org/learn/wharton-cryptocurrency-blockchain-introduction-digital-currency">https://www.coursera.org/learn/wharton-cryptocurrency-blockchain-introduction-digital-currency</a></p> <p><a href="https://www.coursera.org/specializations/introduction-to-blockchain">https://www.coursera.org/specializations/introduction-to-blockchain</a></p> <p><a href="https://presiuniv.knimbus.com/user">https://presiuniv.knimbus.com/user</a></p> <p>Text book of Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained, 2nd Edition, Packt Publishing Ltd, March 2018.</p> <p><a href="https://www.google.co.in/books/edition/Mastering_Blockchain/3ZIUDwAAQBAJ?hl=en&amp;gbpv=1">https://www.google.co.in/books/edition/Mastering_Blockchain/3ZIUDwAAQBAJ?hl=en&amp;gbpv=1</a></p>
<p>Topics relevant to “SKILL DEVELOPMENT”:</p> <p>Bitcoin and Smart Contracts for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.</p>



Course Code:	Course Title: Machine Learning Techniques				
CSE3008	Type of Course: 1] Discipline Elective 2] Laboratory integrated	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	CSE3001 Artificial Intelligence and Machine Learning				
Anti-requisites	[List the Anti -requisites of the course]				
Course Description	Machine Learning algorithms are the key to develop intelligent systems such as Apple's Siri, Google's self-driving cars etc. This course introduces the concepts of the core machine learning techniques such as Regression learning, Bayesian learning, Ensemble learning, Perceptron learning, Unsupervised learning, Competitive learning, learning from Gaussian mixture models and learning to detect outliers. Course lectures covers both the theoretical foundations as well as the essential algorithms for the various learning methods. Lab sessions complement the lectures and enable the students in developing intelligent systems for real life problems.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Machine Learning Techniques and attain Skill Development through experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  1] Apply advanced supervised machine learning methods for predictive modeling. [Application]  2] Produce machine learning models with better predictive performance using meta learning algorithms [Application]  3] Create predictive models using Perceptron learning algorithms[Application]  4] Employ advanced unsupervised learning algorithms for clustering, competitive learning and outlier detection[Application]  5] Implement machine learning based intelligent models using Python libraries. [Application]				
Course Content:					

Module 1	Supervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L – 7 P – 12
Topics: An overview of Machine Learning(ML); ML workflow; types of ML; Types of features, Feature Engineering -Data Imputation Methods; Regression – introduction; simple linear regression, loss functions; Polynomial Regression; Logistic Regression; Softmax Regression with cross entropy as cost function; Bayesian Learning – Bayes Theorem, estimating conditional probabilities for categorical and continuous features, Naïve Bayes for supervised learning; Bayesian Belief networks; Support Vector Machines – soft margin and kernel tricks.				
Module 2	Ensemble Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-3 P-4
Topics: Ensemble Learning – using subset of instances – Bagging, Pasting, using subset of features –random patches and random subspaces method; Voting Classifier, Random Forest; Boosting – AdaBoost, Gradient Boosting, Extremely Randomized Trees, Stacking.				
Module 3	Perceptron Learning	Assignment /Quiz	Programming using Keras/Sklearn	No. of Classes L-7 P -2
Topics: Perceptron Learning – from biological to artificial neurons, Perceptrons, Linear Threshold Units, logical computations with Perceptrons, common activation functions – sigmoid, tanh, relu and softmax, common loss functions, multi-layer Perceptrons and the Backpropagation algorithm using Gradient Descent.				
Module 4	Unsupervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-6 P -6
Topics: Unsupervised Learning – simple k Means clustering- simple and mini-batch; updating centroids incrementally; finding the optimal number of clusters using Elbow method ; Silhoutte coefficient, drawbacks of kMeans, kMeans++ ; Divisive hierarchical clustering – bisecting k-means, clustering using Minimum Spanning Tree (MST) Competitive Learning - Clustering using Kohenen's Self Organising Maps (SOM), Density Based Spatial Clustering – DBSCAN; clustering using Gaussian Mixture Models (GMM) with EM algorithm ; Outlier Detection methods – Isolation Forest, Local Outlier Factor(LOF)				
List of Laboratory Tasks:				
Experiment NO 1: Methods for handling missing values				

Level 1: Given a data set from UCI repository, implement the different ways of handling missing values in it using Scikit-learn library of Python

Level 2: Implement one of these methods using a custom defined function in Python.

#### Experiment No. 2: Data Visualization

Level 1 Perform Exploratory Data Analysis for a given data set by creating Scatter Plot, Pair Plot, Count Plot using Matplotlib and Seaborn

Level 2 Create Heat Maps, WordCloud

#### Experiment No. 3: Regression learning

Level 1 Given a data set from UCI repository, implement the simple linear regression algorithm and estimate the models parameters and the performance metrics. Plot the learning curves.

Level 2 Implement the polynomial regression algorithm. Compare the learning curves of Polynomial and Linear Regression.

#### Experiment No.4: Logistic regression

Level 1 Write custom code for generating the logistic/sigmoid plot for a given input

Level 2 Given a data set from UCI repository, implement the Logistic regression algorithm. Estimate the class probabilities for a given test data set. Plot and analyze the decision boundaries.

#### Experiment No.5: Bayesian Learning

Level 1 Given a data set from UCI repository, implement a classification model using the Bayesian algorithm

#### Experiment No.6: Support Vector Machine(SVM)

Level 1 Given data sets from UCI repository, implement a linear SVM and a non-linear SVM based classification model.

#### Experiment No. 7: Ensemble Learning

Level 1 : Implement Ensemble Learning algorithms such as Bagging, Pasting and Out-of-Bag Evaluation

Level 2 : Random Patches and Random Subspace Method

Experiment No. 8: Ensemble Learning

Level 1 : AdaBoost and Gradient Boosting, Stacking

Experiment No. 9: Perceptron Learning

Level 1 : Implement the Perceptron Classifier

Level 2 : – An Image Classifier Using the Sequential API of Keras

Experiment No. 10: Unsupervised Learning

Level 1 : K-means – simple and mini-batch. Finding the optimal number of clusters using Elbow method and Silhouette Coefficient . Compare the inertia of both as k increases. Tuning the hyperparameter 'k' using GridSearchCV.

Level 2 : – Using clustering for Image segmentation and Preprocessing. Kmeans++

Experiment No. 11: Density Based Clustering

Level 1 Implement DBSCAN – clustering using the local density estimation. Perform hard and soft clustering for new instances.

Experiment No. 12: Outlier Detection

Level 1 Outlier Detection using Isolation Forest and Local Outlier Factor

Targeted Application & Tools that can be used :

Execution of the ML algorithms will be done using the Google's cloud service namely "Colab", available at <https://colab.research.google.com/> or Jupyter Notebook.

The data sets will be from the benchmarking repositories such as UCI machine learning repository available at : <https://archive.ics.uci.edu/ml/index.php>

Laboratory tasks will be implemented using the libraries available in Python such as Scikit learn, matplotlib, seaborn, perceptron and the deep learning framework namely Keras.

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

Students can be assigned a mini project to develop a machine learning application for real-life problems in various domains such as health care, business intelligence, environmental modeling, etc.

Text Book

<p>There are a number of useful textbooks for the course, but each cover only a part of the course syllabus. Following is an indicative list of textbooks.</p> <p>Aurélien Géron, “Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow”, Oreilly, Second Edition, 2019.</p> <p>Andreas C Muller, Sarah Guido, “Introduction to Machine Learning with Python :A Guide for Data Scientists”, Oreilly, First Edition, 2018</p> <p>Giuseppe Bonaccorso, “Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning”, Packt Publishing, 2017.</p>
<p><b>References</b> In references apart from the books and web links, mention a few standards &amp;Hand books relevant to the Laboratory tasks used by the professionals.</p> <p>Tan P. N., Steinbach M &amp; Kumar V. “Introduction to Data Mining”, Pearson Education, 2016.</p> <p><a href="https://towardsdatascience.com/machine-learning/home">https://towardsdatascience.com/machine-learning/home</a></p> <p>MITopencourseware:<a href="https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/resources/lecture-11-introduction-to-machine-learning/">https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/resources/lecture-11-introduction-to-machine-learning/</a></p> <p><a href="https://onlinecourses.nptel.ac.in/noc21_cs85/preview">https://onlinecourses.nptel.ac.in/noc21_cs85/preview</a></p>
<p>Topics relevant to “Skill Development ”: Assignment implementations in software, batch wise presentations are used for developing Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.</p>



Course Code: CSE3152	Course Title: .NET Full Stack Development	L- T-P- C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	CSE3151 Java Full Stack Development				
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of DotNET FULL STACK Development and attain Employability Skills through Experiential Learning techniques.				
Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of C# for developing a small application [Application] 2] Show web applications using Entity Framework. [Application] 3]Solve simple web applications that use SQL and ASP.NET [Application] 4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]				
Course Content:					
Module 1	C# Programming for Full Stack Development	Project	Programming		10 Sessions
Topics: .NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions,					

<p>Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading, Data validation and working with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework</p> <p>Assignment: Develop a small application for managing library using C#.</p>				
Module 2	Entity Framework Core 2.0	Project	Programming	06 Sessions
<p>Topics:</p> <p>Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET</p> <p>Assignment: Develop an application for managing HR policies of a department.</p>				
Module 3	ASP.NET	Project	Programming	06 Sessions
<p>Topics:</p> <p>ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC &amp; Layouts;</p> <p>Assignment: Develop a web application to mark entry/exit of guests in a building.</p>				
Module 4	ASP.NET	Project	Programming	08 Sessions
<p>Topics:</p> <p>Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application</p> <p>Assignment: Develop a software tool to do inventory management in a warehouse.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.</p> <p>Professionally Used Software: Visual Studio</p>				



Project work/Assignment:					
Problem Solving: Design of Algorithms and implementation of programs.					
Programming: Implementation of given scenario using .NET.					
Assignment: Case study on Web sites development					
Text Book:					
T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015					
T2. Valerio De Sanctis, "ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11", 4th Edition, Packt, 2021.					
References					
R1. Benjamin Perkins, Jon D. Reid, "Beginning C# and .NET", Wiley, 2021 Reid, 2021.					
R2. Piotr Gankiewicz, "Full Stack .NET Web Development", Packt Publishing, 2017.					
R3. Tamir Dresher, Amir Zuker, Shay Friedman, "Hands-On Full-Stack Web Development with ASP.NET Core", Packt Publishing, 2018.					
R4. Dustin Metzgar, "Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core", Manning, 2017.					
Topics relevant to development of "Employability": C#, ASP.NET & SQL for developing Employability Skill Development through Experiential Learning techniques.. This is attained through assessment component mentioned in course handout.					

Course Code: CSE 2033	Course Title: Go Programming Type of Course: Theory Only Course	L- T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Computer Programming/ Object Oriented Programming (java)				
Anti-requisites	NIL				
Course Description	Go is an open source programming language created by Google. Go is expressive, concise, clean, and efficient. Its concurrency mechanisms make it easy to write programs that get the most out of multicore and networked machines. Go compiles quickly to machine code yet has the convenience of garbage collection and the power of run-time reflection. It's a fast, statically				

	<p>typed, compiled language that feels like a dynamically typed, interpreted language. It is gaining popularity and it is continuing to grow rapidly in industries such as Dropbox, Uber etc.</p> <p>This course will provide an introduction to the Go programming essentials to students of Engineering through lecture hours with demonstrations.</p> <p>Topics: Topics covered in this course are go program structure; data types and control statements; Composite Types – arrays, slices, strings, runes, bytes, hash maps; functions; methods; garbage collection essentials – pointers, structs, interfaces; error handling; Concurrency – go routines and channels, Packages – import and create custom packages and applications of Go</p>			
Course Objective	The objective of the course is to familiarize the learners with the concepts of GO Programming and attain Employability Skills through Problem Solving techniques.			
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>CO1: Identify primitive programming constructs in GO. (Knowledge)</p> <p>CO2: Discuss composite data types with concepts of modular programming. (Comprehension)</p> <p>CO3: Implement garbage collection using pointers, structs, interfaces and modules. (Application)</p> <p>CO4: Apply concurrent programming and test routines with applications. (Application)</p>			
Course Content:				
Module 1	Introduction to Go Programming Language	Assignment	Data Collection/Interpretation	10 Sessions
<p>Topics: [ Knowledge]</p> <p>Feature of Go language, Installing and Configuring the development environment- Go tools and playground. Structure of Go program; Basic types-numbers, boolean, strings, runes. Variables- declaration, zero values, naming, rules, conversions, constants, multiple variables. Introduction to packages, functions from other packages, println, reading input, Control Structures - if, switch, for, programming exercises using control statements.</p>				
Module 2	Composite types and functions	Assignment	Data Collection/Interpretation	9 Sessions
<p>Topics: [Comprehension]</p>				

Composite types - arrays, slices, slices with overlapping storage, Structs. Functions-declaring, parameters, returning multiple values, variadic functions; Programming exercises				
Module 3	Pointers, Structs, Interfaces and modules	Quiz	Case studies / Case let	9 Sessions
Topics: [ Application] Pointers: *and & operator, types, pointers with functions, garbage collector – history, Methods and Interfaces, Modules,packages – importing and creating custom packages; Programming exercises.				
Module 4	Concurrency and Applications	Quiz	Case studies / Case let	7 Sessions
Topics: [ Application] Concurrency using Go routines, multiple go routines, channels – channel operations, Testing- writing test, Go test command, Core Packages for – strings, containers and lists, Writing Web Applications, Basic Statistical Computations, histogram plotting, encryption and decryption.				
Targeted Application & Tools that can be used: <a href="https://go.dev/play/">https://go.dev/play/</a> <a href="https://go.dev/doc/install">https://go.dev/doc/install</a>				
Project work/Assignment:				
Text Book T1 1. John Badner,"Learning Go: An Idiomatic Approach to Real World Go Programming", Oreilly, California,2021.				
References R1. 1. Alan A.A. Donovan and Brian W. Kernighan, "The Go Programming Language", Pearson Education, India,2016. R2. Tsoukalos M. Mastering Go: Create Golang production applications using network libraries, concurrency, machine learning, and advanced data structures. Packt Publishing Ltd; 2019 Aug 29. Web resources: <a href="https://www.golangprograms.com/go-language.html">https://www.golangprograms.com/go-language.html</a>				

<p>EBSCO database of Presidency University: <a href="https://puniversity.informaticsglobal.com/login">https://puniversity.informaticsglobal.com/login</a></p> <p>W3. GO document: <a href="https://go.dev/doc/">https://go.dev/doc/</a></p> <p>Online tool for program execution:</p> <p>GO Play Ground - <a href="https://go.dev/play/">https://go.dev/play/</a></p> <p>Download and install: <a href="https://go.dev/doc/install">https://go.dev/doc/install</a></p>
<p>Topics relevant to development of “Employability”: Go Programming basics for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</p>

CSE1003	Course Title: Innovation Project-Raspberry Pi Using Python	L- T- P- C	0 -0	4  This includes few lecture sessions	2
Version No.	0.9				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	In this course the students will learn fundamental concepts of ‘Python’ and Python for Raspberry Pi through problem solving using Python in a systematic way to read and write the Python code and to implement them on Raspberry Pi prototype board. The course will also demonstrate how to assemble various sensory devices and program them using Raspberry platform as a basis. Students will have the opportunity of gaining real-world experience in handling IoT devices involving hardware and software combinations. The course also offers in-depth knowledge of designing, developing, coding and implementing Raspberry Pi projects.				
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques.				

Course Outcomes	<p>On successful completion of this course the students shall be able to:</p> <p>Develop beginner level python code. [Application]</p> <p>Explain the main features of the Raspberry Pi board. [Comprehension]</p> <p>Demonstrate the hardware interfacing of the peripherals to Raspberry Pi system. [Ap plication]</p> <p>Demonstrate the functioning of live various projects carried out using Raspberry Pi system. [Appli cation]</p>			
Course Content:				
Module 1	Basics of Python	Quiz	Problem Solving	4 Sessions
<p>Topics:</p> <p>Introduction, Getting started with Python, Variables and Literals, Print function, input function, Data Types Type Conversions, Operations on Strings, Arithmetic and logical Operators, Boolean expression, Data sequence, lists, tuples, sets, dictionary.</p> <p>Concepts will be taught by solving problems through programs.</p>				
Module 2	Decision Making and Iterations	Quiz	Problem Solving	4 Sessions
<p>Topics:</p> <p>Conditional coding and Control statements-if, elif, else, while loop, for loop, nested for loop, range function, break and continue, pass.</p> <p>Concepts will be taught by solving problems through programs.</p>				
Module 3	Functions, Files	Project Development	Problem Solving	4 Sessions
<p>Topics:</p> <p>Introduction to functions, syntax, variables scope and lifetime, function parameters and arguments, importing modules.</p> <p>Concepts will be taught by solving problems through programs.</p>				
Module 4	Interaction with API Services	Project Development	Modeling and Simulation task	3 Sessions
<p>Topics:</p>				

<p>Raspberry Pi interact with online API services through the use of public APIs and SDKs using Firebase, Gspread API.</p> <p>Node-RED – a programming tool for wiring together hardware devices, MQTT.</p> <p>Android/Case study.</p>	
<p>Targeted Application &amp; Tools that can be used:</p> <p>Making it a reality (Raspberry Pi Projects) :</p> <p>Projects will include but not limited to :</p> <ol style="list-style-type: none"> <li>1) Intelligent home locking system.</li> <li>2) Intelligent water level management system.</li> <li>3) Home automation using RFID.</li> <li>4) Real time clock-based home automation.</li> <li>5) Intelligent Automatic Irrigation System</li> </ol> <p>Professionally Used Software: Raspberry Pi.</p>	
Project work/Python Lab Test:	
<p>Project work</p> <p>Python test.</p>	
<p>Text Book(s):</p> <p>Ashok Namdev Kamthane, Amit Ashok Kamthane, “Problem Solving and Python Programming”, Mc Graw Hill Education, 2018.</p>	
<p>Reference(s):</p> <p><a href="https://github.com/thibmaek/awesome-raspberry-pi">https://github.com/thibmaek/awesome-raspberry-pi</a></p> <p>MagPi magazine</p>	
<p>Topics relevant to development of “Skill Development”: Basic Concepts of Python-Programming, and Raspberry Pi for Skill Development through Experiential Learning Techniques. This is attained through assessment component mentioned in course handout.</p>	
Evaluation :	Review-1-20%, Review-2-25%, Python test-25%, Project Expo-30%



Course Code: CSE3098	Course Title: Vulnerability Assessment and Penetration Testing Type of Course: Theory Only Course	L- T- P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				
Course Description	This course explores the tools that can be used to perform information gathering. This course also covers how vulnerability can be carried out by means of tools or manual investigation, and analysis of common attacks in data, mobile applications and wireless networks				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Vulnerability Assessment and Penetration Testing and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:  Understand the basic principles for information gathering and detecting vulnerabilities in the system.  Determine the security threats and vulnerabilities in SDN networks and web applications.  Able to use the exploits in mobile applications and wireless networks  Understand the metasploit and metrepreter are used to automate the attacks and penetration testing techniques.				
Course Content:					
Module 1	Information Gathering, Host Discovery and Evading Techniques	Assignment	Theory	9 Sessions	
Topics: Introduction - Terminologies - Categories of Penetration Testing - Phases of Penetration Test -Penetration Testing Reports - Information Gathering Techniques - Active, Passive and Sources of Information Gathering – Approaches, Host discovery - Scanning for open ports and services- Types of Port, Vulnerability Scanner Function, pros and cons - Vulnerability Assessment with NMAP - Testing, SCADA environment with NMAP					



Module 2	Vulnerability Scanner in SDN Networks and Web application	Quiz	Theory	10 Sessions
<p>Topics:</p> <p>Nessus Vulnerability Scanner - Safe check – Silent dependencies - Port Range Vulnerability Data Resources, SDN Data plane, Control Plane, Application Plane. SDN security attack vectors and SDN Hardening, Authentication Bypass with Insecure Cookie Handling - XSS Vulnerability - File inclusion vulnerability - Remote file Inclusion -Patching file Inclusions - Testing a website for SSI Injection.</p>				
Module 3	Mobile Application Security and wireless network Vulnerability analysis	Quiz	Theory	11 Sessions
<p>Topics:</p> <p>Types of Mobile Application Key challenges in Mobile Application and Mobile application penetration testing methodology, Android and ios Vulnerabilities - OWASP mobile security risk - Exploiting WM - BlackBerry Vulnerabilities - Vulnerability Landscape for Symbian - Exploit Prevention -Handheld Exploitation, WLAN and its inherent insecurities Bypassing WLAN Authentication uncovering hidden SSIDs MAC Filters Bypassing open and shard authentication - Advanced WLAN Attacks Wireless eavesdropping using MITM session hijacking over wireless – WLAN Penetration Test Methodology.</p>				
Module 4	Exploits	Quiz	Theory	8 Sessions
<p>Topics:</p> <p>Architecture and Environment- Leveraging Metasploit on Penetration Tests, Understanding - Metasploit Channels, Metasploit Framework and Advanced Environment configurations – Understanding the Soft Architecture, Configuration and Locking, Advanced payloads and add on modules Global datastore, module datastore, saved environment Meterpreter.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>This course helps the students to understand the threats and vulnerabilities using NMAP.</p>				
Project work/Assignment:				
Project Assignment:				
<p>Text Book</p> <p>Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015. ISBN : 78-1-4822-3161-8.</p> <p>Dr. Patrick Engebretson, The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing made easy , Syngress publications, Elsevier, 2013. ISBN :978-0-12-411644-3.</p>				

Mayor, K.K.Mookey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, Elsevier, 2007. ISBN : 978-1-59749-074-0

#### References

Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016 Packt Publishing.

SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication

Web resources: [https://onlinecourses.nptel.ac.in/noc19\\_cs68/preview](https://onlinecourses.nptel.ac.in/noc19_cs68/preview) - IIT Kharagpur, Prof. Indranil Sen Gupta

Topics relevant to development of “EMPLOYABILITY SKILLS”: Exploitation, Penetration testing techniques, for development of Employability skills through the Participative Learning Techniques. This is attained through the assessment components mentioned in course handout.

Course Code: CSE502	Course Title: Technical Skills in Java Open Elective Type of Course: Lab Integrated Course	L-T-P-C	0	0	6	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of programming and data structure concepts.					
Anti-requisites	NIL					
Course Description	This Course is designed for students who have prior programming experience. It provides assistance to prepare for placements and extensive exposure to object-oriented programming features. It helps to develop robust solutions for real world applications.					
Course Objective	The objective of the course is SKILL DEVELOPMENT and EMPLOYABILITY of students by using participative learning techniques.					

Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <ol style="list-style-type: none"> <li>1. Summarize the Object-oriented concepts with example program.</li> <li>2. Implement Arrays and Strings to solve real world problems.</li> <li>3. Apply the concept of polymorphism &amp; inheritance to solve real time problems.</li> <li>4. Illustrate programs on Interface, Packages</li> <li>5. Demonstrate runtime errors using Exception handling.</li> </ol>			
Course Content:				
Module 1	Introduction to Object-oriented programming	Assignment	Practical Task	14 Hours
<p>Topics:</p> <p>Introduction to object oriented programming, Java Evolution, How Java differs from C++, Features of Java,</p> <p>Java Environment: Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions, JDK, JVM, JRE.</p> <p>Java Tokens: Datatypes, Variables, Operators, Control Statements, Command Line Arguments.</p> <p>Classes, Objects, and Methods: Defining a class, Access Specifiers, instantiating objects, Reference variable, Accessing class members and methods, constructors, method overloading, static members,</p> <p>static methods, inner class, Wrapper class, Auto-boxing and Unboxing.</p>				
Module 2	Arrays, Strings	Assignment	Practical Task	11 Hours
<p>Topics:</p> <p>Defining an Array, Initializing &amp; Accessing Array, Multi –Dimensional Array</p> <p>Strings: Operation on String, Mutable &amp; Immutable String, Creating Strings using String Buffer or StringBuilder.</p> <p>Assignment: Test 1, Quiz1</p>				

Module 3	Inheritance and Polymorphism	Assignment	Practical Task	12 Hours
Inheritance and Polymorphism: Defining a subclass, Types of Inheritance, Method overriding, super keyword, Dynamic method invocation, Dynamic polymorphism, Final, Abstract, this keyword. Forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.				
Module 4	Interface and Package	Assignment	Practical task	8 Hours
<p>Topics:</p> <p>Defining interfaces, extending interfaces, implementing interfaces.</p> <p>Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages Import and Static Import, Naming Convention for Packages.</p> <p>Assignment: Test 2</p>				
Module 5	Exception Handling	Assignment	Theory task	6 Hours
<p>Topics:</p> <p>Exception Handling: Introduction to Exceptions, Difference between Exceptions &amp; Errors, Types of Exception, Handling of Exceptions: Use of try, nested try statements, catch, finally, throw, throws, built in exceptions, User Defined Exceptions, Checked and Un-Checked Exceptions</p>				
<p>Text Book</p> <p>Text Books:</p> <p>Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson 2016.</p> <p>Cay S Horstmann and Cary Gornell, "CORE JAVA volume II-Advanced Features", Pearson 2017.</p>				

## References

Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 10th Edition 2017.

James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers 2000.

## Web resources:

1. <https://www.udemy.com/course/object-oriented-programming-oops-concepts-in-english/>
2. <https://archive.nptel.ac.in/courses/106/105/106105191/>

Course Code: CSE503	Course Title: Technical Skills in Python Open Elective Type of Course: Lab Integrated Course	L-T-P-C	0	0	6	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of programming and data structure concepts.					
Anti-requisites	NIL					
Course Description	This Course is designed for students who have prior programming experience. It provides assistance to prepare for placements and extensive exposure to Programming in Python. It helps to develop robust solutions for real world applications.					

Course Objective	The objective of the course is SKILL DEVELOPMENT and EMPLOYABILITY of students by using participative learning techniques.			
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <ol style="list-style-type: none"> <li>1. Summarize the Object-oriented concepts using Python with example program.</li> <li>2. Implement Lists, Tuples, Dictionary and Strings to solve real world problems.</li> <li>3. Apply the concept of polymorphism &amp; inheritance to solve real time problems.</li> <li>4. Illustrate programs by using Python Library</li> <li>5. Demonstrate runtime errors using Exception handling.</li> </ol>			
Course Content:				
Module 1	Introduction to Python and Basics	Assignment	Practical Task	11 Hours
<p>Topics:</p> <p>Introduction to Python programming, Python Evolution, Features of Python, Python Environment: Installing Python, Python Program Development, Python Source File Structure, Interpretation, Executions.</p> <p>Python Data Structures &amp; Data Types</p> <p>Looping, I/O Formatting, Functions, Lambda Functions</p>				
Module 2	Classes, Files and Exception handling	Assignment	Practical Task	8 Hours

<p>Topics:</p> <p>New Style Classes □ Creating File handling Modes □ Reading Files □ Writing&amp; Appending to Files</p> <p>□ Handling File Exceptions</p> <p>Classes □ Instance Methods □ Inheritance □ Polymorphism □ Exception Classes &amp; Custom Exceptions</p> <p>Assignment: Test 1,Quiz1</p>				
Module 3	Data Structures, Collections, generators and Iterators	Assignment	Practical Task	11 Hours
<p>List Comprehensions □ Nested List Comprehensions □ Dictionary Comprehensions</p> <p>named tuple() □ deque □ ChainMap □ Counter □ OrderedDict</p> <p>Iterators □ Generators □ The Functions any and all □ With Statement</p>				
Module 4	GUIs, Date and time, Regular expressions	Assignment	Practical task	11 Hours
<p>Topics:</p> <p>Components and Events □ An Example GUI □ The root Component □ Adding a Button</p> <p>□ Entry Widgets □ Text Widgets</p> <p>sleep □ Program execution time □ more methods on date/time</p> <p>Filter □ Map □ Reduce □ Decorators □ Frozen set</p> <p>Split □ Working with special characters, date, emails □ Quantifiers □ Match and find all</p> <p>Assignment: Test 2</p>				
Module 5	Threads, API, Django	Assignment	Theory task	10 Hours
<p>Topics:</p> <p>Class and threads □ Multi-threading □ Synchronization □ Treads Life cycle</p> <p>Introduction □ Facebook Messenger □ Openweather</p> <p>Django Overview □ Django Installation □ Creating a Project □ Usage of Project in depth Discussion □ Creating an Application □ Understanding Folder Structure</p>				

## Text Book

### Text Books:

Python Programming – A Modular Approach Pearson 2021.

Martin C Brown “The Complete reference Python”, McGraw Hill 2021.

### References

Mark Lutz, “Learning Python”, OReilly 2021.

### Web resources:

1 <https://developers.google.com/edu/python/>

2 [https://www.educative.io/courses/learn-python-3-from-scratch?affiliate\\_id=5073518643380224](https://www.educative.io/courses/learn-python-3-from-scratch?affiliate_id=5073518643380224)



Course Code: CSE3035	Course Title: R Programming for Data Science  Type of Course: Program Core Lab Integrated Course	L- T-P- C	1-0	4	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	Nil				
Course Description	R Programming for Data Science is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on Data Analytics to a wide range of applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of R Programming for Data Science and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to:  1) Describe the R programming for Data Analytics.[Knowledge] 2) Generalize the appropriate visualization methods.[Comprehension] 3) Demonstrate the various statistical testing methods.[Application] 4) Apply the probability and complex distribution functions for the analysis of data.[Application]				
Course Content:					
Module 1	Introduction to R Programming	Case studies	Programming	8 Sessions	
R Studio: Base R-R Studio IDE-Introduction to R Projects and R Markdown. Basic R: R as a calculator-Scripts and Comments-R Variables. Data I/O: Working Directories-Importing Data-Exporting Data-More ways to save-Data I/O in Base R. Subsetting Data in R: Selecting specific elements-Renaming Columns-Subsetting Columns - Subsetting Rows – Adding/Removing Columns-Ordering Columns - Ordering Rows					

Module 2	Data Analysis	Case studies	Programming	10 Sessions
Data Summarization: One Quantitative and Categorical Variable. Data Classes: One Dimensional Data Classes-Data Frames and Matrices-Lists. Data Cleaning: Dealing with Missing Data-Strings and Recoding Variables. Manipulating Data in R: Reshaping Data-Merging Datasets. Data Visualizations: Plotting with ggplot2- Plotting with Base R				
Module 3	Statistical Analysis in R	Case studies	Programming	8 Sessions
Proportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-Wilcoxon signed rank test- One Way ANOVA- Kruskal Wallis Test-Linear Regression- Logistic Regression and Generalized Linear Models-Poisson Regression.				
Module 4	Simulations	Case studies	Programming	10 Sessions
Functions: Writing your own function-Loops. Simulations: Standard Probability Distributions-Sampling from more Complex Distributions-The Accept and Reject Algorithm-The Metropolis Hasting Algorithm. R Markdown: Exploratory Analysis-Multiple Facets-Linear Models-Grabbing coefficients-Pander-Multiple Models-Data Extraction				
Targeted Applications & Tools that can be used:				
Tools:				
R Programming				
Lab:				
Exp 1.				
Level 1:				
create a new variable called my.num that contains 6 numbers				
multiply my.num by 4				
create a second variable called my.char that contains 5 character strings				
combine the two variables my.num and my.char into a variable called both				
what is the length of both?				
what class is both?				
divide both by 3, what happens?				
Level 2:				
create a vector with elements 1 2 3 4 5 6 and call it x				
create another vector with elements 10 20 30 40 50 and call it y				
what happens if you try to add x and y together? why?				
append the value 60 onto the vector y (hint: you can use the c() function)				
add x and y together				

multiply x and y together. pay attention to how R performs operations on vectors of the same length.

Exp 2.

Level 1:

Read in the Youth Tobacco study, `Youth_Tobacco_Survey_YTS_Data.csv` and name it `youth`.

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

Level 2:

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

Write out the `mon` R object as a CSV file using `readr::write_csv` and call the file "`monuments.csv`".

Write out the `mon` R object as an RDS file using `readr::write_rds` and call it "`monuments.rds`".

Exp 3:

Level 1:

Check to see if you have the `mtcars` dataset by entering the command `mtcars`.

What class is `mtcars`?

How many observations (rows) and variables (columns) are in the `mtcars` dataset?

Copy `mtcars` into an object called `cars` and rename `mpg` in `cars` to `MPG`. Use `rename()`.

Convert the column names of `cars` to all upper case. Use `rename_all`, and the `toupper` command (or `colnames`).

Convert the rownames of `cars` to a column called `car` using `rownames_to_column`. Subset the columns from `cars` that end in "p" and call it `pvars` using `ends_with()`.

Create a subset `cars` that only contains the columns: `wt`, `qsec`, and `hp` and assign this object to `carsSub`. What are the dimensions of `carsSub`? (Use `select()` and `dim()`.)

Level 2:

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

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

Subset the rows that get less than 16 miles per gallon (mpg) of fuel efficiency and have more than 100 horsepower (hp). How many are there? (Use filter().)

Create a subset of the cars data that only contains the columns: wt, qsec, and hp for cars with 8 cylinders (cyl) and reassign this object to carsSub. What are the dimensions of this dataset?

Re-order the rows of carsSub by weight (wt) in increasing order. (Use arrange().)

Create a new variable in carsSub called wt2, which is equal to  $wt^2$ , using mutate() and piping %>%.

Exp 4:

Level 1:

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

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

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

Level 2:

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

What was the average bike lane length per year that they were installed? (Be sure to first set dateInstalled to NA if it is equal to zero.)

Numerically and graphically describe the distribution of bike lane lengths (length).

Describe the distribution of bike lane lengths numerically and graphically after stratifying them by (a) type and then by (b) number of lanes (numLanes).

Exp 5:

Level 1:

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

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

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

Level 2:

- Reassign dateInstalled into a character using as.character. Run head(bike\$dateInstalled).

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

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

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

- Convert type back to a character vector. Make a column type2 (replacing the old one), where if the type is one of these categories c("CONTRAFLOW", "SHARED BUS BIKE", "SHARROW", "SIGNED ROUTE") call it "OTHER". Use %in% and ifelse. Make type2 a factor with the levels c("SIDEPATH", "BIKE BOULEVARD", "BIKE LANE", "OTHER").

- Parse the following dates using the correct lubridate functions:

"2014/02-14"

"04/22/14 03:20" assume mdy

"4/5/2016 03:2:22" assume mdy

Exp 6:

Level 1:

Count the number of rows of the bike data and count the number of complete cases of the bike data. Use sum and complete.cases.

Create a data set called namat which is equal to is.na(bike). What is the class of namat? Run rowSums and colSums on namat. These represent the number of missing values in the rows and columns of bike. Don't print rowSums, but do a table of the rowSums.

Filter rows of bike that are NOT missing the route variable, assign this to the object have\_route. Do a table of the subType variable using table, including the missing subTypes. Get the same frequency distribution using group\_by(subType) and tally() or count().

Filter rows of bike that have the type SIDEPATH or BIKE LANE using %in%. Call it side\_bike. Confirm this gives you the same number of results using the | and ==.

Do a cross tabulation of the bike type and the number of lanes (numLanes). Call it tab. Do a prop.table on the rows and columns margins. Try `as.data.frame(tab)` or `broom::tidy(tab)`.

Read the Property Tax data into R and call it the variable tax.

How many addresses pay property taxes? (Assume each row is a different address.)

What is the total (a) city (CityTax) and (b) state (SateTax) tax paid? You need to remove the \$ from the CityTax variable, then you need to make it numeric. Try `str_replace`, but remember \$ is “special” and you need `fixed()` around it.

Using `table()` or `group_by` and `summarize(n())` or `tally()`.

How many observations/properties are in each ward (Ward)?

What is the mean state tax per ward? Use `group_by` and `summarize`.

What is the maximum amount still due (AmountDue) in each ward? Use `group_by` and `summarize` with `'max'`.

What is the 75th percentile of city and state tax paid by Ward? (`quantile`)

Make boxplots showing CityTax (y-variable) by whether the property is a principal residence (x = ResCode) or not. You will need to trim some leading/trailing white space from ResCode.

Level 2:

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

How many such houses are there?

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

Make an object called `health.sal` using the salaries data set, with only agencies (JobTitle) of those with “fire” (anywhere in the job title), if any, in the name remember `fixed("string_match", ignore_case = TRUE)` will ignore cases.

Make a data set called `trans` which contains only agencies that contain “TRANS”.

What is/are the profession(s) of people who have “abra” in their name for Baltimore’s Salaries? Case should be ignored.

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

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

Create a smaller dataset that only includes the Police Department, Fire Department and Sheriff’s Office. Use the Agency variable with string matching. Call this `emer`. How many employees are in this new dataset?

Create a variable called dept in the emer data set, `dept = str_extract(Agency, ".*(ment|ice)").` E.g. we want to extract all characters up until ment or ice (we can group in regex using parentheses) and then discard the rest. Replot annual salary versus hire date and color by dept (not yet - using ggplot). Use the argument `col = factor(dept)` in plot.

(Bonus). Convert the 'LotSize' variable to a numeric square feet variable in the tax data set. Some tips: a) 1 acre = 43560 square feet b) The hyphens represent a decimals. (This will take a lot of searching to find all the string changes needed before you can convert to numeric.)

Exp 7:

Level 1:

Read in the Bike\_Lanes\_Wide.csv dataset and call it wide.

Reshape wide using `pivot_longer`. Call this data long. Make the key `lanetype`, and the value `the_length`. Make sure we gather all columns but name, using `-name`. Note the NAs here.

Read in the roads and crashes .csv files and call them road and crash.

Replace (using `str_replace`) any hyphens (-) with a space in `crash$Road`. Call this data `crash2`. Table the Road variable.

How many observations are in each dataset?

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

Which and how many years were data collected in the crash dataset?

Read in the dataset Bike\_Lanes.csv and call it bike.

Level 2:

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

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

Reshape sub using `pivot_wider`. Spread the data where the key is type and we want the value in the new columns to be length - the bike lane length. Call this `wide2`. Look at the column names of `wide2` - what are they? (they also have spaces).

Join data in the crash and road datasets to retain only complete data, (using an inner join) e.g. those observations with road lengths and districts. Merge without using `by` argument, then merge using `by = "Road"`. call the output `merged`. How many observations are there?

Join data using a `full_join`. Call the output `full`. How many observations are there?

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

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

## Exp 8

### Level 1:

Plot average ridership (avg data set) by date using a scatterplot.

Color the points by route (orange, purple, green, banner)

Add black smoothed curves for each route

Color the points by day of the week

Replot 1a where the colors of the points are the name of the route (with banner → blue)

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

Plot average ridership by date with one panel per route

### Level 2:

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

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

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

## Exp 9



Level 1:

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

Compute the correlation between the Myanmar, China, and United States mortality data. Store this correlation matrix in an object called `country_cor`

Extract the Myanmar-US correlation from the correlation matrix.

Is there a difference between mortality information from 1990 and 2000? Run a paired t-test and a Wilcoxon signed rank test to assess this. Hint: to extract the column of information for 1990, use `mort$"1990"`

Level 2:

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

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

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

Exp 10

Level 1:

- Write a function, `sqdif`, that does the following:

takes two numbers `x` and `y` with default values of 2 and 3.

takes the difference

squares this difference

then returns the final value

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

Level 2:

- Try to write a function called `top()` that takes a matrix or `data.frame` and a number `n`, and returns the first `n` rows and columns, with the default value of `n=5`.
- Write a function that will calculate a 95% one sample t interval. The results will be stored in a list to be returned containing sample mean and the confidence interval. The input to the functions is the numeric vector containing our data. For review, the formula for a 95% one sample t interval is  $\bar{x} \pm 1.96 s/\sqrt{n}$ .

## Exp 11

### Level 1:

Simulate a random sample of size `n=100`

- from  
a normal distribution with mean 0 and variance 1. (see `rnorm`)  
a normal distribution with mean 1 and variance 1. (see `rnorm`)  
a uniform distribution over the interval `[-2, 2]`. (see `runif`)
- Run a simulation experiment to see how the type I error rate behaves for a two sided one sample t-test when the true population follows a Uniform distribution over `[-10,10]`. Modify the function `t.test.sim` that we wrote to run this simulation by  
changing our random samples of size `n` to come from a uniform distribution over `[-10,10]` (see `runif`).  
performing a two sided t-test instead of a one sided t-test.  
performing the test at the 0.01 significance level.  
choosing an appropriate value for the null value in the t-test. Note that the true mean in this case is 0 for a Uniform(-10,10) population. Try this experiment for `n=10,30,50,100,500`. What happens the estimated type I error rate as `n` changes? Is the type I error rate maintained for any of these sample sizes?

### Level 2:

- From introductory statistics, we know that the sampling distribution of a sample mean will be approximately normal with mean  $\mu$  and standard error  $\sigma/\sqrt{n}$  if we have a random sample from a population with mean  $\mu$  and standard deviation  $\sigma$  and the sample size is “large” (usually at least 30). In this problem, we will build a simulation that will show when the sample size is large enough.

Generate `N=500` samples of size `n=50` from a Uniform`[-5,5]` distribution.

For each of the `N=500` samples, calculate the sample mean, so that you now have a vector of 500 sample means.

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

Turn this simulation into a function that takes arguments N the number of simulated samples to make and n the sample size of each simulated sample. Run this function for  $n=10, 15, 30, 50$ . What do you notice about the histogram of the sample means (the sampling distribution of the sample mean) as the sample size increases.

#### Text Book

Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020

#### References

1. Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014.
2. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Lique, Springer 2013.

#### Topics relevant to Development skills

Topics relevant to development of "Employability": Real time application development using R Programming Tools.

Topics relevant to "Human Values & Professional Ethics"

Course Code:	Course Title: Applied Machine Learning				
CSE3087	Type of Course: 1] Program Core 2] Laboratory integrated	L-T- P-C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	CSE3001 Artificial Intelligence and Machine Learning				
Anti-requisites	NIL				
Course Description	Machine Learning algorithms are the key to develop intelligent systems such as Apple's Siri, Google's self-driving cars etc. This course introduces the concepts of the core machine learning techniques such as Regression learning, Bayesian learning, Ensemble learning, Perceptron learning, Unsupervised learning, Competitive learning, learning from Gaussian mixture models and learning to detect outliers. Course lectures covers both the theoretical foundations as well as the essential algorithms for the various learning methods. Lab sessions complement the lectures and enable the students in developing intelligent systems for real life problems.				
Course Objectives	This course is designed to improve the learners 'EMPLOYABILITY SKILLS' by using EXPERIENTIAL LEARNING techniques. The supervised hands-on laboratory exercises, assessments and the group projects facilitate this learning process.				
Course Out Comes	<p>On successful completion of the course the students shall be able to:</p> <p>1] Apply advanced supervised machine learning methods for predictive modeling. [Application]</p> <p>2] Produce machine learning models with better predictive performance using meta learning algorithms [Application]</p> <p>3] Create predictive models using Perceptron learning algorithms[Application]</p> <p>4] Employ advanced unsupervised learning algorithms for clustering, competitive learning and outlier detection[Application]</p> <p>5] Implement machine learning based intelligent models using Python libraries. [Application]</p>				
Course Content:					
Module 1	Supervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes	

				L – 7 P – 12
Topics: An overview of Machine Learning(ML); ML workflow; types of ML; Types of features, Feature Engineering -Data Imputation Methods; Regression – introduction; simple linear regression, loss functions; Polynomial Regression; Logistic Regression; Softmax Regression with cross entropy as cost function; Bayesian Learning – Bayes Theorem, estimating conditional probabilities for categorical and continuous features, Naïve Bayes for supervised learning; Bayesian Belief networks; Support Vector Machines – soft margin and kernel tricks.				
Module 2	Ensemble Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-3 P-4
Topics: Ensemble Learning – using subset of instances – Bagging, Pasting, using subset of features –random patches and random subspaces method; Voting Classifier, Random Forest; Boosting – AdaBoost, Gradient Boosting, Extremely Randomized Trees, Stacking.				
Module 3	Perceptron Learning	Assignment /Quiz	Programming using Keras/Sklearn	No. of Classes L-7 P -2
Topics: Perceptron Learning – from biological to artificial neurons, Perceptrons, Linear Threshold Units, logical computations with Perceptrons, common activation functions – sigmoid, tanh, relu and softmax, common loss functions, multi-layer Perceptrons and the Backpropagation algorithm using Gradient Descent.				
Module 4	Unsupervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-6 P -6
Topics: Unsupervised Learning – simple k Means clustering- simple and mini-batch; updating centroids incrementally; finding the optimal number of clusters using Elbow method ; Silhoutte coefficient, drawbacks of kMeans, kMeans++ ; Divisive hierarchical clustering – bisecting k-means, clustering using Minimum Spanning Tree (MST) Competitive Learning - Clustering using Kohonen’s Self Organising Maps (SOM), Density Based Spatial Clustering – DBSCAN; clustering using Gaussian Mixture Models (GMM) with EM algorithm ; Outlier Detection methods – Isolation Forest, Local Outlier Factor(LOF)				
List of Laboratory Tasks:				
Experiment N0 1: Methods for handling missing values				

Level 1: Given a data set from UCI repository, implement the different ways of handling missing values in it using Scikit-learn library of Python

Level 2: Implement one of these methods using a custom defined function in Python.

#### Experiment No. 2: Data Visualization

Level 1 Perform Exploratory Data Analysis for a given data set by creating Scatter Plot, Pair Plot, Count Plot using Matplotlib and Seaborn

Level 2 Create Heat Maps, WordCloud

#### Experiment No. 3: Regression learning

Level 1 Given a data set from UCI repository, implement the simple linear regression algorithm and estimate the models parameters and the performance metrics. Plot the learning curves.

Level 2 Implement the polynomial regression algorithm. Compare the learning curves of Polynomial and Linear Regression.

#### Experiment No.4: Logistic regression

Level 1 Write custom code for generating the logistic/sigmoid plot for a given input

Level 2 Given a data set from UCI repository, implement the Logistic regression algorithm. Estimate the class probabilities for a given test data set. Plot and analyze the decision boundaries.

#### Experiment No.5: Bayesian Learning

Level 1 Given a data set from UCI repository, implement a classification model using the Bayesian algorithm

#### Experiment No.6: Support Vector Machine(SVM)

Level 1 Given data sets from UCI repository, implement a linear SVM and a non-linear SVM based classification model.

#### Experiment No. 7: Ensemble Learning

Level 1 : Implement Ensemble Learning algorithms such as Bagging, Pasting and Out-of-Bag Evaluation

Level 2 : Random Patches and Random Subspace Method

Experiment No. 8: Ensemble Learning

Level 1 : AdaBoost and Gradient Boosting, Stacking

Experiment No. 9: Perceptron Learning

Level 1 : Implement the Perceptron Classifier

Level 2 : – An Image Classifier Using the Sequential API of Keras

Experiment No. 10: Unsupervised Learning

Level 1 : K-means – simple and mini-batch. Finding the optimal number of clusters using Elbow method and Silhouette Coefficient . Compare the inertia of both as k increases. Tuning the hyperparameter 'k' using GridSearchCV.

Level 2 : – Using clustering for Image segmentation and Preprocessing. Kmeans++

Experiment No. 11: Density Based Clustering

Level 1 Implement DBSCAN – clustering using the local density estimation. Perform hard and soft clustering for new instances.

Experiment No. 12: Outlier Detection

Level 1 Outlier Detection using Isolation Forest and Local Outlier Factor

Targeted Application & Tools that can be used :

Execution of the ML algorithms will be done using the Google's cloud service namely "Colab", available at <https://colab.research.google.com/> or Jupyter Notebook.

The data sets will be from the benchmarking repositories such as UCI machine learning repository available at : <https://archive.ics.uci.edu/ml/index.php>

Laboratory tasks will be implemented using the libraries available in Python such as Scikit learn, matplotlib, seaborn, perceptron and the deep learning framework namely Keras.

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

Students can be assigned a mini project to develop a machine learning application for real-life problems in various domains such as health care, business intelligence, environmental modeling, etc.

Text Book

There are a number of useful textbooks for the course, but each cover only a part of the course syllabus. Following is an indicative list of textbooks.

Aurélien Géron, “Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow”, Oreilly, Second Edition, 2019.

Andreas C Muller, Sarah Guido, “Introduction to Machine Learning with Python :A Guide for Data Scientists”, Oreilly, First Edition, 2018

Giuseppe Bonaccorso, “Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning”, Packt Publishing, 2017.

**References** In references apart from the books and web links, mention a few standards & Hand books relevant to the Laboratory tasks used by the professionals.

Tan P. N., Steinbach M & Kumar V. “Introduction to Data Mining”, Pearson Education, 2016.

<https://towardsdatascience.com/machine-learning/home>

MITopencourseware:<https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/resources/lecture-11-introduction-to-machine-learning/>

[https://onlinecourses.nptel.ac.in/noc21\\_cs85/preview](https://onlinecourses.nptel.ac.in/noc21_cs85/preview)



Course Code: CSE3095	Course Title: Cloud Security  Type of Course: Discipline Elective in Cloud Computing Basket  Theory	L-T- P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	[1] Cloud Computing and Services (CSE322)				
Anti-requisites	NIL				
Course Description	This course provides ground-up coverage on the high-level concepts of cloud landscape, architectural principles, and techniques. It describes the Cloud security architecture and explores the guiding security for Infrastructure and Softwares.				
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.				
Course Outcomes	<p>On successful completion of this course the students shall be able to:</p> <p>Describe fundamentals of cloud computing [Knowledge].</p> <p>Explain cloud computing security architecture and associated challenges [Comprehension].</p> <p>Discuss cloud computing software security essentials [Comprehension].</p> <p>Apply infrastructure security and data security in cloud computing environment. [Application].</p>				
Course Content:					
Module 1:	Fundamentals of Cloud Computing	Quiz	Knowledge based Quiz	10 Sessions	
Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.					
Module 2:	Cloud Security Challenges and Cloud Security Architecture	Quiz	Comprehension based Quiz	10 Sessions	

Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security.				
Module 3	Cloud Computing Software Security Essentials	Assignment	Batch-wise Assignments	9 Sessions
Topics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software Requirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.				
Module 4:	Infrastructure Security and Data Security	Assignment and Presentation	Batch-wise Assignment and Presentations	9 Sessions
Topics: Infrastructure Security: The Network Level, The Host Level, The Application Level.				
Data Security : Aspects of Data Security, Data Security Mitigation, Provider Data and its Security.				
Targeted Application & Tools that can be used: Use of CloudSim simulator.				
Project work/Assignment: Survey on Cloud Service Providers				
Text Book  Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, July 2021.  Roland L Krutz and Russell Dean Vines, "Cloud Security - A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, Inc. 2019.				
References  Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, "Secure Cloud Computing", Springer, ISBN 978-1-4614-9278-8 (eBook).  John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press, 2010.  Tim Mather, Subra Kumaraswamy and Shahed Latif, "Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance", Oreily Publication, 2009.				
Topics related to development of "FOUNDATION": Cloud computing architecture, Security policy implementation.				
Topics related to development of "EMPLOYABILITY": Infrastructure security and Data security.				

Course Code: CSE3102	Course Title: Malware Analysis Type of Course: Discipline Elective in Cyber Security Basket	L- T- P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	Have the knowledge of Cryptography and Network Security				
Anti-requisites	NIL				
Course Description	The purpose of the course is to explore malware analysis tools and techniques in depth. Understanding the capabilities of malware is critical to an organization's ability to derive threat intelligence, respond to information security incidents, and fortify defenses. This course builds a strong foundation for reverse-engineering malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger, and other tools useful for turning malware inside-out.				
Course Objective	<p>To study the fundamentals of malwares.</p> <p>To know about different malicious programs and their behavior</p> <p>To know how to work on linux systems.</p> <p>To learn, analyze and demonstrate network hacking tools</p>				
Course Outcomes	<p>On successful completion of this course the students shall be able to:</p> <p>Understanding the nature of malware, its capabilities, and how it is combated through detection and classification.</p> <p>Apply the methodologies and tools to perform static and dynamic analysis on unknown executables.</p> <p>Analyze scientific and logical limitations on society's ability to combat malware..</p> <p>Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti analysis techniques in future malware samples.</p>				
Course Content:					
Module 1	Introduction to MALWARE ANALYSIS (Application)		Assignment	Programming activity	12 Hours
<p>Topics:</p> <p>Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.</p>					

Module 2	Static Analysis (Application)		Assignment	Programming activity	11 Hours
<p>Topics:</p> <p>X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture</p>					
Module 3	Dynamic Analysis (Application)		Assignment	Programming activity	11 Hours
<p>Topics:</p> <p>Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark</p>					
Module 4	Malware Functionality and Detection Techniques  (Comprehension)		Assignment	Programming activity	12 Hours
<p>Topics:</p> <p>Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.</p> <p>Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences</p>					
Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)					
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course					
<p>Problem Solving: Choose an appropriate data structure and implementation of programs.</p> <p>Programming: Implementation of given scenario using Java</p>					
Text Book					
Michael Sikorski and Andrew Honig, 2012: “ Practical Malware Analysis”, No Starch Press.					

<p>References</p> <p>Jamie Butler and Greg Hoglund, 2005: "Rootkits: Subverting the Windows Kernel", Addison-Wesley.</p> <p>Dang, Gazet and Bachaalany, 2014: "Practical Reverse Engineering",Wiley.</p> <p>Reverend Bill Blunden, 2012: "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition,Jones&amp; Bartlett.</p>
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Course Code: 2054	Course Title: Storage Area Networks  Type of Course: Program Core	L-T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	Basics of Computer Networks				
Anti-requisites	NIL				
Course Description	The objective of this course is to help students understand the knowledge gap in understanding varied components of modern information storage infrastructure, including virtual environments. It provides comprehensive learning of storage technology, which will enable you to make more informed decisions in an increasingly complex IT environment. ISM builds a strong understanding of underlying storage technologies and prepares you to learn advanced concepts, technologies, and products. You will learn about the architectures, features, and benefits of Intelligent Storage Systems; storage networking technologies such as FC-SAN,IP-SAN, NAS, Object-based and unified storage; business continuity solutions such as backup, replication, and archive; the increasingly critical area of information security; and the emerging field of cloud computing. This unique, open course focuses on concepts and principles which are further illustrated and reinforced with EMC examples.				
Course Out Comes	On successful completion of the course the students shall be able to:  Identify key challenges in managing information and analyze different storage networking technologies and virtualization  Knowledge				



of Local Replicas, Local Replication Technologies, Local Replication in a Virtualized Environment. Remote Replication: Remote Replication Technologies, Three-Site Replication, Remote Replication and Migration in a Virtualized Environment.				
Module 4	Cloud Computing	Assignment	Comprehension, Quizzes	No. of Classes: 8
<p>Topics:</p> <p>Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Outof-Band Virtualization Appliances, High Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications</p>				
Module 5	Securing and Managing Storage Infrastructure	Assignment	Knowledge, Quizzes	No. of Classes: 8
<p>Topics:</p> <p>Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. Managing the Storage Infrastructure : Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering</p>				
List of Laboratory Tasks:				
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<p>Targeted Application &amp; Tools that can be used:</p> <p>SID Tool(Cisco SAN Insights Discovery Tool)</p> <p>SAN Congestion Innovation with Cisco DIRM(Dynamic Ingress Rate Limiting)</p>				
Project work/Assignment:				
1.Cloud storage for accessing file over internet though SAN				

2.Creating and storing daily backup of multiple machine over SAN. Or creating disk-less clients and use one server for processing and one server for storage and access all over network
Textbook(s): Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839 Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516
References Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.
Udemy: <a href="https://www.udemy.com/course/storageintro/">https://www.udemy.com/course/storageintro/</a> c; SANFOUNDRY Online training : <a href="https://www.sanfoundry.com/san-storage-area-networks-training/">https://www.sanfoundry.com/san-storage-area-networks-training/</a>

Course Code: CSE 3050	Course Title: Software Project Management Type of Course: School Core	L- T-P- C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	Software Engineering				
Anti-requisites	NIL				



Course Description	<p>The objective of this course is to provide the fundamentals concepts of Software Project planning approaches and methodologies.</p> <p>The objective of this course is to provide the fundamentals standards of software development and management.</p> <p>This course covers the roles and functions of project management and the process of project life cycle.</p> <p>The objective of the course is to understand the need and techniques for managing users and user.</p>			
Course Out Comes	<p>On successful completion of this course the students shall be able to:</p> <p>1] Describe the Software Project Management, Software Project Effort and Cost Estimation. (Knowledge)</p> <p>2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension)</p> <p>3] Understand People management (Knowledge)</p> <p>4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)</p>			
Course Objectives	<p>The objective of this course are the successful development of the project's procedures of initiation, planning, execution, regulation and closure as well as the guidance of the project team's operations towards achieving all the agreed upon goals within the set scope, time, quality and budget standards.</p>			
Module 1	Project Management Fundamentals	Assignment	Identification of Cost Estimation	12 Sessions
<p>Introduction to Software Project Management – all life cycle activities, Project Initiation Management – scope, objective, size and factors. Software Project Effort and Cost Estimation – cocomo, artifacts. Risk Management : Perform The risk analysis for the given case study. Configuration Management – techniques. Project Monitoring and Control – measuring task, status report, evm. Project Closure – closure steps</p>				
Module 2	Software Life Cycle Management	Assignment	Apply the testing concepts using Programing	10 Sessions
<p>Introduction to Software Life-Cycle Management – life cycle process. Software Requirement Management – requirement and management. Software Design Management – standards, techniques. Software Construction – reviews, walkthrough, inspections. Software Testing – Verification, validation, strategy, automation and monitoring. Product Release and Maintenance – types and techniques</p>				
Module 3	People Management		Comparison of CMO, ISO, IEEE standards	08 Sessions

Introduction to People Management – people, team and supplier management. Team Management – organizational structure, team effectiveness. Customer Management – expectation and negotiation. Supplier Management – agreement and communication.				
Module 4	Software Engineering Management and Tools	Assignment	Apply the testing concepts using Programing	10 Sessions
Introduction to Software Process Standards and Process Improvement – CMM, ISO, IEEE. Software Project Management Tools Introduction – tools application, cost and effectiveness. Project Management and Software Life-Cycle Tools – life cycle and project management templates. Software Project Templates – WBS and monitoring tools. Software configuration management- SCM process, SCM Tools (GitHub).				
Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Identification of Cost Estimation Apply the testing concepts using Programing Comparison of CMO, ISO, IEEE standards Installing Selenium/GitHub software and exploring the functionality				
Text Book 1] Bob Hughes, Mike Cottare, Rajib Mall, “Software Project Management”, 5th Ed, Tata McGraw Hill,				
References 1] Ashfaq Ahmed, “Software Project Management: a process-driven approach”, Boca Raton, Fla. : CRC Press, 2012 2] Ramesh, Gopalswamy, "Managing Global Projects", Tata McGraw Hill, 2005.				
Foundation Skills: Students can able to learn the fundamental foundation skills in this course such as initiation, planning, execution, regulation and closure as well as the guidance of the project team’s operations.				

Course Code: CSE 3051	Course Title: System Monitoring Type of Course: Theory only	L- T- P- C	3 -0	0	3
Version No.	1				
Course Pre-requisites	Agile Structures and Frameworks				
Anti-requisites	NA				
Course Description	This course is intended for understanding the principles of automation and the application of tools for the analysis and testing of software. The automated analysis encompasses both approaches to automatically generate a very large number of tests to check whether programs meet requirements, and also means by which it is possible to prove that software meets requirements and that it is free from certain commonly-occurring defects, such as divide-by-zero, overflow/underflow, deadlock, race-condition freedom, buffer/array overflow, uncaught exceptions, and several other commonly-occurring bugs that can lead to program failures or security problems. The learner will become familiar with the fundamental theory and applications of such approaches, and apply a variety of automated analysis techniques on example programs.				
Course Objective	The objective of the course is skill development of students by using Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to:  Understand testing in DevOps.  Learn its approaches to testing.  Understand to design test cases.				
Course Content:					
Module 1	NEED OF SYSTEM MONITORING	Assignment			8 Sessions
Topics: Predicting system load - Failure prevention – Anomalies					
Module 2	TENETS OF SYSTEM	Assignment			8 Sessions
Topics:  Identifying as many problems as possible - Identifying problems as early as possible - Generating as few false alarms as possible – Automation					

Module 3	CORE COMPONENTS OF MONITORING TOOLS	Assignment		8 Sessions
Topics: Alerts – Graphs - Logs				
Module 4	INTELLIGENTLY MONITORING THE RIGHT METRICS IN EACH	Assignment		8sessions
Topics : Layer 0: The Application - Layer 1: The Process - Layer 2: The Server - Layer 3: The Hosting Provider - Layer 4: External Dependencies - Layer 5: The User				
Module 5	MONITORING STRATEGIES	Quiz		8 Sessions
Topics : Monitor potential faulty entities - Monitor existing faulty entities - Tuning and Continuous Improvement				
Targeted Application & Tools that can be used				
Jenkins, Docker				
Project work/Assignment:				
Assignment:				
Text Book				
Building a Monitoring Infrastructure with Nagios - by David Josephsen. 2016				
Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation - by Jez Humble (Author), David Farley (Author), Martin Fowler (Foreword). 2017				
References				
1. Instant Nagios Starter - by Michael Guthrie, Packt Publishing Limited (23 May 2016)				
Web resources:				
W1. <a href="https://presiuniv.knimbus.com/user#/home">https://presiuniv.knimbus.com/user#/home</a>				

Topics relevant to the development of “Skill Development”: Predicting system load - Failure prevention

Course Code: CSE3073	Course Title: Game Design and Development  Type of Course: Discipline Elective	L-T-P-C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	CSE 2001- Data Structures and Algorithms & C# Programming Specific Topics to be included				
Anti-requisites	NIL				
Course Description	The course helps learners to build the necessary skills to design and development games. The Specialization focuses on both the theory and practice of game making. From a technical standpoint, learners will learn about basic operation using latest Unity 2021 game engine. In Game Design process, learners will write a complete game script and proposal of their own design from initial concept up to the first playable prototype.				
Course Object	The course will give a well-rounded knowledge in the Game Development with an emphasis on understanding and applying techniques in video game production. And this course will cover with a solid grasp of the fundamental game art principles, including knowledge of game engine technology and pre-production and production environments.				
Course Out Comes	On successful completion of the course the students shall be able to:  Recognize Game Preproduction and Design Process.  Identify the UI of Unity Game Engine and its Work Flow.  Illustrate GameObject Behaviour using C# Script.  Produce Game using Unity Game Engine.				
Course Content:					
Module 1	Essentials of Game Design	Assignment	Memory recall quiz from Introduction to Game and its basics	No. of Classes:8	

			and Practical components for Preproduction	
Topics: Introduction to Game - Basic Elements of Play- Basic elements of games- Basic Game Design Tools- Constraint- Direct and indirect actions- Goals-Challenge- Skill, strategy, chance, and uncertainty- Decision-making and Feedback-Abstraction-Theme-Context of Play-Preproduction-Logo - background				
Module 2	The Kinds of Play & Working with Unity API	Assignment	Quiz based on Play Categories and Lab Experiments on Unity Engine API	No. of Classes: 12
Topics: The Kinds of Play- Competitive play, Cooperative play, Skill-based play, Experience-based play, Games of chance and uncertainty, Whimsical play, Role-playing, Player Experience -Introduction to fundamentals of game, Storytelling - basic programming using C#, Game Theory, Unity Interface- Tools- Windows – Game Objects, Components, Camera – Lightning -Building Platform and Project Preferences. Unity Editor Interface: Main Menu- Tool bar- Scene View-Game View-Hierarchy Window-Project Window-Inspector Window- Console Window-Status Bar -Game Objects.				
Module 3	Game Design Process and Working with Game Object in Unity	Assignment	Experiments based on Unity API and basic Operation	No. of Classes:12
Topics: Iterative Game Design Process – Conceptualize- Prototype- Playtest and Evaluate Game Design Values: Experience – Theme - Point of view – Challenge - Skill, strategy, chance, and uncertainty - Introduction to Vectors, Game design- The structure of games, Unity Tools Materials and Textures, Game Objects, Components- Scripting: Unity Mono Behavior Class-Mono Behavior Methods / Messages - Rotations, Translations - Layers, Tags- Colliders, Collisions, Triggers- Physics, Physic Material, Texture, Shader – Lighting.				
Module 4	Game Prototyping, Evaluation and Game Development	Assignment	Game prototyping and Unity Programming	No. of Classes:12
Topics: Game Prototyping: Paper prototypes - Physical Prototypes Playable prototypes - Art and sound prototypes - Core game prototypes - Complete game prototypes, Evaluation – UI: Working with UI & Menus- - Game development, Asset Management, Advanced Unity Programming				
<p>Lab Experiments are to be conducted on the following topics: -</p> <p>Introduction to Preproduction</p> <p>Introduction to Unity Game Engine API</p> <p>Unity Game Objects its properties</p>				

<p>Grouping Object in Environment</p> <p>Multiple Game Objects</p> <p>Object Mono Behavior</p> <p>Object Transform</p> <p>Get Component Method</p> <p>Prefabs</p> <p>Translating Game Objects</p> <p>Textures</p> <p>Unity Physics</p> <p>Player Movement</p> <p>Camera Movement</p> <p>Player Control</p> <p>Character Controller</p> <p>UI</p> <p>Game Development</p>
<p>Mini Project work/Assignment: Mention the Type of Project /Assignment proposed for this course</p>
<p>Building a 2D/3D Game</p>
<p>Text Books</p> <p>Colleen Macklin, John Sharp, Games, Design and Play A Detailed Approach to Iterative Game Design, Pearson Education, Inc. 2016</p> <p>Ernest Adams, “Fundamentals of Game Design”, Pearson Education, 2012</p> <p>Ethan Ham, Tabletop Game Design for Video Game Designers, 2016 Taylor &amp; Francis</p>
<p>References</p> <p>Jeff W Murray, “2D Unity”, William Pollock 2015,</p> <p>Alan Thorn, “Learn Unity for 2D Game Development”, Tia 2017.</p> <p>Unity API, Documentation 2021.</p>

Course Code:	Course Title: E-Commerce	L-T-P-C	2 -0	2	3
CSE3126	Type of Course: Program Core				
Version No.	1.0				
Course Pre-requisites	Web Technology				
Anti-requisites	NIL				
Course Description	This course caters the knowledge of real time ecommerce platforms, their architecture, structure and workflow. It also provides sufficient hands on to build a own e commerce platform and host.				
Course objectives	The objective of the course is skill development of student by using Participative Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to:  Understand the concepts of an E-commerce (Knowledge).  Acquire the knowledge about existing e-commerce applications (comprehension).  Build own e-commerce application (Application)  Deploy e-commerce application (Application).				
Course content:					
Module 1	Introduction to E-Commerce	Assignment	Survey	8 Sessions	
Topics: Introduction to Electronic Commerce: Meaning, nature and scope; Business application of ecommerce; Global trading environment and adopting of e -commerce, evolution of World Wide Web, future of Web.					
Assignment: Perform a survey of state-of-art e-commerce platforms					
Module 2	Website design	Assignment	Case Study	9 Sessions	
Topics: Web sites as market place; Role of web site in B2C e -commerce; Web site strategies; Web site design principles; push and pull approaches; Alternative methods of customer communication such as e -mail, BBA; E-mail etiquette and e-mail security.					



Assignment: Write a case study of any B2C business application				
Module 3	Business Models of E-Commerce	Assignment	Case Study	10 Sessions
<p>Topics: B2B, B2C, B2G and other models of e - commerce; Applications of e-commerce to supply chain management; Product and service digitisation; Remote servicing, procurement and online marketing and advertising; Applications to Customer Relationship Management. Business to Consumer E-Commerce Applications: Cataloging, Order planning and order generation; Cost estimation and pricing; Order receipt and accounting; Order selection and prioritization; Order scheduling, fulfilling and delivery, Order billing, Post sales services.</p> <p>Assignment: Write a case study of any B2B and B2G business application</p>				
Module 4	E-Payment System	case study	Programming Task	9 Sessions
<p>Topics: Types of payment systems –e-cash and currency servers, e-cheques, credit cards, smart cards; electronic purses and debit cards; Operational, credit and legal risk of e - payment, Risk management options for e-payment systems, Set standards.</p> <p>Assignment: Develop one online e-commerce platform for online tutorial</p>				
<p>List of Laboratory Tasks:</p> <p>Level 1: Understand the work flow of various e-commerce applications (Amazon, flipkart, myntra, etc.)</p> <p>Level 2: create a web page of your college.</p> <p>Level 1: Develop a web page for user login</p> <p>Level 2: Develop a web page for registration</p> <p>Level 1: Develop a home page of website consisting of navigation menus.</p> <p>Level 2: Develop a home page of website consisting of navigation menus as links.</p> <p>Level 1: Develop a home page of website consisting of vertical navigation panel.</p> <p>Level 2: Develop a page to navigate a page with user credentials and verify.</p> <p>Level 1: Build multiple web pages and link them to home page.</p> <p>Level 2: Embed relevant videos of recommended in home page.</p> <p>Level 1: Create a small website for online grocery.</p> <p>Level 2: Create a cart of products and navigate to pay portal.</p> <p>Level 1: Build a small B2B website (Shopify)</p>				

<p>Level 2: Build a small B2B website (eBay)</p> <p>Level 1: Build a small B2C business transaction (Amazon).</p> <p>Level 2: Build a small B2C business transaction (Flipkart).</p> <p>Level 1: Create simple customer to customer (eBay like e-commerce application).</p> <p>Level 2: Create simple customer to customer (big Basket like e-commerce application).</p> <p>Level 1: Write a case study on security issues in e-commerce.</p> <p>Level 2: Write a case study on risk management in e-commerce.</p>
<p>Targeted Application &amp; Tools that can be used:</p> <p>Xamp server, Notepad, Visual studio, MySQL</p>
<p>Project work/Assignment:</p>
<p>Design a website to showcase working of 4 types of e-commerce (B2B, B2C, C2B and C2C business transactions).</p>
<p>Textbook(s):</p> <p>Sushila Madan (2022), E-Commerce, Scholar Tech Press</p> <p>S.J. P.T. Joseph (2019), E-COMMERCE : An Indian Perspective, PHI</p> <p>Laudon, Kenneth C. and Carol Guercio Traver (2002) E -commerce: business, technology, society. (New Delhi: Pearson Education).</p> <p>Awad, Elias M. (2007), Electronic Commerce: From Vision to Fulfillment (New Delhi: Pearson Education).</p>
<p>References</p> <p>Kalakota, Ravi and Marcia Robinson (2001). Business 2.0: Roadmap for Success (New Delhi: Pearson Education).</p> <p>Smith, P.R. and Dave Chaffey (2005), eMarketingXcellence; The Heart of eBusiness (UK: Elsevier Ltd.)</p>
<p><a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a></p> <p><a href="https://onlinecourses.swayam2.ac.in">https://onlinecourses.swayam2.ac.in</a></p> <p><a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=4125&amp;query_desc=kwl%20Cwrdl%3A%20e%20commerce">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=4125&amp;query_desc=kwl%20Cwrdl%3A%20e%20commerce</a></p> <p><a href="http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14338&amp;query_desc=kwl%20Cwrdl%3A%20e%20commerce">http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14338&amp;query_desc=kwl%20Cwrdl%3A%20e%20commerce</a></p>

Course Code: CSE3150	Course Title: Front-end Full Stack Development	L- T-P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	NIL				
Course Description	This intermediate course enables students to perform front-end full stack development, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				
Course Outcomes	On successful completion of the course the students shall be able to:  1] Describe the fundamentals of DevOps and Front-end full stack development. [Comprehension]  2] Illustrate development of a responsive web. [Application]  3] Apply concepts of Angular.js to develop a web front-end. [Application]  4] Apply concepts of Angular.js to develop a web front-end. [Application]				
Course Content:					
Module 1	Fundamentals of DevOps and Web Development	Project	Programming		04 Sessions
Topics:  Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes.  Review of GIT source control. HTML5 – Syntax, Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform  Assignment: Develop a website for managing HR policies of a department.					

Module 2	Responsive web design	Project	Programming	03 Sessions
<p>Topics:</p> <p>BootStrap for Responsive Web Design; JavaScript – Core syntax, HTML DOM, objects, classes, Async; Ajax and jQuery Introduction</p> <p>Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society.</p>				
Module 3	Fundamentals of Angular.js	Project	Programming	08 Sessions
<p>Topics:</p> <p>Setting up Development &amp; Build Environment: Node.js and NPM; Introduction to TypeScript; Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications; Components &amp; Databinding in Depth; Angular Directives; Using Services &amp; Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication &amp; Route Protection; Dynamic Components; Angular Modules &amp; Optimizing Angular Apps; Deploying an Angular App; Angular Animations; Adding Offline Capabilities with Service Workers; Unit Testing in Angular Apps (Jasmine, Karma).</p> <p>Assignment: Develop a software tool to do inventory management in a warehouse.</p>				
Module 4	Fundamentals of React.js	Project	Programming	15 Sessions
<p>Topics:</p> <p>Overview of React.js.; Reactive Programming; React Components; Render Method; Virtual DOM and Bandwidth Salvation; Two Distinct Ways of Initializing a React Class; States &amp; Life Cycles; Component Mounting; Node.js &amp; NPM; JSX Walkthrough; React Testing.</p> <p>Assignment: Develop a web-based application to book movies/events (like bookmyshow).</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.</p> <p>Professionally Used Software: GCC compiler.</p>				
Project work/Assignment:				
<p>Problem Solving: Design of Algorithms and implementation of programs.</p> <p>Programming: Implementation of given scenario using Java.</p>				
<p>Text Book:</p> <p>T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015</p>				

T2. Northwood, Chris, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", APress, 2018

References:

R1. Flanagan D S, "Javascript : The Definitive Guide" 7th Edition. 7th ed. O'Reilly Media; 2020.

R2. Alex Libby, Gaurav Gupta, and Asoj Talesra. "Responsive Web Design with HTML5 and CSS3 Essentials", Packt Publishing, 2016

R3. Duckett J Ruppert G Moore J. "Javascript & JQuery : Interactive Front-End Web Development."; Wiley; 2014.

R4. Greg Sidelnikov, "React.js Book\_ Learning React JavaScript Library", 1 edition, Scratch-River Tigris LLC 2016

R5. Web Reference:  
[https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo\\_jxIY\\_uTWA&index=2](https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxIY_uTWA&index=2)

Course Code: CSE3151	Course Title: Java Full Stack Development	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	CSE3152 .NET Full Stack Development				
Course Description	This advanced level course enables students to perform full stack development using Java, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				

Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of Java for full stack development [Application] 2] Show web applications using Java EE. [Application] 3] Solve simple applications using Java Persistence and Hibernate [Application] 4] Apply concepts of Spring to develop a Full Stack application. [Application] 5] Employ automation tools like Maven, Selenium for Full Stack development. [Application]			
Course Content:				
Module 1	Introduction	Project	Programming	03 Sessions
Topics: Review of Java; Advanced concepts of Java; Java generics; Java IO; New Features of Java. Unit Testing tools.				
Module 2	Java EE Web Applications	Project	Programming	05 Sessions
Topics: Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App Assignment: Develop an application for managing HR policies of a department.				
Module 3	Java Persistence using JPA and Hibernate	Project	Programming	06 Sessions
Topics: Fundamentals of Java Persistence with Hibernate; JPA for Object/Relational Mapping, Querying, Caching, Performance and Concurrency; First & Second Level Caching, Batch Fetching, Optimistic Locking & Versioning; Entity Relationships, Inheritance Mapping & Polymorphic Queries; Querying database using JPQL and Criteria API (JPA) Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society..				
Module 4	Spring Core	Project	Programming	10 Sessions

<p>Topics:</p> <p>Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development</p> <p>Assignment: Develop a software tool to do inventory management in a warehouse.</p>				
Module 5	Automation tools	Project	Programming	06 Sessions
<p>Topics:</p> <p>Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands</p> <p>Assignment: Illustrate the use of automation tools in the development of a small software project.</p>				
<p>Targeted Application &amp; Tools that can be used:</p> <p>Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.</p> <p>Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.</p>				
Project work/Assignment:				
<p>Problem Solving: Design of Algorithms and implementation of programs.</p> <p>Programming: Implementation of given scenario using Java.</p>				
<p>Text Book:</p> <p>T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015</p>				
<p>References</p> <p>R1. Soni, Ravi Kant. "Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful.", Apress, 2017.</p> <p>R2. Mardan, Azat. "Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB.", Apress, 2015</p>				

Course Code: CSE3152	Course Title: .NET Full Stack Development	L-T- P- C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	CSE3151 Java Full Stack Development				
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.				
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				
Course Outcomes	On successful completion of the course the students shall be able to: 1] Practice the use of C# for developing a small application [Application] 2] Show web applications using Entity Framework. [Application] 3]Solve simple web applications that use SQL and ASP.NET [Application] 4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]				
Course Content:					
Module 1	C# Programming for Full Stack Development	Project	Programming		10 Sessions
Topics: .NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions, Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading,					



Data validation and working with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework Assignment: Develop a small application for managing library using C#.				
Module 2	Entity Framework Core 2.0	Project	Programming	06 Sessions
Topics: Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET Assignment: Develop an application for managing HR policies of a department.				
Module 3	ASP.NET	Project	Programming	06 Sessions
Topics: ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC & Layouts; Assignment: Develop a web application to mark entry/exit of guests in a building.				
Module 4	ASP.NET	Project	Programming	08 Sessions
Topics: Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application Assignment: Develop a software tool to do inventory management in a warehouse.				
Targeted Application & Tools that can be used:  Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.  Professionally Used Software: Visual Studio				
Project work/Assignment:				

Problem Solving: Design of Algorithms and implementation of programs.

Programming: Implementation of given scenario using .NET.

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

T2. Valerio De Sanctis, "ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11", 4th Edition, Packt, 2021.

References

R1. Benjamin Perkins, Jon D. Reid, "Beginning C# and .NET", Wiley, 2021 Reid, 2021.

R2. Piotr Gankiewicz, "Full Stack .NET Web Development", Packt Publishing, 2017.

R3. Tamir Dresher, Amir Zuker, Shay Friedman, "Hands-On Full-Stack Web Development with ASP.NET Core", Packt Publishing, 2018.

R4. Dustin Metzgar, "Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core", Manning, 2017.

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