PRESIDENCY UNIVERSITY

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PROGRAMME REGULATIONS & CURRICULUM

2023-27

PRESIDENCY SCHOOL OF COMPUTER SCIENCE & ENGINEERING

BACHELOR OF TECHNOLOGY (B.TECH.)

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

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum

2023-2027

BACHELOR OF TECHNOLOGY (B.Tech.) in

CYBER SECURITY(CCS)

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

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

Regulations No.: PU/AC-24.05/SOCSE04/CCS/2023-27

Resolution No.7 of the 24th Meeting of the Academic Council held on 03rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 05th August, 2024.

AUGUST-2024

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PART A – PROGRAM REGULATIONS

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

1.1 Vision of the University

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

1.2 Mission of the University

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

1.3 Vision of Presidency School of Computer Science and Engineering

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

1.4 Mission of Presidency School of Computer Science and Engineering

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

2. Preamble to the Program Regulations and Curriculum

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

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

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations, 2023 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 2023-2027.
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 2023-2027 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 2023-2027.

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, 2023-2027;*

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 2023-2027 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2023-2027 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 16.1 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 to:

PEO1. Demonstrate as a Computer Engineering Professional, applying technical knowledge and skills effectively in various engineering fields.

PEO 2: Become a teaching and research professional in the areas of Computer Science and Engineering, engaging in lifelong learning to stay at the forefront of the field.

PEO 3: Contribute as a key member of a consultancy team in the Computer Science and Engineering industry, providing expert solutions to complex problems.

PEO 4: Emerge as an entrepreneur in the fields of Computer Science and related areas, creating innovative solutions and businesses.

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

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentages (45%) marks in the

final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case of SC / ST and OBC candidates from Karnataka the minimum marks for eligibility shall be forty percent (40%).

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

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

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

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

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

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

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2023-2027, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

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

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

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

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

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 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 Presidency University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) B.Tech. Program commencing on August 1 on the year concerned.

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

10.2.4 The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Tech. Four Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor

for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the B.Tech. Program of the University.

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

11 Change of Branch / Discipline / Specialization

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a change of Branch, at the end of 1st Year of the B.Tech. Program to eligible students in accordance with the following rules and guidelines framed by the University from time to time.

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

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

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

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

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

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

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

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

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

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

12.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 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 Academics 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 %	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	
2	2-0-2-3	Percentage	12.50%	12.50 %	12.50%	12.50 %	25%	25%	-	100 %	Mid-Term & End Term by CoE * Except for full stack courses
		Marks	25	25	25	25	50	50	-	200	
3	1-0-4-3	Percentage	-	25%	10%	40%	5%	20%	-	100 %	Mid-Term & End Term by School
		Marks	-	25	10	40	5	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 developmen

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 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 12.6.1, 12.6.2 of Academic Regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

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

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

13.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer. 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 13.3(As per Academic Regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

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

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

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

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

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

13.3.7 A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original

Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.

13.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11 in the Academic Regulations.

Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses

Sl. No.	Course Duration	Credit Equivalence
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

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

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

13.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (13.0), 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 (2023-2027) totalling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: B.Tech. (Cyber Security) 2023-2027: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	School Core	**65**
2	Program Core	**68**
3	Discipline Elective	**18**
4	Open Elective	**9**
	Total Credits	**160 (Minimum)**

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).

Table 3.1 : List of School Core

Sl. No.	Course Code	Course Name	L	T	P	Credits
1	MAT1001	Calculus and Linear Algebra	3	0	2	4
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3
3	ECE1001	Elements of Electronics Engineering	3	0	2	4
4	ENG1002	Technical English	1	0	2	2
5	PPS1001	Introduction to soft skills	0	0	2	1
7	CHE1018	Environmental Science	1	0	2	0
8	PPS1011	Introduction to Verbal Ability	0	1	0	0
9	MAT1003	Applied Statistics	1	0	2	2
10	ECE2007	Digital Design	2	0	2	3
11	CIV1008	Basic Engineering Sciences	2	0	0	2
12	MEC1006	Engineering Graphics	2	0	0	2
13	CSE1006	Problem Solving using JAVA	1	0	4	3
14	ENG2001	Advanced English	1	0	2	2
15	PPS1002	Soft Skills for Engineers	0	0	2	1
16	ECE2010	Innovative Projects Using Arduino	-	-	-	1
17	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3
18	CSE2001	Data Structures and Algorithms	3	0	2	4
19	MAT2004	Discrete Mathematical Structures	3	0	0	3
20	ECE2011	Innovative Projects Using Raspberry Pi	-	-	-	1
21	PPS4002	Introduction to Aptitude	0	0	2	1
22	MAT2003	Numerical Methods for Engineers	3	0	0	3
23	PPS4004	Aptitutde Training Intermediate	0	0	2	1
24	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1
25	CSE7000	Internship	-	-	-	2
26	PPSXXXX	Industry Preparedness Program	2	0	0	0
27	CSE2510	Competitive Programming and Problem Solving	0	0	4	2
28	CSE7100	Mini Project	-	-	-	4
29	CSE7300	Capstone Project	-	-	-	10

	Total	

Table 3.2 : List of Program Core Courses (PCC)

S. No	Course Code	Course Name	L	T	P	C
1	CSE1004	Problem Solving Using C	1	0	4	3
2	CSE3155	Data Communications and Computer Networks	3	0	2	4
3	CSE2009	Computer Organization and Architecture	3	0	0	3
4	CSE3190	Fundamentals of Data Analytics	2	0	2	3
5	CSE2014	Software Engineering	3	0	0	3
6	CSE1005	Programming in Python	1	0	4	3
7	CSE2007	Design and Analysis of Algorithms	3	0	0	3
8	CSE3156	Database Management Systems	3	0	2	4
9	CSE3351	Operating Systems	3	0	0	3
10	CSE3078	Cryptography and Network Security	3	0	0	3
11	CSE1700	Essentials of AI	3	0	0	3
12	CCS2500	Cyber Forensics	2	0	0	2
13	CCS2504	Ethical Hacking	2	0	0	2
14	CCS2503	Cyber Security	3	0	0	3
15	CSE2500	Theory of Computation	3	0	0	3
16	CSE1504	Web Technologies	2	0	0	2
17	CSE1505	Web Technologies Lab	0	0	2	1
18	CCS2501	Cyber Forensics Lab	0	0	2	1
19	CSE1701	Essentials of AI Lab	0	0	4	2
20	CCS2505	Ethical Hacking Lab	0	0	4	2
21	CCS2502	Cyber Thread for IOT and Cloud	3	0	0	3
22	CCS2506	Intrusion Detection and prevention system	3	0	0	3
23	CCS2507	Web Security	2	0	0	2
24	CSE2506	Cloud Computing	2	0	0	2
25	CSE2507	Cloud Computing Lab	0	0	2	1
26	CCS2508	Web Security Lab	0	0	2	1
27	CCS2509	Malware Analysis	3	0	0	3
					Total No. of Credits	**68**

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

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

18.1 Internship

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

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

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

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

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

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

18.2 Mini Project

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

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

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

18.3 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7th / 8th Semester as applicable, subject to the following conditions:

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

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

18.3.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 18.3.2 above.

18.3.4 A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the I Capstone Project on her / his own. Provided further, that the Industry / Company or academic

/ research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and the Capstone Project Policy of the University.

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

18.4 Research Project / Dissertation

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

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

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.4). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University

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

Table 3.3: Discipline Electives Courses/Specialization Tracks – Minimum of 12 credits is to be earned by the student in a particular track and overall 18 credits.

Track 1 – Cyber Defense and Operations Basket

S.No	Course Code	Course Name	L	T	P	C
1	CCS2510	Security Assessment and Testing	2	0	2	3
2	CCS3403	AI and ML in Cyber Security	3	0	0	3
3	CCS3404	Incident Response and Threat Hunting	3	0	0	3
4	CCS3406	Cyber Digital Twin	3	0	0	3
5	CCS3408	Privacy and Security in Online Social Media	3	0	0	3
6	CCS3409	Machine Learning for Cyber Security	3	0	0	3
7	CCS3411	Security Information and Event Management (SIEM)	3	0	0	3

8	CCS3412	Blockchain Security	3	0	0	3
Track 2 – Digital Evidence and Malware Research Basket						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CCS2509	Malware Analysis	3	0	0	3
2	CCS3407	Quantum Cryptography	3	0	0	3
3	CCS3410	Digital Watermarking and Steganography	3	0	0	3
4	CCS3400	Digital and Mobile Forensics	2	0	2	3
5	CCS3416	Cryptocurrency Technologies	3	0	0	3
Track 3 – Offensive Security and Engineering						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CCS3402	Identity and Access Management	3	0	0	3
2	CCS3414	Security in Internet of Things (IoT)	3	0	0	3
3	CCS3405	Vulnerability Assessment and Penetration Testing	3	0	0	3
4	CCS3413	Security Auditing and Governance	3	0	0	3
5	CCS3415	Cloud Security	3	0	0	3

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

Table 3.4: Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 9											
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Type of Skill / Focus**	**Course Caters to**	**Prerequisites/ Corequisites**	**Antirequisites**	**Future Courses that need this as a Prerequisite**
Chemistry Basket											
1	CHE1003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-
2	CHE1004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-
3	CHE1005	Computational Chemistry	2	0	0	2	S	ES	-	-	-

4	CHE1006	Introduction to Nano technology	3	0	0	3	S	ES	-	-	-
5	CHE1007	Biodegradable electronics	2	0	0	2	S	ES	-	-	-
6	CHE1008	Energy and Sustainability	2	0	0	2	S	ES	-	-	-
7	CHE1009	3D printing with Polymers	2	0	0	2	S	ES	-	-	-
8	CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	S	ES	-	-	-
9	CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	S	ES	-	-	-
10	CHE1012	Introduction to Composite materials	2	0	0	2	S	ES	-	-	-
11	CHE1013	Chemistry for Engineers	3	0	0	3	S	ES	-	-	-
12	CHE1014	Surface and Coatings technology	3	0	0	3	S	ES	-	-	-
13	CHE1015	Waste to Fuels	2	0	0	2	S	ES	-	-	-
14	CHE1016	Forensic Science	3	0	0	3	S	ES	-	-	-
Civil Engineering Basket											
1	CIV1001	Disaster mitigation and management	3	0	0	3	S	-	-	-	-
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
3	CIV2001	Sustainability Concepts in Engineering	3	0	0	3	S	-	-	-	-
4	CIV2002	Occupational Health and Safety	3	0	0	3	S	-	-	-	-
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-

6	CIV2 004	Integrated Project Management	3	0	0	3	EN	-	-	-	-
7	CIV2 005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
8	CIV2 006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-
9	CIV2 044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
10	CIV2 045	Environmental Meteorology	3	0	0	3	S	-	-	-	-
11	CIV3 046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
12	CIV3 059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-
Commerce Basket											
1	COM 2001	Introduction to Human Resource Management	2	0	0	2	F	HP/GS	-	-	-
2	COM 2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
3	COM 2003	Contemporary Management	2	0	0	2	F	-	-	-	-
4	COM 2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
5	COM 2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
6	COM 2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
7	COM 2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Computer Science Basket (not to be offered for Computer Science and Engineering students)											
1	CSE2 002	Programming in Java	2	0	2	3	S/E M	-	-	-	-
2	CSE2 003	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	LAW 1001	Introduction to Sociology	2	0	0	0	2	F	HP	-	-
2	LAW 2001	Indian Heritage and Culture	2	0	0	0	2	F	HP/GS	-	-

3	LAW 2002	Introdcution to Law of Succession	2	0	0	0	2	F	HP/GS	-	-
4	LAW 2003	Introduction to Company Law	2	0	0	0	2	F	HP	-	-
5	LAW 2004	Introduction to Contracts	2	0	0	2	F	HP	-	-	-
6	LAW 2005	Introduction to Copy Rights Law	2	0	0	2	F	HP	-	-	-
7	LAW 2006	Introduction to Criminal Law	2	0	0	2	F	HP	-	-	-
8	LAW 2007	Introduction to Insurance Law	2	0	0	2	F	HP	-	-	-
9	LAW 2008	Introduction to Labour Law	2	0	0	2	F	HP	-	-	-
10	LAW 2009	Introduction to Law of Marriages	2	0	0	2	F	HP/GS	-	-	-
11	LAW 2010	Introduction to Patent Law	2	0	0	2	F	HP	-	-	-
12	LAW 2011	Introduction to Personal Income Tax	2	0	0	2	F	HP	-	-	-
13	LAW 2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
14	LAW 2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
15	LAW 2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
16	LAW 2015	Cyber Law	3	0	0	3	F	HP	-	-	-
17	LAW 2016	Law on Sexual Harrassment	2	0	0	2	F	HP/GS	-	-	-
18	LAW 2017	Media Laws and Ethics	2	0	0	2	F	HP/GS	-	-	-
Mathematics Basket											
1	MAT 2008	Mathematical Reasoning	3	0	0	3	S	-	-	-	-

2	MAT 2014	Advanced Business Mathematics	3	0	0	3	S	-	-	-	-
3	MAT 2041	Functions of Complex Variables	3	0	0	3	S	-	-	-	-
4	MAT 2042	Probability and Random Processes	3	0	0	3	S	-	-	-	-
5	MAT 2043	Elements of Number Theory	3	0	0	3	S	-	-	-	-
6	MAT 2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-
Mechanical Basket											
1	MEC 1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-
2	MEC 1002	Introduction to Matlab and Simulink	3	0	0	3	S/EM	-	-	-	-
3	MEC 1003	Engineering Drawing	1	0	4	3	S	-	-	-	-
4	MEC 2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-
5	MEC 2002	Operations Research & Management	3	0	0	3	F	-	-	-	-
6	MEC 2003	Supply Chain Management	3	0	0	3	S/EM/EN	-	-	-	-
7	MEC 2004	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	MEC2008	-
8	MEC 2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
9	MEC 2006	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-
10	MEC 2007	Additive Manufacturing	3	0	0	3	F/EM	-	-	-	-
11	MEC 3069	Engineering Optimisation	3	0	0	3	S/EM	-	-	-	-

12	MEC 3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-
13	MEC 3071	Hybrid Electric Vehicle Design	3	0	0	3	S/EM	ES	-	-	-
14	MEC 3072	Thermal Management of Electronic Appliances	3	0	0	3	S/EM	-	-	-	-
15	MEC 3200	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
16	MEC 3201	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	MGT 2007	Digital Entrepreneurship	3	0	0	3	S/EM/EN	-	-	-	-
2	MGT 2015	Engineering Economics	3	0	0	3	S	-	-	-	-
3	MGT 2023	People Management	3	0	0	3	S/EM/EN	HP	-	-	-
Management Basket- II											
1	MGT 1001	Introduction to Psychology	3	0	0	3	F	HP	-	-	-
2	MGT 1002	Business Intelligence	3	0	0	3	EN	-	-	-	-
3	MGT 1003	NGO Management	3	0	0	3	S	-	-	-	-
4	MGT 1004	Essentials of Leadership	3	0	0	3	EM/EN	GS/ HP	-	-	-
5	MGT 1005	Cross Cultural Communication	3	0	0	3	S/EM/EN	HP	-	-	-
6	MGT 2001	Business Analytics	3	0	0	3	S/EM/EN	-	-	-	-
7	MGT 2002	Organizational Behaviour	3	0	0	3	F	HP	-	-	-
8	MGT 2003	Competitive Intelligence	3	0	0	3	S	-	-	-	-
9	MGT 2004	Development of Enterprises	3	0	0	3	S/EM/EN	-	-	-	-

10	MGT 2005	Economics and Cost Estimation	3	0	0	3	S/EM	-	-	-	-
11	MGT 2006	Decision Making Under Uncertainty	3	0	0	3	S	-	-	-	-
12	MGT 2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-
13	MGT 2009	Management Consulting	3	0	0	3	S/EM/EN	-	-	-	-
14	MGT 2010	Managing People and Performance	3	0	0	3	S/EM/EN	HP/GS	-	-	-
15	MGT 2011	Personal Finance	3	0	0	3	F	-	-	-	-
16	MGT 2012	E Business for Management	3	0	0	3	S/EM	-	-	-	-
17	MGT 2013	Project Management	3	0	0	3	EN / EM	GS/HP/ ES	-	-	-
18	MGT 2014	Project Finance	3	0	0	3	EN / EM	HP	-	-	-
19	MGT 2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
20	MGT 2017	Principles of Management	3	0	0	3	S/EM/ EN	-	-	-	-
21	MGT 2018	Professional and Business Ethics	3	0	0	3	S/EM/ EN	HP	-	-	-
22	MGT 2019	Sales Techniques	3	0	0	3	S/EM/ EN	HP	-	-	-
23	MGT 2020	Marketing for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
24	MGT 2021	Finance for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-

25	MGT 2022	Customer Relationship Management	3	0	0	3	S/EM/EN	HP	-	-	-
Media Studies Basket											
1	BAJ3 050	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-
2	BAJ3 051	Digital Photography	2	0	2	3	EM	HP	-	-	-
3	BAJ3 055	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-

21.List of MOOC (NPTEL) Courses

21.1 NPTEL - Discipline 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	ion to Computer and Network Performance Analysis Using Queuing	1	1-0-0-1
24	CSE3213	C Programming And Assembly Language	1	1-0-0-1
25	CSE3214	Python For Data Science	1	1-0-0-1
26	CSE3215	Software Conceptual Design	1	1-0-0-1
27	CSE3117	Industrial Digital Transformation	3	3-0-0-3
28	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
29	CSE3349	Technology for Lawyers	3	3-0-0-3
30	CSEXXXX	Deep Learning for Natural Language Processing	3	3-0-0-3
31	CSEXXXX	Machine Learning for Engineering and science applications	3	3-0-0-3
32	CSEXXXX	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
33	CSEXXXX	Introduction to Large Language Models (LLMs)	3	3-0-0-3
34	CSEXXXX	Quantum Algorithms and Cryptography	3	3-0-0-3

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

Semester Wise Course Grids/ Tables: First year - CYCLE 1

Sl. No.	Course Code	Course Name	L	T	P	Credits	Type of Skill/ Focus	Course Caters to	Basket
Semester 1 - Physics Cycle						**17**			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	F		School Core

2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	F		School Core
3	ECE1001	Elements of Electronics Engineering	3	0	2	4	F		School Core
4	ENG1002	Technical English	1	0	2	2	S		School Core
5	PPS1001	Introduction to soft skills	0	0	2	1	S	HP	School Core
6	CSE1004	Problem Solving Using C	1	0	4	3	S		School Core
7	CHE1018	Environmental Science	1	0	2	0	F	ES	School Core
8	PPS1011	Introduction to Verbal Ability	0	1	0	0	S/ EM		School Core
Semester 2 - Engineering Science Cycle						16			
1	MAT1003	Applied Statistics	1	0	2	2	EM		School Core
2	ECE2007	Digital Design	2	0	2	3	F / S		School Core
3	CIV1008	Basic Engineering Sciences	2	0	0	2	S		School Core
4	MEC1006	Engineering Graphics	2	0	0	2	S		School Core
5	CSE1006	Problem Solving using JAVA	1	0	4	3	S		School Core
6	ENG2001	Advanced English	1	0	2	2	S		School Core
7	PPS1002	Soft Skills for Engineers	0	0	2	1	S	HP	School Core
8	ECE2010	Innovative Projects Using Arduino	-	-	-	1	S		School Core

First year - CYCLE 2

Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Type of Skill/ Focus**	**Course Caters to**	**Basket**
Semester 1 - Engineering Science Cycle						**18**			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	F		School Core
2	ECE1001	Elements of Electronics Engineering	3	0	2	4	F		School Core
3	ENG1002	Technical English	1	0	2	2	S		School Core
4	PPS1001	Introduction to soft skills	0	0	2	1	S	HP	School Core
5	CSE1004	Problem Solving Using C	1	0	4	3	S		School Core

6	PPS1011	Introduction to Verbal Ability	0	1	0	0	S/ EM		School Core
7	CIV1008	Basic Engineering Sciences	2	0	0	2	S		School Core
8	MEC1006	Engineering Graphics	2	0	0	2	S		School Core
Semester 2 – Physics Cycle						**15**			
1	MAT1003	Applied Statistics	1	0	2	2	EM		School Core
2	ECE2007	Digital Design	2	0	2	3	F / S		School Core
3	CSE1006	Problem Solving using JAVA	1	0	4	3	S		School Core
4	ENG2001	Advanced English	1	0	2	2	S		School Core
5	PPS1002	Soft Skills for Engineers	0	0	2	1	S	HP	School Core
6	CHE1018	Environmental Science	1	0	2	0	F	ES	School Core
7	PHY1002	Optoelectronics and Device Physics	2	0	2	3	F		School Core
8	ECE2010	Innovative Projects Using Arduino	-	-	-	1	S		School Core

Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Type of Skill/ Focus**	**Course Caters to**	**Basket**
Semester 3						**28**			
1	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	F		School Core
2	CSE2001	Data Structures and Algorithms	3	0	2	4	S		School Core
3	CSE3155	Data Communications and Computer Networks	3	0	2	4	S		Program Core
4	CSE2009	Computer Organization and Architecture	3	0	0	3	S		Program Core
5	MAT2004	Discrete Mathematical Structures	3	0	0	3	EM		School Core
6	CSE3190	Fundamentals of Data Analytics	2	0	2	3	S		Program Core
7	CSE2014	Software Engineering	3	0	0	3	S		Program Core
8	ECE2011	Innovative Projects Using	-	-	-	1	S		School Core

		Raspberry Pi							
9	CSE1005	Programming in Python	1	0	4	3	S		Program Core
10	PPS4002	Introduction to Aptitude	0	0	2	1	S/EM	HP	School Core
Semester 4						**24**			
1	MAT2003	Numerical Methods for Engineers	3	0	0	3	S		School Core
2	CSE2007	Design and Analysis of Algorithms	3	0	0	3	S		Program Core
3	CSE3156	Database Management Systems	3	0	2	4	S		Program Core
4	CSE3351	Operating Systems	3	0	0	3	S		Program Core
5	CSE3078	Cryptography and Network Security	3	0	0	3	S		Program Core
6	CSEXXXX	Professional Elective - I	3	0	0	3			Discipline Elective
7	XXXXXXX	Open Elective – I (Management Basket)	3	0	0	3			Open Elective
8	PPS4004	Aptitutde Training Intermediate	0	0	2	1	S/EM	HP	School Core
9	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1			School Core
Semester 5						**26**			
1	CSE1700	Essentials of AI	3	0	0	3			Program Core
2	CCS2500	Cyber Forensics	2	0	0	2	S		Program Core
3	CCS2504	Ethical Hacking	2	0	0	2			Program Core
4	CCS2503	Cyber Security	3	0	0	3	S		Program Core
5	CSE2500	Theory of Computation	3	0	0	3	S		Program Core
6	CSE1504	Web Technologies	2	0	0	2	S		Program Core
7	CSE1505	Web Technologies Lab	0	0	2	1	S		Program Core
8	CCSXXXX	Professional Elective - II	3	0	0	3			Discipline Elective
9	CCS2501	Cyber Forensics Lab	0	0	2	1	S		Program Core
10	CSE1701	Essentials of AI Lab	0	0	4	2	S		Program Core
11	CCS2505	Ethical Hacking Lab	0	0	4	2	S		Program Core
13	CSE7000	Internship	-	-	-	2			School Core

Semester 6						23			
1	CCS2502	Cyber Thread for IOT and Cloud	3	0	0	3	S		Program Core
2	CCS2506	Intrusion Deduction and prevention system	3	0	0	3	S		Program Core
3	CCS2507	Web Security	2	0	0	2	S		Program Core
4	CSE2506	Cloud Computing	2	0	0	2	S		Program Core
5	CSE2507	Cloud Computing Lab	0	0	2	1	S		Program Core
6	CCS2508	Web Security Lab	0	0	2	1	S		Program Core
7	CCS2509	Malware Analysis	3	0	0	3			Program Core
8	CCSXXXX	Professional Elective - III	3	0	0	3			Discipline Elective
9	XXXXXXX	Open Elective – II	3	0	0	3			Open Elective
10	PPSXXXX	Industry Preparedness Program	2	0	0	0			School Core
11	CSE2510	Competitive Programming and Problem Solving	0	0	4	2	S/EM	HP	School Core

Semester 7						16			
1	XXXXXXX	Open Elective – III (Management Basket)	3	0	0	3			Open Elective
2	CCSXXXX	Professional Elective -IV	3	0	0	3			Discipline Elective
3	CCSXXXX	Professional Elective – V	3	0	0	3			Discipline Elective
4	CCSXXXX	Professional Elective - VI	3	0	0	3			Discipline Elective
5	CSE7100	Mini Project	-	-	-	4	S/ EM/ EN		School Core
Semester 8						**10**			
1	CSE7300	Capstone Project	-	-	-	10	S/ EM/ EN		School Core

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.

Course Code: MAT1001	**Course Title: Calculus and Linear Algebra** **Type of Course: School Core Lab Integrated**	**L-T- P-C**	**3**	**0**	**2**	**4**
Version No.	3.0					
Course Pre-requisites	Basic Concepts of Limits, Differentiation, Integration					
Anti-requisites	**NIL**					
Course Description	The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature. The lab sessions associated with the course are concerned with acquiring an ability to use the MATLAB software.					
Course Objective	The objective of the course is **Skill Development** of student by using **Problem Solving Techniques.**					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Comprehend the knowledge of applications of matrix principles. 2) Understand the concept of partial derivatives and their applications. 3) Apply the principles of integral calculus to evaluate integrals. 4) Adopt the various analytical methods to solve differential equations. 5) Demonstrate the use of MATLAB software to deal with a variety of mathematical problems.					
Course Content:						
Module 1	**Linear Algebra**				**10 Classes**	
Review: Types of matrices, elementary transformations, rank of a matrix, normal form, Solution of systems of linear equations: (Homogenous and non-homogenous system) AX = O and AX = B using rank method. **Linear Algebra:** Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms. Engineering Applications of Linear Algebra.					
Module 2	**Partial Derivatives**				**10 CLASSES**	

Review: Differential calculus with single variable.

Partial Derivatives:
Homogeneous functions and Euler's theorem, Total derivative, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor's series for functions of two variables, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.
Engineering Applications of partial derivatives.

Module 3	**Advanced Integral calculus**			**12 Classes**

Review: Integral calculus for single integrals.

Advanced Integral calculus:
Beta and Gamma functions–interrelation-evaluation of integrals using gamma and beta functions; error function-properties. Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates.
Engineering applications of partial derivatives.

Module 4	**Ordinary Differential Equations**	**Assignment**	**Programming**	**12 Classes**

Review: First order and first-degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non- Homogeneous Equations reducible to Homogeneous form.

Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non- Exact Differential Equations, Higher order Differential Equation with constant coefficients and with right hand side of the form e^{ax}, sinax, cosax, $e^{ax}f(x)$, $x^nf(x)$ etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, D-operators and Inverse D- operators, Method of Variation of Parameters.
Engineering applications of differential equations.

List of Laboratory Tasks:
Introductory Task: Introduction to usage of the software and simple programming tasks. [3 Sessions]
Experiment N0 1: Solution of Simple differentiation with single variable and use of chain Rule.
Experiment No. 2: Solution based on application of Tailors' Series using software
Experiment No. 3: Application of Maxima and Minima condition using software.
Experiment No. 4 Computation of different functions for a specific problem
Experiment No. 5 Computation of Area under a curve.

Experiment No. 6 Solution of a set of simultaneous equations in matrix method
Experiment No. 7 Computation of Eigen Values and Eigen Vectors.
Experiment No. 8 Solution of Partial Differential equation
Experiment No. 9 solution using Cauchy Equation and Lagrange's Equation

Targeted Application & Tools that can be used:
The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.
Tools Used: MatLab, Zylink.

Assignment:

1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB.
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.

Text Book

1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
2. Walter Ledermann, Multiple integrals, Springer, 1st edition
3. Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India.
4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
5. MatLab usage manual

E-resources/ Web links:

1. https://nptel.ac.in/courses/109104124
2. https://nptel.ac.in/courses/111106051
3. https://nptel.ac.in/courses/111102137
4. https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/
5. https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus
6. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/
7. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
8. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

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

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

Course Code: **PHY1002**	**Course Title: Optoelectronics and Device Physics** **Type of Course: 1] School Core & Laboratory integrated**	L-T-P-C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	**NIL**		
Anti-requisites	**NIL**		
Course Description	The purpose of this course is to enable the students to understand the fundamentals, working and applications of optoelectronic devices and to develop the basic abilities to appreciate the applications of advanced microscopy and quantum computers. The course develops the critical thinking, experimental and analytical skills. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to use the concepts for technological applications. The laboratory tasks aim to develop following skills: **An attitude of enquiry, confidence and ability to tackle new problems, ability to interpret events and results, observe and measure physical phenomena, select suitable equipment, instrument and materials, locate faults in systems.**		
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the concepts of semiconductors, magnetic materials and superconductors. CO2: Apply the concept of materials in the working of optoelectronic and magnetic devices. CO3: Discuss the quantum concepts used in advanced microscopy and quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields. CO5: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. **[Lab oriented].**		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Optoelectronics and device physics "and attain **Skill Development** through **Experiential Learning** techniques		
Course Content:			

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

	Level 1: Determination of Wavelength of Laser Level 2: Finding the particle size of lycopodium powder. Experiment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier. Level 1: To determine the proportionality of Hall Voltage and magnetic flux density Level 2: To determine the polarity of Charge carrier. Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions. Level 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage. Level 2: To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance. Experiment No. 5: To study input and output characteristics of a given Transistor. Level 1: To determine the input resistance of a given transistor. Level 2: To determine current transfer characteristics and transistor parameters of a given transistor. Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire. Level 1: Determination of Fermi energy and Fermi temperature of given metal wire. Level 2: Determination of Fermi energy and Fermi temperature of given bimetallic wire. Experiment No. 7: To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance and To measure the photo-current as a function of the irradiance at constant voltage. Level 1 To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance. Level 2: To measure the photo-current as a function of the irradiance at constant voltage. Experiment No. 8: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance. Level 1: To study the I-V characteristics Level 2: I-R characteristics of a solar cell as a function of the irradiance. Experiment No. 9: Calculate the numerical aperture and study the losses that occur in optical fiber cable. . Level 1: Calculate the numerical aperture. Level 2: study the losses that occur in optical fiber cable. Experiment No. 10: To determine the magnetic susceptibility of a given diamagnetic and paramagnetic substances using Quincke's method.

	Level 1: To determine the magnetic susceptibility of a given diamagnetic substance. Level 2: To determine the magnetic susceptibility of a given paramagnetic substance. Experiment No. 11: Plotting I-V characteristics in forward and reverse bias for LEDs and Determination of knee voltage. Level 1: Plotting I-V characteristics in forward and reverse bias for LEDs Level 2: Determination of knee voltage. Experiment No. 12: Determination of Stefan's constant and verification of Stefan-Boltzmann Law. Level 1: Determination of Stefan's constant Level 2: Verification of Stefan-Boltzmann Law.
	Targeted Application & Tools that can be used: 1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM. 2. Origin, excel and Mat lab soft wares for programming and data analysis.
	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
	Assessment Type • Midterm exam • Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.) • Quiz • End Term Exam • Self-Learning 1. Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons. 2. Write a report on importance of quantum entanglement in supercomputers.
	Text Book 1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2018.
	References: 1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002. 2. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011.

	3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017. 4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012. 5. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019
	E-Resourses: 1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live 2. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live 3. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live 4. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live 5. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live
	Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers. for Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout.

Course Code: **ECE1001**	**Course Title: Elements of Electronics Engineering** **Type of Course: School Core Theory & Integrated Laboratory**	**L-T-P-C**	3	0	2	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	Nil					

Course Description	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. 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.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Elements of Electronics Engineering and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING .				
Course Outcomes	On successful completion of this course the students shall be able to: Identify various electrical and electronic components and basic electrical laws. Explainapplications of Diodes and BJTs. Summarize the concepts of Digital Electronics and Communication Systems. Discuss the basic concepts of microprocessorand computer organization. Perform experiments to familiarizevarious Electrical & Electronic components and equipment. Verify Basic Electrical Circuit configurations and Laws.				
Course Content:					
Module 1	Basic Electrical and Electronic Components	Assignment / Quiz		Identification of Practical electronic and electrical components / Memory Recall based Quizzes	10 Sessions
Topics: ELECTRICAL CIRCUITS AND LAWS: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. ELECTRONIC MATERIALS AND COMPONENTS: Conductors, Insulators, Semi-Conductor Material, P-N Junction diode, Characteristics and Parameters, Ideal Diode approximations, DC load line.					
Module 2	Applications of Diodes and Introduction to BJT	Assignment / Quiz		Simulation Task/ Memory Recall based Quizzes	12 Sessions
Topics: RECTIFIERS: Half-wave rectifier, Two-diode Full-wave rectifier, Bridge rectifier, Capacitor filter circuit (only qualitative approach). ZENER DIODE: Zener diode, Zener Characteristics, Zener diode as a voltage regulator. BIPOLAR JUNCTION TRANSISTORS: 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), AC Analysis.					
Module 3	Digital Electronics and Communication System	Assignment / Quiz		Simulation Task / Memory Recall based Quizzes	13 Sessions

Topics:

NUMBER SYSTEMS: 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.

BOOLEAN ALGEBRA: 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.

COMMUNICATION SYSTEM: Block diagram of communication system, Modulation: Definition of Modulation, Need of Modulation, Types of Modulation: Amplitude Modulation and Frequency Modulation (Waveforms only).

Module 4	Microprocessors and Computer Organization	Assignment / Quiz	Memory recall based Quizzes	10 Sessions

Topics:

INTEL 8085 MICROPROCESSOR: Basic Architecture and features of 8085 Microprocessor.

COMPUTER ORGANISATION:Basic structure of Computer Organisation describing the various Computer types, Functional Units, Basic Operational concepts, Bus Structures, Memory System: RAM and ROM.

List of Laboratory Tasks:

Experiment No. 1:Study of Resistors, Measuring instruments and DC Power Supply.

Level 1:Identification of resistor values from color bands and verification with Multimeter.

Level 2:Connecting a resistive circuit to a DC Power Supply and observing the input and output values using Voltmeters, Ammeters and hence calculate resistance values.

Experiment No. 2:Study of Reactive components, Multimeter, CRO and Function Generator.

Level 1:Identification of various types of capacitive and inductive components and verification with Multimeter.

Level 2:Connecting a reactive circuit to a function generator and observing the input and output waveform on CRO and calculation of Reactance and Impedance.

Experiment No. 3: Study of Ohm's Law.

Level 1:Rig up the circuit and verify Ohm's Law.

Level 2: Connect a 100Ω 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 1KΩ resistor and compare the results.

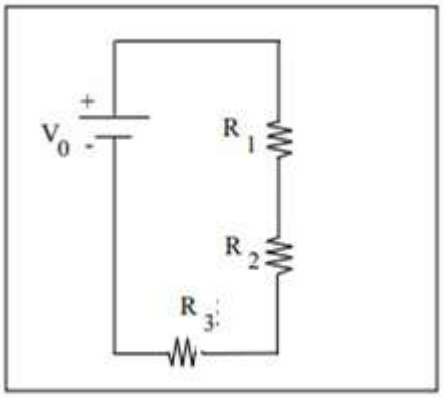
Experiment No. 4:Study of Series and Parallel Resistor Connections.

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

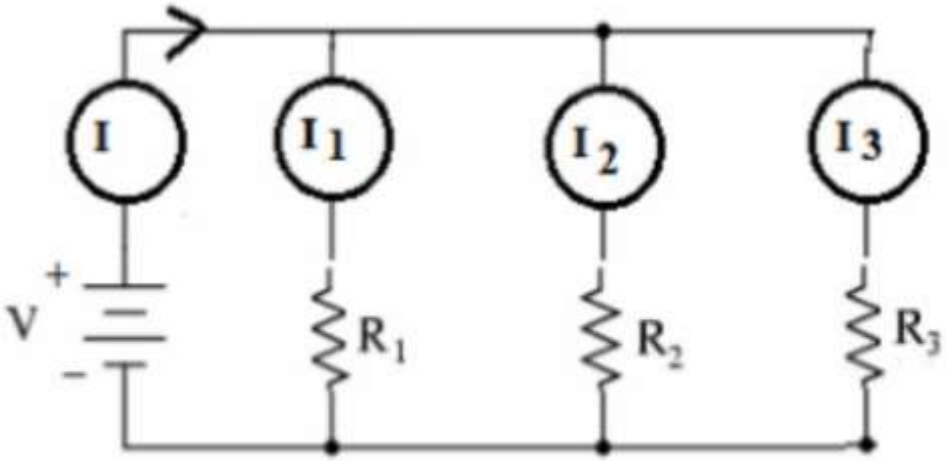
Level 2:Rig up a Current Divider Circuit and a Voltage Divider Circuit and verify the results.

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

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

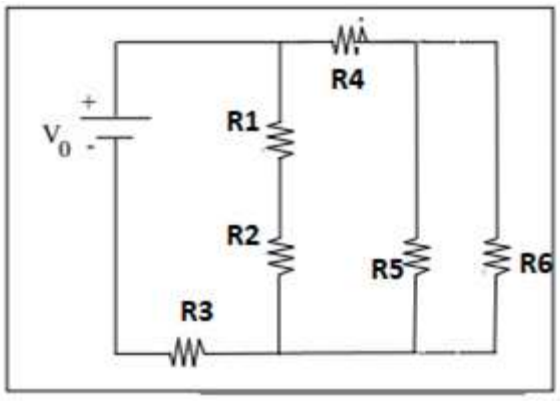


(a)



(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 asAnalog Electronics, Digital Electronics, Microprocessors, VLSI Design, Telecommunication, Computers andWireless 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.

Textbook(s):

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

T2.William Stallings,"Computer Organization and Architecture Designing for Performance", Pearson Education, 10th Edition.

Reference(s):

Reference Book(s):

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

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

R3. Rajendra Prasad, *"Fundamentals of Electronics Engineering",* Cengane Learning, 3rd Edition

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

Video lectures on "BASIC ELECTRONICS" by Prof. Dr. Chitralekha Mahanta, Department of Electronics and communication Engineering, IIT Guwahati": https://nptel.ac.in/courses/117/103/117103063/

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

Lecture Series on "Introduction to Bipolar Junction Transistors BJT " by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=-VwPSDQmdjM&list=PLwjK_iyK4LLDoFG8FeiKAr3IStRkPSxqq

Lecture Series on " PN Junction Diode " by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=USrY0JspDEg

Lecture Series on "Introduction to Digital Electronics" by All About Electronics Youtube Channel: https://www.youtube.com/watch?v=DBTna2ydmC0&list=PLwjK_iyK4LLBC_so3odA64E2MLgIRKafl

Lecture Series on "Introduction to Microprocessors" by Bharat Acharya Education :https://www.youtube.com/watch?v=0M74z5jEAyA

Lecture Notes on : "Electronic Devices", Bipolar Junction Transistors, 2nd Chapter, by Shree Krishna Khadka (PDF) Bipolar Junction Transistor (researchgate.net)https://www.researchgate.net/publication/323384291_Bipolar_Junction_Transistor

E-content:

V. Milovanovic, R. van der Toorn, P. Humphries, D. P. Vidal and A. Vafanejad, "Compact model of Zener tunneling current in bipolar transistors featuring a smooth transition to zero forward bias current," *2009 IEEE Bipolar/BiCMOS Circuits and Technology Meeting*, 2009, pp. 99-102, doi: 10.1109/BIPOL.2009.5314134. https://ieeexplore.ieee.org/document/5314134

M. Oueslati, H. Garrab, A. Jedidi and K. Besbes, "The advantage of silicon carbide material in designing of power bipolar junction transistors," 2015 IEEE 12th International Multi-Conference on Systems, Signals & Devices (SSD15), 2015, pp. 1-6. https://ieeexplore.ieee.org/document/7348149

H. Luo, F. Iannuzzo, F. Blaabjerg, X. Wang, W. Li and X. He, "Elimination of bus voltage impact on temperature sensitive electrical parameter during turn-on transition for junction temperature estimation of high-power IGBT modules," *2017 IEEE Energy Conversion Congress and Exposition (ECCE)*, 2017, pp. 5892-5898 https://ieeexplore.ieee.org/document/8096974

F. Bauer, I. Nistor, A. Mihaila, M. Antoniou and F. Udrea, "Super junction IGBT Filling the Gap Between SJ MOSFET and Ultrafast IGBT," in *IEEE Electron Device Letters*, vol. 33, no. 9, pp. 1288-1290, Sept. 2012 https://ieeexplore.ieee.org/document/6246672

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

Topics relevant to "SKILL DEVELOPMENT": Electrical & Electronic component and laws, Fundamentals of Digital Electronics, Communication Systems, Microprocessors and Computer Organization for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: **ENG1002**	**Course Title:** **Technical English** **Type of Course:** **1] School Core** **2] Laboratory integrated**		**L-T-P-C**	1-0-2-2
Version No.	1.0 V. 3			
Course Pre-requisites	Intermediate Level English			
Course Anti-requisites	NIL			
Course Description	Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.			
Course Objectives	The objective of this course is to develop the learners' **EMPLOYABILITY SKILLS** by using **EXPERIENTIAL LEARNING** and **PARTICIPATIVE LEARNING TECHNIQUES.**			
Course Outcomes	**On successful completion of the course, the students shall be able to:** 1. Develop proficiency in using technical vocabulary and terminology. 2. Apply language skills for better speaking skills in technical fields. 3. Write technical descriptions 4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.			
Course Content:				
Module 1	**Fundamentals of Technical Communication**	**Worksheets& Quiz**	**Vocabulary building**	**9 Classes**

Introduction to Technical English

Differences between Technical English and General English

Technical Writing Basics

Technical Vocabulary

Module 2	**Technical Presentation**	**Presentations**	**Speaking Skills**	**12 Classes**

Introduction

Planning the Presentation

Creating the Presentation

Giving the Presentation

Module 3	**Technical Description**	**Assignment**	**Group Presentation**	**12 Classes**

Product Description

Process Description

User Manuals

Transcoding: Diagrams, charts and images

Module 4	**Technical Writing**	**Assignment**	**Writing Skills**	**12 Classes**

Email Writing

Persuasive and Descriptive Language

Professional Email Etiquette

Writing clear and concise technical emails

Communicating technical information effectively

Technical Report Writing

Types of technical reports (Lab reports, research reports, etc.)

Components of technical reports

Writing an abstract and executive summary

Structure and content organization

Transcoding: diagrams, charts and images

List of Laboratory Tasks:

1. Module-1

Level 1: Worksheets

Level 2: Worksheets

2. Module 2

Level 1: Preparing Presentation

Level 2: Giving Presentation (Individual)

3. Module-3

Level 1: Product Description & User Manual
Level 2: Process Description & Transcoding

4. Module 4

Level 1: Email Writing
Level 2: Report Writing

Targeted Applications & Tools that can be used:

1. Flipgrid
2. Quizzes
3. Youtube Videos
4. Podcast

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

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

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

1. **Presentation**
2. **Describing a product/process**
3. **Individual Reports**

Text Books

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

Reference Book:

1. Chauhan, Gajendra Singh, and Kashmiramka, Smita, ***Technical Communication.*** Cengage Publication. 2018.
2. Sunder Jain. *Technical Report Writing*. Centrum Press, 2013.
3. John Bowden. "Writing a Report: How to Prepare, Write & Present Really Effective Reports?". 9th Edition 2011

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

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

Web Resources:

1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=JSTOR1_3307.

2;https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=5&sid=3a77d69b-abe5-4681-b39d-32dfdcb8f4a5%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=154223466&db=iih

3: Last,Suzan, et. al. ***Technical Writing Essentials.*** University of Victoria, British Columbia, 2019 (E- Book)

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.**

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

Course Content:				
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.				
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.
Topics: Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. Strings: Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.				
Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.
Topics: Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.				
Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.
Topics: Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	9 Hrs.
Topics: Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files				
List of Practical Tasks Lab Sheet 1 (Module I) Programs using IO Statements, Conditional Statements and Looping Statements Lab Sheet 2 (Module II) Programs using Arrays and Strings Lab Sheet 3 (Module III) Programs using Functions and Pointers Lab Sheet 4 (Module IV) Programs using Structures and Unions Lab Sheet 5 (Module V) Programs using Files				
Text Book(s): 1. E. Balaguruswamy, “Programming in ANSI C”, 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.				

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

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

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

Module 2	**Natural Resources and Sustainable Development**	Assignment		**03 Classes**

Topics:

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

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

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

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

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

Topics:

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

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

Self -learning topics: Environmental issues and scales

	Module 4	**Conservation of Biodiversity and Ecosystems**	Assignment		**02 Classes**

Topics:

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

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

	Module 5	**Environmental Pollution and Health**	Case study		**03 Classes**

Topics:

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

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

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

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

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

Topics:

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

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

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

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

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

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

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

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

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

List of laboratory tasks : Any eight experiments will be conducted

ermination of total alkalinity of a water sample (knowledge)
Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)
mation of copper from industrial effluents by colorimetric method (Comprehensive)
mation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)
mation of nickel from industrial effluents by titrimetric method (Comprehensive)
mation of chloride in drinking water by titrimetric method (Comprehensive)
mation of fluoride in ground water by colorimetric method (Comprehensive)
ermination of calcium in aqueous solution (Comprehensive)
ermination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)
Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)
Biological oxygen demand of waste water sample (Comprehensive)
Determination of dissolved oxygen of an industrial effluent (Comprehensive)
Quality monitoring analysis of a soil sample (knowledge)
Flame photometric estimation of Sodium and potassium (Application)
Gas Chromatographic analysis of volatile organic compounds (Application)

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

Project work/Assignment:

Assessment Type
term exam
Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.)
evaluation/Assignment
Term Exam
-learning
Assignment 1: Write a Statement of Environment report of your town/city/state/country

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

Text Book

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

Reference Books

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

E-resources:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_18126
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_8761
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAJ_1_02082022_3333
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3063
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_20719
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_16824
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3954
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_491
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER_INDEST_1_171
https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129
https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_395&xIndex=4
https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

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

Course Code: PPS 1001	**Course Title: Introduction to Soft Skills** **Type of Course: Practical Only Course**	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.		
Anti-requisites	NIL		
Course Description	This course is designed to enable students understand soft skills concepts and improve confidence, communication and professional skills to give the students a competitive advantage and increase chances of success in the professional world. The course will benefit learners in presenting themselves effectively through various activities and learning methodologies.		
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Soft Skills" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**		
Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: **Recognize** significance of soft skills CO2: **Illustrate** effective communication while introducing oneself and others		

	CO3: **List** techniques of forming healthy habits CO4: **Apply** SMART technique to achieve goals and increase productivity			
Course Content:				
Module 1	INTRODUCTION TO SOFT SKILLS		**Classroom activity**	**04 Hours**
Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality				
Module 2	EFFECTIVE COMMUNICATION		**Individual Assessment**	**10 Hours**
Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume Building- Digital, Video, Traditional.				
Module 3	HABIT FORMATION		**Worksheets & Assignment**	**4 Hours**
Topics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right				
Module 4	Goal setting & Time Management		**Goal sheet**	**8 Hours**
A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, Time Management Matrix, steps to managing time through outbound group activity, making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity				
Targeted Application & Tools that can be used: LMS				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
1) Individual Assessment 2) LMS MCQ				
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: **PPS 1011**	**Course Title: Introduction to Verbal Ability Type of Course: Theory Only Course**	L- T- P- C	0	1	0	0
Version No.	1.0					
Course Pre-requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students understand the importance of Verbal Ability and improve confidence, communication and professional skills to give them a competitive advantage and increase chances of success in the professional world. The course will benefit learners in presenting themselves effectively through various worksheets and learning methodologies.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Verbal Ability" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: **Recognize** significance of verbal ability CO2: **Utilize** the rules of communication CO3: **Apply** techniques of vocabulary building to showcase effective communication					
Course Content:						
Module 1	INTRODUCTION TO VERBAL ABILITY	**Individual Assessment**	**01 Hour**			
Topics: Setting Expectations, Ice Breaker, Significance of verbal ability, pre-assessment						
Module 2	EFFECTIVE VERBAL COMMUNICATION	**Practice Worksheets**	**06 Hours**			
Topics: Different rules of grammar and application, Subject-Verb Agreement, Tenses						
Module 3	VOCABULARY BUILDING	**Practice Worksheets**	**04 Hours**			

Topics: Root words, Synonyms and antonyms, analogies, para-jumbles			
Module 4	READING COMPREHENSION	**Individual Assessment**	**02 Hours**
A session where students will be introduced to speed reading and comprehension, **post-assessment**			
Targeted Application & Tools that can be used: LMS			
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
Individual Assessment LMS MCQ			
The topics related to Skill Development: Communication, grammar rules, vocabulary building, effective presentation for skill development through participative learning techniques. This is attained through **learning and practicing the rules of effective communication through worksheets** as mentioned in the assessment component.			

Course Code: **MAT1003**	**Course Title: Applied Statistics** **Type of Course:** School Core	**L T P C**	1	0	2	2
Version No.	3.0					
Course Pre-requisites	None					
Anti-requisites	None					
Course Description	The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability					

	distributions, standard discrete and continuous probability distributions.			
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "**Applied Statistics" and attain **Skill Development Through Problem Solving techniques**.			
Expected Outcome:	At the end of this course, students will be in a position to 1. apply the techniques of descriptive statistics effectively 2. interpret the ideas of probability and conditional probability 3. demonstrate the knowledge of probability distributions 4. Compute statistical parameters, correlation and regression, probability and sampling distributions using R software.			
Module 1	**Descriptive Statistics**	Assignment	Coding needed	**10 classes**
Introduction to Statistics, Data and statistical thinking, review of basic statistical parameters, Covariance, Correlation, Types of Measures of Correlation - Karl Pearson's Correlation Coefficient, Spearman Rank Correlation, linear regression, Multi linear regression **.**				
Module 2	**Probability**			**6 classes**
Introduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional Probability, Total Probability and Baye's theorem with examples				
Module 3	**Random Variables and Probability Distributions**		Coding needed	**14 classes**
Introduction to Random variables, Discrete Random Variables and Continuous Random Variables, Probability Distributions, Probability Mass Function and Probability Density Function, Various Probability distributions, Binomial, **Negative Binominal (Self Study)**, Poisson, Normal and Exponential distributions				
Module 4	**Sampling Theory**		Coding needed	**15 classes**
Introduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard Error. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between Parametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and **Difference of Means (Self Study)**, Small Sample Tests: Student's t-Test for Single Mean and **Difference of Means,** F-Test, Chi-Square Test.				
Targeted Application & Tools that can be used:				

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

Tools used: R Software / MS-Excel

Text Book

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

References

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

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

Course Code: ECE2007	**Course Title:** Digital Design **Type of Course:** Theory &Integrated Laboratory	**L- T-P- C**	**2**	**0**	**2**	**3**
Version No.	2.0					
Course Pre-requisites	**[1] Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra**					
Anti-requisites	**NIL**					

Course Description	**The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc.** The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.			
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through** EXPERIENTIAL **LEARNING.**			
Course Outcomes	**On successful completion of this course the students shall be able to:** i. **Describe** the concepts of number systems, Boolean algebra and logic gates. ii. **Apply** minimization techniques to simplify Boolean expressions. iii. **Demonstrate** the Combinational circuits for a given logic iv. Demonstrate the Sequential and programmable logic circuits v. **Implement** various combinational and sequential logic circuits using gates.			
Course Content:				
Module 1	**Fundamentals of Number systems- Boolean algebra and digital logic**	Application Assignment	Data Analysis task	**06 classes**
Topics: Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.				
Module 2	**Boolean function simplification**	Application Assignment	Data Analysis task	**08 Classes**
Topics: Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.				
Module 3	**Combinational Logic circuits:**	Application Assignment	Programming Task & Data Analysis task	**08 Classes**
Topics: Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.				
List of Laboratory Tasks: **Experiment N0 1:** Verify the Logic Gates truth table **Level 1: By using Digital Logic Trainer kit** **Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs** **Experiment No. 2:** Verify the Boolean Function and Rules				

Level 1: By using Digital Logic Trainer kit
Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

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

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

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

Experiment No. 6: Study of Flip flops

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

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

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

Targeted Application & Tools that can be used:

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

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

Text Book(s):

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

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

Reference(s):
Reference Book(s):

R1. Jain, R. P., *"Modern Digital Electronics",* McGraw Hill Education (India), 4th Edition

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

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

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

}

3. **eBook2:**Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
4. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
5. Digital Logic Design PPT Slide 1 (iare.ac.in)
6. Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video

CircuitVerse - Digital Circuit Simulator online

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

Digital Design 5: LOGISIM Tutorial & Demo

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

E-content:

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

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

Course Code: CIV1008	**Course Title:** Basic Engineering Sciences **Type of Course:** Theory Only	**L-T-P-C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					

Course Description	This basic course on engineering science is designed to introduce students to the fields of civil, mechanical and petroleum engineering. Student will be exposed to various fields in civil engineering and different manufacturing techniques in addition to machinery for power production and consumption. Additionally, students will be getting an overview of various sectors of oil & gas industries. This course acquaints students to basics of Industry 4.0 and Construction 4.0. The course aims to enable students to appreciate the multidisciplinary nature of engineering design and operations in the current era with mechanization and digitization transforming every aspect of engineering.			
Course Objective	The objective of the course is skill development of student by using Participative Learning techniques.			
Course Outcomes	On successful completion of this course the students shall be able to: 1] Recognize the significance of various disciplines in Civil Engineering 2] Discuss the recent evolutions in Civil Engineering 3] Explain various energies, energy generating machineries and energy consumption machineries 4] Describe the fundamental concept and terminology associated with the Petroleum Industry 5] Distinguish between conventional and modern manufacturing techniques.			
Course Content:				
Module 1	**Introduction to various fields in Civil Engineering**	Assignment	Case studies on different Civil Engineering Projects	**6 Sessions**
Topics: Introduction to Civil Engineering: Definition, scope and branches of Civil Engineering, Role of Civil Engineer, Overview of Infrastructure.				
Module 2	**Current Trends and Evolution in Civil Engineering**	Assignment	Article Review	**6 Sessions**
Topics: Mechanization in Construction, Application of Digital Technologies in Planning, Design, execution, monitoring and maintenance of Construction. Overview of Smart Cities.				
Module 3	**Power Production**	Assignment & Quiz	Data Collection	**6 Sessions**

	and Consumption Machinery			
Topics: Energy and its types, Engines and their applications, Pumps-Compressors and their applications.				
Module 4	**Overview of Petroleum Engineering**	Assignment & Quiz	Article Review	**6 Sessions**
Overview of the Petroleum Industry, Importance of Petroleum Engineering, lifecycle of Petroleum products, Classifications of E&P activities: Key difference between Offshore and Onshore, Onshore facilities, offshore platforms, Digitization of petroleum engineering				
Module 5	**Industry 4.0**	Assignment & Quiz	Data Collection	**6 Sessions**
Topics: Conventional manufacturing process: Metal forming, metal removal and metal joining process. Modern Manufacturing process: 3D Printing / Additive Manufacturing.				
Targeted Application & Tools that can be used: Application Areas include design and implementation of Smart City projects, Infrastructure maintenance, Power production, IC engines, Electric vehicles, onshore and offshore exploration and production activities				
Project work/Assignment:				
Assignment 1: Collect data and prepare report on various Mega Projects in Civil Engineering Assignment 2: Review Articles on current evolutions in Civil Engineering. Assignment 3: Collect data related to renewable energy generation (Wind, Solar) Assignment 4: Prepare an energy consumption chart for a compressor or pumps. Assignment 5: Prepare a report on role of 3D printing across various industries. Assignment 6: Prepare an assignment on geopolitical influence on oil and gas industries.				
Text Book: T1. Elements of Civil and Mechanical Engineering, L.S. Jayagopal & R Rudramoorthy, Vikas Publishers T2. Elements of Mechanical Engineering, by VK Manglik T3. Fundamentals of Oil & Gas Industry for Beginners by Samir Dalvi, Notion Press; 1st edition				
References 1. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai. 2. Nontechnical Guide to Petroleum Geology, Exploration, Drilling & Production by Norman J. Hyne, PennWell Books; 3rd Revised edition **Web-resources:** 1. Basic Civil Engineering https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site=ehost-live				

2. Post-parametric Automation in Design and Construction

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site=ehost-live

3. Smart Cities : Introducing Digital Innovation to Cities

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live

4. Innovation Energy: Trends and Perspectives or Challenges of Energy Innovation

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2323766&site=ehost-live

5. Mechanical Engineering
   https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO106_REDO_1705
6. Additive Manufacturing: Opportunities, Challenges, Implications
   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live
7. Society of Petroleum Engineers (SPE)
   https://www.spe.org/en/
8. PetroWiki: A comprehensive online resource created by the Society of Petroleum Engineers that provides information on various aspects of petroleum engineering.
   https://petrowiki.spe.org/PetroWiki
9. Rigzone: A resource for news and information about the oil and gas industry, including job postings and industry trends.
   https://www.rigzone.com/

Topics relevant to the development of SKILLS:

Engines-Turbines and their applications.
Mechanization in Construction.
Digitization in Petroleum Industries

Course Code: MEC1006	**Course Title:** Engineering Graphics **Type of Course:** School Core & Theory Only	**L- T-P- C**	2-0-0-2
Version No.	1.2		
Course Pre-requisites	**NIL**		
Anti-requisites	**NIL**		

Course Description	The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of "**Engineering Graphics**" and attain **SKILL DEVELOPMENT** through Problem solving methodologies.			
Course Outcomes	**On successful completion of this course the students shall be able to:** **(1)** Demonstrate competency of Engineering Graphics as per BIS conventionsand standards. **(2)** Comprehend the theory of projection for drawing projections of Points, Lines andPlanes under different conditions. **(3)** Prepare multiview orthographic projections of Solids by visualizing them indifferent positions. **(4)** Prepare pictorial drawings using the principles of isometric projections to visualizeobjects in three dimensions**.**			
Course Content:				
Module 1	Introduction to Drawing	Assignment	Standard technical drawing	**02 Sessions**
Topics: Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Lineconventions, dimensioning, Selection of drawing sheet size and scale. [02 Hours: Comprehension Level]				
Module 2	Orthographic projections of Points, Straight Linesand Plane Surfaces	Assignment	Projection methods Analysis	**10 Sessions**
Topics: Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points inall 4 quadrants. Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only. **[10 Hours: Application Level]**				
Module 3	Orthographic Projections of	Assignment	Multi-view drawing Analysis	**10 Sessions**

	Solids			
Topics: Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection). **[10 Hours: Application Level]**				
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	**8 Sessions**
Topics: Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects. **[8 Hours: Application Level]**				
Text Book: 1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.				
References: **1.** K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore. **2.** D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall. **3.** D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill. **Web resources:** https://nptel.ac.in/courses/112103019				
Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.				

Course Code: **CSE1006**	**Course Title:** Problem Solving using JAVA **Type of Course: Lab Integrated**	**L- T-P-C**	1	0	4	3
Version No.	2.0					
Course Pre-requisites	CSE1004 – Problem-Solving Using C					

Anti-requisites	Nil			
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes 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 in 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 Objects, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.

List of Laboratory Tasks:

P1 - Problem Solving using Basic Concepts.

P2 - Problem Solving using Basic Concepts and Command Line Arguments.

P3 - Programming assignment with class, objects, methods and Constructors.

P4 - Programming assignment with method overloading.

P5 - Programming assignment with constructor overloading.

P6 - Programming assignment with Static members and static methods.

P7 - Programming assignment with Nested classes.

P8 - Programming assignment using Arrays.

P9 - Programming assignment using Strings.

P10 - Programming assignment using String Builder.

P11 - Programming assignment using Inheritance and super keyword.

P12 - Programming assignment using Method overriding and Dynamic method invocation.

P13 - Programming assignment using Final keywords.

P14 - Programming assignment using Abstract keywords.

P15 - Programming assignment using Interface.

P16 - Programming assignment using Interface.

P17 - Programming assignment CharacterStream Classes

P18 - Programming assignment Read/Write Operations with File Channel

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

Text Book

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

References

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

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

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

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

Web **resources**

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

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

Topics relevant to the development of "Skill Development":

1. Static Polymorphism
2. Method overloading, constructors
3. constructor overloading
4. this keyword
5. static keyword and Inner classes
6. Inheritance and Polymorphism.

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

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

Course Content: Theory

Module 1	**Critical Reasoning and Writing**	**Writing Essays**	**Critical Reading**	**4 Classes**

Topics:

- A Catalog of Reading Strategies
- The Myth of Multitasking
- A Guide to Writing Essays Speculating about Causes or Effects
- Is Google Making Us Stupid (Self Study)

Module 2	**Technical Presentation**	**Presentation**	**Oral Skills**	**3 Classes**

Topics:

- Planning the presentation
- Creating the presentation

- Giving the presentation

Module 3	**Writing Reviews**	**Prezi**	**Review Writing**	**4 Classes**

Topics:

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

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

Topics**:**

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

Course Content: Practical Sessions

Module 1	**Critical Reasoning and Writing**	**8 Classes**

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

Module 2	**Technical Presentation**	**10 Classes**

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

Module 3	**Writing Reviews**	**4 Classes**

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

Module 4	**Starting your Career**	**6 Classes**

7. Collaborative Project
   Job search and writing report
   Writing Resume

Module 1-4	**Academic Journal**	**2 Classes**

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

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

Project work/Assignment:

Academic Journal – Assignment

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

References

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

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

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

Course Code: ECE2010	**Course Title: Innovative Projects using Arduino**		**L- T-P- C**	-	-	-	1
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	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.						
Course Objective	The objective of the course is **Employability Skills** of student by using **PARTICIPATIVE LEARNING** techniques.						
Course Outcomes	**On successful completion of the course the students shall be able to** 1) Explain the main features of the Arduino prototype board 2) Demonstrate the hardware interfacing of the peripherals to Arduino system. 3) Understand the types of sensors and its functions 4) Demonstrate the functioning of live projects carried out using Arduino system.						
Course Content:							
Module 1	**Basic concepts of Arduino**	Hands-on	Interfacing Task and Analysis	**4 Sessions**			

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

Module 2	**Sensory Devices**	Hands-on	Interfacing Task and Analysis	**4 Sessions**

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.

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

Targeted Application & Tools that can be used:

Application Area:

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.

Professionally Used Software: students can use open SOURCE Softwares Arduino IDE and Tincker CAD

Project work/Assignment:

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

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 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

Textbook(s):
Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition

References

Reference Book(s)

1. **Neerparaj Rai "Arduino Projects for Engineers" BPB publishers,first edition, 2016.**

2. Ryan Turner "Arduino Programming " Nelly B.L. International Consulting Ltd. first edition,2019.

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

1. Arduino trending Projects < https://www. https://projecthub.arduino.cc/>
2. Introduction to Arduino < https://onlinecourses.swayam2.ac.in/aic20_sp04/preview>
3. Case studies on Wearable technology< https://www.hticiitm.org/wearables>

E-content:

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

2. M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh" IOT BASED SMART SECURITY SYSTEM USING ARDUINO" 2021 JETIR August 2021, Volume 8, Issue 8.

3. R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. Amiri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer Management Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. https://ieeexplore.ieee.org/document/8494144.
4. Yaser S Shaheen,Hussam., " Arduino Mega Based Smart Traffic Control System ," December 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): 43-52, 2021):15(12): 43-52, 2021.

Topics relevant to development of "SKILL": System design for achieving Sustainable Development Goals.

<table>
<tr><td>Course Code:
PPS 1002</td><td colspan="3">Course Title: Soft Skills for Engineers

Type of Course: Practical Only Course</td><td>L- T-P- C</td><td>0-0-2-1</td></tr>
<tr><td>Version No.</td><td colspan="5">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="5">Students are expected to understand Basic English.

Students should have desire and enthusiasm to involve, participate and learn.</td></tr>
<tr><td>Anti-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Description</td><td colspan="5">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.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The objective of the course is to familiarize the learners with the concepts of “Soft Skills” and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="5">On successful completion of this course the students shall be able to:

CO1: Recognize significance of soft skills

CO2: Illustrate effective communication while introducing oneself and others
CO3: List techniques of forming healthy habits

CO4: Apply SMART technique to achieve goals and increase productivity</td></tr>
<tr><td>Course Content:</td><td colspan="5"></td></tr>
<tr><td>Module 1</td><td colspan="2">INTRODUCTION TO SOFT SKILLS</td><td></td><td>Classroom activity</td><td>04 Hours</td></tr>
<tr><td colspan="6">Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality</td></tr>
<tr><td>Module 2</td><td colspan="2">EFFECTIVE COMMUNICATION</td><td></td><td>Individual Assessment</td><td>10 Hours</td></tr>
<tr><td colspan="6">Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume Building- Digital, Video, Traditional.</td></tr>
</table>

Module 3	HABIT FORMATION		**Worksheets & Assignment**	**4 Hours**
Topics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right				
Module 4	Goal setting & Time Management		**Goal sheet**	**8 Hours**
A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, Time Management Matrix, steps to managing time through outbound group activity, making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity				
Targeted Application & Tools that can be used: LMS				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
1) Individual Assessment 2) LMS MCQ				
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: MAT1002	**Course Title: Transform Techniques, Partial Differential Equations and Their Applications** **Type of Course: School Core**	**L-T-P- C**	**3**	**0**	**0**	**3**
Version No.	2.0					
Course Pre-requisites	**MAT1001 - Linear Algebra and Calculus**					
Anti-requisites	**NIL**					
Course Description	This course aims to introduce various transform techniques such as Laplace transform, Fourier transform and Z transform in addition to expressing functions in terms of Fourier series. The course covers applications of Laplace transform to LCR circuits and solution of difference equations using z-transform. The course also deals with the analytical methods for solving partial differential equations and the classical applications of partial differential equations.					
Course Objective	The objective of the course is **Skill Development** of student by using **Problem Solving Techniques.**					

Course Outcomes	On successful completion of this course the students shall be able to: CO-1: Express functions in terms of uniformly convergent Fourier series. CO-2: Apply Laplace transform technique to solve differential equations. CO-3: Employ z-transform technique to solve difference equations. CO-4: Solve a variety of partial differential equations analytically.			
Course Content:				
Module 1	**Fourier Series**			**10 CLASSES**
Fourier series: Fourier series - Euler's formulae - Dirichlet's conditions - Change of Interval - half range series – RMS value – Parseval's identity – Computation of harmonics. Engineering Applications of Fourier series.				
Module 2	**Integral Transforms**			**15 Classes**
Laplace Transform: Definition and Laplace transforms of elementary functions. Properties of Laplace transform. Laplace transform of periodic function, unit-step function and impulse function and the related problems. Inverse Laplace transform of standard functions and problems, initial and final value theorems. Convolution theorem, solution of linear ordinary differential equations, LCR circuit problems. **Fourier Transform:** Integral transforms, infinite Fourier transforms, Fourier sine and cosine transforms, inverse Fourier transforms. Engineering Applications of Fourier transform.				
Module 3	**Z Transform and Difference Equations**			**8 Classes**
Definition of Z-transform, Z transforms of standard functions and the related problems, standard inverse Z transforms and problems, computation of inverse Z-transform by partial fraction and convolution methods, solution of difference equations using Z-transforms. Business and Engineering Applications of Z transform.				
Module 4	**Partial Differential Equations**			**12 Classes**
Partial Differential Equations: Formation of PDEs, solution of non-homogeneous PDEs by direct integration, solution of homogeneous PDEs involving derivatives with respect to only one independent variable, method of separation of variables, solution of the Lagrange's PDE of the type Pp + Qq = R. **Applications of PDEs**: Various possible solutions of the one dimensional wave and heat equations by the method of separation of variables, D'Alembert's solution of the wave equation, solution of related boundary value problems.				

Targeted Applications & Tools that can be used: Applications to electrical engineering, vibrational analysis, acoustics, optics, signal processing, image processing, quantum mechanics, econometrics and shell theory by means of Fourier Series and integral transforms. Opens up new approaches in terms of Z-transform to solving one of the central problems of modern science involving difference equations. Finding the solutions of boundary value problems involving PDEs with reference to wave, heat, and Laplace equations.
Assignment: Mention the Type of Project /Assignment proposed for this course
Two Assignments based on the applications of the concepts leading to a minimum of 5 engineering problems from a common pool of problems.
Text Book Erwin Kreyszig, 2017: " Advanced Engineering Mathematics", 10th Edition, John Wiley.
References: 1. B. S. Grewal, 2017: "Higher Engineering Mathematics" 45th Edition, Khanna Publishers. 2. Peter V O'Neil, 2015: "Advanced Engineering Mathematics", 7th Edition, Cengage Learning. 3. Glyn James, 2016: "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education. 4. Michael D. Greenberg, 2018: "Advanced Engineering Mathematics", 2nd Edition, Pearson Education.
Topics relevant to the development of Foundation Skills: All the solution methods. **Topics relevant to development of Employability skills: Use of relevant scientific application packages.**

Course Code: CSE2001	**Course Title:** Data Structures and Algorithms **Type of Course:** **Integrated**	**L- T-P- C**	3-0-2-4
Version No.	1.0		
Course Pre-requisites	Problem Solving Using Java		
Anti-requisites	NIL		
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data		

	structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Structures and Algorithms and attain Skill Development through Experiential Learning techniques.			
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Implement program for given problems using fundamentals of data structures. [Application] **CO2:** Apply an appropriate linear data structure for a given scenarios. [Application] **CO3:** Apply an appropriate non-linear data structure for a given scenarios. [Application] **CO4:** Explain the performance analysis of given searching and sorting algorithms.			
Course Content:				
Module 1	**Introduction to Data Structure and Linear Data Structure – Stacks and Queues**	Assignment	Program activity	**18 Sessions**
Introduction – Introduction to Data Structures, Types and concept of Arrays. **Stack -** Concepts and representation, Stack operations, stack implementation using array and Applications of Stack. **Queues -** Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.				
Module 2	**Linear Data Structure- Linked List**	Assignment	Program activity	**17 Sessions**
Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list. **Recursion** - Recursive Definition and Processes, Programming examples.				
Module 3	**Non-linear Data Structures - Trees and Graph**	Assignment	Program activity	**15 Sessions**
Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal. **Graph** - Basic Concept of Graph Theory and its Properties, Representation of Graphs.				
Module 4	**Searching & Sorting Performance Analysis**	Assignment	Program activity	**14sessions**
Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort.				

Performance Analysis - Time and space analysis of algorithms – Average, best and worst case analysis.

List of Laboratory Tasks:

Lab sheet -1

Level 1: Prompt the user, read input and print messages. Programs using class, methods and objects

Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.

Lab sheet -2

Level 1: Programming Exercises on Stack and its operations

Level 2: Programming Exercises on Stack and its operations with condition

Lab sheet -3

Level 1: Programming on Stack application infix to postfix Conversion

Level 2: -

Lab sheet -4

Level 1: Programming Exercises on Queues and its operations with conditions

Level 2: -

Lab sheet -5

Level 1: Programming Exercises on Linked list and its operations.

Level 2: Programming Exercises on Linked list and its operations with various positions

Lab sheet -6

Level 1: -

Level 2: Programming scenario based application using Linked List

Lab sheet -7

Level 1: Programming Exercises on factorial of a number

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -8

Level 1: -

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -9

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

Level 2: -

Lab sheet -10

Level 1: Program to Construct Binary Search Tree and Graph

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

Lab sheet -11

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

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

Lab sheet -12

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

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

Lab sheet -13

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

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

Targeted Application & Tools that can be used

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

Project work/Assignment:

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

Text Book

T1 Narasimha Karumanchi: *"Data Structures and Algorithms Made Easy in Java",* 5th Edition, CareerMonk Publications, 2017.

References

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

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

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

Web resources:

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

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

Course Code: CSE3155	**Course Title: Data Communications and Computer Networks** **Type of Course: Program Core Theory–Laboratory integrated**	**L-T-P-C 3-0-2-4**	3	0	2	4
Version No.	1.0					

Course Pre-requisites	Digital Design
Anti-requisites	NIL
Course Description	The objective of this course is to provide knowledge in data communications and computer networks, its organization and its implementation, and gain practical experience in the installation, monitoring, and troubleshooting of LAN systems. . The associated laboratory is designed to implement and simulate various networks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffics.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain **Employability** through **Problem Solving** Methodologies.
Course Out Comes	On successful completion of the course, the students shall be able to: 1] I llustrate the Basic Concepts Of Data Communication and Computer Networks. 2] Analyze the functionalities of the Data Link Layer. 3] Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. 4] Demonstrate the working principles of the Transport layer and Application Layer.
Course Content:	

Module 1	Introduction and Physical Layer-CO1	Assignment	Problem Solving	07 Classes
Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media –Reference Models -OSI Model – TCP/IP Suite. Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.				
Module 2	Reference Models and Data Link Layer – CO2	Assignment	Problem Solving	**7 Classes**
Data Link Layer - Error Detection and Correction – Parity, LRC, CRC, Hamming Code, Flow Control and Error Control, Stop and Wait, ARQ, Sliding Window, Multiple Access Protocols, CSMA/CD,CSMA/CA, IEEE 802.3, IEEE 802.11 Ethernet.				
Module 3	Network Layer – CO 3	Assignment	Problem Solving	**10 Classes**

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

Module 4	Transport and Application Layer -CO3	Assignment	Problem Solving	**10 Classes**

Transport Layers - Connection management – Flow control – Retransmission, UDP, TCP, congestion control, – Congestion avoidance (DECbit, RED)
The Application Layer: Domain Name System (DNS), Domain Name Space, SSH, FTP, Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – – SNMP, Web Services, Virtual Networking.

List of Laboratory Tasks:

Lab sheet -1, M-1, 3 [2 Hours]
Experiment No 1:
Level 1: Study of basic network commands and network configuration commands.

Lab sheet -2, M-1[2 Hours]
Experiment No 1:
Level 1: Identify and explore Network devices, models and cables. Introduction to Cisco packet tracer.
Experiment No. 2:
Level 2 – Create various network topologies using a cisco packet tracer.

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

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

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

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

Lab sheet – 7, M-4 [2 Hours]
Experiment No. 1:
Configure the telnet protocol in the router using the Cisco packet tracer.
Lab sheet – 8, M-4[2 Hours]

Experiment No. 1:
Level1- Introduction to NS2 and basic TCL program.
Lab sheet – 9, M-4 [2 Hours]
Experiment No. 1:
Level 1: Simulate three node Point to point network using UDP in NS2.
Experiment No. 2:
Simulate transmission of Ping message using NS2.
Lab sheet – 10, M-4[2 Hours]
Experiment No. 1:
Simulate Ethernet LAN using N-node in NS2.
Experiment No. 2:
Simulate Ethernet LAN using N-node using multiple traffic in NS2
Lab sheet –11, M-3,4 [2 Hours]
Experiment No. 1:
Level 1- Introduction to Wire Shark.
Experiment No. 2:
Level 2- Demonstration of packet analysis using wire shark.

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

Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.

Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4

1. **Problem Solving: Choose and appropriate devices and implement various network concepts.**
2. **Programming: Simulation of any network using NS2.**

Text Book

1. **Behrouz A. Forouzan, "Data Communications and Networking 5E", 5th Edition, Tata McGraw-Hill, 2017.**
2. **Andrew S Tanenbaum, Nick Feamster & David J Wetherall, "Computer Networks" Sixth Edition, Pearson Publication, 2022**

References

1. **"Computer Networking: A Top-Down Approach", Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.**
2. **William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.**
3. **Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.**

E-Resources:

1.https://archive.nptel.ac.in/courses/106/105/106105183/
2. http://www.nptelvideos.com/course.php?id=393
3.https://www.youtube.com/watch?v=3DZLItfbqtQ

4.https://www.youtube.com/watch?v=_fIdQ4yfsfM
5. https://www.digimat.in/keyword/106.html
https://puniversity.informaticsglobal.com/login

Course Code: CSE2009	Course Title: **Computer Organization and Architecture**		L-T- P- C	3-0-0-3
Version No.	2.0			
Course Pre-requisites	CSE 2015 Digital Design			
Anti-requisites	**NIL**			
Course Description	This course introduces the core principles of computer architecture and organization from basic to intermediate level. This theory based course emphasizes on understanding the interaction between computer hardware and software. It equips the students with the intuition behind assembly-level instruction set architectures. It helps the students to interpret the operational concepts of computer technology as well as performance enhancement.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Computer Organization and Architecture** and attain **Skill Development** through **Participative Learning** techniques.			
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the basic components of a computer, their interconnections, and instruction set architecture [Comprehension] 2] Apply appropriate techniques to carry out selected arithmetic operations 3] Explain the organization of memory and processor sub-system			
Course Content:				
Module 1	Basic Structure of computers	Assignment	Data Analysis task	**12 Classes**
Topics: Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.				
Module 2	Instruction Set Architecture and Memory Unit	Assignment	Analysis, Data Collection	**12 Classes**
Topics: **Instruction Set Architecture:** Addressing Modes, Stacks and Subroutines. **Memory System:** Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.				
Module 3	Arithmetic and Input/output Design	Case Study	Data analysis task	**10 Classes**

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

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

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

Topics:
Basic Processing Unit: Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization.
Pipelining: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards.

Targeted Application & Tools that can be used:

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

Tools:

- Virtual Lab, IIT KGP
- Tejas – Java Based Architectural Simulator, IIT Delhi

Text Book

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

References

1. William Stallings, "Computer Organization & Architecture – Designing for Performance", 11th Edition, Pearson Education Inc., 2019

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

Web References:

1. NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta, Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163
2. NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman. https://nptel.ac.in/courses/106106092
3. https://puniversity.informaticsglobal.com:2229/login.aspx

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

Course Code: MAT2004	**Course Title: Discrete Mathematical Structures** **Type of Course: Program Core**	**L-T- P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**Nil**					
Anti-requisites	**Nil**					
Course Description	The course provides insights into the fundamental aspects of mathematical logic and predicate calculus. The course delves deeply into the concepts of algebraic structures, lattices and Boolean algebras which are widely used in computer science and engineering. It also highlights the principles of counting techniques and their applications.					
Course Objective	The objective of the course is **Skill Development** of student by using **Problem Solving Techniques.**					
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: Comprehend the basic principles of set theory and different types of relations. CO3: Elucidate the concepts of lattices and Boolean algebra. CO4: Deploy the counting techniques to tackle combinatorial problems.					
Course Content:						
Module 1	**Mathematical Logic and Predicate Calculus**			**12 classes**		
Propositional Logic, Propositional Logic Equivalences, Normal forms, Inference rules, Introduction to Proofs, Conversion to clausal form, Predicate calculus, The Statement function, Inference theory of the Predicate Calculus.						
Module 2	**Algebraic Structures**			**10 classes**		
Sets and set-operations, functions, relations and their properties & representations of relation by matrix, closure of different type of relations, equivalence relations, primitive recursive function.						
Module 3	**Lattices and Boolean Algebra**			**11 classes**		
Partial ordering, Posset, Lattices & Algebraic structures, Sub lattice, Basic properties of algebraic systems by lattices, Distributive lattices, complement of an element in a lattice, Boolean lattice & Boolean algebra, cancellation laws and unique complement theorem.						

Module 4	Principles of Counting Techniques			12 classes

Chinese Remainder Theorem, pigeonhole principle, generalized pigeonhole principle, Generalized Permutations and Combinations, Recurrence Relations.

Targeted Application & Tools that can be used:

Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems.

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

Assignment 1: Logic Equivalences and Predicate calculus.
Assignment 2: Equivalence Relations and Lattices
Assignment 3: Recurrence Relations

Text Books

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill's 7th Edition, 2011.
2. Kolman, Bernard; Busby, Robert C; Ross, Sharon Cutler," Discrete mathematical structures", Pearson India, 6th Edition, 2015.
3. Liu, C L Mohapatra, D P.," Elements of Discrete Mathematics a Computer oriented approach", New Delhi McGraw Hill Education, 4th Edition, 2015.
4. Mott, Joe L; Kandel, Abraham; Baker, Theodore P, "Discrete Mathematics for Computer Scientists and Mathematicians", Pearson India, 2nd Edition, 2015.
5. Epp, Susanna S, "Discrete Mathematics with applications", New Delhi Cengage Learing, 4th Edition, 2016.

References:

1. Tremblay, J.P. and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
2. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
3. Discrete Mathematics, Richard Johnsonbaugh, 8th Edition, Prentice Hall, 2017.

Course Code: **CSE3190**	**Course Title: Fundamentals of Data Analytics** **Type of Course: Theory-embedded Lab**	**L-T- P- C**	2	0	2	3
Version No.	3.0					
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 R Programming**					
Course Content:						
Module 1	Introduction to Data Analysis	Assignment	Data Collection, data analysis, Programming		**8 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. **R Studio:** Base R-R Studio IDE-Introduction to R Projects and R Markdown. Basic R: R as a Calculator-Scripts and Comments-R Variables. Data I/O: Working Directories-Importing Data Exporting Data-More ways to save-Data I/O in Base R.						
Module 2	Data Analysis and Visualization	Case studies	Programming		**8 Sessions**	

Topics: Data Summarization**:** One Quantitative and Categorical Variable. Data Classes: One Dimensional Data Classes-Data Frames and Matrices-Lists. Data Cleaning: Dealing with Missing Data-Strings and Recoding Variables. Manipulating Data in R: Reshaping Data-Merging Datasets. Data Visualizations: Plotting with ggplot2- Plotting with Base R				
Module 3	Statistical Analysis	Case studies	R programming	**7 Sessions**
Topics: Proportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-Wilcoxon signed rank test- one-way ANOVA test- Kruskal Wallis test				
Module 4	Predictive Analysis	Case studies	Programming	**8 Sessions**
Topics: Linear least-squares – implementation – the goodness of fit – testing a linear model – weighted resampling. Regression using Stats models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy. Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis				

List of Laboratory Tasks:

Experiment No. 1: Introduction to R and RStudio

Level 1: Getting Started with R and RStudio

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

Level 2: Working with RStudio

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

Experiment No. 2: Basic Data Handling in R

Level 1: Data Types and Structures in R

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

Level 2: Data Import and Export

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

Level 3: Exploring Datasets

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

Experiment No. 3: Basic Data structure in R

Level 1: a. Demonstrate a program to join columns and rows in a data frame using cbind() and rbind() in R.

b.Implement different data structures in R (Vectors, Lists, Data Frames)

Level 2: R AS CALCULATOR APPLICATION a. Using with and without R objects on console

a. Using mathematical functions on console

b. Write an R script, to create R objects for the calculator application

Experiment No. 4: Data Cleaning and Preprocessing

Level 1: Handling Missing Data in R

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

Level 2: Data Transformation in R

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

Experiment No. 5: Exploratory Data Analysis (EDA) with R

Level 1: Descriptive Statistics

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

Experiment No. 6: Data Visualization with ggplot2

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

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

Experiment No. 7: Perform Tests of Hypotheses hypothesis test (parametric)

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

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

Experiment No 8: Hypothesis – Non-Parametric Test

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

Experiment No 9: Correlation and Covariance

Level 1: Using the iris data set in R

a. Find the correlation matrix.
b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Level 2 : Ramesh is doing a statistics paper in his post-graduation course. He met his friend Amal who is a textile engineer. Ramesh, who is doing his internship at ABC Researchers, is interested in a question. He poses this question to Amal and tries to find if he can answer. The question is as follows:

The data regarding sales of soft- drinks and sales of cotton clothes in a place during the last 12 months are given. Find if there is any association between sales of soft drinks and sales of cotton clothes. Also explain the reason if there is any relationship.

Experiment No 11: Regression Model

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

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

Experiment No. 12: Time Series Analysis in R

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

Targeted Application & Tools that can be used:

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

Text Books

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

References

1. Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014.
2. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.

Online resources:

http://www.modernstatisticswithr.com/solutions.html#solutionsch3

https://johnmuschelli.com/intro_to_r/

https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/

Topics relevant to development of "FOUNDATION SKILLS":

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

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

Course Code: CSE2014	**Course Title: Software Engineering** **Type of Course: School Core [Theory Only]**		**L-T- P-C**	**3-0-0-3**
Version No.	1.0			
Course Pre-requisites	**NIL**			
Anti-requisites	**NIL**			
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.			
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)			
Module 1	**Introduction to Software Engineering and Process Models (Knowledge level)**	Quiz		**09 Hours**
Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle **Models:** Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.				
Module 2	**Software Requirements, Analysis and Design (Comprehension level)**	Assignment	Development of SRS documents for a given scenario	**11 Hours**
Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment. **Design:** Design concepts, Architectural design, Component based design, User interface design.				
Module 3	**Agile Principles & Devops**	Quiz		**09 Hours**

	(Knowledge level)			
Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method. **Devops:** Introduction, definition, history, tools.				
Module 4	**Software Testing and Maintenance (Application Level)**	Assignment	Apply the testing concepts using Programing	**12 Hours**
Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing. **Software Quality Assurance**-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub). **Maintenance-** Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.				
Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools				
Text Book 1] Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, Graw-Hill, 2017. 2] Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, Graw-Hill, 2018.				
References Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 5. Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011. Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002				
Topics Relevant to "Skill Development: Balck box Testing, White box Testing, Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout				

Course Code: ECE2011	**Course Title: Innovation Project-Raspberry Pi** **Type of Course: School Core & Practical Only.**	**L- T-P-C**	0	4 This includes few lecture sessions	1
Version No.	1.0				
Course Pre-requisites	**NIL**				
Anti-requisites	**NIL**				
Course Description	The Raspberry Pi is an amazing single board computer (SBC) capable of running Linus and a whole host of applications. Python is a beginner-friendly programming language that is used in schools, web development, scientific research, and in many other industries. This course will enable students in writing own programs with Python to blink lights, respond to button pushes, read sensors, log data on the Raspberry Pi and many more. The course also offers in-depth knowledge of designing, developing, coding and implementing projects using Raspberry Pi.				

Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Write a program in Python. 2. Explain the main features of the Raspberry Pi board 3. Demonstrate the hardware interfacing of the peripherals to Raspberry Pi system. 4. Demonstrate the functioning of live various projects carried out using Raspberry Pi system.			
Course Content:				
Module 1	Basics of Python, functions	Quiz	Problem Solving	**4 Lab Sessions**
Topics: Introduction, Structure of Python Program, Data Types and Variables, Input and Output, Operators, Importing libraries, Functions, Development Tool. **Concepts will be taught by solving problems through programs.**				
Module 2	**Python Programming**	Quiz	Problem Solving	**4 Lab Sessions**
Control statements, Lists and Dictionaries, Problem solving using Python. **Concepts will be taught by solving problems through programs.**				
Module 3	**Overview of Raspberry Pi**	Project Development	System Design Task and Analysis	**4 Lab Sessions**
Topics: An exploration of GPIO pins, LED and switch control. Installation of libraries, PuTTY SSH. Raspberry Pi to interface with more complicated sensors and actuators like Pi Camera, servo motor ADS51115 through PIP libraries. Arduino with Raspberry-pi				
Module 4	**Interaction with API Services**	Project Development	Modeling and Simulation task	**3 Lab Sessions**
Topics: Raspberry Pi interact with online API services through the use of public APIs and SDKs using Firebase, Gspread API. Node-RED – a programming tool for wiring together hardware devices, MQTT. Android/Case study.				
Targeted Application & Tools that can be used: Making it a reality (Raspberry Pi Projects) : Projects will include but not limited to : 1) Intelligent home locking system. 2) Intelligent water level management system. 3) Home automation using RFID. 4) Real time clock-based home automation. 5) Intelligent Automatic Irrigation System **Professionally Used Software: Raspberry Pi.**				
Project work/Python Lab Test:				
Project work **Python test.**				
Text Book(s): **1) Ashok Namdev Kamthane, Amit Ashok Kamthane, *"Problem Solving and Python Programming"*, Mc Graw Hill Education, 2018.**				
Reference(s):				

1. **https://github.com/thibmaek/awesome-raspberry-pi** 2. MagPi magazine	
Topics relevant to development of "Foundation Skills": Basic Concepts of Python-Programming, and Raspberry Pi. Topics related to development of "Employability Skills": Problem solving, Creative Thinking, Team work, Prototype Development. Topics related to development of "Entrepreneurship": Effective Communication, Strategic Thinking, Creative Thinking.	
Evaluation:	Review-1-20%, Review-2-25%, Python test-25%, Project Expo-30%

Course Code: CSE1005	**Course Title:** Programming in Python **Type of Course:** School Core Lab Integrated	**L- T-P-C**	1	0	4	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of Computers and Mathematics					
Anti-requisites	**NIL**					
Course Description	The purpose of this course is to enable the students to develop python scripts using its basic programming features and also to familiarize the Python IDLE and other software's. This course develops analytical skills to enhance the programming abilities. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to build real time applications.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Programming in Python and attain **Employability** through **Problem Solving** Methodologies.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Summarize the basic Concepts of python. 2. Demonstrate proficiency in using data structures. 3. Illustrate user-defined functions and exception handling. 4. Identify the various python libraries.					

Course Content:				
Module 1	Basics of Python programming	Assignment	Programming	**14 Classes**
Topics: Data types, operators and Expressions, Input and Output Statements. Control Structures – Selective and Repetitive structures				
Module 2	Indexed and Associative Data Structures	Simple applications	Programming	**20 Classes**
Topics: Strings, Lists, Sets, Tuples, Dictionaries				
Module 3	Functions, Exception handling and libraries	Case study	Programming	**10 Classes**
Topics: User defined functions, exception handling, Introduction to python built-in libraries				

Targeted Application & Tools that can be used:

Targeted Application : Web application development, AI, Operating systems

Tools: Python IDLE, ANACONDA

- **Application Areas:**
- Web Development
- Game Development
- Scientific and Numeric Applications
- Artificial Intelligence and Machine Learning
- Software Development
- Enterprise-level/Business Applications
- Education programs and training courses
- Language Development
- Operating Systems
- Web Scrapping Applications
- Image Processing and Graphic Design Applications

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

Project work/Assignment:

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

Text Books:

- Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, Forth edition (20 March 2018).
- Alex Campbell, "Python for Beginners: Comprehensive Guide to the Basics of Programming, Machine Learning, Data Science and Analysis with Python", August 29, 2021.
- Charles Dierbach, "Introduction to Computer Science Using Python", Wiley India Edition,2015.

References:

1. E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", Tata McGraw-Hill, 2016
2. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2017

3. Brady Ellison, “Python for Beginners: A crash course to learn Python Programming in 1 Week (Programming Languages for Beginners)”, August 25, 2021.
4. Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code execution
5. https://practice.geeksforgeeks.org/courses/Python-Foundation

Topics relevant to development of “FOUNDATIONS SKILLS”- Solve the real time problems by analyzing and visualizing the data.
Topics relevant to “HUMAN VALUES & PROFESSIONAL ETHICS”- Data collection and its arrangement

Course Code: PPS4002	**Course Title: Introduction to Aptitude Type of Course: Practical Only Course**	**L- P- C**	0	2	1
Version No.	1.0				
Course Pre-requisites	Students should know the basic Mathematics & aptitude along with understanding of English				
Anti-requisites	Nil				
Course Description	The objective of this course is to prepare the trainees to tackle the questions on various topics and various difficulty levels based on Quantitative Ability, and Logical Reasoning asked during the placement drives. There will be sufficient focus on building the fundamentals of all the topics, as well as on solving the higher order thinking questions. The focus of this course is to teach the students to not only get to the correct answers, but to get there faster than ever before, which will improve their employability factor.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.				
Course Outcomes	On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts they learnt in high school. CO2] **Identify** the principle concept needed in a question. CO3] **Solve** the quantitative and logical ability questions with the appropriate concept. CO4] **Analyze** the data given in complex problems. CO5] **Rearrange** the information to simplify the question				
Course Content:					
Module 1	Quantitative Ability	Assignment	Bloom’s Level : Application		**02 Hours**

Topics: Introduction to Aptitude, working of Tables, Squares, Cubes				
Module 2	Logical Reasoning	Assignment	Bloom's Level : Application	**18 Hours**
Topics: Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars, Number Series, Wrong number series, Visual Reasoning				
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS				
Text Book Quantitative Aptitude by R S Aggarwal Verbal & Non-Verbal Reasoning by R S Aggarwal				
References www.indiabix.com www.youtube.com/c/TheAptitudeGuy/videos				
Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.				

Course Code: **MAT2003**	**Course Title:** **NUMERICAL METHODS FOR ENGINEERS** **Type of Course:** **School Core**	**L-T- P-C**	1	0	2	2
Version No.	1.0					
Course Pre-requisites	MAT1002 – Transform Techniques, Partial Differential Equations and Their Applications					
Anti-requisites	**Nil**					
Course Description	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 **familiarize the learners with the concepts of " NUMERICAL METHODS FOR ENGINEERS" and attain Skill Development Through Problem Solving.**					

Course Outcomes	On successful completion of the course the students shall be able to: 1] Solve algebraic and transcendental equations numerically. 2] Adopt numerical techniques to differentiate and integrate functions. 3] Apply numerical methods to solve ordinary differential equations.			
Course Content:				
Module 1	**Numerical solution of Algebraic and Transcendental Equations**			**15 Classes**
Algebraic and Transcendental Equations, Regula - Falsi method, Bisection method (Self study), 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.				
Module 2	**Numerical Interpolation, differentiation and Integration**			**15 Classes**
Numerical Interpolation: Newton's forward and backward 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.				
Module 3	**Numerical solution of ODEs and PDEs**			**15 Classes**
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.				
Targeted Application & Tools that can be used: The objective of the course is to familiarize students with a variety of numerical techniques and the theoretical concepts of probability and statistics so as to equip them with the necessary numerical approaches and basic statistical tools to tackle engineering and real-life problems.				
Assignment:				
1. Gauss-Jacobi iteration method. 2. Numerical differentiation. 3. Gaussian quadrature rule for numerical integration.				

4. Taylor series method for ODEs.
5. Implicit and explicit schemes for PDEs.

Text Books

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.

R4: C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill, 2012.

Topics relevant to SKILL DEVELOPMENT: This 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 with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods for **Skill Development through Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Course Code: CSE2007	**Course Title:** **Design and Analysis of Algorithms** **Type of Course:** **Program Core & Theory only**	**L- T- P- C**	3	0	0	3

Version No.		2.1
Course Pre-requisites		CSE2001, Data Structure and Algorithms
Anti-requisites		**NIL**
Course Description		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.

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] Identify the efficiency of a given algorithm. [Comprehension]** **2] Employ divide and conquer approach to solve a problem. [Application]** **3] Illustrate dynamic programming approach to solve a given problem. [Application]** **4] Solve a problem using the greedy method. [Application]** **5] Discuss the techniques to solve a real-world problem based on its complexity classes. [Comprehension]**
Course Content:		

Module 1	Introduction to Algorithms	Assignment		Problem Solving	**06 Sessions**
	Topics: Algorithm Design and efficiency, measuring of running time of algorithms. Insertion sort and merge sort, Asymptotic Growth and Notations. Recurrences--Masters method. **Assignment:** Comparatively evaluate bubble sort, insertion sort and mergesort.				
Module 2	Review of Searching and Sorting techniques	Assignment		Programming/ Problem Solving	**12 Sessions**
	Topics: **Divide and Conquer:** Examples. Strassen's Matrix multiplication. **Sorting:** Quicksort, Heapsort, Lower bound of comparison-based sorting, non-comparison-based sorting: Radix sort. **Search:** Review of Linear Search and Binary Search, Hashing and hash tables. **Assignment:** Design and develop an algorithm using Divide and Conquer technique for a given scenario.				
Module 3	Greedy Algorithms	Assignment		Programming/ Problem Solving	**09 Sessions**
	Topics: Introduction, Fractional Knapsack Problem, Minimal Spanning Tree: Prim's Algorithm and Kruskal's Algorithm, Single-source Shortest Path: Dijkstra's Algorithm. Huffman Codes. **Assignment:** Design and Develop a solution to a given scenario using greedy method.				
Module 4	Dynamic Programming	Assignment		Programming/ Problem Solving	**09 Sessions**

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

Course Code: CSE3156	Course Title: Database Management Systems Type of Course: 1) School Core 2) Laboratory Integrated	L-T-P-C	3	0	2	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces the core principles and techniques required in the design and implementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve information efficiently. It helps the students to learn and practice data modeling and database designs. The course also introduces the concept of object oriented and object relational databases. The associated laboratory is designed to implement database design using MySQL DATABASE in information technology applications. All the exercises will focus on the fundamentals for creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Demonstrate a database system using ER model and relational algebra. [Understanding] 2] Build databases using SQL queries query processing. [Applying] 3] Apply the functional dependencies and design the database using normalization. [Applying] 4] Interpret the concept of object-oriented databases and object-relational databases. [Understanding]					
Course Content:						

Module 1	**Introduction to Database Modelling and Relational Algebra (Understanding)**	Assignment	**Problem Solving**	**8 Classes**

Topics:
Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.
Relational Algebra with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.

Module 2	**Fundamentals of SQL and Query Optimization (Applying)**	Assignment	**Programming**	**8 Classes**

Topics:
SQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.
Database programming issues and techniques: Embedded SQL, Dynamic SQL; SQL / PSM and NoSQL.
Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.

Module 3	**Relational Database Design & Transaction Management (Applying)**	Assignment	**Problem Solving**	**12 Classes**
Topics: **Relational database design:** Problems in schema design, redundancy and anomalies, Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions, Database De-normalization. **Transaction Management:** The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.				
Module 4	**Advanced DBMS Topics (Understanding)**	Assignment	**Case Study**	**8 Classes**
Topics: **Advanced topics:** Object oriented database management systems, Deductive database management systems, Spatial database management systems, Temporal database management systems, Constraint database management systems. **New database applications and architectures** such as Data warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, Statistical databases.				

List of Laboratory Tasks:

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

Labsheet-1 [3 Practical Sessions]

Experiment No 1: [1 Session]

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

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

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

Experiment No. 2: [2 Sessions]

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

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

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

Labsheet-2 [3 Practical Sessions]

Experiment No. 3: [1 Session]

3. **Implement complex queries in SQL.**

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

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

Experiment No. 4: [2 Session]

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

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

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

Labsheet-3 [2 Practical Sessions]
Experiment No. 5: [2 sessions]

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

Level 1: Implement MySQL Views, and Procedures in ORACLE DB on Employee database.
Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database]

Labsheet-4 [2 Practical Sessions]
Experiment No. 6: [2 Sessions]

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

Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database.
Level 2: Analyze the requirement and construct Functions and Triggers. [Supply chain Database]

Labsheet-5 [2 Practical Sessions]
Experiment No. 7: [2 Sessions]
To implement the concept of forms and reports.
Level 1: Implement the concept of forms and reports.
Level 2: Analyze the schema relationship.

Labsheet-6 [2 Practical Sessions]
Experiment No. 8: [2 Sessions]
Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc.
Level 1: Implement the real time database.
Level 2: Analyze the working of database in real time.

Targeted Application & Tools that can be used:
Application Area: Relational database systems for Business, Scientific and Engineering Applications.
Tools/Simulator used: MySQL DB for student practice.
Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

Percentage of changes in this version: 50% of changes from earlier version. New topics are highlighted initalic.

1. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra.
2. Programming: Implementation of any given scenario using MySQL.

Text Book

1] RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.
2] Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.
3] W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.

References

1] Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018.
2] M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.

Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB.
Topics relevant to development of Employability: Develop, test and implement computer databases, creating sophisticated, interactive and secure database applications
Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Nil

Course Code: CSE3351	**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**
Topics: Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system					
Module 2	Process Management	Assignment/Case Study	Programming/Simulation		**11 Hours**
Topics: Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.					
Module 3	Process Synchronization and Deadlocks	Assignment	Programming		**11 Hours**

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

Module 4	Memory Management	Assignment	Programming/Simulation	**10 Hours**

Topics:
Introduction to Memory Management, Basic hardware-Base and Limit Registers, Memory Management Unit(MMU), Dynamic loading and linking, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Virtual Memory and Demand Paging – Page Faults and Page Replacement Algorithms, Copy-on-write, Allocation of Frames, Thrashing
Introduction to File system management: File System Interface (access methods, directory structures), File system implementation.

Targeted Application:

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

Software Tools:

1. 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.

2. Intel Processor identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.

Project work/Assignment

1. **Demonstrate process concepts in LINUX OS.**
2. **Simulation of CPU scheduling algorithms.**
3. **Develop program to demonstrate use of Semaphores in threads.**
4. **Develop program to demonstrate use of deadlock avoidance algorithms.**
5. **Develop program to demonstrate use of page replacement algorithms.**
6. **Simulation of memory allocation strategies [first fit, best fit and worst fit].**

Text Book

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

References

1. Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 10th edition Wiley, 2018.
2. William Stallings, "Operating Systems",Ninth Edition, By Pearson Paperback ,1 March 2018.
3. Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, " Cracking the Operating System skills", Dreamtech, paperback, 2020
4. Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , "Operating Systems: Three Easy Pieces, Amazon digital Services", September 2018.

E-resources/Weblinks

5. https://www.os-book.com/OS9/
6. https://pages.cs.wisc.edu/~remzi/OSTEP/
7. https://codex.cs.yale.edu/avi/os-book/OS10/index.html

<table>
<tr><td>Course Code:
CSE3078</td><td colspan="4">Course Title: Cryptography and Network Security

Type of Course: Program Core & Theory only</td><td>L- T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="9">1</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="9">“Data Communications and Computer Networks”.</td></tr>
<tr><td>Anti-requisites</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description</td><td colspan="9">The Course covers the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet.
Topics: 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.</td></tr>
<tr><td>Course Objective</td><td colspan="9">The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="9">On successful completion of this course the students shall be able to:
CO1: Identifies the basic concept of Cryptography (Knowledge)
CO2: Express the different types of Cryptographic Algorithms. (Comprehension)
CO3: Recognize the Public key Cryptographic Techniques for various applications. (Comprehension)
CO4: Apply the network security concepts during their implementation of network security application developments. (Application)</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module 1</td><td colspan="2">Introduction to Cryptography</td><td>Assignment</td><td colspan="3">Identify the Concepts</td><td colspan="3">08 Sessions</td></tr>
<tr><td colspan="10">Topics:
Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active attacks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution Ciphers : Caesar, Mono alphabetic, Polyalphabetic, Play-fair and Hill Cipher, Introduction to Block Cipher and Stream Cipher, Festal Structure.</td></tr>
<tr><td>Module 2</td><td colspan="2">Private Key Cryptography and Number Theory</td><td>Assignment</td><td colspan="3">Analysis of requirement of complexity in cryptography</td><td colspan="3">13 Sessions</td></tr>
<tr><td colspan="10">Topics:</td></tr>
</table>

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, Euclidean and Extended Euclidean Algorithm, Euler Totient Function, Chinese Remainder Theorem

Module 3	**Public Key Cryptography and its Applications**	Assignment	Recognize the importance of various security concepts to achieve sufficient solutions	10 Sessions

Topics:
Overview of Public Key Cryptography, RSA, Diffie - Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Discussion on real time practices of Cryptography.

Module 4	**Network Security**	Assignment	Implement the advanced network security algorithms in recent applications.	07 Sessions

Topics:
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.

Targeted Application & Tools that can be used:
Students get the knowledge about cryptography techniques followed, the algorithms used for encryption and decryptions & the techniques for authentication and confidentiality of messages.

Assignment:

Assignment 1: Solve the problems of basic encryption techniques.
Assignment 2: Solve and analyze the problems on symmetric and asymmetric encryption.

Textbooks:

1.William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall, 8th Edition, 2019.

2. Wade Trappe and Lawrence C Washington, "Introduction to Cryptography with Coding Theory", Pearson, 2020.

Reference Books:

1.Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill, third edition, 2010.

2. R.Rajaram, "Network Security and Cryptography" SciTech Publication.3rd Edition, 2014.

3. AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2nd Edition, 2019.
4. BruceSchneier, "Applied Cryptography", John Wiley and Sons Inc. Second Edition, 2015.

Web references:

1.https://onlinecourses.nptel.ac.in/noc22_cs90/preview

2.e-pgpathshala UGC lecture series : E-Series and Self learning Materials.

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ==

3. http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=10133&query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security 4.http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5875&query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security.
Topics relevant to "Skill Development": Symmetric and Asymmetric Encryption Algorithms and its problems.

Course Code: PPS4004	**Course Title: Aptitude Training-Intermediate** **Type of Course: Practical Only Course**	**L-T P- C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Students should have the basic concepts of Quantitative aptitude along with its applications in real life problems.					
Anti-requisites	Nil					
Course Description	This is a skill-based training program for the students (Undergraduate). This course is designed to enable the students to enhance their skills in Quantitative Aptitude.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: CO1] **Understand** all the concepts. CO2] **Apply** the concepts in problem solving (Bloom's taxonomy Level 3)					
Course Content:						
Module 1	Quantitative Ability	Assignment				**24 Hours**
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss, Time Speed and Distance, Boats and Streams, Simple Interest and Compound Interest, Probability, Permutation and Combination.						
Targeted Areas Application area: Placement activities and Competitive examinations.						

Tools: LMS
Text Book Fast Track Objective by Rajesh Verma R S Aggarwal Rakesh Yadav
References www.indiabix.com www.testbook.com www.youtube.com/c/TheAptitudeGuy/videos
Topics relevant to Skill development: Quantitative aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.
Evaluation – Continuous Evaluation (Topic wise evaluation Mid-Term & End term)

Course Code: **CSE3216**	**Course Title:** Mastering Object- Oriented Concepts in Python **Type of Course:** Lab	**L- T- P- C**	0-0-2-1
Version No.	1		
Course Pre-requisites	CSE1005 – Programming in Python		
Anti-requisites	NIL		
Course Description	This course covers mastering object-oriented concepts in Python, including classes, inheritance, polymorphism, and encapsulation. Students will learn to design and implement robust, reusable code using real-world examples. Ideal for those with basic Python knowledge, it enhances problem-solving skills and software development proficiency.		
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Mastering Object Oriented Concepts in Python and attain Skill Development through Experiential Learning.**		

<table>
<tr><td>Course Out Comes</td><td colspan="4">CO1: Explain features of Oops along with creation of Python classes and objects to represent real world Objects. [Understand]

CO2: Demonstrate inheritance, polymorphism, and abstraction in Python to build maintainable and extendable software systems.[Apply]

CO3: Demonstrate exception handling in Python to build robust error-handling mechanisms and debugging tool and Assess various file handling techniques in Python. [Apply]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to OOPS, Classes and Objects</td><td>MCQ</td><td>Assignment</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:

Introduction to OOPs: Problems in Procedure Oriented Approach, Specialty of Python Language, Features of OOPS - Classes and Objects, Encapsulation, Abstraction, Inheritance and Polymorphism.

Classes and Objects: Creating a Class, The Self Variable, Constructor, Destructors, Types of Variables, Namespaces, Types of Methods - Instance Methods, Class Methods, Static Methods, Passing Members of One Class to Another Class, Inner Classes.</td></tr>
<tr><td>Module 2</td><td>Inheritance and Polymorphism</td><td>MCQ</td><td>Assignment</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Constructors in Inheritance, Overriding Super Class Constructors and Methods, The Super() Method, Types of Inheritance – Single Inheritance, Multiple Inheritance, Method Resolution Order(MRO), Polymorphism, Duck Typing Philosophy of Python, Operator Overloading, Method Overloading, Method Overriding.

Abstract Classes and Interfaces: Abstract Method and Abstract Class, Interfaces in Python, Abstract Classes vs. Interfaces.</td></tr>
<tr><td>Module 3</td><td>Exceptions and Files in Python</td><td>MCQ</td><td>Assignment</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Exceptions: Errors in a Python Program – Compile-Time Errors, Runtime Errors, Logical Errors. Exceptions, Exception Handling, Types of Exceptions, The Except Block, The assert Statement, User-Defined Exceptions, Logging the Exceptions.

Files in Python: Files, Types of Files in Python, Opening a File, Closing a File, Working with Text Files Containing Strings, Knowing whether a File Exists or Not, Working with Binary Files, The with Statement, Pickle in Python, The seek() and tell() Methods.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:

Python, PyCharm</td></tr>
</table>

Project work/Assignment:

Assignment:

Module 1 Assignment: Design and implement a Python application that simulates a banking system using classes and methods for customers and accounts.

Module 2 Assignment: Develop a Python application that simulates Library management system that demonstrates inheritance, polymorphism and abstraction concepts.

Module 3 Assignment: Develop a Python program that handles different types of exceptions while processing user input for a movie ticket booking system showcasing exception handling and File handling concepts.

Text Book

1. Dr. R Nageshwara Rao, "Core Python Programming", Dreamtech Press, 3rd Edition, 2021.

References

1. Alex Martelli, Anna Ravenscroft & Steve Holden, "Python in a Nutshell The Definitive Reference", O'Reilly Media, 3rd edition, 2017.
2. Luciano Ramalho, "Fluent Python Clear, Concise, and Effective Programming", O'Reilly Media, 2nd edition, 2022.
3. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th edition, 2013.
4. David Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media, 3rd edition, 2013.

Weblinks:

1. www.learnpython.org
2. https://realpython.com/python3-object-oriented
3. https://www.tutorialspoint.com/python/python_oops_concepts.htm

Topics relevant to "SKILL DEVELOPMENT":

Building Real-World Applications Using OOPS Concepts, Error Handling and Debugging Techniques, Concurrency in Python, Advanced File Handling Techniques, Creating and Managing Python Packages and Modules, Designing and Implementing Python Interfaces

This is attained through assessment component mentioned in course handout.

Course Code: CSE1700	**Course Title:** Essentials of AI **Type of Course:** Theory	**L- T-P- C**	3	**0**	0	**3**
Version No.	2.0					
Course Pre-requisi Data **tes**	Basic knowledge of programming, mathematics, understanding of data handling					
Anti-requisites	**NIL**					
Course Description	This course is a comprehensive introductory course designed to equip learners with the fundamental Python programming skills necessary to work with artificial intelligence (AI) technologies. This course is aimed at individuals who are new to AI but have a basic understanding of programming concepts. It combines Python					

	programming fundamentals with hands-on experience in implementing AI techniques such as machine learning, neural networks, and natural language processing.			
Course Objective	The objective of the course is to Understand Python Programming Fundamentals, Manipulate and Process Data with Python, Implement Machine Learning Algorithms and Build and Train Neural Networks for AI Applications.			
Course Outcomes	On successful completion of the course the students shall be able to: CO 1: Apply Python Programming to AI Projects CO 2: Build and Train Machine Learning Models CO 3: Develop Deep Learning Models with Neural Networks CO 4: Deploy AI Solutions and Understand Ethical Implications			
Course Content:				
Module 1	Introduction to Python Programming for AI	Assignment	Implementation	**10 Sessions**
Topics: Python Basics: Variables, Data Types, Operators, and Control Flow Functions, Loops, and Conditionals statements, Data Structures: Lists, Tuples, Dictionaries, Sets ,Introduction to Libraries: NumPy and Pandas for data manipulation, Basic Input/Output and File Handling Introduction to Python for AI: Libraries and Frameworks Overview				
Module 2	Data Processing, Visualization	Assignment	Implementation	10 Sessions
Topics: cleaning and preprocessing with Pandas,Handling missing data, outliers, and duplicates, Data transformation (Normalization, Encoding), Introduction to Matplotlib and Seaborn for Data Visualization, Exploratory Data Analysis (EDA), Visualizing datasets to understand patterns and relationships.				
Module 3	Introduction to Machine Learning	Mini - Project	Implementation	10 Sessions
Topics: What is Machine Learning? Types of ML algorithms Supervised Learning: Regression, Classification, Unsupervised Learning: Clustering, Key ML Algorithms: Linear Regression, Decision Trees, K-Means ,Introduction to Scikit-learn library Model evaluation (Accuracy, Precision, Recall, Confusion Matrix)				
Module 4	Neural Networks and Deep Learning	Quiz	Implementation	10 Sessions
Topics: Introduction to Neural Networks and Deep Learning, Perceptron Model and Backpropagation Deep Neural Networks and Activation Functions, Introduction to TensorFlow and Keras, Building and Training Neural Networks for Image and Text Classification, Overview of Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)				
Targeted Application & Tools that can be used: **Applications**: 1. **Data Preprocessing**: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs. 2. **Exploratory Data Analysis (EDA)**: Gain insights into datasets by identifying trends, patterns, and outliers. 3. **Predictive Modeling**: Build models for classification (e.g., spam detection) and regression (e.g., house price prediction).				

4. **Clustering**: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
5. **Model Evaluation**: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.

Tools:

- **Pandas**: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
- **NumPy**: For numerical operations and working with arrays and matrices.
- **Matplotlib**: For creating static, animated, and interactive visualizations.
- **Seaborn**: For advanced data visualizations (e.g., heatmaps, pair plots).
- **Plotly**: For creating interactive visualizations, especially useful for large datasets.
- **Scikit-learn**: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering).
- **XGBoost**: For advanced gradient boosting models, particularly for large-scale machine learning tasks.
- **TensorFlow** (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.
- **Keras**: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.
  NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging.
  spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing.
  Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):

T1: **Essentials of Python for Artificial Intelligence and Machine Learning** by Pramod Gupta and Anupam Bagchi

Reference(s):

- "Artificial Intelligence with Python" – Prateek Joshi
- "Python Machine Learning" – Sebastian Raschka & Vahid Mirjalili
- "Hands-On Artificial Intelligence with Python" – Teet Straus
- "Deep Learning for Coders with Fastai and PyTorch" – Jeremy Howard & Sylvain Gugger

Course Code: CSE1701	**Course Title:** Essentials of AI LAB **Type of Course:** Lab	**L- T-P- C**	0	0	4	2
Version No.	2.0					
Course Prerequisites	Basic Java Programming Knowledge, Mathematics: Linear Algebra and Probability, Basic Data Structures and Algorithms, Familiarity with Libraries and Tools, Understanding of Basic Machine Learning Concepts.					
Anti-requisites	**NIL**					
Course Description	This course introduces students to the essential concepts and techniques of Artificial Intelligence (AI) with a focus on practical implementation using Python. Students will explore core AI topics such as search algorithms, knowledge representation, machine learning, and neural networks, while gaining proficiency in using popular					

	Python libraries like NumPy, pandas, scikit-learn, and TensorFlow. Through a series of lab exercises and projects, students will apply AI principles to solve real-world problems, develop intelligent applications, and understand how AI systems function at a foundational level.
Course Objective	The primary objectives of the course are to Gain Proficiency in AI Concepts and Python Implementation, Develop and Implement Machine Learning Models, Understand and Build Neural Networks, Apply AI to Real-World Problems
Course Outcomes	On successful completion of the course the students shall be able to: 1. Proficiency in Implementing AI Algorithms Using Python 2. Ability to Build and Evaluate Machine Learning Models 3. Hands-on Experience with Neural Networks and Deep Learning 4. Practical Application of AI to Solve Real-World Problems
Course Content:	

Module 1	Introduction to AI and Python for AI	ssignment	mplementation	**8 Sessions**

Lab Assignment 1: Setting Up the Python Environment

- **Objective:** Get familiar with setting up a Python environment for AI projects.
- **Tasks:**
  1. Install Python, Anaconda, and Jupyter Notebook.
  2. Set up a virtual environment for AI development.
  3. Install essential Python libraries: numpy, pandas, matplotlib, and scikit-learn.
  4. Write and execute simple Python code to verify installation (e.g., print a "Hello AI" message).

Lab Assignment 2: Basic Python Programming for AI

- **Objective:** Understand and practice the basic Python syntax and data structures used in AI.
- **Tasks:**
  1. Write Python code to work with basic data types (integer, float, string, boolean).
  2. Implement and manipulate Python lists, tuples, sets, and dictionaries.
  3. Create basic control flow structures: if-else, for loops, while loops.
  4. Use functions and lambda functions to solve small AI-related problems, such as calculating factorial or Fibonacci numbers.

Lab Assignment 3: Data Exploration and Preprocessing

- **Objective:** Learn how to work with data for AI models.
- **Tasks:**
  1. Load a dataset (e.g., Titanic or Iris dataset) using pandas.
  2. Clean the dataset by handling missing values, removing duplicates, and converting data types if needed.
  3. Explore the dataset by visualizing it using matplotlib and seaborn.
  4. Perform basic data preprocessing tasks such as feature scaling, encoding categorical variables, and splitting data into training and testing sets.

Module 2	Data Processing, Visualization	Assignment	Implementation	8 Sessions

Lab Assignment 1: Data Preprocessing with Pandas

Objective:

Learn the fundamentals of data preprocessing, including cleaning, handling missing values, and performing basic transformations using **Pandas**.

Tasks:

1. **Load and Inspect the Dataset:**
    - Load a dataset (e.g., **Iris**, **Titanic**, **Wine Quality** dataset) using pandas.read_csv() or pandas.read_excel().
    - Inspect the first few rows of the dataset using .head() and check basic information using .info().
2. **Handle Missing Values:**
    - Identify missing values in the dataset using .isnull() or .isna().
    - Handle missing data by imputing with mean, median, or mode using SimpleImputer from sklearn, or remove rows with missing data using .dropna().
3. **Data Transformation:**
    - Convert categorical variables to numerical values using one-hot encoding or label encoding.
    - Normalize/standardize numerical columns using StandardScaler or MinMaxScaler from sklearn.
4. **Subset and Filter Data:**
    - Create subsets based on certain conditions (e.g., select rows where a specific feature value is greater than a threshold).
    - Filter outliers from numerical data using interquartile range (IQR).

Lab Assignment 2: Data Aggregation and Grouping with Pandas

Objective:

Master aggregation and grouping techniques using **Pandas** for summarizing data.

Tasks:

1. **Group Data by Category:**
    - Group data by one or more categorical features (e.g., "class" in the Iris dataset or "embarked" in Titanic dataset).
    - Use .groupby() to calculate aggregate statistics such as mean, median, sum, and count.
2. **Pivot Tables:**
    - Create a pivot table to summarize data (e.g., aggregate the average age of passengers in the Titanic dataset by class and gender).
    - Use .pivot_table() to perform multi-dimensional aggregation.
3. **Data Aggregation and Custom Functions:**
    - Apply custom aggregation functions to the grouped data (e.g., calculate custom metrics or perform complex transformations within each group).
4. **Sorting and Ranking Data:**
    - Sort the dataset by multiple columns (e.g., sorting by "age" or "fare").
    - Rank data based on specific metrics (e.g., assign ranks to passengers by fare in the Titanic dataset).

Lab Assignment 3: Data Visualization with Matplotlib and Seaborn

Objective:

Learn to visualize datasets using **Matplotlib** and **Seaborn** for better understanding and insights.

Tasks:

1. **Basic Plotting with Matplotlib:**
    - Create simple plots like line plots, bar plots, and histograms using **Matplotlib**.
    - Customize the plots by setting titles, labels, and legends.
    - Create scatter plots to visualize relationships between two variables.

2. **Advanced Plotting with Seaborn:**
    - Use **Seaborn** to create advanced visualizations like pair plots, heatmaps, box plots, and violin plots.
    - Customize visualizations with color palettes, styling, and themes.
    - Create a correlation heatmap to visualize correlations between features in the dataset.
3. **Distribution Visualizations:**
    - Plot distributions of continuous variables using **Seaborn's** distplot() or kdeplot().
    - Create bar plots for categorical variables to understand their frequency distribution.
4. **Multi-Plot Grid Layouts:**
    - Use **Matplotlib's** subplots() function to create multiple plots in a grid layout for comparison (e.g., scatter plot and histogram in the same figure).

Lab Assignment 4: Visualizing Relationships and Feature Importance

Objective:

Understand how to visualize relationships between features and evaluate feature importance for predictive models.

Tasks:

1. **Scatter Plot Matrix:**
    - Use **Seaborn's** pairplot() to create a scatter plot matrix to visualize the relationships between multiple features.
    - Analyze the pairwise relationships between features and identify any patterns or correlations.
2. **Heatmap of Correlation Matrix:**
    - Use **Pandas** to calculate the correlation matrix of numeric features.
    - Visualize the correlation matrix using **Seaborn's** heatmap() to understand feature correlations and multicollinearity.
3. **Feature Importance from Models:**
    - Train a decision tree or random forest model using **scikit-learn** on a dataset (e.g., **Iris** or **Titanic**).
    - Visualize feature importance using a bar chart to understand which features have the most impact on the model.
4. **Visualizing Predictions vs. Actual Values:**
    - For regression tasks, visualize the predicted values against the actual values using a scatter plot.
    - For classification tasks, visualize the classification results with a confusion matrix.

Lab Assignment 5: Time Series Data Visualization and Processing

Objective:

Learn how to process and visualize time series data, which is common in AI applications like forecasting and trend analysis.

Tasks:

1. **Load and Preprocess Time Series Data:**
    - Load a time series dataset (e.g., stock market data, weather data).
    - Parse dates properly and set the date column as the index using pd.to_datetime() and .set_index().
2. **Plot Time Series Data:**
    - Plot a time series line chart using **Matplotlib** to visualize trends over time.
    - Create rolling averages (e.g., 7-day, 30-day) to smooth out short-term fluctuations in the time series data.

3. **Seasonal Decomposition of Time Series:**
    - Use **statsmodels** to decompose a time series into seasonal, trend, and residual components.
    - Visualize the decomposed components to understand seasonal variations.
4. **Forecasting with Simple Models:**
    - Use simple forecasting models (e.g., moving average, ARIMA) to predict future values.
    - Visualize the forecasted data along with actual historical data.

Module 3	Introduction to Machine Learning	Assignments	Implementation	8 Sessions

Lab Assignment 3: Implementing Linear Regression

- **Tasks:**
    1. Load a real-world dataset (e.g., **Boston Housing Price** dataset).
    2. Train a **Linear Regression** model using LinearRegression() from scikit-learn.
    3. Evaluate the model using **Mean Squared Error (MSE)** and **R-squared Score**.
    4. Visualize the regression line using Matplotlib.

Lab Assignment 4: Logistic Regression for Classification

- **Tasks:**
    1. Load the **Iris** or **Breast Cancer** dataset.
    2. Preprocess the dataset (handle missing values, encode categorical variables, scale data).
    3. Train a **Logistic Regression** model using LogisticRegression().
    4. Evaluate performance using **Accuracy, Precision, Recall, F1-score**.
    5. Plot the **Confusion Matrix** and **ROC Curve**.

Lab Assignment 5: Implementing K-Nearest Neighbors (KNN)

- **Tasks:**
    1. Load the **Iris dataset** and split it into training and testing sets.
    2. Train a **KNN classifier** using KNeighborsClassifier().
    3. Experiment with different values of **K** and evaluate performance.
    4. Visualize decision boundaries using a **scatter plot**.

Lab Assignment 6: Decision Trees and Random Forests

- **Tasks:**
    1. Train a **Decision Tree classifier** on the Titanic dataset.
    2. Visualize the tree structure using plot_tree().
    3. Train a **Random Forest classifier** and compare performance with the decision tree.
    4. Determine the **feature importance** using feature_importances_.

Module 4	Neural Networks and Deep Learning	Quiz	Implementation	6 Sessions

Lab Assignment 7: Introduction to Perceptron and Activation Functions

Tasks:

1. Implement a **single-layer perceptron** using NumPy.
2. Train the perceptron to classify **AND, OR, XOR** gates.
3. Experiment with different **activation functions** (Sigmoid, ReLU, Tanh).
4. Visualize decision boundaries.

Lab Assignment 8: Building a Simple Neural Network with Keras

Tasks:

1. Load the **MNIST dataset** from keras.datasets.
2. Preprocess the data (normalize pixel values, reshape input).
3. Create a **fully connected neural network** using Sequential API.
4. Train and evaluate the model using **categorical cross-entropy loss** and **accuracy**.

Lab Assignment 9: Implementing CNN from Scratch

Tasks:

1. Load the **CIFAR-10 dataset**.
2. Build a CNN with **Conv2D, MaxPooling2D, Flatten, Dense, Dropout** layers.
3. Use **Adam optimizer** and **categorical cross-entropy loss**.
4. Train and visualize loss/accuracy curves.

Lab Assignment 10: Image Augmentation & Regularization

Tasks:

1. Apply **data augmentation** (rotation, zoom, flipping) using ImageDataGenerator.
2. Add **dropout and batch normalization** to prevent overfitting.
3. Compare model performance with and without augmentation.

Lab Assignment 11: Transfer Learning with Pre-trained Models

Tasks:

1. Use **VGG16 or ResNet50** pre-trained on ImageNet.
2. Replace the output layer to classify **new images**.
3. Freeze earlier layers and fine-tune deeper layers.
4. Evaluate the model on a custom **dataset (e.g., Cats vs. Dogs)**.

Lab Assignment 12: Implementing RNN for Text Classification

Tasks:

1. Load **IMDB movie reviews dataset** from keras.datasets.
2. Preprocess text (tokenization, padding sequences).
3. Build an **RNN** with **Embedding, SimpleRNN, Dense** layers.
4. Train and evaluate the model.

Lab Assignment 13: Building an LSTM for Time Series Prediction

Tasks:

1. Load a **time series dataset** (e.g., stock prices, temperature data).
2. Preprocess the data (normalize, reshape).
3. Build an **LSTM-based model**.
4. Predict future values and visualize trends.

Targeted Application & Tools that can be used:

Applications:

1. **Data Preprocessing**: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs.

- **Exploratory Data Analysis (EDA)**: Gain insights into datasets by identifying trends, patterns, and outliers.
- **Predictive Modeling**: Build models for classification (e.g., spam detection) and regression

(e.g., house price prediction).

- **Clustering**: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
- **Model Evaluation**: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.

Tools:

- **Pandas**: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
- **NumPy**: For numerical operations and working with arrays and matrices.
- **Matplotlib**: For creating static, animated, and interactive visualizations.
- **Seaborn**: For advanced data visualizations (e.g., heatmaps, pair plots).
- **Plotly**: For creating interactive visualizations, especially useful for large datasets.
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- **XGBoost**: For advanced gradient boosting models, particularly for large-scale machine learning tasks.
- **TensorFlow** (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.
- **Keras**: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.

NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging.

spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing.

Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):

*T1: **Essentials of Python for Artificial Intelligence and Machine Learning** by Pramod Gupta and Anupam Bagchi*

Reference(s):

1. "Artificial Intelligence with Python" – Prateek Joshi
2. "Python Machine Learning" – Sebastian Raschka & Vahid Mirjalili
3. "Hands-On Artificial Intelligence with Python" – Teet Straus
4. "Deep Learning for Coders with Fastai and PyTorch" – Jeremy Howard & Sylvain Gugger

Course Code: CCS2500	**Course Title: Cyber Forensics** **Type of Course: Program Core**	**L-T-P- C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	**Cryptography and Network Security**					
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce to the students Cyber Forensic concepts. The course is both conceptual and analytical and is understood with various open-source software's. The course develops critical thinking like correctly collect and analyze computer forensic evidence, analyze and validate Forensics Data, study the tools and tactics associated with Cyber Forensics. The course involves quizzes, assignments with various open-source software.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Cyber Forensics** and attain **Skill Development** through **Experiential Learning** techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** **(1) understand** various digital investigation terminologies and methods (knowledge) **(2) understand** various file formats (knowledge) **(3) Recognize** the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications (Comprehension) **(4) Apply** techniques for forensic investigation (Application)					
Course Content:						
Module 1	**DIGITAL INVESTIGATION**	Quiz		MCQ/Based on Investigation process	**No. of Sessions: 09**	
Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process -Investigative Reconstruction - Modus Operandi, Motive and Technology -Digital Evidence in the Courtroom.						
Module 2	**UNDERSTANDING INFORMATION**	Quiz		MCQ/Based on file format	**No. of Sessions: 09**	
Methods of storing data: number systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats - Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers - Extraction of forensic artifacts– understanding the dimensions of other latest storage devices – SSD Devices.						
Module 3	**COMPUTER BASICS FOR DIGITAL INVESTIGATORS**	Assignment		Writing task	**No. of Sessions: 09**	

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

Information warfare: Arsenal – Surveillance Tools – Hackers and Theft of Components – Contemporary Computer Crime-Identity Theft and Identity Fraud – Organized Crime &Terrorism.
Computer forensic cases: Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence –Processing Evidence and Report Preparation – Future Issues.
Assignment: Computer Crime

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

Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden Data.
Data Collection and Data seizure: why collect evidence? - Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody. Reconstructing the Attack.
Assignment: Data Recovery

Targeted Application & Tools that can be used:

1. **FTK Forensic Toolkit**
2. **Encase**
3. **Kali Linux- Vinetto, galatta**
4. **Autopsy – Disk Forensics**

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

Textbook(s):

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

References

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

2. ChristofPaar, Jan Pelzl," Understanding Cryptography: A Textbook for Students and Practitioners", Springer's, Second Edition, 2010,
3. Ali Jahangiri," Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts", First edition, 2009
4. Computer Forensics: Investigating Network Intrusions and Cyber Crime", Ec-Council Press, 2010.
5. C. Altheide& H. Carvey," Digital Forensics with OpenSource Tools, Syngress", 2011, ISBN: 781597495868.,https://esu.desire2learn.com

NPTEL: https://onlinecourses.swayam2.ac.in/cec21_ge10/preview
Udemy: https://www.udemy.com/topic/digital-forensics/
E-book Link(PU):
Links
http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14073&query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC

Topics relevant to "Skill Developemnt": Cyber Forensics techniques for **Skill development** through **Experiential Learning techniques.** This is attained through the assessment component mentioned in the course handout.

Course Code: CCS2501	**Course Title: Cyber Forensics** Lab **Type of Course: Program Core**	**L- T-P- C**	0-0-2-1
Version No.	1.0		
Course Pre-requisites	**Cryptography and Network Security**		
Anti-requisites	NIL		
Course Description	The purpose of this course is to introduce to the students Cyber Forensic concepts. The course is both conceptual and analytical and is understood with various open-source software's. The course develops critical thinking like correctly collect and analyze computer forensic evidence, analyze and validate Forensics Data, study the tools and tactics associated with Cyber Forensics. The course involves quizzes, assignments with various open-source software.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Cyber Forensics** and attain **Skill Development** through **Experiential Learning** techniques.		
Course Outcomes	**On successful completion of this course the students shall be able to:** **(1) understand** various digital investigation terminologies and methods (knowledge) **(2) understand** various file formats (knowledge) **(3) Recognize** the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications (Comprehension) **(4) Apply** techniques for forensic investigation (Application)		
Course Content:			

List of Laboratory Tasks:

1. Case Studies of Opensource Forensic Tools
2. FTK Forensic Tool kit for taking mirror image

Disk Forensics-

3. Identify digital evidences
4. Acquire the evidence
5. Authenticate the evidence
6. Preserve the evidence
7. Analyze the evidence
8. Report the findings

Network Forensics:

9. Intrusion detection
10. Logging
11. Correlating intrusion detection and logging

Device Forensics

12. Mobile phone
13. Digital Music
14. Printer Forensics
15. Scanner Forensics
16. Credit Card Forensics
17. Telecommunications Forensics
18. Forensic Analysis of a Virtual Machine
19. Forensic analysis of Cloud storage and data remnants
20. RAM Dumping Tool

Targeted Application & Tools that can be used:

2. **FTK Forensic Toolkit**
3. **Encase**
4. **Kali Linux- Vinetto, galatta**
5. **Autopsy – Disk Forensics**

Project work/Assignment:

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

Textbook(s):

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

References

1. Ravi Kumar & B Jain,2006," Cyber Forensics - Concepts and Approaches", icfai university press
2. ChristofPaar, Jan Pelzl," Understanding Cryptography: A Textbook for Students and Practitioners", Springer's, Second Edition, 2010,
3. Ali Jahangiri," Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts", First edition, 2009
4. Computer Forensics: Investigating Network Intrusions and Cyber Crime", Ec-Council Press, 2010.
5. C. Altheide& H. Carvey," Digital Forensics with OpenSource Tools, Syngress", 2011, ISBN: 781597495868.,https://esu.desire2learn.com

NPTEL: https://onlinecourses.swayam2.ac.in/cec21_ge10/preview
Udemy: https://www.udemy.com/topic/digital-forensics/
E-book Link(PU):
Links
http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14073&query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC

Topics relevant to "Skill Developemnt": Cyber Forensics techniques for **Skill development** through **Experiential Learning techniques.** This is attained through the assessment component mentioned in the course handout.

Course Code: CCS2504	**Course Title:** Ethical Hacking **Type of Course:** Core Subject	**L-T- P- C**	**2**	**0**	**2**	**2**
Version No.	1.3					
Course Pre-requisites	Basic networking tools knowledge and Cryptography & Network Security					
Anti-requisites	NIL					
Course Description	This course introduces students to a wide range of topics related to ethical hacking. It also provides an in-depth understanding of how to effectively protect computer networks. These topics cover some of the tools and penetration testing methodologies used by ethical hackers and provide a thorough discussion of what and who an ethical hacker is and how important they are in protecting corporate and government data from cyber-attacks					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Ethical Hacking and attain to improve the learners' Employability Skills by using Experiential Learning techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1] Extrapolate the importance of ethical hacking. 2] Determine the various techniques for performing reconnaissance 3] Categorize various types of system scanners and their functions. 4] Identify the function of sniff on a network.					
Course Content:						

Module 1	**Introduction to Hacking**	Assignment		Programming activity	**12 Hours**
Topics: Introduction to Hacking-Important Terminologies - Asset - Vulnerability - Penetration Test - Vulnerability Assessments versus Penetration Test - Penetration Testing Methodologies - Categories of Penetration Test. **Assignment:** Different phase methodologies on penetration testing					
Module 2	**Linux Basics**	Assignment		Programming activity	**10 Hours**
Topics: Major Linux Operating Systems - File Structure inside of Linux - BackTrack - Changing the Default Screen Resolution - Some Unforgettable Basics. **Assignment:** Penetration testing distribution					

Module 3	**Information Gathering Techniques**	Assignment		Programming activity	**11 Hours**
Topics: Sources of Information Gathering - Copying Websites Locally - NeoTrace - Xcode Exploit Scanner - Interacting with DNS Servers - DNS Cache Snooping - DNS Lookup with Fierce - SNMP - SMTP. **Assignment:**Domain internet groper					
Module 4	**Target Enumeration and Port Scanning Techniques**	Assignment		Programming activity	**13 Hours**
Topics: Target Enumeration and Port Scanning Techniques - Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - Vulnerability Assessment. **Assignment:** Demonstrations for port scanning					
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.					

Course Code: CCS2505	Course Title: Ethical Hacking Lab Type of Course: Core Subject	L-T- P- C	0	0	4	2
Version No.	1.3					
Course Pre-requisites	Basic networking tools knowledge and Cryptography & Network Security					
Anti-requisites	NIL					
Course Description	This course introduces students to a wide range of topics related to ethical hacking. It also provides an in-depth understanding of how to effectively protect computer networks. These topics cover some of the tools and penetration testing methodologies used by ethical hackers and provide a thorough discussion of what and who an ethical hacker is and how important they are in protecting corporate and government data from cyber-attacks					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Ethical Hacking and attain to improve the learners' Employability Skills by using Experiential Learning techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 5] Extrapolate the importance of ethical hacking. 6] Determine the various techniques for performing reconnaissance 7] Categorize various types of system scanners and their functions. 8] Identify the function of sniff on a network.					
Course Content:						

List of Laboratory Tasks:

Experiments:

1. Command Prompt
2. Wireshark
3. Netscantool
4. OWZAP
5. Neotrace
6. NMAP
7. AngryIPScanner
8. Maltigo
9. Readnotify
10. HTTRACK
11. Yougetsignal
12. CAPSA Portable Network Analyzer
13. Samspade
14. Shodan
15. Oputils
16. Brupsuit

17. Zenmap 18. OSINT 19. John the ripper
Targeted Application & Tools that can be used: Application Software and open source tools like SQL Injection and NIDS,HIDS.
Text Book 1.Rafay Baloch, 2014: "Ethical Hacking and Penetration Testing Guide" Apple Academic Press Inc**.**
References 1.Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security Testing,Penetration Testing, and Basic Security". 2.James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and Network Defense", 2nd Edition, Cengage Learning. **E-Resources**: (1) Ethical Hacking in 12 Hours - Full Course - Learn to Hack! - YouTube
Topics relevant to "EMPLOYABILITY SKILLS": CEH Certification Ethical hacking techniques for **Employability skills** through **Experiential Learning techniques**. This is attained through the assessment component mentioned in course handout.

Course Code: CCS2503	**Course Title:** Cyber Security	**L- T-P- C**	3 -0-0-3
Version No.	1.1		
Course Pre-requisites	Fundamental knowledge in Information Security and Networks		
Anti-requisites	**NIL**		
Course Description	This is a foundation program geared towards generating and enhancing awareness about cyber security challenges and the concept of Cyber Security and Cyber Ethics among the stakeholders to help them become responsible Cyber Citizens and participate safely and securely in the rapidly evolving information-age society. The important topics include: Network Security model, attacks, malware, firewall, IT act and Cyber forensics		
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Cyber Security** and attain **Employability** through **Participative Learning** techniques.		
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe the basic concept of Cyber Security **[Knowledge]** 2)Classify different types of attacks for a scenario **[Comprehension]** 3) Prepare a mitigation policy for security threat **[Comprehension]** 4) Demonstrate Cyber Security tools **[Application]**		
Course Content:			

Module 1	**Introduction to Cyber Security**	Quiz	**Knowledge**	**10 Sessions**

Topics

History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Guidelines to choose web browsers, Securing web browser, Antivirus, Email security, Guidelines for setting up a Secure password , Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques .

Module 2	**Security in Networks**	Assignment	**Comprehension**	**10 Sessions**

Topics:

Security in Networks – Concepts, threats in Network, website vulnerabilities, man in the middle attack, denial of Service attack, distributed denial of service attack, Firewalls – introduction and design, types of firewalls, personal firewalls, Program Security – non malicious program errors, malicious program flaws, virus and other malicious code, prevention of virus infection.

Assignment: Program Security – non malicious program errors.

Module 3	**Smartphone Security**	Assignment	**Comprehension**	**12 Sessions**

Topics:

Introduction to mobile phones, Smartphone Security, Android Security, IOS Security, Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance, Guidelines for social media security, Tips and best practices for safer Social Networking ,Basic Security for Windows, User Account Password

Assignment: Social Media Security

Module 4	Ethical Issues in Cyber Security	Assignment	Programming/Data analysis task	**9 Sessions**

Legal and ethical issues in Cyber Security – protecting program and data, copyright, patents and trade secrets, IT Act, EDP audit, Overview of CISA, Privacy in computing, Cyber Forensic Tools – types and categories, Cyber forensic suite. Forensic tools: types, categories, open source proprietary

Assignment: Cyber Forensic Tools

Textbooks

T1. Charles P. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education, 5th Edition,2012

T2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons, 2018 .

T3. Dejey and Murugan, “Cyber Forensics”, Oxford University Press, 2018.

References

R1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th Ed, Pearson Education, 2015.
R2. Behrouz A Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, Mc Graw Hill Publication, ISBN 13: 978-93-392-2094-5.2008.

Web links:
W1. https://www.youtube.com/watch?v=RYB4cG8G2xo
W2. https://www.coursera.org/lecture/detecting-cyber-attacks/Cyber Security-UeDqJ ,https://presiuniv.knimbus.com/user#/home

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

Course Code: CSE2500	**Course Title: Theory of Computation** **Type of Course: Theory Only**	**L- T-P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	The students should have the Knowledge on Set Theory					
Anti-requisites	Nil					
Course Description	The course deals with introduction of formal languages and the correspondence between language classes and the automata that recognize them. Topics include: Formal definitions of grammars and acceptors, Deterministic and Nondeterministic systems, Grammar ambiguity, finite state and push-down automata; normal forms; Turing machines and its relations with algorithms.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Theory of Computation as mentioned above** and attain **Skill Development** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Describe various components of Automata. (Knowledge) 2. Illustrate Finite Automata for the given Language. (Application) 3. Distinguish between Regular grammar and Context free grammar. (Comprehension) 4. Construct Push down Automata. (Application) 5. Construct Turing machine for a Language. (Application)					
Course Content:						
Module 1	**Introduction to automata theory**	Assignment	Problems on Strings and Language operations		**06 Sessions**	
Topics: Introduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages & operations on languages, Representation of automata, Language recognizers, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs						

Module 2	**Finite Automata**	Assignment	Problems on DFA, NFA's	**13 Sessions**
Topics: Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages and DFA's, Regular Languages, NFA- Definition of a Nondeterministic Accepter, Languages and NFA's Why Non-determinism? Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.				
Module 3	**Regular Expressions & Context Free Grammar**	Assignment	Problems on RE, CFG, PT, PL and Ambiguity	**12 Sessions**
Topics: Formal Definition of a Regular Expression, Languages Associated with Regular Expressions, Languages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show some languages are not RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and Derivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity, Chomsky Normal Form, Gribiche Normal Form.				
Module 4	**Push down Automata**	Assignment	Problems on pushdown Automaton	**08 Sessions**
Topics: Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack Equivalence of PDA's and CFG's: From Grammars to Pushdown Automata.				
Module 5	**Turing Machine**	Assignment	Problems on Turning Machine	**07 Sessions**
Topics: Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing machine, Turing Machines as Transducers, Halting Programming Techniques for Turing Machines				
Targeted Application & Tools that can be used: Targeted Application: 1. Text Processing 2. Compilers 3. Text Editors 4. Robotics Applications 5. Artificial Intelligence Tools: 1. JFLAP (Java Formal Language and Automata Package) Software simulation tool. It's interactive educational software written in Java to experiment topics in automata theory. 2. Turing machine Online simulators.				
Text Book 1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6th Ed, 2018.				
References 1. Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008. 2. Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014. **E-Resources** NPTEL course – https://onlinecourses.nptel.ac.in/noc21_cs83/preview				
Topics relevant to "SKILL DEVELOPMENT": Deterministic and Non-Deterministic Automaton, Regular Expressions, CFGs, Turning Machine and Pushdown automaton for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

Course Code: CSE1504	**Course Title: Web Technology** **Type of Course: Program core** **Theory Only**		**L- T-P- C**	2-0-0-2
Version No.	2.0			
Course Pre-requisites	**NIL**			
Anti-requisites	**NIL**			
Course Description	This course highlights the basic web design using Hypertext Markup Language and Cascading Style Sheets. Students will be trained in planning and designing effective web pages by writing code using current leading trends in the web domain, enhancing web pages with the use of page layout techniques, text formatting, graphics, images, and multimedia. The focus is on popular key technologies that will help students to build Internet- and web-based applications that interact with other applications and with databases.			
Course Objective	**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**			
Course Outcomes	**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Application level)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Application level)** **CO3**: Illustrate java-script concepts to demonstration dynamic web site **(Application level)** **CO4:** Apply server-side scripting languages to develop a web page linked to a database. **(Application level)**			
Course Content:				
Module 1	**Introduction to XHTML**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications	**8 Sessions**
Topics: Basics: Web, WWW, Web browsers, Web servers, Internet. XHTML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML.				
Module 2	**Advanced CSS**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages	**8 Sessions**
Topics:				

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

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

Module 3	**Fundamentals of JavaScript**	Quizzes and assignments	Application of JavaScript for dynamic web page designing	**7 Sessions**

Topics:

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

Module 4	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**7 Sessions**

Topics:

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

Targeted Application & Tools that can be used:

Xampp web server to be used to demonstrate PHP.

Project work/Assignment:

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

Textbook(s):

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

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

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

References

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

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

Topics related to development of "FOUNDATION":

1. Web, WWW, Web browsers, Web servers, Internet.
2. CSS, PHP.
3. Designing for healthcare.

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

E-References

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

Course Code: CSE1505	**Course Title: Web Technologies Lab**	**L-T-P- C**	0	0	2	1

	Type of Course: Program core lab course						
Version No.		1.0					
Course Pre-requisites		Database Management Systems-CSE3156					
Anti-requisites		**NIL**					
Course Description		This course highlights the comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.					
Course Objective		**The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.**					
Course Outcomes		**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Apply)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Apply)** **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Apply)**					
Course Content:							

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

Level 1: Demonstration of various XHTML Tags (Level 1)
Level 2: Design and develop static web pages for an online Book store (Level 2).

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.
Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

Experiment No. 3: Application of PHP in web designing.

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.
Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

Build a website for organizing an International Conference. The conference website must be able to collect the author's details and upload a file.

Targeted Application & Tools that can be used: Xampp web server to be used to demonstrate PHP.
Project work/Assignment:

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

Textbook(s):

1. Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 9th Edition, 2016.
2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.
3]CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)
4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson Education, 2021.

Reference Book(s):

R1. Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.

R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.

Additional web-based resources

W1. W3schools.com
W2. Developer.mozilla.org/en-US/docs/Learn
W3. docs.microsoft.com
W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking
https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION":

1. Web, WWW, Web browsers, Web servers, Internet.
2. CSS, PHP.
3. Designing the website for healthcare.

The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.

Course Code: CCS2502	**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**

Topics

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

Assignment:

Module 2	**Cyber Threats**	Assignment	Programming Task	**8 Sessions**

Topics:

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

Assignment:

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

Topics:

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

Assignment:

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

Topics:

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

Assignment:

Text Books

T1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives" ,Wiley India Pvt Ltd,2013
T2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
T3. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

References

R1. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons,2018
R2. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond", NCC Group, 2014
R3. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier) - 978-1-59749-592-9

Weblinks:

https://www.coursera.org/learn/cloud-security-basics
https://www.imperva.com/learn/application-security/cyber-security-threats/
https://presiuniv.knimbus.com/user#/home

Topics relevant to "SKILL DEVELOPMENT":

Cyber threats in IoT and Cloud Computing for **skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CCS2506	**Course Title: Intrusion Detection and Prevention System** **Type of Course:1] Program Core** **2] Theory Only**	**L- T- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Fundamental knowledge in Operating Systems, Information Security and Networks					
Anti-requisites	**NIL**					
Course Description	Objective of the course is to Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems and Analyze intrusion detection alerts and logs to distinguish attack types from false alarms.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Intrusion Detection and Prevention System** and attain **Skill Development** through **Participative Learning** techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: • Understand about the intruders. • Define intrusion detection and prevention policies • Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets. • Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.					
Course Content:						
Module 1	**Introduction to Intrusion Detection and Prevention System**	Assignment		Programming Task		**10 Sessions**
Topics Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anomaly detection – specification based detection – hybrid detection. Internal and external threats to data, Need and types of IDS, Information sources,Host based information sources, Network based information sources.						

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

Topics:

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

Assignment: Applying Intrusion detection in security applications.

Topics:

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

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

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

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

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

Textbooks

T1. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
T2. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

References

R1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition,
Prentice Hall , 2003.
R2. Christopher Kruegel, Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
R3. Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall , 2001.

Weblinks: https://www.youtube.com/watch?v=RYB4cG8G2xo https://www.coursera.org/lecture/detecting-cyber-attacks/intrusion-detection-systems-UeDqJ
Topics relevant to "SKILL DEVELOPMENT": Agent development for intrusion detection for Skill Development through **Participative Learning techniques**. This is attained through assessment component mentioned in course handout.

Course Code: CCS2507	Course Title: Web Security Type of Course: Theory course	L- T-P- C	2	0	0	2
Version No.	1.0					
Course Pre-requisites	Data Communication and Computer Networks (CSE3011)					
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web encryption.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. **Define** the **fundamentals** of Web applications and validation. (Remember) 2. **Recognize** the significance of password and authentication in web applications. (Understand) 3. **Explain** the importance of session management in web. (Understand) 4. **Apply** web attack techniques to find vulnerabilities in web applications. (Apply)					
Course Content:						
Module 1	Introduction to Web Security	Quiz	Knowledge		08 Sessions	

Topics: Web Functionality, Encoding Schemes, Mapping the Application - Enumerating the Content and Functionality, Analyzing the Application Bypassing, Client-Side Controls: Transmitting Data Via the Client, Capturing User Data, Handling Client-Side Data Securely - Input Validation, Blacklist Validation, Whitelist Validation. **The Defense in-Depth Approach - Attack Surface Reduction, Rules of Thumb, Classifying and Prioritizing Threats.**					
Module 2	**Web Application Authentication**	Assignments	Comprehension		**08 Sessions**
Topics: Authentication Fundamentals- Two Factor and Three Factor Authentication - Password Based, Built-in, HTTP, Single Sign-on Custom Authentication- Secured Password Based Authentication: Attacks againstPassword, Importance of Password Complexity, Design Flaws in Authentication Mechanisms - Implementation, Flaws in Authentication Mechanisms - Securing Authentication.					
Module 3	**Session Management &Web Security Principles**	Quiz	Comprehension		**08 Sessions**
Topics: Need for Session Management, Weaknesses in Session Token Generation, Weaknesses in Session Token Handling, Securing Session Management; Access Control: Access Control Overview, Common Vulnerabilities, Attacking Access Controls, Securing Access Control. Origin Policy, Exceptions, Browser security Principles- Cross Site Scripting and Cross Site Request Forgery, File Security Principles: Source Code Security, Forceful Browsing, Directory Traversals.					
Module 4	**Web Application Vulnerability**	Assignment	Application		**06 Sessions**
Topics: Attacking data-stores and backend components- Injecting into Interpreted Contexts, injecting into SQL, NoSQL, XPath, LDAP, Injecting OS Commands, Manipulating File Paths, Injecting into XML Interpreters, Injecting into Back-end HTTP Requests, Injecting into Mail Services, Attacking application logic-real world logic flaws, Attacking users-Cross site scripting-varieties of XSS,XSS attacks in action, finding and exploiting XSS vulnerabilities, preventing XSS attacks, Other techniques-cookie based Attacks, HTTP Header Injection					
Textbook(s): T1. **Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook", Willey Publishing Inc. ,2008**					

References:

R1. B. Sullivan, V. Liu, and M. Howard, *"Web Application Security"*, A B Guide. New York: McGraw-Hill Education, 2011.

R2. *Web Application Security:* Exploitation and Countermeasure for Modern Web Applications, byAndrew Hoffman.

E-book Links

T1: https://www.oreilly.com/library/view/web-application-security/9780071776165/

T2: https://www.oreilly.com/library/view/web-application-security/9781492053101/

Web links-

1. **NPTEL course** : Introduction to Information Security I, IIT Madras https://nptel.ac.in/courses/106106129
2. **Coursera Link** : https://www.coursera.org/learn/security-and-authentication

Topics related to development of "Skills":

Web technology fundamentals, web security measures and webvulnerability/attacks.

Topics related to development of "Experimental Learning":

Writing different web exploits to demonstrate vulnerabilities in web applications.

Course Code: CCS2508	Course Title: Web Security Lab Type of Course: Lab Course	L- T-P- C	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Data Communication and Computer Networks					
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web					

		encryption.
Course Objective		The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.
Course Outcomes		On successful completion of this course the students shall be able to: 5. **Define** the **fundamentals** of Web applications and validation. (Remember) 6. **Recognize** the significance of password and authentication in web applications. (Understand) 7. **Explain** the importance of session management in web. (Understand) 8. **Apply** web attack techniques to find vulnerabilities in web applications. (Apply)
Course Content:		

List of Laboratory Tasks:

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

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

Use the **Nessus tool** to scan the network for vulnerabilities.

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

Level 1: Identification of vulnerabilities

Level 2: Apply the concept

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

HTTP and setting up stacks

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

Various types of databases Access Controls

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

Vulnerability: Study and work with KF Sensor

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

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

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

STEP-4: Click Next to setup wizard.

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

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

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

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

Level 1: Identification of vulnerabilities
Level 2: Apply the concept

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

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

Level 1: Install the tools required

Level 2: Apply the concept

4. Testing web applications

Study and work with Word press tool

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

Level 1: Define the test cases

Level 2: Apply the concept to test the web application

5. SQL injection and prevention

From the given data set ,

i. Put limits on all result sets
ii. Cleanse and Validate Freeform User Input
iii. Remove Freeform User Input When Possible
iv. Validate Data Prior to Processing
v. Ensure Errors are Not User-Facing
vi. Use Stored Procedures to Abstract Business Logic and Control parameters
vii. Use LIKE Operators Carefully
viii. Limit Use of xp_cmdshell and Other Extended Stored Procedures
ix. Perform Penetration Tests
x. Code Review
xi. Minimizing the Impact of SQL Injection
xii. Principle of Least Privilege & Login Security
xiii. Secure Linked Servers and Data Sources

Level 1: Recognize and acquire the data

Level 2: Apply the concept

6. Cross site request forgery attack lab

With the usage of Virtual Machines

i. Configure the Virtual Machines:
ii. Observing HTTP Request in Victim VM
iii. CSRF Attack using GET Request
iv. CSRF Attack using POST Request
v. Implementing a countermeasure

Level 1: Identify and acquire the data

Level 2: Apply the concept

7. Web tracking

Tracking the Web based scenario by

- Environment Configuration
- clear history and cookies
- open a new private window in Firefox

Task 1: Understand the basic working of the web tracking

Task 2: Importance of cookie in Web tracking

Task 3: Tracked user interests and data

	Task 4: How ads are displayed in a website Task 5: Tracking in a Private browser window Task 6: Real world tracking Task 7: Countermeasures Level 1: Identify and acquire the data logs Level 2: Apply the concept
	Targeted Application & Tools that can be used: **(1)** Word press tool can be used for building websites with possible vulnerabilities. **(2)** Tools such as Nmap and Nessus can be used for web attack demonstration. **(3)** KF Sensor advanced 'honeypot' intrusion and insider threat detection system for Windows networks **(4)** Snort can be used for network intrusion detection system and intrusion prevention system **(5)** Net Stumbler tool for Windows that facilitates detection of Wireless LANs using the 802.11b, 802.11a and 802.11g WLAN standards.
	Textbook(s): T1. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook", Willey Publishing Inc. ,2008

Course Code: CSE2506	**Course Title: Cloud Computing** **Type of Course: Theory**	**L- T-P- C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	**Data Communication and Computer Networks (CSE2011)**					
Anti-requisites	Nil					
Course Description	Cloud Computing provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **CLOUD COMPUTING** and is designed to improve the learners' **SKILL DEVELOPMENT** through **PARTICIPATIVE LEARNING TECHNIQUES.**					

Course Out Comes	On successful completion of the course the students shall be able to: 1. Describe the fundamental components and layers of Cloud Computing Architecture. [Remember] 2. Identify appropriate Virtualization techniques to virtualize infrastructures [Understand] 3. Summarize various Cloud mechanisms to optimize the QoS parameters [Understand] 4. Apply cloud platforms to develop various applications [Apply]				
Course Content:					
Module 1	**Introduction to Cloud services**	Assignment	Theory		**L: 10**
Evolution of cloud computing, Computing Platforms and Technologies, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, Cloud Computing Environments. [Understanding]					
Module 2	**Virtualization Techniques**	Assignment	Theory		**L: 10**
Basics of Virtualization - Types of Virtualizations, Taxonomy of Virtualization Techniques, Implementation Levels of Virtualization. [Understanding]					
Module 3	**Cloud QoS and Management**	Assignment	Theory		**L: 10**
Cloud Infrastructure Mechanisms- Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Ready-Made Environment, SLAs, Specialized Cloud Mechanisms- Automated Scaling Listener, Load Balancer, SLA Monitor, Pay-Per-Use Monitor, Audit Monitor, Cloud Security Mechanisms. [Understanding]					
Module 4	**Cloud Application development in Cloud**	Assignment	Theory		**L: 10**
Programming Models for Cloud Computing – MapReduce, CGL Mapreduce, Cloud Haskell, Development environments for service development (Demonstration using AWS Cloud/Saturn Cloud); Dockers and Containers. [Apply]					
Targeted Application & Tools that can be used : **Applications:** Cloud Platform, Use of cloud technology in different applications like healthcare, agriculture etc. **Tools:** 1. Google App Engine 2. AWS, Saturn Cloud etc.					
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course • **Students can design and implement dynamic resource allocation for virtual machine using cloud computing environment.** • **Design and Implementation of a Scalable Cloud-Based Data Storage System** • **Development of a Multi-Cloud Management Platform**					

Text Book 1. **Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013 edition.** 2. **John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press, 2010 edition.**
References 1. **Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", PHI publisher 2013 edition.** 2. **K. Chandrasekaran, "Essentials of CLOUD COMPUTING", CRC Press, 2015 edition.** 3. **David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press, 2018 edition.** 4. **Manvi, Sunilkumar, and Gopal K. Shyam. "Cloud Computing: Concepts and Technologies". CRC Press, 2021.** **Web Based Resources and E-books:** **W1. IEEE Transactions on Cloud Computing-** **https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519 W2. International Journal of Cloud Computing- https://www.inderscience.com/jhome.php?jcode=ijcc** **W3. CloudSim Resources** **https://javadoc.io/doc/org.cloudsimplus/cloudsim-plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html** **W4. Journal of Network and Computer Networking- https://www.journals.elsevier.com/journal-of-network-and-computer- applications**
Topics relevant to "Skill Development": AWS, Azure, APIs, Aneka Cloud Platform, Virtualization, Cloud Platforms in Industry, EC2, Installation of VM Workstation, Cloud Infrastructure and Challenges for Skill Development through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Course Code: CSE2507	**Course Title: Cloud Computing Lab**	**L- T-P- C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	**Data Communication and Computer Networks (CSE2011)**					
Anti-requisites	Nil					

Course Description	Cloud Computing provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **CLOUD COMPUTING** and is designed to improve the learners' **SKILL DEVELOPMENT** through **PARTICIPATIVE LEARNING TECHNIQUES.**
Course Content:	

Targeted Application & Tools that can be used :

Applications:

Cloud Platform, Use of cloud technology in different applications like healthcare, agriculture etc.

Tools:

1. Google App Engine
2. AWS, Saturn Cloud etc.

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

- **Students can design and implement dynamic resource allocation for virtual machine using cloud computing environment.**
- **Design and Implementation of a Scalable Cloud-Based Data Storage System**
- **Development of a Multi-Cloud Management Platform**

List of Laboratory Tasks:

Experiments:

1. **Create a simple cloud software application and provide it as a service using any Cloud Service Provider to demonstrate Software as a Service (SaaS).**
2. **Create a Virtual Machine with 1 vCPU, 2GB RAM and 15GB storage disk using a Type 2 Virtualization Software**
3. **Create a Virtual Hard Disk and allocate the storage using VM ware Workstation**
4. **Create a Snapshot and Cloning of a VM and Test it by loading the Previous Version/Cloned VM**
5. **Demonstrate Infrastructure as a Service (IaaS) by Creating a Virtual Machine using a Public Cloud Service Provider (Azure/GCP/AWS), configure with minimum CPU, RAM, and Storage and Launch the VM image.**
6. **Create a Simple Web Application using Java or Python and host it in any Public Cloud Service Provider (Azure/GCP/AWS) to demonstrate Platform as a Service (PaaS)**
7. **Create a Storage service using any Public Cloud Service Provider (Azure/GCP/AWS) and check the public accessibility of the stored file to demonstrate Storage as a Service**
8. **Create a SQL storage service and perform a basic query using any Public Cloud Service Provider (Azure/GCP/AWS) to demonstrate Database as a Service (DaaS)**
9. **Perform the basic configuration setup for Installing Hadoop 2.x like Creating the HDUSER and SSH localhost**
10. **Install Hadoop 2.x and configure the Name Node and Data Node.**
11. **Launch the Hadoop 2.x and perform MapReduce Program for a Word Count problem**

Text Book 3. **Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013 edition.** 4. **John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press, 2010 edition.**
References **Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", PHI publisher 2013 edition.** **K. Chandrasekaran, "Essentials of CLOUD COMPUTING", CRC Press, 2015 edition.** **David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press, 2018 edition.** **Manvi, Sunilkumar, and Gopal K. Shyam. "Cloud Computing: Concepts and Technologies". CRC Press, 2021.** **Web Based Resources and E-books:** **W1. IEEE Transactions on Cloud Computing-** **https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519 W2. International Journal of Cloud Computing- https://www.inderscience.com/jhome.php?jcode=ijcc** **W3. CloudSim Resources** **https://javadoc.io/doc/org.cloudsimplus/cloudsim-plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html** **W4. Journal of Network and Computer Networking- https://www.journals.elsevier.com/journal-of-network-and-computer- applications**
Topics relevant to "Skill Development": AWS, Azure, APIs, Aneka Cloud Platform, Virtualization, Cloud Platforms in Industry, EC2, Installation of VM Workstation, Cloud Infrastructure and Challenges for Skill Development through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Course Code: CCS2509	**Course Title:** Malware Analysis	**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 MalwareAnalysis and attain **Employability** through **Participative Learning** techniques.
Course OutComes	On successful completion of this course the students shall be able to: 1. Understanding the nature of malware, its capabilities, and how it is combatedthrough detection and classification. 2. Apply the methodologies and tools to perform static and dynamic analysis onunknown executables. 3. Analyze scientific and logical limitations on society's ability to combat malware.. 4. Apply techniques and concepts to unpack, extract, decrypt, or bypass new antianalysis techniques in future malware samples.
Course Content:	

Module 1	**Introduction to MALWARE ANALYSIS**		Assignment		Programming activity	**12 Hours**
Topics: Introduction to malware, OS security concepts, malware threats, evolution of malware, malware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis. **Assignment:** Brief study on types of spyware						
Module 2	**Static Analysis**		Assignment		Programming activity	**11 Hours**
Topics: X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture **Assignment:** Static analysis on malware (PeStudio & ProcMon)						
Module 3	**Dynamic Analysis**		Assignment		Programming activity	**11 Hours**
Topics: Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark **Assignment:** Demonstration of wireshark						
Module 4	**Malware Functionality and Detection Techniques**		Assignment		Programming activity	**12 Hours**

Topics: Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection. Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences **Assignment:** Packet malware signature
Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Any appropriate tool can be given to demonstrate.
Text Book 1. Michael Sikorski and Andrew Honig, 2012: " Practical Malware Analysis", No Starch Press. E-Resources **W1.** https://www.geeksforgeeks.org/introduction-to-malware-analysis/ **W2.** https://ine.com/learning/courses/malware-analysisW3: https://sm-nitk.vlabs.ac.in/
References 1. Jamie Butler and Greg Hoglund, 2005: "Rootkits: Subverting the Windows Kernel", Addison-Wesley. 2. Dang, Gazet and Bachaalany, 2014: "Practical Reverse Engineering",Wiley. 3. Reverend Bill Blunden, 2012: "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of theSystem" Second Edition,Jones& Bartlett.
Topics relevant to "EMPLOYABILITY SKILLS": X86 Architecture, Packet Sniffing, Wireshark, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSEXXXX	**Course Title: Internet of Things** **Type of Course: Integrated**	**L- T-P- C**	1	0	4	3
Version No.	2.0					
Course Pre-requisites	1. Students should know basic python programming. 2. Students have basic knowledge basic electronic components such as sensors – temperature, motion, pressure, and actuators etc. 3. Students should have basic idea about Cloud and its uses.					
Anti-requisites	NIL					

<table>
<tr><td>Course Description</td><td colspan="4">The Internet of Things (IoT) is an emerging paradigm combining heterogeneous devices at an unprecedented scale, thereby enabling individuals and organizations to gain greater value from networked connections among people, processes, data, and things. The Internet of Things (IoT) is a course of objects interacting with people, with information systems, and with other objects. The course will focus on creative thinking, IoT concepts & IoT technologies.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Internet of Things and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:
1. Identify the application areas of IoT
2. Understand building blocks of Internet of Things and characteristics
3. Describe IoT Protocols
4. Demonstrate use of IoT devices for simple application</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>INTRODUCTION TO INTERNET OF THINGS</td><td>Assignment</td><td>Simulation/Data Analysis</td><td>18 Sessions</td></tr>
<tr><td colspan="5">Introduction, Definition & Characteristics of IOT, Physical Design of IoT- Things in IoT, IoT Protocols, Logical design of IoT- IoT functional blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies- Wireless sensor networks, Cloud computing, Big data Analytics</td></tr>
<tr><td>Module 2</td><td>IOT COMMUNICATION MODEL AND PROTOCOLS</td><td>Assignment</td><td>Numerical from E-Resources</td><td>18 Sessions</td></tr>
<tr><td colspan="5">Connectivity Protocols: 6LoWPAN, IEEE 802.15.4, Zigbee, Wireless HART, Z-Wave, ISA 100,NFC, RFID. Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (CoAP), Advanced Message Queuing Protocol (AMQP), XMPP – Extensible Messaging and Presence Protocol</td></tr>
<tr><td>Module 3</td><td>IOT COMMUNICATION MODEL AND PROTOCOLS</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>19 Sessions</td></tr>
<tr><td colspan="5">Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (CoAP), Advanced Message Queuing Protocol (AMQP), XMPP – Extensible Messaging and Presence Protocol. RFID: Introduction, Principle of RFID, Components of an RFID system.</td></tr>
<tr><td colspan="5">List of Laboratory Tasks
1 Installation of arduino IDE & Arduino program to implement scrolling LED, to glow even/odd LED
2 Arduino program to demonstrate usage of push button to control the LED
3 Arduino program to demonstrates traffic control system
4 Arduino program to demonstrates usage of servo motor with potentio meter.
5.Arduino program to Control an LED using Bluetooth.
6.Arduino program to implement RFID reader for security access.
7. Arduino Program to detect obstacle using IR sensor.
8.Arduino Program to detect motion using PIR sensor.
9.Installation of Raspberry pi software
10. Working basic commands on Raspberry pi & to demonstrate remote logging in raspberry pi
11.Raspberry pi program to implement blinking LED
12. Raspberry pi program to implement camera module for video
13. Raspberry pi program to obtain the temperature using DHT sensors
14.Using a Raspberry Pi with distance sensor (ultrasonic sensor HCSR04)</td></tr>
</table>

15. Raspberry pi program to implement Garage spot light
Targeted Application & Tools that can be used: **Interfacing of ARDUINO and Raspberry pi for developing smart CITIES** **Tools:** Tinker cad Cooja simulator Contiki Thingspeak
Text Book T1 Arshdeep Bagha, Vijay Madisetti, Internet of Things A hands on approach, First Edition, Universities Press, 2018 T2 Hakima Chaouchi, The internet of Things Connecting Objects to web Wiley 2017
References R1 Vinit Kumar Gunjan, MohdDilshad Ansari,Mohammed Usman, ThiDieuLinh Nguyen Internet of Things Technology, Communications and Computing Springer January 2023 R2 Dr. Hassan Internet of Things A to Z: Technologies and Applications IEEE Press 2018 **E-Resources** NPTEL course – a) https://onlinecourses.nptel.ac.in/noc22_cs53/preview b) https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/ c) https://puniversity.informaticsglobal.com:2229/login.aspx
Topics relevant to "SKILL DEVELOPMENT": Case studies of water supply projects – Design criteria through group discussion. Interpolation of sensors through group presentation for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3132	**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**
Topics: 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. 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.				
Module 3	Remote Monitoring	Quiz	Case studies / Case let	**14 Sessions**
Topics: RMON : What is Remote Monitoring? ,RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON 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.				
Module 4	NETWORK MANAGEMENT TOOLS AND SYSTEMS	Quiz	Case studies / Case let	**14 Sessions**
Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management, Enterprise Management Solutions.				
Module 5	WEB-BASED MANAGEMENT	Quiz	Case studies / Case let	**14 Sessions**
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.				
Targeted Application & Tools that can be used: Kiwi CatTools, SolarWinds Network Configuration Manager.				
Project work/Assignment:				

Assignment: Simulation of NMS using any of the tools mentioned above.
Text Book **T1.** Mani Subrahmanian, "Network Management Principles and Practice", 2nd Edition, Pearson Education, 2010.
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 **E book link R2.** https://documentation.solarwinds.com/ **E book link R3.** https://www.youtube.com/watch?v=liBB_Q7Go5k **NPTEL 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: CSE 2058	**Course Title: Firewall and Internet security** **Type of Course: Integrated**	**L- T-P- C**	2-0-2-3
Version No.	1		
Course Pre-requisites	Computer Networks		
Anti-requisites			
Course Description	This course provides an in-depth study of various network attacks techniques and methods to defend against them. A number of threats and vulnerabilities of the Internet will be covered, including various vulnerabilities of TCP/IP protocols, denial of service (DOS), attacks on routing, attacks on DNS servers, TCP session hijacking, and so on. This course will also cover defending mechanisms, including intrusion detection, firewalls, tracing the source of attacks, anonymous communication, IPsec, virtual private network, and PKI. To make it easy for students to understand these attacks, basics of the TCP/IP protocols will also be covered in the course.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Firewall and Internet security** and attain **Skill Development** through **Problem Solving** Methodologies.		
Course Out Comes	**On successful completion of the course the students shall be able to:** • To identify elements of firewall design, types of security threats and responses to security attacks. • Examine security incident postmortem reporting and ongoing network security activities. • Construct code for authentication algorithms. • Develop a signature scheme using Digital signature standard. • Demonstrate the network security system using open source tools		

Course Content:				
Module 1	Introduction to Firewall	Assignment	Data Collection/Interpretation	**12 Sessions**
Introduction of Firewall in computer network,Categories of firewall,How firewall works,Types of firewall, Firewall location and Configuration,Firewall Policies,Firewall Biasing,Network Architecture,Net masks,Packet filters,Stateful firewalls,Resources				
Module 2	**Computer security**	Case studies / Case let	Case studies / Case let	**12 Sessions**
Topics: Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH)				
Module 3	**Network Security**	Quiz	Case studies / Case let	**10 Sessions**
Topics: Overview of Network Security:Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures.				
Module 4	Cyber laws and Compliance Standards	Quiz	Case studies / Case let	**11 Sessions**
Topics: Kerberos:Working ,ASS,TGS,SS-Internet security protocols-AH,ESP,Models-Transport and tunnel-Email security,Public key Infrasturcture,Certificates,certificates authority.Cyber Crime: Introduction,Hacking,Digital forgery,Cyber Stalking,Identify theft and Fraud,Cyber terrorism,Cyber defamation,Crime against individual,Government,Property.				

List of Laboratory Tasks:

1. Perform encryption, decryption using the following substitution techniques
(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME – Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
11. 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:

1. https://networklessons.com/cisco/asa-firewall
2. https://www.udemy.com/course/cisco-asa-firewall-lab-guide
3. 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: **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	On successful completion of this course the students shall be able to: 1. **Describe** fundamentals of cloud computing [**Knowledge].** 2. **Explain** cloud computing security architecture and associated challenges **[Comprehension].** 3. **Discuss** cloud computing software security essentials **[Comprehension].** 4. **Apply** infrastructure security and data security in cloud computing enviroment. **[Application].**			
Course Content:				
Module 1:	**Fundamentals of Cloud Computing**	**Quiz**	Knowledge based Quiz	**10 Sessions**
Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.				
Module 2:	**Cloud Security Challenges and Cloud Security Architecture**	**Quiz**	Comprehension based Quiz	**10 Sessions**
Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security**.**				
Module 3	**Cloud Computing Software Security Essentials**	**Assignment**	Batch-wise Assignments	**9 Sessions**
Topics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software Requirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.				
Module 4:	**Infrastructure Security and Data Security**	Assignment and Presentation	Batch-wise Assignment and Presentations	**9 Sessions**
Topics: Infrastructure Security: The Network Level, The Host Level, The Application Level. **Data Security :** Aspects of Data Security, Data Security Mitigation, Provider Data and its Security.				
Targeted Application & Tools that can be used: Use of CloudSim simulator.				
Project work/Assignment: **Survey on Cloud Service Providers**				
Text Book 1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "*Mastering Cloud Computing*", McGraw Hill Education, July 2017. 2. Roland L Krutz and Russell Dean Vines, "*Cloud Security - A Comprehensive Guide to Secure Cloud Computing*", Wiley Publishing, Inc. 2010.				

References

1. Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, "*Secure Cloud Computing*", Springer, ISBN 978-1-4614-9278-8 (eBook).
2. John Rittinghouse and James Ransome, "*Cloud Computing, Implementation, Management and Security*", CRC Press, 2010.
3. Tim Mather, Subra Kumaraswamy and Shahed Latif", "Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance", Oreily Publication, 2009.

WEB RESOURCES:

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

Topics relevant to "EMPLOYABILITY SKILLS": Cloud computing architecture, Security policy implementation, Infrastructure security and Data security **for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Course Code: CCS3406	**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			
Anti-requisites	**NIL**		
Course Description	This course is designed to improve the learners 'Skill Development' by using modeling, optimizing, and risk management approach. The course objective is to get familiar with the Cyber digital twin-working principal, Development considerations, Data-Modelling Environment, Digital Twin Optimization, Risk Management and Applications.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Cyber Digital Twin** and attain **Employability** through **Participative Learning** techniques.		
Course Out Comes	On successful completion of the course the students shall be able to: 1. Understand the basic concepts of Cyber Digital twin, and its working principle. **[KNOWLEDGE]** 2. Explain Data modeling and development consideration in digital twin model for cloud and IoT technology.**[COMPREHENSION]** 3. Observe digital twin-human behavior modeling in digital twin-optimization **[COMPREHENSION]** 4. Show Risk Assessment-Digital twin reference model-Implementation. **[APPLICATION]** 5. Apply Digital twin in various area like Manufacturing, Automotive and Healthcare.**[APPLICATION]**		
Course Content:			

Module 1	Introduction	Assignment	Theory	**No. of Classes:09**
Introduction- Cyber Digital twin-definition-uses and benefits-need for digital twin-working principal Technology Digital thread-digital shadow-building blocks of digital twin-digital twin technology drivers and enablers.				
Module 2	Data Modelling Environment	Assignment	Theory	**No. of Classes:10**
Types of digital twin-Based on Product and Process-Based on Functionality-Based on Maturity. Development considerations-Overview of Data-Modelling Environment. Modelling-model and data management-Managing data-implementing the model- Cloud and IOT technologies.				
Module 3	Digital Twin Optimization	Assignment	Theory	**No. of Classes:10**
Cyber range vs digital twin-human behavior modeling in digital twin-optimization using digital twin-digital twin and cyber security-Techniques. Technologies-Industrial IOT and Digital Twin-simulation and digital twin-Machine learning and digital twin-virtual reality and digital twin-cloud technology and digital twin.				
Module 4	Risk Management and Applications	Assignment	Case Study	**No. of Classes:10**
Digital twin and Risk Assessment-Digital twin reference model-Implementation-Development of risk assessment plan-Development of communication and control system-Development of digital twin tools-Integration-platform validation-Difficulties-Practical implications. Applications: Digital Twin in Manufacturing-Digital Twin in Automotive-Digital Twin in Healthcare-Digital Twin in Utilities-Digital Twin in Construction				
Targeted Application & Tools that can be used: **Ansys Twin Builder** is a powerful solution for building, validation and deploying simulation-based systems and digital twins: Build, validate, and deploy digital twins. Digital twin models integrate real-world data. Increase efficiency with digital twins.				
Project work/Assignment:				
Project Assignment:				
Text Book 1. 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. 2. 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 1. Michael E. AuerKalyan Ram B. Digital," Cyber-physical System and Digital Twins - Part of the Lecture Notes in Networks and Systems book series". 2. Nassim Khaed, Bibin Pattel and Affan Siddiqui," Development and Deployment on the Cloud", Elsevier, 2020.				
Weblinks:				

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

Course Content:				
Module 1	**Introduction to Digital Health and Digital Image**	Assignment	Theory	**L : 8**
Introduction to Digital Health Overview of digital health and its impact on healthcare, Introduction to telemedicine, wearables, and health monitoring devices, Ethical and legal considerations in digital health. **Digital Image Processing Fundamentals:** Digital image representation and properties, Image enhancement techniques, Image filtering and restoration, Image segmentation and feature extraction				
Module 2	Medical Imaging Modalities	Assignment	Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions	**L: 10**
Medical Imaging Modalities: Principles and applications of various medical imaging modalities. X-ray imaging, computed tomography (CT), and magnetic resonance imaging (MRI) , Ultrasound imaging and nuclear medicine imaging, Imaging modalities for specific healthcare domains (e.g., radiology, cardiology)				
Module 3	**Image Analysis in Healthcare**	Assignment /Quiz	Researching and reviewing academic papers or industry publications on specific AI applications	**L:12**
Image registration and fusion techniques, Quantitative image analysis for disease diagnosis and treatment planning, Computer-aided detection and diagnosis in medical imaging, Machine learning in medical image analysis. Health Informatics and Electronic Health Records, Introduction to health informatics and electronic health records (EHR), EHR systems and interoperability, Data privacy, security, and regulatory considerations in health informatics.				
Module 4	**Digital Health Applications and Innovations**	Assignment	Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.	**L: 10**
Mobile health (mHealth) applications and remote patient monitoring, Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health. Emerging technologies and trends in digital health.				
Targeted Application & Tools that can be used: **Applications:** Quantitative image analysis for disease diagnosis, Mobile health (mHealth **Tools:** TensorFlow, PyTorch, Computer-aided detection				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Assignments can involve researching and reviewing academic papers or industry publications on specific AI applications in engineering / Students may be given programming assignments to				

implement AI algorithms / Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions / Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.
Text Book 1. "Digital Health: Scaling Healthcare to the World" by Paul Sonnier-2020 2. Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods 3. "Biomedical Signal and Image Processing" by Kayvan Najarian and Robert Splinter
References 1. Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley , 2021.. 2. "Introduction to Health Informatics" by Mark S. Braunstein 3. https://talentsprint.com/course/ai-digital-health 4. https://www.udemy.com/topic/medical-imaging/
Topics relevant to "EMPLOYABILITY SKILLS": Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health **for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**

Course Code: CCS2509	**Course Title:** Malware Analysis	**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: 1. Understanding the nature of malware, its capabilities, and how it is combated through detection and classification. 2. Apply the methodologies and tools to perform static and dynamic analysis on unknown executables. 3. Analyze scientific and logical limitations on society's ability to combat malware..		

	4. Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti analysis techniques in future malware samples.				
Course Content:					
Module 1	**Introduction to MALWARE ANALYSIS**		Assignment	Programming activity	**12 Hours**
Topics: Introduction to malware, OS security concepts, malware threats, evolution of malware, malware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis. **Assignment:** Brief study on types of spyware					
Module 2	**Static Analysis**		Assignment	Programming activity	**11 Hours**
Topics: X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture **Assignment:** Static analysis on malware (PeStudio & ProcMon)					
Module 3	**Dynamic Analysis**		Assignment	Programming activity	**11 Hours**
Topics: Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark **Assignment:** Demonstration of wireshark					
Module 4	**Malware Functionality and Detection Techniques**		Assignment	Programming activity	**12 Hours**
Topics: Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection. Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences **Assignment:** Packet malware signature					
Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)					
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course					

Any appropriate tool can be given to demonstrate.
Text Book 1. Michael Sikorski and Andrew Honig, 2012: " Practical Malware Analysis", No Starch Press. E-Resources **W1.** https://www.geeksforgeeks.org/introduction-to-malware-analysis/ **W2.** https://ine.com/learning/courses/malware-analysis W3: https://sm-nitk.vlabs.ac.in/
References 1. Jamie Butler and Greg Hoglund, 2005: "Rootkits: Subverting the Windows Kernel", Addison-Wesley. 2. Dang, Gazet and Bachaalany, 2014: "Practical Reverse Engineering",Wiley. 3. Reverend Bill Blunden, 2012: "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition,Jones& Bartlett.
Topics relevant to "EMPLOYABILITY SKILLS": X86 Architecture, Packet Sniffing, Wireshark, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: **CIT2502**	**Course Title: Privacy and Security in IoT** **Type of Course: Program Core & Theory only**	**L- P- C**	3	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:** 1. **Explain** benefits of modern cryptographic algorithms 2. **Apply** the Elliptic curve Diffie Hellman and digital signature algorithms to encrypt-decrypt , generate and verify the signatures				

	3. **Estimate** the performance of ECC with other traditional cryptography algorithms.			
Course Content:				
Module 1	**Introduction to Elliptic Curves**	Quiz	Comprehension based Quizzes and assignments;	**15 Classes**
Topics: **Elliptic Curve Cryptosystems (ECC):** Introduction to ECC, Method of Diophantus, Elliptic curves in Cryptography, Discrete Logarithms in Finite Fields, Elliptic Curve on a finite set of Integers, Definition of Elliptic curves,General form of a EC, Weierstrass Equation, Points on the Elliptic Curve (EC),The Abelian Group, Operations on ECC- Point addition, Point doubling.				
Module 2	**Elliptic Curve Cryptosystems**	Quizzes and assignments	Comprehension based Quizzes and assignments;	**15 Classes**
Topics: E**lliptic Curve Cryptosystems (ECC):** Public-Key Cryptosystems, Public-Key Cryptography, What Is Elliptic Curve Cryptography (ECC)?,Using Elliptic Curves In Cryptography, Generic Procedures of ECC, Example – Elliptic Curve Cryptosystem Analog to El Gamal, Diffie-Hellman (DH) Key Exchange, ECC Diffie-Hellman, Example – Elliptic Curve Diffie-Hellman Exchange, Elliptic Curve Digital Signature Algorithm (ECDSA) Why use ECC?, Security of ECC, Applications of ECC, Benefits of ECC.				
Module 3	IOT Protocols	Assignment and Lab projects with presentation	Project implementations in software, batch wise presentations	**10 Classes**
Topics: **IoT Communication model and Protocols :** Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (COAP), Advanced Message Queuing Protocol (AMQP), Extensible Messaging and Presence Protocol (XMPP), Introduction, Principle of RFID, Components of an RFID system.				
Targeted Application & Tools that can be used: **Application areas are to secure crypto currency- Bitcoin, Ethereum and Ripple using ECC in key agreement, digital signatures.** **Professionally Used Software:** elliptic2 : https://www.graui.de/code/elliptic2/				
Project work/Assignment:				
Each batch of students (self-selected batch mates) will identify projects from searching on Google, and implement with the most suitable 2 or 3 NIST /SECP curves **Project Assignment:** **Assignment: 1] Collect the running time of ECC on different standard NIST curves.** **Assignment 2: Prepare a compressive report on the efficiency of NIST Vs SECP curves.**				
Textbook(s): 1. **I. Blake, G. Seroussi, N. Smart, Elliptic Curves in Cryptography , Cambridge University 2020** 2. **Arshdeep Bagha, Vijay Madisetti, "Internet of Things - A hands on approach", Universities Press, 2021.**				
References				

1. **Joseph H Silver man The Arithmetic of Elliptic Curves: Springer; 2nd Edition April 2016** 2. **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: CCS3408	**Course Title: Privacy and Security in Online Social Media**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**Basic of Network security and cryptography.**					
Anti-requisites	**NIL**					
Course Description	Objective of this course is to make students learn the basics of privacy and security in online social media and develop ability to understand the importance of privacy in anyone's life and their consequences if it is in peril. This course is both conceptual and analytical in nature that would help the student to predict the effects of any activity on Social Media. The students should have prior knowledge of some Social media platforms. After successful completion of the Course, the students would acquire knowledge to protect themselves from the online data theft on social media from attacker.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Privacy and Security in Online Social Media** and attain **Employability** through **Participative Learning** techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Recognize the significance of the Privacy and how to protect it **[Knowledge]** 2] Summarize the privacy and security Encryption for Peer to Peer Social Networks. **[Comprehension]** 3] Understand the function of stealing Reality and K-Anonymity. **[Knowledge]** 4]Use the Link Reconstruction attack in privacy Social Networks. **[Application]**					
Course Content:						
Module 1	ANALYSIS OF PRIVACY IN SOCIAL NETWORKS	Assignment	Knowledge			**8 Sessions**
Topics: Three-Layered Framework-Characteristics Used to Analyze Social Web Privacy-Privacy Issues Related to Social Web Users-Privacy Issues Related to Service Providers-Security and Privacy for Digital Facets-Identifiable Facets-Private Facets. **Assignment:** Find real world problems and suggest solutions.						

Module 2	ENCRYPTION FOR PEER-TO-PEER SOCIAL NETWORKS	Assignment	Comprehension	**8 Sessions**
Topics: Essential Criteria for the P2P Encryption Systems-Existing P2P OSN Architectures-Evaluations of Existing Encryption Schemes Based on Our Criteria-Broadcast Encryption-Predicate Encryption. **Assignment: -** Survey of Unethical Behavior and Influencing factors.				
Module 3	STEALING REALITY AND K-ANONYMITY	Quiz	Comprehension	**11 Sessions**
Topics: Stealing Reality- Social Attack Model- Social Learnability- k-Anonymity- k-Degree Anonymity- k-Neighborhood Anonymity- k- Automorphism- k-Isomorphism-L-diversity- Attack Model and Privacy Guarantee-Insights from an ℓ-Diversified Graph.				
Module 4	PRIVACY IN SOCIAL NETWORKS- LINKS RECONSTRUCTION ATTACK	Assignment/Case study	Application	**11 Sessions**
Privacy in Social Networks- Link Prediction- Feature Extraction- Communities Datasets- Electronic Currencies- Anonymity- The Bit coin System- The Transaction Network- The User Network- Anonymity Analysis- Integrating Off-Network Information. Use Case and the Threat Model- Use Case for Private Record Linkage- Use Case for Privacy-Preserving Record Linkage- **Assignment: -** The Bit coin Faucet- Voluntary Disclosures- TCP/IP Layer Information- Context Discovery- Flow and Temporal Analyses**.**				
Text Book / References T1. Yaniv Altshuler, Yuval Elovici, Armin B. Cremers Nadav Aharony, Alex Pentland," Security and Privacy in Social Networks", Springer Publisher,2012,1st Edition **Online Resources: -** W1: https://presiuniv.knimbus.com/user#/searchresult?searchId=Privacy%20and%20Security%20in%20Online%20Social%20Media%20&curPage=0&layout=list&sortFieldId=none&topresult=false W2: https://onlinecourses.nptel.ac.in/noc21_cs28/preview				
Topics relevant to "EMPLOYABILITY SKILLS": Link Prediction, features extraction, for developing Employability Skills through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.				

Course Code: CCS3400	**Course Title: Digital and Mobile Forensics** **Type of Course: Integrated**	**L- T-P- C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	**Data Communications and Computer Networks (CSE3155)**					
Anti-requisites	Nil					
Course Description	This course demonstrates the use of Mobile phones and digital devices across the globe has increased dramatically. These devices are more susceptible to information security attacks and thus they also possess huge evidences which shall be used during crime scene investigation. This makes the Course on mobile and digital forensics an inevitable one for the security professionals. This Course on mobile and digital forensics will provide a better understanding on different forms of evidences in many digital devices, collection and interpretation of the same. Topics include: Wireless technologies and security-wireless protocols, wireless threats, cell phones and GPS, SMS and data interception in GSM. Mobile phone forensics - files present in SIM card, device data, external memory dump, Android forensics. Digital forensics: - evaluating digital evidence, Digital forensics examination principles.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain EMPLOYABILITY SKILLS through PARTICIPATIVE Learning techniques					
Course Outcomes	On successful completion of this course the students shall be able to: CO 1: Outline the basic concepts of Cybercrime and digital Forensics. (Remember) CO 2: Employ various digital Forensic tools to perform Forensic investigation (Apply) CO 3: Interpret security challenges and Forensic examination process of wireless devices. (Understand) CO 4: Produce digital evidence through the usage of mobile device Forensic tools (Understand)					
Course Content:						
Module 1	Cybercrime and Digital Forensic Principles	Assignment	Cybercrime	Bloom's level selected: Remember	**13 Sessions - L[07] + P[06]**	
	Cybercrime: Definition, Nature and Scope of Cybercrime, Types of cybercrime, Categories of cybercrime, Investigating Cybercrime, Digital Evidence, Prevention of cybercrime, Case studies on Cyber Crimes. **Overview of Digital Forensics:** Phases of Digital Forensics, Digital devices in society, Evidential Potential of Digital Devices, closed and open systems.					
Module 2	Digital Forensics examination process	Case Studies	Digital Evidence	Bloom's level selected: Apply	**16 Sessions - L[08] + P[08]**	

	Language of Computer crime investigation, preparing a Digital Forensics Investigation, challenging aspects of digital evidence, presenting digital evidence, Device usage. **Digital forensics examination principles**: Previewing, Imaging, Continuity and hashing, Evidence locations, A seven-element security model.

Module 3	Wireless technologies and Wireless threats	Certification	GSM, Paraben's Cell Seizure	Bloom's level selected: Understand	**15 Sessions - L[07] +P[08]**

	Overview of Modern Wireless Technology: Wireless Crime Prevention Techniques, War-Driving, War-Chalking, War Flying, Voice SMS, GSM and Identification, Cell Phone Hacking and Phreaking, Cell Phone Forensics, Forensic Rules for Cellular Phones.

Module 4	Mobile phone Forensics	Presentation	Forensic Tools	Bloom's level selected: Understand	**16 Sessions - L[08]]+P[08]**

	Importance and Motivation behind Mobile Forensics, Mobile Phone Forensics: Crime and Mobile Phones, Evidence, Forensic Procedures of mobile phones, The SIM Card, Files Present in SIM Card, SMS Spam, Mobile Phone Forensics Tools and Methods, Social Media Forensics on Mobile Devices.
	Targeted Application & Tools that can be used: • Wireless Security • Digital Forensics • Android Forensics
	Textbooks: **T1:** Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 1st Edition, September 19, 2019.
	References: **R1:** Losif I. Androulidakis, "Mobile phone security and forensics: A practical approach", Springer publications, 2nd Edition, 2016. **R2:** Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 1st Edition, 15th June 2011. **R3:** Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, November 2008, p 180. **Web references:** https://presiuniv.knimbus.com/user#/home
	Topics relevant to "Employability": 1. Prevention of cybercrime 2. preparing a Digital Forensics Investigation 3. Mobile Phone Forensics: Crime and Mobile Phones. 4. Mobile Phone Forensics Tools for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CIT2503	**Course Title: Mobile Application for IoT** **Type of Course: Program Core& Theory Only**	**L-T-P-C**	3-0-0-3
Version No.	1.0		
Course Pre-requisites	**NIL**		
Anti-requisites	**NIL**		
Course Description	Mobile Application is the essential part for IoT infrastructure, which helps in understanding the architectural overview of IOT. The purpose of this course is to expose the students to understand the IoT Reference Architecture and Real World Design Constraints along with various IOT protocols. This course is both conceptual and analytical in nature that would help the student to predict the effects of forces and its motion while carrying out creative design functions.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Mobile and Application for IoT** and attain **Skill Development** through **Participative Learning** techniques.		
Course Out Comes	On successful completion of the course the students shall be able to: 1. Able to understand the application areas of IOT 2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks 3. Able to understand building blocks of Internet of Things and characteristics. 4. Learn about android application development		
Course Content:			

Module 1	Overview	Assignment	Programming Task	**9 Sessions**

Topics:

IoT-An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

Assignment: Case study on Business processes in IoT.

Module 2	Basic Design	Assignment	Data Collection/Excel	**10 Sessions**

Topics:

Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability.

Assignment: Recent trends In mobile application development

Module 3	IOT mobile apps	Assignment	Programming/Data analysis task	**9 Sessions**
Topics: IoT Mobile App Development Trends In 2020 - Role of Mobile Apps in revolutionizing the world of IoT - UX / UI design for IoT Mobile apps - challenges of UX/UI design for IoT applications - practice tips on design for IoT mobile apps IoT App Design Solutions **Assignment:** Challenges faced during mobile application development				
Module 4	TECHNOLOGY I-ANDROID	Assignment	Programming/Data analysis task	**10 Sessions**
Topics: Introduction Establishing the development environment Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment Interaction with server side applications Using Google Maps, GPS and Wifi Integration with social media applications.				
Targeted Protocols & Tools that can be used: Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread				
Text Book T1: "From machine to machine to the internet of things: Introduction to the new age of intelligence", 1st edition, Academic press, 2014. T2: Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012				
References R1: Bernd Scholz- -3-642-19156-5 e-ISBN 978-3- 642-19157-2, Springer R2: Andrea Goldsmith, "Android in practice," Cambridge University Press, 2005 **Weblinks:** W1: https://relevant.software/blog/mobile-iot-apps/ W2: https://medium.com/@its.mattfitzgerald/top-14-iot-mobile-app-development-trends-to-expect-in-2020-7fd7718155dc W3:https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-%2520live%26ebv%3dEB%26ppid%3dpp_xiii				
Topics relevant to "SKILL DEVELOPMENT": Wifi integration and social media analysis for developing **Skill Development** through **Participative Learning Techniques.** This is attained through the assessment component mentioned in the course handout.				

Course Code: CIT2502	**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	On successful completion of the course the students shall be able to: 1. To understand the fundamentals of wireless networks 2. Analyze the standards of IoT which employed for wireless networks 3. Explain the use of various wireless technologies in IoT 4. Design and develop various applications of IoT		
Course Content:			

Module 1	Cellular standards	Assignment	Programming Task	**9 Sessions**

Topics:

Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells,

Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS), Mobile IP, WCDMA

Assignment: Case study on generation cellular systems.

Module 2	Radio Frequency (RF) Fundamentals	Assignment	Data Collection/Excel	**10 Sessions**

Topics:

Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards, Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements, Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM.

Assignment: Determination of RF and Microwave spectral Analysis

Module 3	WLAN: Wi-Fi Organizations and Standards	Assignment	Programming/Data analysis task	**9 Sessions**
Topics: IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11- 2007,802.11a/b/g, 802.11e/h/I,802.11n **Assignment:** Protocols on WLAN connectivity				
Module 4	Wi-Fi Hardware & Software	Assignment	Programming/Data analysis task	**10 Sessions**
Topics: Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, Direct-connect Aps, Distributed connect Aps, PoE Infrastructure, Endpoint, Client hardware and software, Wi-Fi Applications				
Targeted Protocols & Tools that can be used: Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread				
Text Book T1: Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd. T2: Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd.				
References R1:Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi 4. R2:Wilson , "Sensor Technology hand book," Elsevier publications 2005. 5. R3: Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005 **Weblinks:** W1: https://pianalytix.com/wireless-communication-protocols-in-iot/ W2: https://behrtech.com/blog/6-leading-types-of-iot-wireless-tech-and-their-best-use-cases/				
Topics relevant to "SKILL DEVELOPMENT": GSM, CDMA for developing **Skill Development** through **Participative Learning Techniques.** This is attained through the assessment component mentioned in the course handout.				

Course Code: CIT3411	**Course Title:** **Big Data Analytics for IoT** **Type of Course: Program Core** **Theory with embedded lab**	**L- T-P-C**	1 -0-4-3
Version No.	1.0		
Course Pre-requisites			

Anti-requisites	**NIL**
Course Description	The course covers basic concepts for IOT Analytics, collection of data for IOT, Integration of IOT with Cloud, Big Data Environments. Students can learn about applying geospatial analytics and applying machine learning to the IOT data. The course also covers the organization of the IOT data, cost benefits of using IOT and review of IOT in various sectors.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Big Data Analytics for IoT and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Demonstrate IOT Data Analytics and machine learning application in IOT (Apply) CO2: Apply appropriate Hadoop Ecosystem tools to perform data analytics for a given problem (Apply) CO3: Examine concepts of cloud based IOT, Big data and IOT (Apply) CO4: Illustrate techniques and strategies for data collection and Geospatial Analytics to IOT Data (Apply)
Course Content:	

Module 1	IOT Analytics	Assignment		**5 sessions**
Introduction – IOT Data, Challenges of IOT analytics Applications – IOT analytics Lifecycle and Techniques. IOT Cloud and Big Data Integration – Cloud based IOT platform – Data Analytics for IOT, IOT devices in different domains. IOT Analytics for the Cloud.				
Module 2	Hadoop Ecosystem Tools			**5 sessions**
Introduction – Big Data and Big Data Analytics – Hadoop Ecosystem – Hadoop Distributed File System (HDFS) – MapReduce – YARN Architecture – PIG Architecture – Apache HIVE – Mahout – Apache Spark – Apache HBase –Apache Zookeeper.				
Module 3	Overview of AWS and Thingworx	Assignment		**5 sessions**
AWS overview - AWS key services for IOT analytics. Thingworx overview. Creating an AWS Cloud Analytics environment.				

Module 4	Geospatial Analytics to IOT Data	Case Study	Data Collection and Analysis
Strategies and Techniques in Data collection: Designing data processing for analytics – Applying big data to storage for Geospatial.			

List of Practical Tasks:

Experiment 1:[Module 1]

Level 1: Installation of Raspbian OS,working basic commands on raspberry pi

Level 2: Demonstrate to obtain the temperature using DHT22 sensors .

Experiment 2: [Module 1]

Level 1: Design and Simulate the RADAR SYSTEM Using Arduino and display on the serial monitor using ultrasonic sensor/PIR WITH &WITH OUT BUZZER/Servo motor

Level 2: using a raspberry pi to Demonstrate to find the distance using ultrasonic sensor hc-sr04

Experiment 3: [Module 1]

Level 1 : using a raspberry pi Set the connections of healthcare sensors

Level 2: using a raspberry pi to Demonstrate to find the ECG, Temperature, etc using Healthcare sensors

Experiment 4: [Module 2]

Level 1: Hadoop Single node cluster installation on ubuntu

Level 2: Hadoop Multiple node cluster installation, windows installation

Experiment 5: [Module 2]

Level 1: Basic hadoop commands and Word count analysis for given dataset

Level 2: Analysis on particular matching word on huge dataset

Experiment 6: [Module 2]

Level 1: Basic hadoop commands and Stock analysis on given dataset

Level 2: Analysis with max, min, average functions on particular field with missing values

Experiment 7: [Module 2]

Level 1: Basic hadoop commands and Temperature analysis on given dataset

Level 2: Analysis with max, min, average functions on particular field with missing values

Experiment 8: [Module 3]

Level 1: Working on hive commands

Level 2: Apply bucketing technique to bring out the difference between partitioning and bucketing

Experiment 9: [Module 3]

Level 1: Working on Hbase commands .

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

Experiment 10: [Module 3]

Level 1: Installation of spark and word count analysis

Level 2: Using RDD and FlatMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark

Experiment 11: [Module 4]

Level 1: Temperature Data stored in cloud through IoT devices

Level 2: Retrieve the data set for cloud and Apply data analytics techniques

Experiment 12: [Module 4]

Level 1: Healthcare Data stored through IoT sensors in Cloud

Level 2: Retrieve the data set for cloud and Apply data analytics techniques

Targeted Application & Tools that can be used:

Hadoop ecosystem tools, Thingworx , AWS Cloud

Project work/Assignment:

Student will be asked to carry out a mini project integrating IoT & data Analytics.

Text Book

T1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley., 2nd Edition, 2019.
T2. Analytics for the Internet of things,Andrew Minteer. Packt publishing, 1st Edition,2017.
T3. Big Data and the Internet of Things, Robert Stackowiak, Art Licht, Venu Mantha and Louis Nagode, Apress, 2nd Edition, 2020

References

R1. IOT and Analytics in Agriculture.,Prasant Kumar Pattnaik, Raghvendra Kumar, Souvik Pal, S. N. Panda. Springer, First Edition, 2020.
R2. Building blocks for IOT Analytics. Internet-of-Things Analytics. John Soldatos (Editor). River Publisher Series in Signal Image and Speech Processing.2020

(iii) web resources

W1. NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs92/preview
W2. Coursera: https://www.coursera.org/learn/big-data-introduction
W3. EDX: https://www.edx.org/course/big-data-fundamentals
W4. E-book Link : https://www.wiley.com /en-us/Internet+of+Things+and+ Data+ Analytics + Handbook -p-9781119173625
https://presiuniv.knimbus.com/user#/home

Topics relevant to "SKILL DEVELOPMENT": Organize IOT data – Linked analytics datasets – Managing data lakes for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

ourse 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	The purpose of the course is to provide the fundamental knowledge onBlockchaintechnologyand explore various aspects of Blockchain technology like types of Blockchain, Bitcoin and EthereumBlockchain platform. With a good knowledge of block chain technology, the student can understand the mechanism of Bitcoin and able to write simple smart contracts			
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Foundations of Blockchain Technology** and attain **Skill Development** through **Participative Learning** techniques.			
Course OutComes	Onsuccessfulcompletionofthiscoursethestudentsshallbeableto: 1. **Understand** the concepts of anemerging blockchain technology(Knowledge). 2. **Infer** the knowledge about consensus protocols (comprehension). 3. **Explore** Bitcoin payment methods(comprehension). 4. **Develop simple** smart contract(comprehension).			
CourseContent:				
Module 1	BlockchainBasics	Quiz	Knowledge based quiz on distributed ledger	**10 Sessions**
Topics: The history of Blockchain: Blockchain, Generic elements of a blockchain, Benefits and limitations of Blockchain, Tiers of Blockchain technology, Features of Blockchain. Types of Blockchain: Distributed ledgers, Public Blockchain, private Blockchain, shared ledger. **Quiz:**Knowledge based quiz on distributed ledger				
Module 2	Distributed Consensus	Assignment	PoW	**08 Sessions**

Topics: Consensus: Consensus mechanism, Types of consensus mechanisms, Consensus in Blockchain.

Assignment: Write an assignment on PoW consensus mechanism

Module 3	Introducing Bitcoin	Case study	Bitcoin network wallets	**10 Sessions**

Topics: Bitcoin definition, Digital keys and addresses, Transactions, mining, Bitcoin network wallets, Bitcoin payments.

Case Study: Conduct a study about hot bitcoin wallets

Module 4	Smart contracts	Case study	how to execute smart contract	**10 Sessions**

Topics:History, Definition, Introduction to Ethereum,Ethereum network,Components of Ethereum ecosystem, Smart contracts.

Case Study: Create a simple smart contract for User identity management using Solidity language and show how to execute.

Targeted Application & Tools that can be used:

- Ethereum Remix
- MetaMask
- Truffle
- Ganache

Textbook

T1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018.
Weblinks: Mastering Blockchain - Google Books

References

R1. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015.
R2. Blockchain by Melanie Swa, O'Reilly .

Weblinks:

1. Blockchain A-Z™: Learn How To Build Your First Blockchain | Udemy
2. https://www.coursera.org/learn/wharton-cryptocurrency-blockchain-introduction-digital-currency
3. https://www.coursera.org/specializations/introduction-to-blockchain
4. https://presiuniv.knimbus.com/user

Text book of Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained, 2nd Edition, Packt Publishing Ltd, March 2018.

https://www.google.co.in/books/edition/Mastering_Blockchain/3ZlUDwAAQBAJ?hl=en&gbpv=1

Topics relevant to "SKILL DEVELOPMENT":
Bitcoin and Smart Contracts for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: 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, 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:

1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using .NET.**
3. 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 3002**	**Course Title:** Big Data Technologies **Type of Course: Program Core** **Theory and Lab Integrated Course**	**L-T- P- C**	2 -0-2-3
Version No.	1.0		
Course Pre-requisites	CSE2012-Database Management System, CSE1001- Problem solving using Java.		
Anti-requisites	**NIL**		
Course Description	The purpose of the course is to provide the fundamentals of Big data technology, to emphasize the importance of choosing suitable tools for processing and analyzing big data to gain insights. The student should have knowledge and skill to select and use most appropriate big data tools to solve business problems. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills. With a good knowledge in the fundamentals of Big data technology, the student can gain practical experience in implementing them, enabling the student to be an effective solution provider for applications that involve huge volume of data.		
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Big Data Technologies and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.		
Course Outcomes	On successful completion of the course the students shall be able to: • Apply Map-Reduce programming on the given datasets to extract required insights. (Application). • Employ appropriate Hadoop Ecosystem tools such as scoop, Hbase, Hive, to perform data analytics for a given problem. (Application). • Use Spark tool to analyze the given dataset for a given problem. (Application).		
Course Content:			
Module 1	Introduction to Hadoop	Programming Assignment	Data Collection and Analysis	**10 Classes**
Introduction to Big Data and its importance: Basics of Distributed File System, Four Vs, Drivers for Big data, Big data applications, Structured, unstructured, semi-structured and quasi structured data. Big data Challenges-Traditional versus big data approach, The Big Data Technology Landscape: No-SQL. **The Hadoop**: History of Hadoop-Hadoop use cases, The Design of HDFS, Blocks and replication management, Rack awareness, HDFS architecture, HDFS Federation, Name node and data node, Anatomy of File write. Anatomy of File read, Hadoop Map Reduce			

paradigm, Map and reduce tasks, Job Tracker and task tracker, Map reduce execution pipeline, Key value pair, Shuffle and sort, Combiner and Partitioner, APIs used to Write/Read files into/from Hadoop, Need for Flume and Sqoop.
Anatomy of a YARN: Hadoop 2.0 Features, Name Node High Availability, YARN Architecture, Introduction to Schedulers, YARN scheduler policies, FIFO, Fair And Capacity scheduler.

Module 2	Hadoop Ecosystem Tools	Programming Assignment	Data Collection and Analysis	**8 Classes**

Introduction to SQOOP: SQOOP features, Sqoop Architecture, Sqoop Import All Tables, Sqoop Export All Tables, Sqoop Connectors, Sqoop Import from MySQL to HDFS, Sqoop vs flume.
Hive: Apache Hive with Hive Installation, Hive Data Types, Hive Table partitioning, Hive DDL commands, Hive DML commands, and Hive sort by vs. order by, Hive Joining tables, Hive bucketing.
Hbase: Introduction to HBase and its working architecture- Commands for creation and listing of tables- disabled and is disabled of table - enable and is enabled of table- describing and dropping of table-Put and Get command - delete and delete all command-commands for scan, count, truncate of tables.

Module 3	Spark	Programming Assignment	Data analysis	**8 Classes**

Introduction to Apache Spark A unified Spark, Who uses Spark and for what?, A Brief History of Spark, Spark version and releases, Storage layers for Spark. Programming with RDDs: RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. Spark SQL: Linking with Spark SQL, Using Spark SQL in Applications, Loading and Saving Data, JDBC/ODBC Server, User-defined functions, Spark SQL Performance.
Scala: The Basics, Control Structures and functions, Working with arrays, Maps and Tuples.

List of Laboratory Tasks:

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

2. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
   Level 1: Find the number of occurrence of each word appearing in the input file(s)
   Level 2: Performing a Map Reduce Job for word search count (look for specific keywords in a file).

3. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with Map Reduce, since it is record-oriented. Data available at: https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all.
   Level 1: Find average, max and min temperature for each year in NCDC data set?
   Level 2: Programming assignment to analyze the social media data for business analytics.

4. **Level 1:** Finding out Number of Products Sold in Each Country using map reduce with sample
   dataset
   Level 2: Find matrix multiplication using map reduce

5. **Level 1:** Installation of Hive, working on basic hive commands. (Create, Alter and Drop tables)
Level 2: Apply Hive commands to student database/employee database.

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

7. **Level 1:** Working on advance hive commands-2. (Bucketing)
Level 2: Continue the previous experiment, apply bucketing technique to bring out the difference between partitioning and bucketing.

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

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

10. **Level 1:** Working on advanced Hbase commands. (DML).
Level 2: Continue the previous experiment to demonstrate CRUD operations.

11. **Level 1:** Install, Deploy & configure Apache Spark.
Level 2: Using RDD and FlatMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark

12. **Level 1:** Write a program in Apache spark to count the occurrences words in a given text file and display only those words starting with 'a' in ascending order of count.
Level 2: Apache access logs are responsible for recording data for all web page requests processed by the Apache server. An access log record written in the Common Log Format will look something like this: 127.0.0.1 - Scott [10/Dec/2019:13:55:36 – 0700] "GET /server-status HTTP/1.1" 200 2326 Where, HTTP 200 status response code indicates that the request has succeeded. Write a program to read the records of access log file log.txt and display the number of successful requests using Spark.

13. **Level 1:** Chess king moves horizontally, vertically or diagonally to any adjacent cell. Given two different cells of the chessboard, determine whether a king can go from the first cell to the second in one move.
Write a scala program that receives input of four numbers from 1 to 8, each specifying the column and row number, first two - for the first cell, and then the last two - for the second cell. The program should output YES if a king can go from the first cell to the second in one move, or NO otherwise.
Level 2: Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.

Write a single Spark application that: • Transposes the original Amazon food dataset, obtaining a Pair RDD of the type: • Counts the frequencies of all the pairs of products reviewed together; • Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.
Targeted Application & Tools that can be used: • **Business Analytical Applications** • **Social media Data Analysis** • **Predictive Analytics** **Tools: Hadoop Framework tools like map reduce, Hive, Hbase, Scoop, Spark.**
Text Book Seema Acharya, Subhashini Chellappan. 2015. *Big Data and Analytics*. Wiley Publication. Matei Zaharia, Bill Chambers. 2018. *SPARK: The Definitive Guide*. Oreilly.
References Tom White. 2016. *Hadoop: The Definitive Guide*. O'Reilley. Cay S. Horstmann. 2017. *Scala for the Impatient*. Wesley.
Topics relevant to development of "Skill Development": Real time application development using Hadoop Ecosystem tools through Experiential Learning as mentioned in the course handout.

Course Code: **CSE3125**	**Course Title:** **Service Oriented Architecture** **Type of Course:** **Program Core**	**L-T-P-C**	3-0-0-3
Version No.	2.0		
Course Pre-requisites	CSE207-Data Base Management System, CSE264 -Web Technology		
Anti-requisites	NIL		
Course Description	The study of the course is to enable the students to understand the different architectural styles and XML based web applications which is required to explore the basics of service-oriented Architecture(SOA) in two approaches i.e. Web Services (WS) and Representational State Transfer (REST) architecture.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Service Oriented Architecture and attain Skill Development through Participative Learning techniques.		
Course Out Comes	On successful completion of this course the students shall be able to: 1. Discuss the XML Fundamentals and to manipulate the data using XML. [Comprehension] 2.Define the key principles of SOA [Knowledge] 3.Discuss the web services technology elements for realizing SOA[Comprehension] 4. Illustrate the various Web Service Standards[Application]		

Course Content:				
Version No.	2.0			
Module 1	**Introduction to XML**	**Assignment**	**Programming Task**	**08 Sessions**
Topics: XML document structure ,Well formed and valid documents ,Namespaces – DTD – xml Schema – X-Files,Parsing XML – using DOM, SAX – XML Transformation and XSL Formatting – Modelling Databases in XML.				
Module 2	**Service Oriented Architecture**	**Assignment**	**Architectural study**	**10 Sessions**
Topics: Types of Architecture, Objectives of Software architecture, SOA Planning and analysis, Architecture patterns and styles ,Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA ,Security and implementation ,Principles of Service orientation ,Service Layers, Application development process, SOA methodology for Enterprise.				
Module 3	**Web Services**	**Quiz**	**Data patterns**	**08 Sessions**
Topics: Service Descriptions – WSDL – Messaging with SOAP – Service Discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography – WS Transactions.				
Module 4	**Building SOA based Applications**	**Quiz**	**Security aspects**	**11 Sessions**
Topics: Business Process Design, Business case for SOA, Stake holder objectives, Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines – Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security , Tools available for implementing SOA, SOA Security, approach for enterprise wide SOA implementation, Trends in SOA, Technologies in Relation to SOA, Advances in SOA, SOA Support in J2EE.				
Targeted Application & Tools that can be used: **Basic HTML and XML**				
Textbook(s): 1. Thomas Erl, "*Service Oriented Architecture: Concepts, Technology, and Design*", Pearson Education, 2016. http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6532 2. Ron Schmelzer et al. "*XML and Web Services*", Pearson Education, 2013 http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6645				
References 1. Frank P.Coyle, "*XML, Web Services and the Data Revolution*", Pearson Education, 2002 http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6647 2. Eric Newcomer, Greg Lomow, "*Understanding SOA with Web Services*", Pearson Education, 2005 http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6619 3. Sandeep Chatterjee and James Webber, "*Developing Enterprise Web Services: An Architect's Guide*", Prentice Hall, 2004.				

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

4. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "*Java Web Services Architecture*", Morgan Kaufmann Publishers, 2003.
https://www.elsevier.com/books/java-web-services-architecture/mcgovern/978-1-55860-900-6

Web Resources:

1. https;//presiuniv.knimbus.com/user#/home
2. https://www.coursera.org/learn/service-oriented-architecture
3. https://nptel.ac.in/courses/soa

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

Course Code: CCS3405	**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**
Topics: Nessus Vulnerability Scanner - Safe check – Silent dependencies - Port Range Vulnerability Data Resources, SDN Data plane, Control Plane, Application Plane. SDN security attack vectors and SDN Harderning, Authentication Bypass with Insecure Cookie Handling - XSS Vulnerability - File inclusion vulnerability - Remote file Inclusion -Patching file Inclusions - Testing a website for SSI Injection.				
Module 3	**Mobile Application Security and wireless network Vulnerability analysis**	Quiz	Theory	**11 Sessions**
Topics: Types of Mobile Application Key challenges in Mobile Application and Mobile application penetration testing methodology, Android and ios Vulnerabilities - OWASP mobile security risk - Exploiting WM - BlackBerry Vulnerabilities - Vulnerability Landscape for Symbian - Exploit Prevention -Handheld Exploitation, WLAN and its inherent insecurities Bypassing WLAN Authentication uncovering hidden SSIDs MAC Filters Bypassing open and shard authentication - Advanced WLAN Attacks Wireless eavesdropping using MITM session hijacking over wireless – WLAN Penetration Test Methodology.				
Module 4	**Exploits**	Quiz	Theory	**8 Sessions**
Topics: Architecture and Environment- Leveraging Metasploit on Penetration Tests, Understanding - Metasploit Channels, Metasploit Framework and Advanced Environment configurations – Understanding the Soft Architecture, Configuration and Locking, Advanced payloads and add on modules Global datastore, module datastore, saved environment Meterpreter.				
Targeted Application & Tools that can be used: This course helps the students to understand the threats and vulnerabilities using NMAP.				
Project work/Assignment:				
Project Assignment:				
Text Book 1. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015. ISBN : 78-1-4822-3161-8. 2. 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. 3. Mayor, K.K.Mookey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, Elsevier, 2007. ISBN : 978-1-59749-074-0				
References				

1. Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 PacktPublishing. 2. SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication **Web resources:** https://onlinecourses.nptel.ac.in/noc19_cs68/preview - **IIT Kharagpur,** Prof. Indranil Sen Gupta
Topics relevant to development of "EMPLOYABILITY SKILLS": Exploitation, Penetration testing techniques, for development of Employability skills through the Participative Learning Techniques. This is attained through the assessment components mentioned in course handout.

Course Code: **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	On successful completion of this course the students shall be able to: 1. **Describe** fundamentals of cloud computing [**Knowledge].** 2. **Explain** cloud computing security architecture and associated challenges **[Comprehension].** 3. **Discuss** cloud computing software security essentials **[Comprehension].** 4. **Apply** infrastructure security and data security in cloud computing enviroment. **[Application].**		
Course Content:			

Module 1:	**Fundamentals of Cloud Computing**	**Quiz**	Knowledge based Quiz	**10 Sessions**
Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.				
Module 2:	**Cloud Security Challenges and Cloud Security Architecture**	**Quiz**	Comprehension based Quiz	**10 Sessions**
Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security**.**				
Module 3	**Cloud Computing Software Security Essentials**	**Assignment**	Batch-wise Assignments	**9 Sessions**
Topics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software Requirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.				
Module 4:	**Infrastructure Security and Data Security**	Assignment and Presentation	Batch-wise Assignment and Presentations	**9 Sessions**
Topics: Infrastructure Security: The Network Level, The Host Level, The Application Level. **Data Security :** Aspects of Data Security, Data Security Mitigation, Provider Data and its Security.				
Targeted Application & Tools that can be used: Use of CloudSim simulator.				
Project work/Assignment: **Survey on Cloud Service Providers**				
Text Book 1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "*Mastering Cloud Computing*", McGraw Hill Education, July 2021. 2. Roland L Krutz and Russell Dean Vines, "*Cloud Security - A Comprehensive Guide to Secure Cloud Computing*", Wiley Publishing, Inc. 2019.				
References 1. Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, "*Secure Cloud Computing*", Springer, ISBN 978-1-4614-9278-8 (eBook). 2. John Rittinghouse and James Ransome, "*Cloud Computing, Implementation, Management and Security*", CRC Press, 2010. 3. 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: **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**
Topics: BootStrap for Responsive Web Design; JavaScript – Core syntax, HTML DOM, objects, classes, Async; Ajax and jQuery Introduction **Assignment:** Design and develop a website that can actively keep track of entry-exit information of a housing society.				
Module 3	Fundamentals of Angular.js	Project	Programming	**08 Sessions**
Topics: Setting up Development & Build Environment: Node.js and NPM; Introduction to TypeScript; Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications; Components & Databinding in Depth; Angular Directives; Using Services & Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication & Route Protection; Dynamic Components; Angular Modules & Optimizing Angular Apps; Deploying an Angular App; Angular Animations; Adding Offline Capabilities with Service Workers; Unit Testing in Angular Apps (Jasmine, Karma). **Assignment:** Develop a software tool to do inventory management in a warehouse.				

Module 4	Fundamentals of React.js	Project	Programming	15 Sessions

Topics:
Overview of React.js.; Reactive Programming; React Components; Render Method; Virtual DOM and Bandwidth Salvation; Two Distinct Ways of Initializing a React Class; States & Life Cycles; Component Mounting; Node.js & NPM; JSX Walkthrough; React Testing.
Assignment: Develop a web-based application to book movies/events (like bookmyshow).

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: GCC compiler.

Project work/Assignment:

1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using Java.**

Text Book:

T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015
T2. Northwood, Chris, "*The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer",* APress, 2018

References:

R1. Flanagan D S, *"Javascript : The Definitive Guide"* 7th Edition. 7th ed. O'Reilly Media; 2020.
R2. Alex Libby, Gaurav Gupta, and Asoj Talesra. *"Responsive Web Design with HTML5 and CSS3 Essentials",* Packt Publishing, 2016
R3. Duckett J Ruppert G Moore J. *"Javascript & Jquery : Interactive Front-End Web Development.";* Wiley; 2014.
R4. Greg Sidelnikov, *"React.js Book_ Learning React JavaScript Library"*, 1 edition, Scratch-River Tigris LLC 2016
R5. Web Reference: https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2

Course Code: CSE3151	Course Title: Java Full Stack Development	L- T-P- C	2-0-2-3
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**
Topics: Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development **Assignment:** Develop a software tool to do inventory management in a warehouse.				
Module 5	Automation tools	Project	Programming	**06 Sessions**

Topics: Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands **Assignment:** Illustrate the use of automation tools in the development of a small software project.
Targeted Application & Tools that can be used: **Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.** **Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.**
Project work/Assignment:
1. **Problem Solving: Design of Algorithms and implementation of programs.** 2. **Programming: Implementation of given scenario using Java.**
Text Book: T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015
References R1. Soni, Ravi Kant. *"Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful."* , Apress, 2017. R2. Mardan, Azat. *"Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB."*, Apress, 2015

Course Code: **CSE3152**	**Course Title: .NET Full Stack Development**	**L-T- P- C**	2-0-2-3
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:
1. **Problem Solving: Design of Algorithms and implementation of programs.** 2. **Programming: Implementation of given scenario using .NET.**
Text Book: T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015 T2. Valerio De Sanctis, *"ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11"*, 4th Edition, Packt, 2021.
References R1. Benjamin Perkins, Jon D. Reid, *"Beginning C# and .NET"*, Wiley, 2021 Reid, 2021. R2. Piotr Gankiewicz, *"Full Stack .NET Web Development"*, Packt Publishing, 2017. R3. Tamir Dresher, Amir Zuker, Shay Friedman, *"Hands-On Full-Stack Web Development with ASP.NET Core"*, Packt Publishing, 2018. R4. Dustin Metzgar, *"Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core"*, Manning, 2017.

Course Code: CCS3402	Course Title: Identity and Access Management	L- T - P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Data Communication and Computer Networks					
Anti-requisites	NIL					
Course Description	This course introduces the principles and practices of Identity and Access Management (IAM), including authentication, authorization, access control models, and identity lifecycle management. Students will learn to implement IAM solutions using technologies like SSO, MFA, and directory services, gaining hands-on experience in securing user access and managing identities in compliance with organizational policies.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of security in IAM to attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1: **Recall** key concepts of identity, authentication, authorization, and access control models. [Remember] CO2: **Explain** the components and workflow of IAM systems, including identity lifecycle management and federation protocols. [Understand] CO3: A**pply** IAM technologies such as Single Sign-On (SSO), Multi-Factor Authentication (MFA), and directory services to secure user access. [Apply]					
Course Content:						
Module 1	Introduction to IAM and Access Control Models					15 hours

Topics: ⍰ Fundamentals of Identity and Access Management - Key IAM Concepts: Authentication, Authorization, Accounting (AAA) - Identity lifecycle and governance - Access control models: DAC, MAC, RBAC, ABAC - Principles of least privilege and zero trust architecture		
Module 2	**IAM Technologies and Infrastructure**	13 hours
Topics: - Directory Services: LDAP, Active Directory - Authentication protocols: Kerberos, RADIUS, TACACS+ - Identity Federation: SAML, OAuth, OpenID Connect - Single Sign-On (SSO) and Multi-Factor Authentication (MFA) - Cloud IAM services (e.g., AWS IAM, Azure AD)		
Module 3	Implementation, Governance and Compliance	15 hours
Topic: IAM solution design and deployment strategies - Identity provisioning and de-provisioning - Role and policy management - IAM governance and risk compliance (GRC) - Auditing, access reviews, and reporting - Case studies and industry best practices		
Assignment:		
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.		
Text Book(s): 1. **Ertem Osmanoglu**, *Identity and Access Management: Business Performance Through Connected Intelligence*, Syngress, 2013.		
Reference(s): Reference Book(s): 1. **David B. Stirling**, *Effective Cybersecurity: A Guide to Using Best Practices and Standards*, Apress, 2020. Online Resources (e-books, notes, ppts, video lectures etc.): Weblinks: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live		
Topics related to development of "FOUNDATION": Introduction to IAM Topics related to development of "EMPLOYABILITY": SSO & MFA		

Course Code: CCS3401	Course Title: Post-Quantum Cryptography	L- T - P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Cryptography and Networks Security					
Anti-requisites	NIL					
Course Description	This course explores the principles, algorithms, and challenges of **Post-Quantum Cryptography (PQC)—a** field dedicated to developing cryptographic systems that can resist attacks from quantum computers. As quantum computing advances, traditional encryption methods such as RSA and ECC become vulnerable, necessitating the adoption of quantum-resistant cryptographic techniques.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of post-quantum cryptographic algorithms to attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1: **Identify** the vulnerabilities of traditional cryptographic algorithms against quantum attacks. [Remember] CO2: **Explain** the principles and security assumptions behind post-quantum cryptographic algorithms. [Understand] CO3: **Implement** post-quantum cryptographic schemes using tools like Open Quantum Safe (OQS). [Apply]					
Course Content:						
Module 1	Introduction to post-quantum cryptography				13 hours	
Topics: Is cryptography dead? - A taste of post-quantum cryptography - Challenges in post-quantum cryptography -Comparison to quantum cryptography - Quantum computing - Classical cryptography and quantum computing - The computational model - The quantum Fourier transform - The hidden subgroup problem - Search algorithms						
Module 2	Hash-based Digital Signature Schemes				15 hours	
Topics: Hash-based Digital Signature Schemes - Merkle's tree authentication scheme - One-time key-pair generation using an PRNG - Authentication path computation - Tree chaining -Distributed signature generation - Security of the Merkle Signature Scheme - Code-based cryptography -						
Module 3	Lattice-based Cryptography				15 hours	
Topics: Lattice-based Cryptography - Multivariate Public Key Cryptography – Introduction - The Basics of Multivariate PKCs- Examples of Multivariate PKCs - Basic Constructions and Variations - Standard Attacks – The Future. AlienVault OSSIM Implementation - AlienVault OSSIM Operation - Cisco Security: MARS Implementation - Cisco MARS Advanced Techniques						
Assignment:						

1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.
Text Book(s): 1. Daniel J. Bernstein, Johannes Buchmann, "Post-Quantum Cryptography"Springer.
Reference(s): **Reference Book(s):** 1. **Daniel J. Bernstein, Johannes Buchmann, Erik Dahmen**, *Post-Quantum Cryptography*, Springer, 2009. 2. **Nicolas Sendrier**, *An Introduction to Post-Quantum Cryptography*, NIST Reports, 2019. 3. **Carlos Aguilar Melchor, Jean-Christophe Deneuville**, *Mathematical Foundations of Post-Quantum Cryptography*, Springer, 2021. **Online Resources (e-books, notes, ppts, video lectures etc.):** Weblinks: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live
Topics related to development of "FOUNDATION": **Introduction to Post-Quantum Cryptography (PQC), Quantum Threats to Classical Cryptography** Topics related to development of "EMPLOYABILITY": Cryptanalysis and Security Evaluation, Industry Standards and Compliance

Course Code: CCS3404	**Course Title:** Incident Response with Threat Intelligence	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**Cryptography and Network Security**					
Anti-requisites	**NIL**					

Course Description	This course covers the fundamentals of incident response and threat intelligence, focusing on identifying, analyzing, and mitigating cybersecurity threats. Students will learn the incident response lifecycle, threat actor profiling, and the use of tools like TheHive, Security Onion, and Velociraptor. The course also explores frameworks such as MITRE ATT&CK and emphasizes hands-on skills in evidence collection, threat hunting, and intelligence-driven response. By the end, learners will be equipped to manage incidents and enhance organizational security using actionable threat intelligence.	
Course Objective	The objective of the course is to familiarize the learners with the concepts of security in IR&TI to attain **Skill Development** through **Participative Learning** techniques.	
Course Outcomes	On successful completion of this course the students shall be able to: CO1: **Describe** key concepts of incident response, threat intelligence, and common cyber-attack techniques. [Understand] CO2: **Explain** the incident response lifecycle and threat intelligence concepts, including attacker tactics, techniques, and procedures (TTPs) [Understand] CO3: **Perform** appropriate tools and techniques to investigate, respond to, and document cybersecurity incidents. [Apply]	
Course Content:		
Module 1	Foundations of Incident Response and Threat Landscape	15 hours
Topics: Threat Landscape and Cybersecurity Incidents - Concepts of Digital Forensics and Incident Response - Basics of the Incident Response and Triage Procedures - Applying First Response Procedures - Identifying and Profiling Threat Actors - Understanding the Cyber Kill Chain and the MITRE ATT&CK Framework		
Module 2	Strategic Planning and Program Development	13 hours
Topics: - Creating Incident Response Plans and Playbooks - Developing an Incident Response Program - Implementing and Using TheHive and Cortex for Incident Management		
Module 3	Tools, Techniques, and Threat Hunting	15 hours
Topic: Collecting Evidence with Velociraptor and KAPE - Integrating ELK Stack into Incident Response - Utilizing Security Onion for Network Monitoring and Detection - Threat Hunting with Sigma and YARA Rules - Automating Detection and Response with MITRE ATT&CK and TRAM		
Assignment:		
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.		
Text Book(s): **1.** Roberto Martínez*, Incident Response with Threat Intelligence: A practical guide to catching attackers and defending your organization,* Packt Publishing, 2022.		

Reference(s):
Reference Book(s):

1. **Jason Luttgens, Matthew Pepe, and Kevin Mandia**, *Incident Response & Computer Forensics*, McGraw Hill, 2014.
2. **Chris Sanders and Jason Smith**, *Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems*, No Starch Press, 2017.

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

Weblinks:

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Topics related to development of "FOUNDATION": Introduction to incident response and thread intelligence

Topics related to development of "EMPLOYABILITY": Tools, Techniques and Thread Hunting

Course Code: CSS3413	Course Title: Security Auditing and Governance	L- T - P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Cryptography and Networks Security					
Anti-requisites	NIL					
Course Description	This course covers security auditing principles, governance frameworks, and compliance regulations essential for organizational cybersecurity. It includes risk assessment, vulnerability management, and security controls while aligning with standards like ISO 27001, NIST, PCI-DSS, and GDPR. Students will explore governance, risk, and compliance (GRC) models, audit methodologies, and hands-on log analysis, security assessments, and incident response. By the end, they will be equipped to conduct audits, ensure compliance, and strengthen enterprise security.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of security auditing and governance post-quantum cryptographic algorithms to attain **Skill Development** through **Participative Learning** techniques.					

Course Outcomes	On successful completion of this course the students shall be able to: CO1: **Define** key concepts of **security auditing, governance, and compliance frameworks.** [Remember] CO2: **Explain risk assessment methodologies** and the role of governance in cybersecurity. [Understand] CO3: **Perform security audits, log analysis, and compliance checks** using industry standards. [Apply] CO4: **Assess vulnerabilities, security controls, and risk management strategies** in IT environments. [**Analysis**]	
Course Content:		
Module 1	The Principles of Auditing	12 hours
Topics: The Principles of Auditing - Security Fundamentals: The Five Pillars - Building a Security Program - Security Controls - Managing Risk - The Auditing Process		
Module 2	Information Security and the Law	12 hours
Topics: IT Security Laws - Hacking, Cracking, and Fraud Laws - Intellectual Property Laws - CAN-SPAM Act of 2003 - State and Local Laws - Reporting a Crime - Regulatory Compliance Laws		
Module 3	Information Security Governance, Frameworks, and Standards	11 hours
Topics: Understanding Information Security Governance - Process: Security Governance Frameworks - Technology: Standards Procedures and Guidelines - Auditing Tools and Techniques - Evaluating Security Controls - Auditing Security Practices - Testing Security Technology - Security Testing Frameworks		
Module 4	Auditing	10 hours
Topics: Auditing Cisco Security Solutions - Policy, Compliance, and Management - Infrastructure Security		
Assignment:		
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.		
Text Book(s): **2. Chris Jackson**, *Network Security Auditing*, Cisco Press, 2010		

Reference(s):

Reference Book(s):

1. Russell Dean Vines, *Wireless Security Audit Methods and Tools*, McGraw-Hill, 2002.
2. Eric Cole, Ronald Krutz, and James Conley, *Network Security Bible*, Wiley, 2009.
3. Richard Bejtlich, *The Practice of Network Security Monitoring: Understanding Incident Detection and Response*, No Starch Press, 2013.
4. William Stallings, *Network Security Essentials: Applications and Standards*, Pearson, 2020.

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

Weblinks:

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Topics related to development of "FOUNDATION": Information Security and the Law

Topics related to development of "EMPLOYABILITY": Security Governance, Frameworks, and Standards

Course Code: CCS3412	Course Title: Blockchain Security	L- T - P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Cryptography and Networks Security					
Anti-requisites	NIL					
Course Description	This course explores the security challenges, risks, and solutions in blockchain technology, covering cryptographic principles, consensus mechanisms, and smart contract security. It addresses threats such as 51% attacks, Sybil attacks, and private key vulnerabilities, along with techniques for securing blockchain networks, transactions, and decentralized applications (DApps). Students will gain hands-on experience in auditing smart contracts, implementing security best practices, and understanding regulatory compliance. By the end, learners will be equipped to identify vulnerabilities, secure blockchain ecosystems, and design robust decentralized systems.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of security in blockchain to attain **Skill Development** through **Participative Learning** techniques.					

Course Outcomes	On successful completion of this course the students shall be able to: CO1: **Define** key blockchain security concepts, including cryptographic techniques and consensus mechanisms. [Remember] CO2: **Explain** common blockchain threats such as **51% attacks, Sybil attacks, and private key vulnerabilities.** [Understand] CO3: **Perform** security best practices for securing blockchain transactions, smart contracts, and decentralized applications. [Apply]	
Course Content:		
Module 1	Introduction to Blockchain	15 hours
Topics: The history of blockchain and Bitcoin - Types of blockchain - Decentralization - Decentralization using blockchain - Methods of decentralization - Blockchain and full ecosystem decentralization		
Module 2	Symmetric Cryptography	13 hours
Topics: Introduction to Symmetric Cryptography - Cryptography - Confidentiality - Cryptographic primitives - Symmetric cryptography - Data Encryption Standard - Public Key Cryptography - Discrete logarithm problem in ECC - Hash functions - Financial markets and trading		
Module 3	Introducing Bitcoin	15 hours
Topics: Introducing Bitcoin - Digital keys and addresses – Blockchain - Bitcoin Network and Payments - Bitcoin Clients and APIs - Alternative Coins		
Assignment:		
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.		
Text Book(s): **3. Imran Bashir**, *Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications*, Packt Publishing, 4th Edition, 2023.		

Reference(s):

Reference Book(s):

1. **Andreas M. Antonopoulos and Gavin Wood,** *Mastering Ethereum: Building Smart Contracts and DApps*, O'Reilly Media, 2018.
2. **Joseph Bonneau, Andrew Miller, Jeremy Clark, Arvind Narayanan, Joshua Kroll, and Edward Felten,** *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction*, Princeton University Press, 2016.
3. **Narayan Prusty**, *Blockchain for Enterprise: Build Scalable Blockchain Applications with Privacy, Interoperability, and Permissioned Features*, Packt Publishing, 2021.

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

Weblinks:

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Topics related to development of "FOUNDATION": Introduction to blockchain security and bitcoin

Topics related to development of "EMPLOYABILITY": Bitcoin Network and Payments - Bitcoin Clients and APIs - Alternative Coins

Course Code: CCS3411	Course Title: Security Information and Event Management (SIEM) Type of Course: Core subject Cyber Security	L- T - P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Cryptography and Networks Security					
Anti-requisites	NIL					
Course Description	This course provides a comprehensive understanding of Security Information and Event Management (SIEM), focusing on its role in real-time threat detection, incident response, and compliance monitoring. It covers key concepts such as log collection, event correlation, and security analytics, enabling students to detect and mitigate cyber threats effectively. Through hands-on experience with industry-leading SIEM tools like Splunk, IBM QRadar, and Elastic SIEM, students will learn to investigate security incidents and automate threat detection. The course also explores threat intelligence integration, regulatory compliance (GDPR, PCI-DSS, HIPAA), and SOC operations, equipping learners with the skills needed for enterprise security monitoring and cybersecurity defense.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Security Information and Event Management (SIEM)** solutions for **real-time threat**					

	detection, incident response, compliance monitoring and attain **Skill Development** through **Participative Learning** techniques.				
Course Outcomes	On successful completion of this course the students shall be able to: CO1: **Identify** the fundamental components and functions of **Security Information and Event Management (SIEM)** systems [Remember] CO2: Classify the process **of log collection, normalization, and event correlation** in a SIEM environment. [Understand] CO3: **Configure** a SIEM system to **ingest logs from various security devices** and generate alerts for suspicious activities [Apply]				
Course Content:					
Module 1	Introduction to SIEM: Threat Intelligence for IT Systems				13 hours
Topics: Introduction to SIEM: Threat Intelligence for IT Systems - Business Models - Threat Models - Regulatory Compliance					
Module 2	IT Threat Intelligence Using SIEM Systems				15 hours
Topics: SIEM Concepts: Components for Small and Medium-size Businesses - The Anatomy of a SIEM - Incident Response - Using SIEM for Business Intelligence					
Module 3	SIEM Tools	Case study	Kerberos configuration for ecosystem tools		15 hours
Topics: AlienVault OSSIM Implementation - AlienVault OSSIM Operation - Cisco Security: MARS Implementation - Cisco MARS Advanced Techniques					
Assignment:					
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.					
Text Book(s): 2. **Security Information and Event Management (SIEM) Implementation** by **David R. Miller, Shon Harris, Allen Harper, Stephen VanDyke, and Chris Blask, McGrawHill.** 3. Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2015.					

Reference(s):

Reference Book(s):

1. Joseph Muniz, Security Information and Event Management (SIEM) Fundamentals, Cisco Press.
2. Matthew Hubbard, The Security Analyst's Guide to SIEM, Apress.

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

Weblinks:

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Topics related to development of "FOUNDATION": Introduction to SIEM, Log Collection & Management

Topics related to development of "EMPLOYABILITY": Configuring SIEM for Security Monitoring, Incident Response & Compliance

Course Code: CCS3410	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: **CCS3414**	**Course Title: Security In IOT** **Type of Course: Theory**	**L- T-P-C**	**3**	0	**0**	**3**
Version No.	1.0					
Course Pre-requisites	Familiarity with IoT,cns					
Anti-requisites	**NIL**					
Course Description	This course provides a comprehensive understanding of security challenges and solutions in the Internet of Things (IoT) and cloud computing environments. Students will explore IoT system design, hardware and software security, cryptographic approaches, cloud computing fundamentals, and security concepts related to virtualization. The course covers security threats specific to IoT devices and cloud infrastructure, along with countermeasures against cyberattacks, including system-specific vulnerabilities such as guest hopping, VM-based attacks, and hyper jacking. By the end of this course, students will gain practical knowledge of securing IoT ecosystems and cloud services while understanding emerging threats in these domains.						

<table>
<tr><td>Course Objective</td><td colspan="4">To learn about the security issues in IoT and cloud computing. To learn about the cryptography solutions and issues in IoT. To learn about the security measures taken in IoT and Cloud systems to improve security.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On completion of the course, student will be able to
CO1 - Understand the fundamental security issues in Internet of things.
CO2 - Demonstrate different Frameworks and Hardware Architecture of IoT Device.
CO3 - Analyze different IoT Protocols and Layer Functioning.
CO4 - Protect and secure the network connecting IoT devices to back-end systems on the internet.
CO5 - Demonstrate different authentication mechanism such as digital certificates, biometrics, etc.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>FUNDAMENTALS OF IoT ECOSYSTEM</td><td>Assignment</td><td>Theory</td><td>9 Sessions</td></tr>
<tr><td colspan="5">Topics:
IoT security issues, how to design an IoT system, Hardware, software and network security related to IoT systems - Basics of cryptographic solutions to IoT systems.</td></tr>
<tr><td>Module 2</td><td>OVERVIEW OF CLOUD COMPUTING AND ITS SERVICES</td><td>Assignment</td><td>Programming activity</td><td>9 Sessions</td></tr>
<tr><td colspan="5">Topics:
Cloud Computing Fundamental: Cloud computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS</td></tr>
<tr><td>Module 3</td><td>CHALLENGES IN CLOUD COMPUTING</td><td>Assignment</td><td>Programming activity</td><td>9 Sessions</td></tr>
<tr><td colspan="5">Topics:
Benefits and challenges of cloud computing - Public vs. Private clouds, Role of virtualization in enabling the cloud.</td></tr>
</table>

Module 4	SECURITY CONCEPTS IN CONTEXT TO IoT DEVICES	Assignment	Programming activity	**9 Sessions**
Topics: Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, Virtualization.				
Module 5	**IoT SECURITY THREATS AND COUNTERMEASURES**	Assignment	Programming activity	**9 Sessions**
Topics: System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyper jacking				
Targeted Application & Tools that can be used				
Project work/Assignment:				
Assignment:				
Text Book T1. David Etter, " IoT Security: Practical guide book " Create Space, 1st Edition, 2016.				
References : 1.Drew Van Duren, Brian Russell, "Practical Internet of Things Security", Packt, 1st Edition, 2016. 2. Sean Smith, "The Internet of Risky Things", O'Reilly Media, 1st Edition, 2017. 3. Brian Russell, Drew Van Duren, "Practical Internet of Things Security: Design a security framework for an Internet connected ecosystem", 2nd Edition, 2018.				

Course Code: **CSE2510**	**Course Title:** Competitive Programming and Problem Solving **Type of Course: Program Core**	L-T-P-C	0	0	4	2
Version No.	1.0					
Course Pre-requisites	NIL					

Anti-requisites	**NIL**
Course Description	The **Competitive Programming and Problem Solving** course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.
Course Out Comes	On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches.
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Competitive Programming and Problem Solving** and attain **Skill Development** through **Experiential Learning** techniques.

Module 1: Introduction to Competitive Programming

Overview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL

Module 2: Number Theory for Problem-Solving

Use of Number Theory for problem-solving: reducing time/space complexity of brute force coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding

for Permutation Combination; XORing based and pattern-based solutions.

Module 3: Optimizing Time & Space Using Sequential Storage

Coding for Optimizing time and Space using Sequential Storage: two pointer approach; problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string

matching algorithms; Kadane's algo, stacks, priority-queues and hashing based efficient coding; median based problems and alternate solutions.

Module 4: Non-Linear Data Structures

Applying Non-Linear Data Structures for real-life problems: design of efficient solutions for problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem

solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path
algos for CP problems with reduced time/space complexity.

Module 5: Problem Solving using Advanced Topics

CP Problem Solving using Advanced Topics: concept of disjoint sets and their efficient representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and applying them for CP problems using bottom-up dynamic programming.

List of Laboratory Tasks:

1. You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.
2. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.
3. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).
4. The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.
5. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.
6. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.
7. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.
8. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.
9. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.
10. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics (permutations and

combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.

11. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).
12. In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.
13. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.
14. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.
15. Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).
16. Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.
17. An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.
18. The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.
19. A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).
20. In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). **Focus:** Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.
21. A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).
22. Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a

combination of tree structures and hash tables for efficient indexing and searching. **Focus:** Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.

23. An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.
24. Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.
25. In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. **Focus:** Disjoint set union (DSU) data structure, basic connectivity checks.
26. Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.
27. A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. **Focus:** Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.
28. In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.
    Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.
29. In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.
30. In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. **Focus:** Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

Targeted Application & Tools that can be used:

1. C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).
2. IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.
3. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions.
4. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
5. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).

6. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.
7. **String Libraries:** Familiarize students with the string manipulation functions available in C++.
8. **Graph Visualization Tools:** Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.
9. **DP Debugging Techniques:** Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.

Text Books:

1 **Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition), *Antti Laaksonen, springer, 2024***

2 **"Data Structures and Algorithms in Java: A Project-Based Approach" – *Dan S. Myers, Cambridge University Press***

Reference Books:

1. **Data Structures and Algorithmic Thinking with Python/C++/Java", *Narasimha Karumanchi, 5th Edition, Career Monk, 2017.***
2. **Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022**

Web Resources

1. https://nptel.ac.in/courses/106106231
2.

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

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

Course Code: CSE7000	Course Title: Internship Type of Course:	L- T-P- C	-	-	-	2
Version No.	1.0					
Course Pre-requisites	Knowledge and Skills related to all the courses studied in previous semesters.					
Anti-requisites	NIL					

Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate)

Course Code:CSE 7100	**Course Title: Mini Project** **Type of Course:**	**L- T-P- C**	0	0	0	4
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation					

	components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate) 5. Appraise project findings and communicate effectively through scholarly publications. (Create)

Course Code:CSE 7300	**Course Title: Capstone Project** **Type of Course:**	**L- T-P- C**	0	0	0	10
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have					

	options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify problems based on societal /research needs. (Understand) 2. Apply Knowledge and skill to solve societal problems in a group. (Apply) 3. Develop interpersonal skills to work as member of a group or leader. (Apply) 4. Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) 5. Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) 6. Improve in written and oral communication. (Create) 7. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)

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