PRESIDENCY UNIVERSITY

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Approved by AICTE, New Delhi

PRESIDENCY SCHOOL OF ARTIFICIAL INTELLIGENCE & ADVANCED COMPUTING

Program Regulations and Curriculum 2026-2030

BACHELOR OF TECHNOLOGY (B.Tech.) in COMPUTER SCIENCE AND ENGINEERING (Cyber Security)

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

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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 transforming Society.

1.4 Mission of Presidency School of Computer Science and Engineering

- Cultivate a practice-driven environment with a contemporary Learning-pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the field of Core Computer Science and Engineering.
- Establish state-of-the-art facilities for effective Teaching and Learning-experiences.
- Promote Interdisciplinary Studies to nurture talent and impart relevant skill-sets 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 Industrial Based Project Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

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

3. Short Title and Applicability

a. These Regulations shall be called the Bachelor of Technology Degree Program Regulations and Curriculum 2026-2030.
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 2026-2030 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 2026-2030.

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, 2026-2030;*

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

gg. *"PSCSE" 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 2026-2030 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 2026-2030 offered by the Presidency School of Computer Science and Engineering (PSCS):

1. Bachelor of Technology in Computer Science and Engineering, abbreviated as CSE

2. Bachelor of Technology in Computer Science and Technology (Big Data), abbreviated as CBD
3. Bachelor of Technology in Computer Science and Engineering (Block Chain), abbreviated as CBC
4. Bachelor of Technology in Computer Science and Technology (Dev Ops), abbreviated as CDV
5. Bachelor of Technology in Computer Science and Engineering (Cyber Security), abbreviated as CCS
6. Bachelor of Technology in Computer Science and Engineering (Internet of Things), abbreviated as CIT
7. Bachelor of Technology in Computer Science and Engineering (Data Science), abbreviated as CSD
8. Bachelor of Technology in Computer Science and Technology, abbreviated as CSG
9. Bachelor of Technology in Information Science and Technology, abbreviated as IST
10. Bachelor of Technology in Computer Science and Information Technology, abbreviated as CSI
11. Bachelor of Technology in Computer Science and Engineering (Networks), abbreviated as CSN
12. Bachelor of Technology in Computer Engineering, abbreviated as COM
13. Bachelor of Technology in Information Science and Engineering, abbreviated as ISE and
14. Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) abbreviated as CAI
15. Bachelor of Technology in Robotics and Artificial Intelligence Engineering, abbreviated as RAI
16. Bachelor of Technology in Artificial Intelligence and Data Science Engineering, abbreviated as AID

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:

PEO 1: Demonstrate proficiency 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 knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking 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: Display a strong grasp of computer science fundamentals to clearly explain essential concepts, analyze problems, and utilize theory to model and construct reliable, efficient computing systems**.**

PSO 02: Leverage on their programming abilities, knowledge of software development platforms, and understanding of cybersecurity principles to design practical solutions, supporting diverse paths in industry, academia, advanced studies, research, or entrepreneurship.

PSO 03: Comprehend and evaluate the ethical, legal, societal implications of cybersecurity practices to ensure responsible decision-making while designing, implementing, applications that protect data, networks, and infrastructure against cyber threats.

9 Admission Criteria (as per the concerned Statutory Body)

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

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

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

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

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

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

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

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

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

10 Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

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

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

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

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

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

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

10.1.6 The existing Program Regulations of the concerned Program to which the student is admitted through the provision of Lateral Entry shall be binding on the student

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

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

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

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. (Computer Science and Engineering-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 Computer Science and Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

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

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

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

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

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

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

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

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

11 Change of Branch / Discipline / Specialization

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

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

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

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

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

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

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

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

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

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

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

12.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 8.8 of Academic regulations12.5) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

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

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

- Non-Teaching Credit Courses (NTCC)
- Courses with a class strength less than 30

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

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause 8.10 of Academic Regulations) be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

12.5 Assessment Components and Weightage

S.No	Credit Structure [L-T-P-C]	Percentage/ Marks	CA		Mid-Term		End-term		Project	Total	Exam Conducted by
			Theory	Practical	Theory	Practical	Theory	Practical			
1	3-0-0-3	Percentage	25%	-	25%	-	50%	-	-	100 %	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	
2	2-0-2-3	Percentage	12.50%	12.50 %	12.50%	12.50 %	25%	25%	-	100 %	Mid-Term & End Term by CoE * Except for full stack courses
		Marks	25	25	25	25	50	50	-	200	
3	1-0-4-3	Percentage	-	25%	10%	40%	5%	20%	-	100 %	Mid-Term & End Term by School
		Marks	-	25	10	40	5	25	-	100	
4	2-0-4-4	Percentage	12.50%	12.50 %	10%	15%	20%	30%	-	100 %	*Mid-Term & End Term by CoE
		Marks	25	25	20	30	40	60	-	200	
5	0-0-4-2	Percentage	-	50%	-	-	-	-	50%	100 %	Project evaluated by IC at School level
		Marks	-	50	-	-	-	-	50	100	
6	0-0-2-1	Percentage	-	100%	-	-	-	-	-	100 %	Only CA at School Level
		Marks	-	100	-	-	-	-	-	100	
7	3-0-2-4	Percentage	12.50%	12.50 %	15%	10%	30%	20%	-	100 %	Mid-Term & End Term by CoE
		Marks	25	25	30	20	60	40	-	200	
8	2-0-0-2	Percentage	25 %	-	25%	-	50%	-	-	100 %	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	

*CSS3426-Front End Full stack development
CSS3427-Java Full Stack Development
CSS3428-.Net Full Stack development

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

Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

12.6 **Minimum Performance Criteria:**

12.6.1 Theory only Course and Lab/Practice Embedded Theory Course

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

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

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

12.6.2 Lab/Practice only Course and Project Based Courses

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

12.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per sub-clauses 12.6.1 and 8.9.2 of Academic Regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

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

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

13.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer ANNEXURE B of Academic Regulations) and approved by the Dean - Academics.

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

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

13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 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 have 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 summarized 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.

13.5 Mandatory Non-Credit Course Completion Requirements: All mandatory non-credit courses shall be satisfactorily completed by the student as part of the degree requirements. These courses will be evaluated and awarded letter grades based on the following criteria:

S (Satisfactorily Completed): Awarded when the student successfully completes all prescribed course requirements.

NC (Not Completed): Awarded when the student fails to meet the prescribed course requirements.

A student receiving an NC grade must reappear for and complete the course in accordance with the guidelines prescribed by the University.

In the case of non-taught and non-credited mandatory courses—where students are advised to undertake learning through MOOC platforms—there shall be a clearly defined Course Catalogue and a corresponding Course Plan. The Course Plan shall outline the assessment components, which will form the basis for evaluation.

PART B – PROGRAM STRUCTURE

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

The B.Tech. (Computer Science and Engineering-Cyber Security) Program Structure (2026-2030) totaling 160 credits. Table 3.0 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: B.Tech. (Computer Science & Engineering-Cyber Security) 2025-2029: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	Humanities and Social Sciences including Management Courses (HSMC)	10
2	Basic Science Courses (BSC)	24
3	Engineering Science Courses (ESC)	22
4	Professional Core Courses (PCC)	64
5	Project Work (PRW)	16
6	Professional Elective Courses (PEC)	18
7	Open Elective Courses (OEC)	06
8	Mandatory Courses (MAC)*	0
	Total Credits	**160 (Minimum)**

* Please refer to Table 3.6, (where the number '8' corresponds to the serial number of the Mandatory course basket.)

In the entire Program, the practical and skill based course component contribute to an extent of approximately 61% out of the total credits of 160 for B.Tech. (Computer Science and Engineering-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 19.2.1**Error! Reference source not found.** 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).

Type of Skill
F - Foundation
S - Skill Development
EM – Employability
EN – Entrepreneurship
SS-Soft Skills
AT-Aptitude Training

Course Caters to
GS - Gender Sensitization
ES - Environment and sustainability
HP - Human values and Professional Ethics

Baskets
HSMC - Humanities and Social Sciences (including Management courses) (HSMC)
BSC - Basic Science Courses ESC - Engineering Science Courses
PCC - Professional Core Course
PEC - Professional Elective Courses
OEC - Open Elective Courses
EEC - Employment Enhancement Courses
MAC - Mandatory Course

Table 3.1:
List of Humanities and Social Sciences including Management Courses (HSMC)

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite
1	ENG1900	English for Technical Communication	2	0	0	2	2	S	Nil
2	DES1146	Introduction to Design Thinking	1	0	0	1	1	F	Nil
3	ENG2501	Advanced English	2	0	0	2	2	S	Nil
4	FIN1002	Essentials of Finance	3	0	0	3	3	S	Nil
5	APT4005	Aptitude for Employability	0	0	2	1	2	AT	Nil
6	PPS3018	Preparedness for Interview	0	0	2	1	2	SS	Nil
		Total	8	0	4	10	12		

Table 3.2: List of Basic Science Courses (BSC)

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite
1	MAT1211	Linear Algebra, Differential Equations and Statistical Methods	3	1	0	4	4	F	Nil
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	3	F	Nil
3	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	2	F	Nil
4	MAT1212	Mathematical foundations for Machine Learning and Data Analysis	3	1	0	4	4	F	Nil
5	CHE2501	Chemistry of Smart Materials	3	0	0	3	3	S	Nil
6	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	2	S	Nil
7	MAT2311	Vector Calculus, Numerical Methods and Sampling Distributions	3	1	0	4	4	EM	Nil

8	MAT2321	Discrete Mathematical Structures	3	1	0	4	4	F	Nil
		Total	**18**	**4**	**4**	**24**	**26**		

Table 3.3: List of Engineering Science Courses (ESC)

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite
1	MEC1006	Engineering Graphics	2	0	0	2	2	**S**	Nil
2	CSS1500	Computational Thinking using Python	2	0	2	3	4	**S**	Nil
3	ECE2022	Digital Design	2	0	0	2	2	**F/S**	Nil
4	ECE2052	Digital Design Lab	0	0	2	1	2	**F/S**	Nil
5	CIV1200	Foundations of Integrated Engineering	2	0	0	2	2	**S**	Nil
6	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	3	**F/S**	Nil
7	EEE1251	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	2	**F/S**	Nil
8	ECE1511	Design Workshop	1	0	2	2	3	**S/EM**	Nil
9	CSS2264	Essentials of AI	3	0	0	3	3	**S/EM**	Nil
10	CSS2265	Essentials of AI Lab	0	0	2	1	2	**S/EM**	Nil
11	CSS2274	Competitive Programming and Problem Solving	0	0	4	2	4	**S/EM**	Nil
		Total	**15**	**0**	**14**	**22**	**29**		

Table 3.4: List of Professional Core Courses (PCC)

S. No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills/Focus	Pre-requisites / Co-requisites
1	CSS2200	Problem Solving using C	2	0	0	2	2	S	Nil
2	CSS2201	Problem Solving using C Lab	0	0	4	2	4	S/EM	Nil
3	CSS2251	Data Communication and Computer Networks	3	0	0	3	3	S	Nil
4	CSS2252	Data Communication and Computer Networks Lab	0	0	2	1	2	S	Nil
5	CSS2253	Data Structures	3	0	0	3	3	S	Nil
6	CSS2254	Data Structures Lab	0	0	2	1	2	S/EM	Nil

7	CSS2255	Object Oriented Programming Using Java	3	0	0	3	3	S	Nil
8	CSS2256	Object Oriented Programming Using Java Lab	0	0	2	1	2	S/EM	Nil
9	CSS2257	Computer Organization and Architecture	3	0	0	3	3	S	NIL
10	CSS2258	Web Technologies	3	0	0	3	3	S	CSS2251
11	CSS2259	Web Technologies Lab	0	0	2	1	2	S	NIL
12	CSS2502	Cryptography and Network Security	3	0	0	3	3	S	CSS2251
13	CSS2269	Operating Systems	3	0	0	3	3	S/EM	NIL
14	CSS2270	Operating Systems Lab	0	0	2	1	2	S/EM	NIL
15	CSS2260	Database Management Systems	3	0	0	3	3	S	NIL
16	CSS2261	Database Management Systems Lab	0	0	2	1	2	**S**	CSS2251
17	CCS2512	Ethical Hacking	2	0	0	2	2	**S**	CSS2251
18	CCS2505	Ethical Hacking Lab	0	0	4	2	4	**S**	CSS2251
19	CSS2262	Analysis of Algorithms	3	1	0	4	4	**S**	NIL
20	CSS2263	Analysis of Algorithms Lab	0	0	2	1	2	**S**	NIL
21	CSS2266	Theory of Computation	3	0	0	3	3	S	NIL
22	CCS2500	Cyber Forensics	2	0	0	2	2	S/EM	CSS2251
23	CCS2501	Cyber Forensics Lab	0	0	2	1	2	S/EM	CSS2251
24	CCS2502	Cyber Threats for IoT and Cloud	3	0	0	3	3	S/EM	CSS2251
25	CCS3405	Vulnerability Assessment and Penetration Testing	3	0	0	3	3	S/EM	CSS2251
26	CSS2271	Software Design and Development	3	0	0	3	3	S/EM	Nil
27	CCS2507	Web Security	2	0	0	2	2	S/EM	CSS2251
28	CCS2508	Web Security Lab	0	0	2	1	2	S/EM	CSS2251
29	CCS2506	Intrusion Detection and Prevention System	3	0	0	3	3	S/EM	CSS2502
Total No. of Credits			50	01	26	64	78		

Table 3.5: List of course in Project Work basket (PRW)									
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Contact Hours**	**Type of Skill**	**Pre-requisite**
1	CSS7000	Internship	0	0	0	2	0	S/EM	--
2	CSS7100	Mini Project	0	0	0	4	0	S/EM	--
3	CSS7300	Capstone Project	0	0	0	10	0	S/EM	--
		Total	**0**	**0**	**0**	**16**	**0**		

Table 3.6 : List of Mandatory Courses (MAC)						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CHE7601	Environmental Studies	1	0	0	0
2	LAW7601	Indian Constitution	1	0	0	0
3	CIV7601	Universal Human Values and Ethics	1	0	0	0
4	PPS1025	Industry Readiness Program - I	0	0	2	0
5	PPS1026	Industry Readiness Program - II	0	0	2	0
6	APT4002	Introduction to Aptitude	0	0	2	0
7	APT4004	Aptitude Training - Intermediate	0	0	2	0
8	APT4006	Logical and Critical Thinking	0	0	2	0
					Total No. of Credits	**0**

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

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

18.1 Internship / In-plant Training / Skill-based Program / International Immersion (IM) / Recognition of Prior Learning (RPL)

A student may undergo an Internship / In-plant Training / Skill-based Program / IM / RPL for a period minimum 04 weeks in an industry / company, government bodies, academic / research institution or recognized online platforms offering certified skill-based programs during the semester break between 4th and 5th semesters, subject to the following conditions:

18.1.1 The Internship / In-plant Training / Skill-based Program / IM / RPL shall be conducted in accordance with the Internship Policy prescribed by the University from time to time.

18.1.2 Internship: student shall undergo internship, either in industry / company, academic / research organizations, government bodies, or international institutions. The objective is to provide practical exposure, industry insights, and real-world experience relevant to the student's field of study.

18.1.3 In-plant Training: student shall undergo training / industrial exposure program aimed at providing with practical insights into real-world working environments. The training may be conducted by industries / companies on-campus or through student visits to industries / companies, government bodies / institutions, or technical organizations.

18.1.4 Skill-based Program: student shall undergo a certified skill-based program of 30 hours / 04 weeks. Skill-based program should cater to Skill-Enhancement, Practical Focus, and Career orientation, Complementary to Curriculum or Industry relevant.

18.1.5 International Immersion (IM): student shall undergo IM aimed at providing global exposure through collaborations with foreign universities, industries, or research institutions. The International Immersion may include industry visits, expert interactions, and cultural exchange activities, enhancing students' international outlook, communication skills, and professional readiness.

18.1.6 Recognition of Prior Learning (RPL): student who shall undergo any formally recognize relevant prior work experience, internships, or project-based learning that meet the internship learning outcomes, thereby allowing students to earn internship credit without repeating equivalent practical training.

18.1.7 The number of Internships available for the concerned Academic Term. Further, the available number of Internships / In-plant training / Skill-based Program / IM / RPL shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student and as per the selection criteria. Provided further, the student fulfils the criteria, as applicable, specified by the industry / company, government bodies, academic / research or through certified courses.

18.1.8 A student may opt for Internship / In-plant Training / IM / RPL in an industry / company, government bodies / academic / research institution, international bodies of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship / In-plant Training / IM / RPL on her / his own. Provided further, that the industry / company, government bodies, academic / research institution national or international offering such Internship /

Training confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University / Rubrics.

18.1.9 A student undergoing RPL must submit an application with supporting documents such as experience letters, project reports, employer feedback, certifications, a self-reflection report etc. Application must be submitted before the commencement of the internship semester.

18.1.10 A student selected for an Internship / In-plant Training / Skill-based Program / IM / RPL in an industry / company, government bodies, academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

The performance will be assessed and grades awarded as per the university's academic grading policy. It may be included as a non-GPA course (Grade-based Satisfactorily Completed / Not Completed). The student must secure a minimum of 50% of the total marks to be declared as having successfully completed the course.

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 Specializations / Stream Basket

Type of Skill
F - Foundation
S - Skill Development
EM – Employability
EN – Entrepreneurship
SS-Soft Skills
AT-Aptitude Training

Course Caters to
GS - Gender Sensitization
ES - Environment and sustainability
HP - Human values and Professional Ethics

Baskets
HSMC - Humanities and Social Sciences (including Management courses) (HSMC)
BSC - Basic Science Courses ESC - Engineering Science Courses
PCC - Professional Core Course
PEC - Professional Elective Courses
OEC - Open Elective Courses
EEC - Employment Enhancement Courses
MAC - Mandatory Course

Table 3.7: Professional Electives Courses/Specialization Tracks – Minimum of 12 credits is to be earned by the student in a particular track and overall 18 credits.

Track 1 – Cyber Defense and Operations Basket

S. No	Course Code	Course Name	L	T	P	C	Contact hours	Type of Skills	Pre-Requisite
1	CCS2510	Security Assessment and Testing	2	0	2	3	4	S/EM	CSS2251
2	CCS3403	AI and ML in Cyber Security	3	0	0	3	3	S/EM	CSS2502
3	CCS3404	Incident Response and Threat Hunting	3	0	0	3	3	S/EM	CSS2502
4	CCS3406	Cyber Digital Twin	3	0	0	3	3	S/EM	CSS2502
5	CCS3408	Privacy and Security in Online social media	3	0	0	3	3	S/EM	CSS2502
6	CCS3409	Machine Learning for Cyber Security	3	0	0	3	3	S/EM	CSS2264
7	CCS3411	Security Information and Event Management (SIEM)	3	0	0	3	3	S/EM	CSS2502
8	CCS3412	Blockchain Security	3	0	0	3	3	S/EM	CSS2502

Track 2 – Digital Evidence and Malware Research Basket

S. No	Course Code	Course Name	L	T	P	C	Contact hours	Type of Skills	Pre-Requisite
1	CCS3407	Quantum Cryptography	3	0	0	3	3	S/EM	CSS2264
2	CCS3410	Digital Watermarking and Steganography	3	0	0	3	3	S/EM	CSS2502
3	CCS3400	Digital and Mobile Forensics	2	0	2	3	4	S/EM	CSS2251
4	CCS3416	Cryptocurrency Technologies	3	0	0	3	3	S/EM	CSS2502

Track 3 – Offensive Security and Engineering

S. No	Course Code	Course Name	L	T	P	C	Contact hours	Type of Skills	Pre-Requisite
1	CCS3402	Identity and Access Management	3	0	0	3	3	S/EM	CSS2251
2	CCS3414	Security in IoT	3	0	0	3	3	S/EM	CSS2502
3	CCS3405	Vulnerability Assessment and Penetration Testing	3	0	0	3	3	S/EM	CSS2251
4	CCS3413	Security Auditing and	3	0	0	3	3	S/EM	CSS2502

		Governance							
5	CCS3415	Cloud Security	3	0	0	3	3	S/EM	CSS2502
6	CCS3417	Security and Privacy in Cloud	2	0	2	3	3	S/EM	CSS2502
7	CCS3426	Security Operations and Threat Hunting	2	0	1	3	3	S/EM	
8	CCS3427	Advanced Penetration Testing and Offensive Security	2	0	1	3	3	S/EM	
Track 04-Special Basket									
1	CSS3426	Front End Full Stack Development*	2	0	2	3	4	S/EM	CSS2258
2	CSS3427	Java Full Stack Development*	2	0	2	3	4	S/EM	CSS2258
3	CSS3428	.Net Full Stack Development*	2	0	2	3	4	S/EM	CSS2258
4	CAI3427	Language Models for Text Mining+	2	0	2	3	4	S/EM	CSS2264
5	CAI3428	Practical Deep Learning with TensorFlow+	2	0	2	3	4	S/EM	CSS2264
6	CAI3429	Deep Learning Techniques for Computer Vision+	2	0	2	3	4	S/EM	MAT1212
Track 05 - Industrial Track (Cybersecurity for Digital Finance)									
1	CCS3418	System Security Design and Threat Surface Analysis	2	0	2	3	4	S/EM	
2	CCS3419	Encryption Systems and Protocol Design for Secure Communication	2	0	2	3	4	S/EM	
3	CCS3420	Network Defense Infrastructure and Real-Time Threat Inspection	2	0	2	3	4	S/EM	
4	CCS3421	Secure Code Architecture and Exploit Mitigation Engineering	2	0	2	3	4	S/EM	
5	CCS3422	Cloud-Native Security and Virtualized Infrastructure Defense	2	0	2	3	4	S/EM	
6	CCS3423	Cyber Risk Leadership, Compliance Engineering, and Breach Response Operations	2	0	2	3	4	S/EM	
7	CCS3424	Mini Project/Hackathon - Offensive and Defensive Cyber Challenge	0	0	0	4	4	S/EM	
8	CCS3425	Capstone Project - End-to-End Cyber Defense Deployment	0	0	0	10	10	S/EM	
Track -06 Mandatory Non-Credited Course (Offered for Lateral Entry students in higher semester wherever applicable in MOOC mode)**									
1	LAW7601	Indian Constitution **	1	0	0	0	1	F	Nil
2	CHE7601	Environmental Studies **	1	0	0	0	1	F	Nil
3	CIV7601	Universal Human Values and Ethics **	1	0	0	0	1	F	Nil
*Mandatory for Students selected for Tech Mahindra and Capgemini									
** Offered for Lateral Entry students in higher semester wherever applicable in MOOC mode									
+Mandatory for Students Selected for Samsung Innovation Campus									

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

Type of Skill
F - Foundation
S - Skill Development
EM – Employability
EN – Entrepreneurship

Course Caters to
GS - Gender Sensitization ES - Environment and sustainability HP - Human values and Professional Ethics

Baskets
HSMC - Humanities and Social Sciences (including Management courses) (HSMC)
BSC - Basic Science Courses ESC - Engineering Science Courses
PCC - Professional Core Course
PEC - Professional Elective Courses
OEC - Open Elective Courses
EEC - Employment Enhancement Courses
MAC - Mandatory Course

Table 3.8: Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 06

Sl. No.	Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Prerequisites / Corequisites	Antirequisites	Future Courses that need this as a Prerequisite	Course Category
Chemistry Basket												
1	CHE1003	Fundamentals of Sensors	3	0	0	3	SD	ES	-	-		OEC
2	CHE1004	Smart materials for IOT	3	0	0	3	SD	ES	-	-		OEC
3	CHE1006	Introduction to Nano technology	3	0	0	3	SD	ES	-	-		OEC
4	CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	SD	ES	-	-		OEC
5	CHE1013	Chemistry for Engineers	3	0	0	3	SD	ES	-	-		OEC
6	CHE1014	Surface and Coatings	3	0	0	3	SD	ES	-	-		OEC

		technology										
7	CHE1016	Forensic Science	3	0	0	3	SD	HP	-	-		OEC
Civil Engineering Basket												
1	CIV1001	Disaster mitigation and management	3	0	0	3	SD	ES / HP	-	-		OEC
2	CIV1002	Environmental Science and Disaster Management	3	0	0	3	FC	ES	-	-		OEC
3	CIV2001	Sustainablility Concepts in Engineering	3	0	0	3	SD	ES	-	-		OEC
4	CIV2002	Occupational Health and Safety	3	0	0	3	SD		-	-		OEC
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	SD / EM	ES	-	-		OEC
6	CIV2004	Integrated Project Management	3	0	0	3	SD / EM / EN	HP / GS	-	-		OEC
7	CIV2005	Environmental Impact Assessment	3	0	0	3	EM / EN	ES	-	-		OEC
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EM / EN	ES	-	-		OEC
9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	SD / EM	ES	-	-		OEC
10	CIV2045	Environmental Meteorology	3	0	0	3	SD	ES	-	-		OEC
11	CIV3046	Project Problem Based Learning	3	0	0	3	SD	ES	-	-		OEC
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	EN	ES	-	-		OEC

Commerce Basket												
1	COM2007	Basics of Accounting	3	0	0	3	FC	-	-	-		OEC
Computer Science Basket												
1	CSS2002	Programming in Java	2	0	2	3	S/EM					ESC
2	CSS2003	Social Network Analytics	3	0	0	3	S					ESC
3	CSS2004	Python Application Programming	2	0	2	3	S/ EM					ESC
4	CSS2005	Web design fundamentals	2	0	2	3	S/ EM /EN					
Design Basket												
1	DES2001	Design Thinking	3	0	0	3	SD		-	-		OEC
2	DES2080	Art of Design Language	3	0	0	3	SD		-	-		OEC
3	DES2081	Brand Building in Design	3	0	0	3	SD		-	-		OEC
4	DES2085	Web Design Techniques	3	0	0	3	SD		-	-		OEC
5	DES2089	3D Modeling for Professionals	1	0	4	3	SD		-	-		OEC
6	DES2090	Creative Thinking for Professionals	3	0	0	3	SD		-	-		OEC
7	DES2091	Idea Formulation	3	0	0	3	SD		-	-		OEC
Electrical and Electronics Engineering Basket												
1	EEE1002	IoT based Smart Building Technology	3	0	0	3	SD	-	-	-		OEC
2	EEE1003	Basic Circuit Analysis	3	0	0	3	SD	-	-	-		OEC
3	EEE1004	Fundamentals of Industrial Automation	3	0	0	3	SD	-	-	-		OEC
4	EEE1005	Electric Vehicles & Battery technology	3	0	0	3	SD	-	-	-		OEC

5	EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	SD	-	-	-		OEC
Electronics and Communication Engineering Basket												
1	ECE1003	Fundamentals of Electronics	3	0	0	3	FC	-	-	-		OEC
2	ECE1004	Microprocessor based systems	3	0	0	3	FC	-	-	-		OEC
3	ECE3089	Artificial Neural Networks	3	0	0	3	SD	-	-	-		OEC
4	ECE3097	Smart Electronics in Agriculture	3	0	0	3	FC / EM	-	-	-		OEC
5	ECE3098	Environment Monitoring Systems	3	0	0	3	FC / EM	-	-	-		OEC
6	ECE3102	Consumer Electronics	3	0	0	3	FC / EM	-	-	-		OEC
7	ECE3103	Product Design of Electronic Equipment	3	0	0	3	SD / FC / EM / EN	-	-	-		OEC
8	ECE3106	Introduction to Data Analytics	3	0	0	3	FC / EM	-	-	-		OEC
9	ECE3107	Machine Vision for Robotics	3	0	0	3	FC / EM	-	-	-		OEC
English Basket												
1	ENG1009	Reading Advertisement	3	0	0	3	SD		-	-		OEC
2	ENG1010	Verbal Aptitude for Placement	2	0	2	3	SD		-	-		OEC
3	ENG1011	English for Career Development	3	0	0	3	SD		-	-		OEC
4	ENG1013	Indian English Drama	3	0	0	3			-	-		OEC
5	ENG1014	Logic and Art of Negotiation	2	0	2	3						OEC

Kannada Basket												
1	KAN1003	Kannada Kaipidi	3	0	0	3	SD	-	-	-		OEC
2	KAN2005	Anuvadha Kala Sahithya	3	0	0	3	SD	-	-	-		OEC
3	KAN2006	Vichara Manthana	3	0	0	3	SD	-	-	-		OEC
4	KAN2007	Katha Sahithya Sampada	3	0	0	3	SD	-	-	-		OEC
5	KAN2008	Ranga Pradarshana Kala	3	0	0	3	SD	-	-	-		OEC
Foreign Language Basket												
1	FRL1009	Mandarin Chinese for Beginners	3	0	0	3	SD	-	-	-		OEC
Law Basket												
1	LAW2014	Introduction to Competition Law	3	0	0	3	FC	HP	-	-		OEC
2	LAW2015	Cyber Law	3	0	0	3	FC	HP	-	-		OEC
Mathematics Basket												
1	MAT2008	Mathematical Reasoning	3	0	0	3	SD	-	-			OEC
2	MAT2014	Advanced Business Mathematics	3	0	0	3	SD	-	-	-		OEC
3	MAT2041	Functions of Complex Variables	3	0	0	3	SD	-	-	-		OEC
4	MAT2042	Probability and Random Processes	3	0	0	3	SD	-	-	-		OEC
5	MAT2043	Elements of Number Theory	3	0	0	3	SD	-	-	-		OEC
6	MAT2044	Mathematical Modelling and Applications	3	0	0	3	SD	-	-	-		OEC
Mechanical Engineering Basket												
1	MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	SD	-	-	-		OEC
2	MEC1002	Introduction to Matlab and Simulink	3	0	0	3	SD / EM	-	-	-		OEC

3	MEC1003	Engineering Drawing	1	0	4	3	SD	-	-	-		OEC
4	MEC2001	Renewable Energy Systems	3	0	0	3	FC	ES	-	-		OEC
5	MEC2002	Operations Research & Management	3	0	0	3	FC	-	-	-		OEC
6	MEC2003	Supply Chain Management	3	0	0	3	SD / EM / EN	-	-	-		OEC
7	MEC2004	Six Sigma for Professionals	3	0	0	3	SD / EM	-	MEC 2008	-		OEC
8	MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	FC	-	-	-		OEC
9	MEC2006	Safety Engineering	3	0	0	3	SD / EM	ES	-	-		OEC
10	MEC2007	Additive Manufacturing	3	0	0	3	FC / EM	-	-	-		OEC
11	MEC3069	Engineering Optimisation	3	0	0	3	SD / EM	-	-	-		OEC
12	MEC3070	Electronics Waste Management	3	0	0	3	FC / SD	ES	-	-		OEC
13	MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	SD / EM	ES	-	-		OEC
14	MEC3072	Thermal Management of Electronic Appliances	3	0	0	3	SD / EM	-	-	-		OEC
15	MEC3200	Sustainable Technologies and Practices	3	0	0	3	SD / EM	-	-	-		OEC
16	MEC3201	Industry 4.0	3	0	0	3	SD / EM	-	-	-		OEC
Petroleum Engineering Basket												
1	PET1011	Energy Industry Dynamics	3	0	0	3	FC / SD / EM	ES	-	-	-	OEC

2	PET1012	Energy Sustainability Practices	3	0	0	3	FC / SD / EM	ES	-	-	-	OEC
Physics Basket												
1	PHY1003	Mechanics and Physics of Materials	3	0	0	3	FC / SD		-	-		OEC
2	PHY1004	Astronomy	3	0	0	3	FC		-	-		OEC
3	PHY1005	Game Physics	2	0	2	3	FC / SD		-	-		OEC
4	PHY1007	Physics of Nanomaterials	3	0	0	3	FC		-	-		OEC
5	PHY2004	Laser Physics	3	0	0	3	FC	ES	-	-		OEC
6	PHY2005	Science and Technology of Energy	3	0	0	3	FC	ES	-	-		OEC
Management Basket												
1	MGT1001	Introduction to Psychology	3	0	0	3	FC	HP	-	-		OEC
2	MGT1002	Business Intelligence	3	0	0	3	EN		-	-		OEC
3	MGT1003	NGO Management	3	0	0	3	SD		-	-		OEC
4	MGT1004	Essentials of Leadership	3	0	0	3	EM / EN	GS / HP	-	-		OEC
5	MGT1005	Cross Cultural Communication	3	0	0	3	SD / EM / EN	HP	-	-		OEC
6	MGT2001	Business Analytics	3	0	0	3	SD / EM / EN		-	-		OEC
7	MGT2002	Organizational Behaviour	3	0	0	3	FC	HP	-	-		OEC
8	MGT2003	Competitive Intelligence	3	0	0	3	SD	-	-	-		OEC
9	MGT2004	Development of Enterprises	3	0	0	3	SD / EM / EN		-	-		OEC
10	MGT2005	Economics and Cost	3	0	0	3	SD /		-	-		OEC

		Estimation					EM					
11	MGT2006	Decision Making Under Uncertainty	3	0	0	3	SD		-	-		OEC
12	MGT2008	Econometrics for Managers	3	0	0	3	SD		-	-		OEC
13	MGT2009	Management Consulting	3	0	0	3	SD / EM / EN		-	-		OEC
14	MGT2010	Managing People and Performance	3	0	0	3	SD / EM / EN	HP / GS	-	-		OEC
15	MGT2011	Personal Finance	3	0	0	3	FC		-	-		OEC
16	MGT2012	E Business for Management	3	0	0	3	SD / EM		-	-		OEC
17	MGT2013	Project Management	3	0	0	3	EN / EM	GS / HP / ES	-	-		OEC
18	MGT2014	Project Finance	3	0	0	3	EN / EM	HP	-	-		OEC
19	MGT2015	Engineering Economics	3	0	0	3	SD		-	-		OEC
20	MGT2016	Business of Entertainment	3	0	0	3	EM / EN		-	-		OEC
21	MGT2017	Principles of Management	3	0	0	3	SD / EM / EN		-	-		OEC
22	MGT2018	Professional and Business Ethics	3	0	0	3	SD / EM / EN	HP	-	-		OEC
23	MGT2019	Sales Techniques	3	0	0	3	SD / EM / EN	HP	-	-		OEC
24	MGT2020	Marketing for Engineers	3	0	0	3	SD / EM / EN	HP				OEC

25	MGT2021	Finance for Engineers	3	0	0	3	SD / EM / EN	HP				OEC
26	MGT2022	Customer Relationship Management	3	0	0	3	SD / EM / EN	HP				OEC
27	MGT2023	People Management	3	0	0	3	SD / EM / EN	HP				OEC
Media Studies Basket												
1	BAJ3051	Digital Photography	2	0	2	3	EM	HP				OEC

Special Basket (NVIDIA)											
1	CSSXXX	Introduction to NVIDIA Accelerated Computing and AI	2	0	2	3			-	-	-
2	CSSXXX	NVIDIA Applied Artificial Intelligence and Generative AI	2	0	2	3					
3	CSSXXX	Advanced AI Systems and Generative Intelligence using NVIDIA Platforms	2	0	2	3					

21.List of MOOC (NPTEL) Courses

21.1 Presidency University students are given the opportunity to study abroad in International Universities through a selection process coordinated by the Office of International Affairs (OIA). Such selected students need to complete their credits for the semester that they are abroad in the following way:

21.1.1. The student needs to study and complete School Core and Program Core Courses in offline mode only.

21.1.2. Massive Open Online Course (MOOC) courses maybe given for Open Elective and Discipline Elective Courses. These courses need to be approved by the concerned BOS and Academic Council from time to time.

21.1.3. SWAYAM/NPTEL/ other approved MOOCs shall be approved by the concerned Board of Studies and placed in the concerned PRC.

21.1.4. Student shall register for these courses in the ERP of Presidency University.

21.1.5. For these MOOC courses faculty coordinators are identified. These faculty should have undergone similar MOOC courses and therefore should be familiar with the mode of class conduction, types of assessments and evaluation procedures.

21.1.6. Study materials shall be provided to the students as video lectures shared by the MOOCs Coordinator(s), or the students may access the approved MOOCs Portal directly. The mode of class conduction is determined by the MOOCs coordinator(s) as detailed in the Course Catalogue and Course Plan.

21.1.7. The question paper shall be prepared by the MOOCs coordinator(s).

21.1.8. Students write the exams in online mode. These exams are scheduled and conducted by the School.

21.1.9. Results are evaluated by School and given to the Office of the Controller of Examinations (CoE).

21.1.10. The details of the duration, credits and evaluation are given below:

Sl#	Duration	Credits	Evaluation
1.	12 weeks	3	Continuous Assessment –50 Marks Mid Term –50 Marks End Term-100 Marks
2.	8 weeks	2	Mid Term-50 Marks End Term-100 Marks
3	4 weeks	1	End Term-100 Marks

21.2 MOOC – Discipline Elective Courses for B.Tech. Computer Science and Engineering (Cyber Security) Program of 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)

Table 3.9 : MOOC Discipline Elective Courses

Sl.No	Course Code	Course Name	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	CSE3196	Foundations of Cyber Physical Systems	3	3-0-0-3
16	CSE3197	Getting Started with Competitive Programming	3	3-0-0-3
17	CSE3198	GPU Architectures and Programming	3	3-0-0-3
18	CSE3199	Artificial Intelligence: Knowledge Representation and Reasoning	3	3-0-0-3
19	CSE3200	Programming in Modern C++	3	3-0-0-3
20	CSE3201	Circuit Complexity Theory	3	3-0-0-3
21	CSE3202	Basics of Computational Complexity	3	3-0-0-3
22	CSE3212	Introduction to Computer and Network Performance Analysis using Queuing	1	1-0-0-1
23	CSE3213	C Programming and Assembly Language	1	1-0-0-1
24	CSE3214	Python for Data Science	1	1-0-0-1
25	CSE3215	Software Conceptual Design	1	1-0-0-1
26	CSE3117	Industrial Digital Transformation	3	3-0-0-3
27	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
28	CSE3349	Technology for Lawyers	3	3-0-0-3

29	CSE3430	Deep Learning for Natural Language Processing	3	3-0-0-3
30	CSE3431	Machine Learning for Engineering and Science Applications	3	3-0-0-3
31	CSE3432	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
32	CSE3433	Introduction to Large Language Models (LLMs)	3	3-0-0-3
33	CSE3434	Quantum Algorithms and Cryptography	3	3-0-0-3

21.3 MOOC - Open Elective Courses for B. Tech. (Computer Science and Engineering-Cyber Security)

Table 3.10: MOOC Open Elective Courses
Courses duration is 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)

Sl. No.	Course Code	Course Name	Total Credits	L-T-P-C
1	BBA2022	Supply Chain digitization	3	3-0-0-3
2	BBA2021	E Business	3	3-0-0-3
3	BBB2016	Business Analytics for Management Decisions	3	3-0-0-3
4	BBB2015	Artificial Intelligence for Investments	3	3-0-0-3
5	MEC3001	Design and Development of Product	1	1-0-0-1
6	ENG3004	Perspectives of Neurolinguistics	1	1-0-0-1
7	PPS4009	Working in Contemporary Teams	1	1-0-0-1
8	MGT3001	Data Analysis and Decision Making	3	3-0-0-3
9	MEC3001	Design and Development of Product	1	1-0-0-1
10	EEE3105	Microsensors and Nanosensors	3	3-0-0-3
11	CIV3065	Drone Systems and Control	3	3-0-0-3
12	ECE3183	Neural Networks for Signal Processing - I	3	3-0-0-3
13	CIVXXXX	Disaster Management	3	3-0-0-3

Note :

** MEC3001 is offered to the students who had 1 credit shortage because of implementation of CBCS system during their 1st year.*

*** ENG3004 is offered to the students who had 2 credits shortage along with the MEC3001 because of implementation of CBCS System during their 1st year.*

**** PPS4009 is offered to only International students in place of Interview Preparedness course of their batch mates.*

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	C	Type of Skill/ Focus	Course Caters to	Basket
Semester 1 - Physics Cycle						**21**			

1	MAT1211	Linear Algebra, Differential Equations and Statistical Methods	3	1	0	4	F		BSC
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	F		BSC
3	MEC1006	Engineering Graphics	2	0	0	2	S		ESC
4	ENG1030	Fundamentals of Communication	1	0	2	2	3		HSMC
5	CSS1500	Computational Thinking using Python	2	0	2	3	S		ESC
6	ECE2022	Digital Design	2	0	0	2	F/S		ESC
7	ECE1512	Design Thinking in Practice	2	0	2	3	4		HSMC
8	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	F		BSC
9	PPS1025	Industry Readiness Program – I	0	0	2	0	S		MAC
10	ECE2052	Digital Design Lab	0	0	2	1	F/S		ESC
Semester 1 – Chemistry Cycle						**20**			
1	MAT1212	Mathematical foundations for Machine Learning and Data Analysis	3	1	0	4	F		BSC
2	CIV1200	Foundations of Integrated Engineering	2	0	0	2	S		ESC
3	CHE2501	Chemistry of Smart Materials	3	0	0	3	S		BSC
4	CSS2200	Problem Solving using C	2	0	0	2	S		PCC
5	ENG2030	Communication in Practice	1	0	2	2	3		HSMC
6	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	F/S		ESC
7	CSS2201	Problem Solving using C Lab	0	0	4	2	S		PCC
8	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	S		BSC
9	PPS1026	Industry Readiness Program – II	0	0	2	0	S		MAC
10	EEE1251	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	F/S		ESC

First year - CYCLE 2

Sl. No.	Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Basket
Semester 2 - Chemistry Cycle						**20**			
1	MAT1212	Mathematical foundations for Machine Learning and Data Analysis	3	1	0	4	F		BSC
2	CIV1200	Foundations of Integrated Engineering	2	0	0	2	S		ESC
3	CHE2501	Chemistry of Smart Materials	3	0	0	3	S		BSC
4	CSS2200	Problem Solving using C	2	0	0	2	S		PCC
5	ENG2030	Communication in Practice	1	0	2	2	3		HSMC
6	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	F/S		ESC
7	CSS2201	Problem Solving using C Lab	0	0	4	2	S		PCC
8	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	S		BSC
9	PPS1026	Industry Readiness Program –	0	0	2	0	S		MAC

		II							
10	EEE1251	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	F/S		ESC
Semester 2 – Physics Cycle						**21**			
1	MAT1211	Linear Algebra, Differential Equations and Statistical Methods	3	1	0	4	F		BSC
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	F		BSC
3	MEC1006	Engineering Graphics	2	0	0	2	S		ESC
4	ENG1030	Fundamentals of Communication	1	0	2	2	3		HSMC
5	CSS1500	Computational Thinking using Python	2	0	2	3	S		ESC
6	ECE2022	Digital Design	2	0	0	2	F/S		ESC
7	ECE1512	Design Thinking in Practice	2	0	2	3	4		HSMC
8	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	F		BSC
9	PPS1025	Industry Readiness Program – I	0	0	2	0	S		MAC
10	ECE2052	Digital Design Lab	0	0	2	1	F/S		ESC

Sl. No.	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skill	Pre-requisite	Basket
Semester 3			**19**	**1**	**10**		**23**	**30**			
1	MAT2311	Vector Calculus, Numerical Methods and Sampling Distributions	3	1	0	4	4	EM	Nil	BSC
2	CSS2251	Data Communication and Computer Networks	3	0	0	3	3	S	Nil	PCC
3	CSS2252	Data Communication and Computer Networks Lab	0	0	2	1	2	S	Nil	PCC
4	CSS2253	Data Structures	3	0	0	3	3	S	Nil	PCC
5	CSS2254	Data Structures Lab	0	0	2	1	2	S	Nil	PCC
6	CSS2255	Object Oriented Programming Using Java	3	0	0	3	3	S/EM	Nil	PCC
7	CSS2256	Object Oriented Programming Using Java Lab	0	0	2	1	2	S/EM	Nil	PCC
8	CSS2257	Computer Organization and Architecture	3	0	0	3	3	S	Nil	PCC
9	CSS2258	Web Technologies	3	0	0	3	3	S/EM	Nil	PCC
10	CSS2259	Web Technologies Lab	0	0	2	1	2	S/EM	Nil	PCC
11	CIV7601	Universal Human Values and Ethics	1	0	0	0	1	S	Nil	MAC

12	APT4002	Introduction to Aptitude	0	0	2	0	2	AT	Nil	MAC
Semester 4			**18**	**2**	**12**	**24**	**32**			
1	CHE7601	Environmental Studies	1	0	0	0	1	F	Nil	MAC
2	MAT2321	Discrete Mathematical Structures	3	1	0	4	4	F	Nil	BSC
3	CSS2502	Cryptography and Network Security	3	0	0	3	3	S	CSS2251	PCC
4	CSS2269	Operating Systems	3	0	0	3	3	S	Nil	PCC
5	CSS2270	Operating Systems Lab	0	0	2	1	2	S/EM	Nil	PCC
6	CSS2260	Database Management Systems	3	0	0	3	3	S	Nil	PCC
7	CSS2261	Database Management Systems Lab	0	0	2	1	2	S	Nil	PCC
8	CCS2512	Ethical Hacking	2	0	0	2	2	S/EM	CSS2251	PCC
9	CCS2505	Ethical Hacking Lab	0	0	4	2	4	S/EM	CSS2251	PCC
10	CSS2262	Analysis of Algorithms	3	1	0	4	4	S	Nil	PCC
11	CSS2263	Analysis of Algorithms Lab	0	0	2	1	2	S	Nil	PCC
12	APT4004	Aptitude Training- Intermediate	0	0	2	0	2	AT	Nil	MAC
Semester 5			**20**	**0**	**6**	**24**	**26**			
1	CSS2266	Theory of Computation	3	0	0	3	3	S	Nil	PCC
2	CCS2500	Cyber Forensics	2	0	0	2	2	S/EM	CSS2251	PCC
3	CCS2501	Cyber Forensics Lab	0	0	2	1	2	S/EM	CSS2251	PCC
4	CCS2502	Cyber Threats for IoT and Cloud	3	0	0	3	3	S/EM	CSS2251	PCC
5	CSS2264	Essentials of AI	3	0	0	3	3	S/EM	Nil	ESC
6	CSS2265	Essentials of AI Lab	0	0	2	1	2	S/EM	Nil	ESC
7	CCS3405	Vulnerability Assessment and Penetration Testing	3	0	0	3	3	S/EM	-	PCC
8	CSSXXXX	Professional Elective – I	3	0	0	3	3	S/EM	Nil	PEC
9	CSS7000	Internship	-	-	-	2	0	S/EM	Nil	PRW
10	FIN1002	Essentials of Finance	3	0	0	3	3	S	Nil	HSMC
11	APT4006	Logical and Critical Thinking	0	0	2	0	2	AT	Nil	MAC
Semester 6			**18**	**0**	**8**	**21**	**26**			
1	LAW7601	Indian Constitution	1	0	0	0	1	F		MAC
	CSS2271	Software Design and Development	3	0	0	3	3	S	Nil	PCC
2	CCS2507	Web Security	2	0	0	2	2	S/EM	CSS2251	PCC
3	CCS2508	Web Security Lab	0	0	2	1	2	S/EM	CSS2251	PCC
4	CCS2506	Intrusion Detection and	3	0	0	3	3	S/EM	CSS2502	PCC

		Prevention System								
5	CSS2274	Competitive Programming and Problem Solving	0	0	4	2	4	S/EM	Nil	ESC
6	CSSXXXX	Professional Elective – II	3	0	0	3	3	S	Nil	PEC
7	CSSXXXX	Professional Elective – III	3	0	0	3	3	S	Nil	PEC
8	XXXXXXX	Open Elective – I	3	0	0	3	3	S	Nil	OEC
9	APT4005	Aptitude for Employability	0	0	2	1	2	AT	Nil	HSMC
Semester 7			**12**	**0**	**2**	**17**	**14**			
1	CSSXXXX	Professional Elective – IV	3	0	0	3	3	S	Nil	PEC
2	CSSXXXX	Professional Elective – V	3	0	0	3	3	S	Nil	PEC
3	CSSXXXX	Professional Elective – VI	3	0	0	3	3	S	Nil	PEC
4	XXXXXXX	Open Elective – II	3	0	0	3	3	S	Nil	OEC
5	PPS3018	Preparedness for Interview	0	0	2	1	2	S	Nil	HSMC
6	CSS7100	Mini Project	-	-	-	4	0	S/ EM/ EN	Nil	PRW
Semester 8			**0**	**0**	**0**	**10**	**0**			
1	CSS7300	Capstone Project	0	0	0	10	0	S/EM	Nil	PRW

23. Course Catalogue

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

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

Course Code: MAT1211	Course Title: Linear Algebra, Differential Equations and Statistical Methods Type of Course:1] School Core	- P- C	3	1	0	4
Version No.	1.0					
Course Pre-requisites						
Anti-requisites						
Course Description	This course introduces fundamental mathematical concepts from linear algebra, differential calculus, ordinary differential equations and statistics. The content includes matrices, systems of linear equations, eigenvalues and eigenvectors, functions of several variables, differential equations, correlation and regression analysis, and curve fitting					

	techniques. The course combines theoretical developments with illustrative applications drawn from scientific and engineering settings. The course emphasizes the application of these mathematical tools in solving problems in science and engineering. It extends student's problem-solving abilities through analytical and computational approaches, with focus on both theoretical understanding and applications.
Course Objective	The objective of this course is to provide students with a strong mathematical foundation required for engineering and scientific studies. The course introduces fundamental concepts from linear algebra, differential calculus, ordinary differential equations, and statistical methods that are widely used in modeling, analysis and problem solving. It aims to familiarize students with mathematical techniques for representing engineering systems, studying relationships among variables, describing dynamic processes and interpreting data. The course serves as a foundation to prepare students for advanced engineering subjects that rely on mathematical modeling, computation and analytical methods.
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Use linear algebra concepts to evaluate properties of matrices and quadratic forms. (L3) **CO2:** Apply matrix-based methods to solve systems of linear equations. (L3) **CO3:** Use fundamental theorems and analytical techniques of differential calculus to single variable functions. (L3) **CO4:** Apply the concepts of partial derivatives to multivariable functions. (L3) **CO5:** Solve first order ordinary differential equations using analytical methods. (L3) **CO6:** Employ statistical techniques for data analysis and to interpret relationships between variables. (L3)

Course Content:

Module 1	ndamentals of Linear Algebra	(15L+5T=20 Sessions)
Matrices, echelon forms, rank of matrix, Systems of linear equations: Consistency, solution to system of linear homogeneous and non-homogeneous equations- Gauss elimination method, Gauss-Jordan method (Self-study), LU decomposition method, Network analysis using linear systems, Design of traffic patterns, Electrical circuits. Eigenvalue and eigenvector, diagonalization of symmetric matrices, quadratic forms.		
Module 2	ferential Calculus	(15L+5T=20 Sessions)
Introduction, limit, continuity, Rolle's theorem, mean value theorems, Indeterminate forms and L'Hôpital's rule. Partial derivatives, Euler's theorem, total derivative, Jacobians, Taylor's and Maclaurin's theorems, maxima, minima and saddle points, method of Lagrange multipliers, Current Growth in an RL Circuit, Velocity Estimation, Fuel consumption optimization, Cost function optimization.		
Module 3	dinary Differential Equations	(6L+2T=8 Sessions)
Definition, types of differential equations-variable separable, homogeneous, exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Newton's law of cooling, Current in RL circuit.		
Module 4	tistical Methods and Curve Fitting	(9L+3T=12 Sessions)

Measures of central tendency, moments, skewness, and kurtosis. Correlation - Karl Pearson's coefficient of correlation, rank correlation, multiple correlation. Regression analysis - lines of regression, multiple regression. Principle of least square, curve fitting- straight line, parabola and exponential curves, Stress and strain curve fitting, Feature selection and Prediction models.

geted Applications & Tools that can be used:

- Linear Algebra is applied to solve systems of equations in circuits, traffic flow, and network analysis, with eigenvalues and quadratic forms aiding stability and optimization studies.
- Differential Calculus supports process speed analysis, velocity estimation, and optimization techniques such as minimizing fuel consumption and cost functions.
- Differential Equations model dynamic behaviours like current in RL circuits, heat transfer in materials, and growth or decay in environmental and nuclear engineering.
- Statistical Methods and Curve Fitting enable effective data analysis through correlation, regression, and curve fitting, supporting predictive modeling and interpretation of experimental data such as stress-strain relationships.

Software: MATLAB, Python, R Programming, Mathematica, Scilab, Octave

Assignment:

Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – obtain the solution and compare the solution sets by varying the values of the dependent variable.

Text Book

1. B. S. Grewal, *Higher Engineering Mathematics*, 44th ed. New Delhi, India: Khanna Publishers, 2017.
2. D. C. Montgomery and G. C. Runger, *Applied Statistics and Probability for Engineers*, 7th ed. Hoboken, NJ, USA: Wiley, 2018.

References:

1. P. V. O'Neil, *Advanced Engineering Mathematics*, 8th ed. Boston, MA, USA: Cengage Learning, 2018.
2. R. I. Miller and J. E. Freund, *Probability and Statistics for Engineers*, 9th ed. Noida, India: Pearson Education Ltd., 2017.
3. E. Kreyszig, *Advanced Engineering Mathematics*, 10th ed. Hoboken, NJ, USA: John Wiley & Sons, 2011.
4. V. Henner, T. Belozerova, and M. Khenner, *Ordinary and Partial Differential Equations*. Boca Raton, FL, USA: CRC Press, 2013.

E-resources/ Web links:

1. https://nptel.ac.in/courses/111105121
2. https://nptel.ac.in/courses/111106146
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_106839
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_61605
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_134719

6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_174
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of differential calculus, differential equations and statistical methods with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving. This is attained through the assessment component mentioned in course handout.

Catalogue prepared by	Dr. Kavita Permi, Dr. Rahul M. P. and Dr. Athmakoori Prashant
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: PHY2501	Course Name: Optoelectronics and Quantum Physics Type of Course: School Core	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-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 and analytical skills.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Applied Physics for Computer Science Cluster "and to attain the basic knowledge related to quantum mechanics and computation.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Understand the concepts of electrical conducting properties of metal, semiconductor, and superconductivity. — Level 2 – Understand **CO2:** Understand the principles of quantum mechanics. — Level 2 – Understand **CO3:** Discuss the quantum concepts used in quantum computers. — Level 2 – Understand **CO4:** Explain the applications of lasers and optical fibers in various technological fields. — Level 2 – Understand		
Course Content:			
Module 1	Electrical Conductivity Of Solids And Semiconducting Devices	Assessment : Assignment	11 Sessions
Topics: Classification of materials based on bandgap, Fermi energy and Fermi level, Fermi level in semiconductors, Law of mass action, Electrical conductivity of a semiconductor, Hall effect, Superconductivity, p-n junctions, Zener diode, Solar cells, I-V characteristics, and LEDs			

Module 2	Quantum Mechanics	Assessment : Assignment	11 Sessions
Topics: Introduction, de-Broglie hypothesis, Heisenberg's uncertainty principle- statement and physical significance. Wave function-properties and physical significance. Schrodindger's time independent wave equation, Probability density and normalization of wave function. Wave Function in Ket Notation: Matrix form of wave function, Identity operator, Determination of I|0> and I|1>, Pauli Matrices and its operations on 0 and 1 states, Mention of Conjugate and Transpose, Unitary Matrix U, Examples: 2x2 Matrices and their multiplication (Inner Product), Probability, Orthogonality			
Module 3	Quantum Computing	Assessment : Term paper	12 Sessions
Topics: Introduction to quantum computing, Moore's law & its end, Differences between classical and quantum computing, Concept of Qubit and its properties, . Representation of qubit by Bloch sphere, Quantum Gates: Single Qubit Gates: Quantum Not Gate, Pauli Z Gate, Hadamard Gate, Phase Gate (or S Gate), T Gate. Multiple Qubit Gates: Controlled gate - CNOT Gate, (Discussion for 4 different input states). Representation of Swap gate, Controlled - Z gate, Toffoli gate. Problems.			
Module 4	Lasers And Optical Fibers	Assessment : Term paper	11 Sessions
Topics: Interactions of radiations with matter, expression for energy density of a system under thermal equilibrium in terms of Einstein's coefficients, conditions for LASER action using Einstein's coefficients, Characteristics of laser, conditions and requisites of laser, 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.			
Module 5	Unsupervised Learning and Anomaly Detection	Assessment : Mini Project (Programming using Sklearn/Keras)	9 Sessions
Topics: Clustering: K-Means and Mini-Batch K-Means, Evaluation: Elbow Method, Silhouette Score, K-Means++, MST-based Clustering Hierarchical Clustering: Agglomerative and Divisive Competitive Learning: Kohonen's SOM Density-Based Clustering: DBSCAN Probabilistic Clustering: Gaussian Mixture Models (GMM) with EM Outlier and Anomaly Detection: Isolation Forest, LOF. Hands-on: Cluster Analysis and Outlier Detection on Public Datasets			
Targeted Applications & Tools: 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. 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.			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications, 2024. **T2:** Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition.			
References **R1:** Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002. **R2:** Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011. **R3:** Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017. **R4:** Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012. **R5:** Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019			

E-Resources/Web Resources https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live 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: MEC1006	Course Name: 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		
Co-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 the course the students shall be able to:** **CO1:** Demonstrate competency in Engineering Graphics as per BIS conventions and standards. [Level 3 - Apply] **CO2**: Comprehend the theory of projection for drawing projections of points, lines, and planes under different conditions. [Level – Understand] **CO3:** Prepare multiview orthographic projections of solids by visualizing them in different positions. [Level 3 – Apply] **CO4:** Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions. [Level 3 – Apply]		
Course Content:			
Module 1	Introduction to Drawing	Assessment: Assignment	7 Sessions
Topics: Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Line conventions, dimensioning, Selection of drawing sheet size and scale. [02 Hours: Comprehension Level]			
Module 2	Orthographic projections of Points, Straight Lines and Plane Surfaces	Assessment : Assignment	7 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 in all 4 quadrants.Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different			

positions inclined to both the planes using change of position method only. [10 Hours: Application Level]			
Module 3	Orthographic Projections of Solids	Assessment : Assignment	8 Sessions
Topics: Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different positions (Problems resting on HP only and First angle projection). [10 Hours: Application Level]			
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assessment : Assignment	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]			
Targeted Applications & Tools:			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.			
References **R1:** K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore. **R2:** D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall. **R3:** D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.			
E-Resources/Web Resources 1. 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: ENG1030	Course Name: Fundamentals of Communication Type of Course: Integrated	L- T-P- C	1-0-2-2
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	Fundamentals of Communication is a lab intensive, practice first integrated course designed to introduce first-year undergraduate engineering and computer science students to the foundational principles and advanced applications of effective communication across interpersonal, spoken, written, and digital contexts. Anchored in real world scenarios directly relevant to college life, cross-functional technical teams, and digital workplaces, the curriculum develops students' abilities to navigate cultural differences, speak with clarity, read texts critically, and write with precise audience awareness. The course explicitly relies on scenario-based learning, interactive case studies, and hands-on lab applications to ensure that theoretical communication frameworks are immediately actionable. By guiding students from reflective self-awareness to complex digital and AI-mediated content creation, the course builds an enduring communicative foundation optimized for performance-oriented professional practice.		

Course Objective	The course aims to explain the key principles of interpersonal, intercultural, and professional communication and apply them to real-world scenarios. It also focuses on developing spoken communication strategies, including structured delivery and impromptu responses, for academic and group contexts. Furthermore, it aims to develop effective writing skills to produce clear, coherent, and audience-appropriate texts across formal and professional contexts.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** 1. Understand the principles of interpersonal, intercultural, and professional communication in academic, social, and technical team contexts [Level 3 - Understand] **CO2**: 2. Demonstrate audience-centered spoken communication in individual presentations, group discussions, and simulated professional scenarios through vocal control, adaptive register, and collaborative engagement. [Level 3 – Apply] **CO3:** 3. Interpret written, multimodal, and AI-generated texts to identify underlying assumptions, rhetorical strategies, logical errors, and credibility markers across diverse media and professional contexts. [Level 3 – Apply] **CO4:** 4. Utilize plain-language principles and professional conventions to produce clear, purposeful, and appropriately formatted written and multimodal communication, including technical content adapted for non-specialist audiences. [Level 3 – Apply] **CO5:** 5. Employ responsible and critical practices in AI-assisted communication by designing iterative prompts, evaluating generated outputs, and applying ethical frameworks in academic and professional contexts. [Level 3 – Apply]		
Course Content:			
Module 1	Communication in a New World	Assessment: CA1 + Project Milestone (Deep Listening and Contextual Response Lab)	6 Sessions
Topics: The topics will be discussed through case studies: • The Communication Process: How Messages Are Sent, Received, and Misread • Verbal, Non-Verbal, and Vocal Communication in Everyday Contexts • Communication Breakdown: Recognising Barriers Across Psychological, Cultural, and Semantic Dimensions • Active Listening: Attention, Paraphrasing, and Purposeful Response; asking for clarification • Interpersonal Communication and Self-Awareness (including cross-cultural dimensions)			
Module 2	Contemporary Speaking Practices	Assessment : CA2, CA3, CA4 (Narrative and Adaptive Oral Delivery Facilitated Stakeholder Group Discussion Simulated Workplace Crisis Briefing)	15 Sessions
Topics: The topics will be discussed through structured, individual presentations and group discussions: • Elements of Spoken Communication: Voice, Clarity, and Presence • Storytelling and Narrative in Spoken Contexts • Structuring Spoken Messages: From Idea to Delivery • Speaking with Confidence: Managing Anxiety and Building Presence • Communicating in Groups: Participation, Productive Disagreement, and Turn-Taking • Giving and Receiving Feedback Effectively • Presentation Design and Delivery: Structure, Evidence, and Audience Engagement; eliciting responses • Speaking for Technical and Non-Technical Audiences			
Module 3	Critical Reading	Assessment : Project Milestone(Source Audit and Fallacy Brief)	9 Sessions
Topics: The topics will be discussed through case studies and real-world scenarios: • Critical Reading: Purpose, Context, and Analytical Approach • Perspective and Persuasion: Identifying Tone, Bias, and the Fact-Opinion Distinction • Understanding Flawed Reasoning (patterns of weak argumentation in everyday contexts)			

- Evaluating Sources: Credibility, Reliability, and AI-Generated Content; accuracy of the content
- Reading Multimodal Texts: Images, Infographics, and Digital Media

Module 4	Writing with Purpose	Assessment : CA 5 + Project Milestone(Technical Translation and Annotated Script)	9 Sessions

Topics:
The topics will be discussed through case studies:

- Principles of Effective Writing: Clarity, Coherence, Precision and Concise; audience analysis
- Plain Language and Technical Communication: Making Complex Ideas Accessible
- Writing for Professional Contexts: Email, Formal Reports, and Correspondence
- Argumentative Writing: Claim, Evidence, and Logical Progression
- Summary Writing and Short-Form Academic Response

Module 5	Unsupervised Learning and Anomaly Detection	Assessment : Communication in the Age of AI(CA 6 – Project Milestone) Cross-Disciplinary Case Analysis and Defence	6 Sessions

Topics:
The topics will be discussed through case studies featuring real-world examples:

- AI as a Communication Tool: Capabilities, Limitations, and the Hallucination Problem
- Prompt Engineering: Communicating Effectively with AI Systems
- AI-Assisted Writing: Drafting, Refining, and Maintaining Your Voice
- Ethical and Legal Dimensions of AI in Communication (includes India's Digital Personal Data Protection Act, 2023)
- AI, Bias, and Critical Evaluation: Reading AI Outputs Responsibly

Targeted Applications & Tools:
Otter.ai, Microsoft Word/PowerPoint/Teams/Clipchamp/Whiteboard/OneNote/Forms/Copilot, Miro, Padlet, Canva, Mentimeter, AllSides Media Bias Ratings, Ad Fontes Media Bias Chart, Snopes/factcheck.rog, Zotero, NotebookLM, Canva, Adobe Express, CapCut, OBS Studio, Claude, ChatGPT, Gemini, DeepSeek, Google Docs

Skill-Building Activities through Experiential Learning:

Project Work / Assignment:

1. Multimodal Communication Portfolio (Project) with multiple milestones: Continuous, milestone based. Developed across all five modules. Final consolidated submission at the end of the course. Develop a progressive, publicly shareable communication portfolio that demonstrates the student's ability to move a technical concept across multiple audiences, formats, and media.
2. Active Listening and Contextual Response Lab (Individual): Students listen to an unedited, multi-speaker audio recording of a real or simulated professional scenario. Under timed conditions, students produce a structured written brief consisting of four parts. Assessed on comprehension accuracy, analytical precision, quality of questioning, and practicality of the proposed strategy.
3. Narrative and Adaptive Oral Delivery (Individual): Each student delivers a 4-minute structured presentation. At the 3-minute mark, the faculty assessor introduces a counter-perspective or an unexpected constraint, and the student must adapt their argument in real time for the remaining minute. The assessment evaluates: the quality of the prepared 3 minutes; the quality of the improvised adaptation; and the degree to which the full 4 minutes function as a coherent whole.
4. Facilitated Stakeholder Group Discussion (Group): Groups of 5–6 students are each assigned a distinct stakeholder position within a shared scenario. and must engage in a live, facilitated discussion to resolve a stated policy impasse. No prepared scripts are permitted; students receive their role brief 15 minutes before the discussion begins. Assessment is individual, not group-level.
5. Simulated Workplace Crisis Briefing (Group): Groups of 4–5 students receive an unexpected corporate or institutional emergency brief. Teams have exactly 30 minutes to read the brief, distil the critical information, assign speaking roles, and prepare a 5-minute status update for a simulated leadership panel.
6. Technical Translation and Annotated Script (Individual): Students receive a dense, jargon-heavy technical document. Students must: (a) read and fully comprehend the document; (b) identify the core idea that a non-specialist audience needs to understand; and (c) produce an annotated script for a 90-second public explainer.
7. Cross-Disciplinary Case Analysis and Defence (Group): Groups of 3–4 students select one case from a faculty-curated shortlist of five to six approved cases. The group delivers a 10-minute structured presentation that goes beyond narrative description - identify the specific communication failures, explain the ethical or regulatory dimensions of those failures, and propose what a communication-competent response would have looked like. This is followed immediately by a 5-minute live Q&A in which individual group members must defend their analytical assertions against probing questions from both faculty and peers.

Text Book

T1: Markel, M., & Selber, S. A. (2021). Technical Communication (13th ed.). Bedford/St. Martin's.

References

R1: Carnegie, D. (1936/1998). How to Win Friends and Influence People. Simon & Schuster.

R2: Orwell, G. (1946). Politics and the English Language. **R3:** Strunk, W., & White, E. B. (1999). The Elements of Style (4th ed.). Longman. **R4:** Kahneman, D. (2011). Thinking, Fast and Slow. Farrar, Straus and Giroux. **R5:** O'Neil, C. (2016). Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. Crown Publishers. **R6:** Adler, R. B., Rodman, G., & DuPré, A. (2019). Understanding Human Communication (14th ed.). Oxford University Press.
E-Resources/Web Resources • owl.purdue.edu • plainlanguage.gov • allsides.com • adfontesmedia.com • ted.com • economist.com/styleguide • factcheck.org • ailiteracy.org • learnprompting.org • unesco.org/en/artificial-intelligence/ethics
Topics relevant to "SKILL DEVELOPMENT": Active listening, verbal and non-verbal communication, interpersonal communication and self-awareness, elements of spoken communication — voice, clarity, and presence, storytelling and narrative in spoken contexts, structuring spoken messages, speaking with confidence, group communication and productive disagreement, giving and receiving feedback, presentation design and delivery, speaking for technical and non-technical audiences, critical reading, identifying tone and bias, understanding flawed reasoning, source credibility and information evaluation, reading multimodal texts, principles of effective writing, plain language and technical communication, professional writing — email, reports, and correspondence, argumentative writing, summary writing, prompt engineering, AI-assisted writing, ethical AI use in academic and professional communication, AI bias and critical evaluation.

Course Code: CSS1500	Course Name: Computational Thinking using Python Type of Course: Lab Integrated Course (ESC)	L-T-P-C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	Nil		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The course efficiently introduces fundamental ideas including conditionals, loops, functions, lists, strings, and tuples through some inspiring examples. It then discusses dynamic programming like handling exceptions and file usage. In terms of data structures, the course covers Python dictionaries, classes, and objects for constructing user-defined datatypes like linear and binary search.		
Course Objective	To develop computational thinking and problem-solving skills using Python by enabling students to design algorithms, implement programs using core programming constructs and build efficient solutions using data structures and file handling techniques for real-world applications.		

Course Outcomes	On successful completion of this course, students will be able to: **CO1:** Apply computational thinking principles to design algorithms for solving basic and intermediate computing problems. **CO2:** Implement Python programs using data types, operators, and expressions to perform computational tasks. **CO3:** Develop programs using control structures, functions, and recursion to solve structured problems. **CO4:** Utilize data structures such as lists, tuples, and dictionaries for efficient data representation and manipulation. **CO5:** Design and implement Python programs for file handling and exception management to handle real-world data.	Level 2 – Understand Level 3 – Apply Level 3 – Apply Level 3 – Apply Level 3 – Apply

Course Content:

Module 1	Computational Thinking And Problem Solving	6 Sessions

Topics:
Fundamentals of Computing– Identification of Computational Problems Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi

Module 2	Datatypes, Expressions, Statements	6 Sessions

Topics:
Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Module 3	Control flow, Functions, Strings	6 Sessions

Topics:
Conditionals:Boolean values and operators, conditional (if), alternative (if else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Module 4	Lists, Tuples, Dictionaries	6 Sessions

Topics:
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing- list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

Module 5	Files	6 Sessions

Topics:
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

List of Practical Tasks 30 Sessions

WEEK 1: Computational Thinking & Algorithms

Lab Sheet 1: Problem Solving & Algorithm Design

Level 1: Write an algorithm and Python program to find the minimum element in a list of numbers.

Level 2: Write an algorithm and Python program to insert an element into a sorted list at the correct position.

Lab Sheet 2: Algorithm Strategies (Iteration & Recursion)

Level 1: Write a Python program to guess a number within a given range using iteration.

Level 2: Write a Python program to solve the Tower of Hanoi problem using recursion.

WEEK 2: Data Types & Expressions

Lab Sheet 3: Data Types & Variables

Level 1: Write a Python program to demonstrate different data types (int, float, boolean, string, list).

Level 2: Write a Python program to perform type conversions and display results.

Lab Sheet 4: Expressions & Operators

Level 1: Write a Python program to swap two variables using tuple assignment.

Level 2: Write a Python program to circulate the values of n variables.

WEEK 3: Expressions & Problem Solving

Lab Sheet 5: Mathematical Expressions

Level 1: Write a Python program to calculate the distance between two points.

Level 2: Write a Python program to evaluate complex arithmetic expressions with operator precedence.

Lab Sheet 6: Debugging & Interactive Mode

Level 1: Write a Python program with intentional errors and debug it.

Level 2: Write a Python program to demonstrate interactive mode operations.

WEEK 4: Conditional Statements

Lab Sheet 7: Decision Making

Level 1: Write a Python program to check whether a number is positive, negative, or zero.

Level 2: Write a Python program to find the largest of three numbers using if-elif-else.

Lab Sheet 8: Advanced Conditions

Level 1: Write a Python program to check whether a number is even or odd.

Level 2: Write a Python program to implement a grading system using chained conditions.

WEEK 5: Iteration (Loops)

Lab Sheet 9: Looping Basics

Level 1: Write a Python program to print numbers from 1 to N using a loop.

Level 2: Write a Python program to compute factorial using loops.

Lab Sheet 10: Loop Control

Level 1: Write a Python program demonstrating break and continue.

Level 2: Write a Python program to generate number patterns using nested loops.

WEEK 6: Functions

Lab Sheet 11: Functions Basics

Level 1: Write a Python function to calculate square root of a number.

Level 2: Write a Python function to find GCD of two numbers.

Lab Sheet 12: Recursion & Scope

Level 1: Write a recursive function to calculate exponentiation.

Level 2: Write a Python program demonstrating local and global variables.

WEEK 7: Strings

Lab Sheet 13: String Operations

Level 1: Write a Python program to demonstrate string slicing.

Level 2: Write a Python program to check whether a string is a palindrome.

Lab Sheet 14: String Methods

Level 1: Write a Python program using string functions (upper, lower, replace).

Level 2: Write a Python program to count vowels and consonants in a string.

WEEK 8: Lists

Lab Sheet 15: List Basics

Level 1: Write a Python program to create and display a list.

Level 2: Write a Python program to find the sum of elements in a list.

Lab Sheet 16: List Operations

Level 1: Write a Python program to demonstrate list slicing.

Level 2: Write a Python program to perform linear search on a list.

WEEK 9: Advanced Lists

Lab Sheet 17: List Methods

Level 1: Write a Python program to demonstrate list methods (append, remove).

Level 2: Write a Python program to sort a list.

Lab Sheet 18: List Comprehension

Level 1: Write a Python program using list comprehension to generate squares.

Level 2: Write a Python program to create a histogram of list values.

WEEK 10: Tuples

Lab Sheet 19: Tuple Basics

Level 1: Write a Python program to create and access tuple elements.

Level 2: Write a Python program to demonstrate tuple assignment.

Lab Sheet 20: Tuples as Return Values

Level 1: Write a Python function returning multiple values using tuple.

Level 2: Write a Python program to swap values using tuples.

WEEK 11: Dictionaries

Lab Sheet 21: Dictionary Basics

Level 1: Write a Python program to create and access dictionary elements.

Level 2: Write a Python program to count frequency of elements using dictionary.

Lab Sheet 22: Dictionary Applications

Level 1: Write a Python program to store student marks using dictionary.

Level 2: Write a Python program to generate a retail bill using dictionary.

WEEK 12: Advanced List Processing

Lab Sheet 23: Sorting & Searching

Level 1: Write a Python program to implement simple sorting.

Level 2: Write a Python program to implement binary search.

Lab Sheet 24: Data Processing

Level 1: Write a Python program to generate student marks statement.

Level 2: Write a Python program to analyze list data (min, max, average).

WEEK 13: File Handling Basics

Lab Sheet 25: File Operations

Level 1: Write a Python program to create and write to a text file.

Level 2: Write a Python program to read and display file contents.

Lab Sheet 26: File Processing

Level 1: Write a Python program to count words in a file.

Level 2: Write a Python program to copy contents from one file to another.

WEEK 14: Exceptions & Validation

Lab Sheet 27: Exception Handling

Level 1: Write a Python program using try-except.

Level 2: Write a Python program to handle multiple exceptions.

Lab Sheet 28: Validation Programs

Level 1: Write a Python program to validate voter's age.

Level 2: Write a Python program to validate marks range (0–100).

WEEK 15: Modules & Advanced Concepts

Lab Sheet 29: Modules & Packages

Level 1: Write a Python program to create and use a module.

Level 2: Write a Python program to use built-in modules.

Lab Sheet 30: Command Line Arguments

Level 1: Write a Python program to accept command-line arguments.

Level 2: Write a Python program to perform operations using command-line inputs

Project work/Assignment:

1. Assignment 1 on (Module 1 and Module 2)
2. Assignment 2 on (Module 3 and Module 4 & 5)

Skill-Building Activities through Experiential Learning:

1. Topics relevant to development of "Employability": Data structures using python.
2. Topics relevant to "PROFESSIONAL ETHICS": Naming and coding convention for simple programs using python.

Text Book

T1: Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021

T2: Eric Matthes, Python Crash Course,: A Hands-On, Project-Based Introduction to Programming, 3rd Edition, 2023.

References

R1: Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

R2: Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning Development Limited, 2017.

E-Resources/Web Resources
1. https://onlinecourses.nptel.ac.in/noc20_cs70/preview 2. https://openFullText.html?DP=https://docs.python.org/3/tutorial/ 3. https://openFullText.html?DP=https://www.python.org/about/gettingstarted/

Course Code: ECE2022	Course Name: Digital Design Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	ECE2052		
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. Further to focusing on combinational and sequential digital logic circuits. This course is analytical in nature and needs a fundamental knowledge on logical computation with Boolean algebra. The focus of the course will be to discuss the minimization techniques for making low-cost canonical digital circuit implementations. In this course, we emphasize design procedures of digital electronic circuits. Additionally, this course will create a foundation for future courses that includes Computer Architecture, Microprocessors, Microcontrollers and Embedded Systems etc.		
Course Objective	The objective of the course is to familiarize the learners with Design and Analysis of Digital Logic Circuits concepts and to improve the learner's SKILL DEVELOPMENT by using PARTICIPATIVE LEARNING TECHNIQUES through Assessments.		
Course Outcomes	On successful completion of this course the students shall be able to: CO1. Explain the fundamental concepts of Number system, Boolean algebra and Logic gates CO2. Determine the minimum literal Boolean Expression using K-Map minimization techniques CO3. Make use of relevant logic gates for constructing the combinational circuit. CO4. Produce standard and real world combinational logic circuits using minimum number of logic gates CO5. Demonstrate the working principles of flip-flops and latches within the context of sequential logic circuits. CO6. Design synchronous and asynchronous logic circuit using Flip-flops		
Course Content:			
Module 1	Number System, Logic Gates & Boolean function simplification (Comprehension Level)	Assessment	10 Sessions
Topics: Review of Number systems -Overview of Boolean Algebra- Boolean Laws, Rules & Theorems. Boolean function Standard form and Canonical form. Review of logic gates -Basic gates, Universal gates & Special Gates- Boolean functions simplifications using Algebraic functions & Karnaugh-map. SOP and POS simplifications & Implementations.			
Module 2	Combinational Logic circuits: (Application Level)	Assessment	10 Sessions
Topics: Digital logic circuit Introduction –Classification of circuit- Analysis and Design procedure of Combinational Logic circuits - Binary			

Adder and Subtractor- Magnitude comparator- , Multiplexers - DeMultiplexers, Decoders, Encoders and Priority Encoders-Real world scenario based application design using logic gates.			
Module 3	Sequential logic circuits (Application Level)	Quiz	10 Sessions
Topics: Introduction to sequential circuits- Storage elements: latches and flip flops- Characteristic tables and equations, excitation table- Analysis of clocked sequential circuits- state diagram-state table and design of finite state machines - Registers & Counters.			
Text Book **T1:** Thomas L Flyod, "Digital Fundamentals", Eleventh Edition, Pearson Education. ISBN-10: 132737965. (2014).eBook-[PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org **T2:** Mano, M. Morris and Ciletti Michael D., "Digital Design", Pearson Education, 6th edition ., [PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download (studymaterialz.in)			
References **R1:** Jain, R. P., "Modern Digital Electronics", McGraw Hill Education (India). **R2:** Roth, Charles H., Jr and Kinney Larry L., "Fundamentals of logic Design", Cengage Learning			
E-Resources/Web Resources 1. https://openFullText.html?DP=https://nptel.ac.in/courses/108105132 2. https://openFullText.html?DP=https://ocw.mit.edu/courses/6-111-introductory-digital-systems-laboratory-fall-2006/ 3. https://openFullText.html?DP=https://www.javatpoint.com/digital-electronics 4. https://openFullText.html?DP=https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/ 5. https://openFullText.html?DP=https://circuitverse.org			

Course Code: ECE1512	Course Name: Design Thinking in Practice Type of Course: Integrated	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces students to Design Thinking frameworks for identifying real-world user needs and transforming them into innovative technology solutions using embedded systems, sensors, IoT platforms, and AI-enabled computing devices. The course blends human-centered innovation methodologies with hands-on development using Arduino, Aries, ESP32, Raspberry Pi, NVIDIA Jetson, and GPU-based embedded platforms. Students will develop problem-solving skills while learning problem identification, ideation, rapid prototyping, sensor integration, edge AI, and intelligent system development for applications in smart automation, healthcare, agriculture, robotics, and Industry 5.0. The course emphasizes experiential and project-based learning to build future-ready innovators capable of developing scalable, intelligent, and socially impactful products.		
Course Objective	The objective of the course is to enhance students' employability skills through participative learning techniques by integrating Design Thinking, embedded systems, IoT, and AI technologies to develop innovative, intelligent, and socially impactful real-world solutions.		

Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the principles, framework, and process of design thinking [Level 3 - Understand] **CO2**: Formulate Engineering Problem from user challenges, customer expectations, and market opportunities using design thinking process. [Level 3 – Apply] **CO3:** 3 3. Analyze the Engineering Problem using the basic concepts of microcontroller and sensory devices. [Level 3 – Apply] **CO4:** 4 4. Find alternate methods to solve the engineering problem by working with embedded computing platforms. [Level 3 – Apply] **CO5:** 5. 5. Develop functional prototypes using embedded boards, sensors, and an intelligent system for the chosen method [Level 3 – Apply] CO6: 6. Validate prototype performance through testing, user feedback, and iterative improvements.		
Course Content:			
Module 1	Introduction to Design Thinking	Assessment:	6 Sessions
Topics: Introduction to Design Thinking Importance of Design Thinking History of Design Thinking- Design Thinking Framework - Design Thinking process - Empathise Define Understanding Purpose - Ideate - What is Creativity? -Thinking Differently Basic Rules of Design Thinking The Creativity Heart Set Everyone is a Designer - Activity-based with case studies			
Module 2	Basic concepts of Microcontrollers and sensory Devices	Assessment :	8 Sessions
Topics: Introduction to Arduino, ESP and NodeMCU - Pin Configuration and Architecture - Device and Platform Features - Concept of Digital and Analog Ports - Familiarizing with Arduino Interfacing Board Programming using Arduino IDE and Embedded C - Datatypes and Variables - I/O Functions Sensors, types and its applications - Humidity Sensor - Temperature Sensor - Water Detector / Sensor - PIR Sensor - Ultrasonic Sensor - Connecting Switches and Actuators - Sensor Interface with ESP Microcontroller - Various Cloud Platforms			
Module 3	Working with Embedded computing platforms and 3D printing technology	Assessment :	8 Sessions
Topics: Introduction to Raspberry Pi boards, pin diagram, different types of Raspberry Pi boards and their applications, Configuration of Raspberry Pi boards - LED and switch control Exploring various libraries and their functions. GPU fundamentals Configuration of Jetson Nano board, Working with H200 GPU Servers. Introduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with Tinker CAD Simulator.			
Module 4	Prototype Development and validation techniques	Assessment :	8 Sessions
Topics: Importance of Prototyping in Design Thinking-Concept Refinement Using Prototypes From Idea to Functional PrototypeUser Testing and Validation Iteration and Design Optimization Prototype Readiness for Product Development (DFM & Market Feasibility overview) Activity-based with case studies.			

Prototype Development Tasks:

Total Sessions: 30

1. Smart illumination system using Arduino
2. Intelligent Plant Health Monitoring System.
3. Aries Rover Drive and Control System Development
4. IoT-Based Environmental Intelligence System using ESP32
5. Edge Computing Platform Setup using Raspberry Pi
6. Raspberry Pi-based smart lighting Controller

7. VoiceX: AI-Powered Smart Home Automation System
8. VisionAI: Intelligent Object Recognition System.
9. Smart Traffic Management System using NVIDEA Jetson Nano
10. High-Performance AI Vision Analytics using H200-GPU Computing.

Rapid Prototype Development using 3D Design and printing

Topics: Types of embedded boards, Thonny Python, Python IDLE, sensors, 3D Printer, Jetson Nano board, GPUs

Targeted Applications & Tools:

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, Aries, ESP32, Raspberry Pi, and sensors can be applied. The flexibility and affordability of all embedded boards, combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

Professionally Used Software: Students can use open-source software, such as Arduino IDE, Blynk console, Tinker CAD, Thonny Python, Python IDLE, etc.

Skill-Building Activities through Experiential Learning:

Project work/Assignment:

- **Projects:** At the end of the course, students will be completing the project work on solving many real-time problem statements on different domains, such as women-centric, agritech, medtech, climate cell, robotics, drones, and smart cities etc.
- **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 to the library resources and write a report on their understanding of the assigned article in an appropriate format **Presentation:** There will be a review presentation (Phase 1, Phase 2, and Phase 3) from among the students' groups, where the students will be given a project, and they have to demonstrate the working and discuss the
- applications for the same

Text Book

T1: Thinking Design by S Balaram. New Delhi [India]: Sage Publications Pvt. Ltd. 2010. eBook. Database: eBook Collection (EBSCOhost)

T2: Monk Simon, "Programming Arduino: Getting started with sketches"McGraw-Hill Publications, Second Edition

T3: Monk Simon. Raspberry Pi Cookbook: Software and Hardware Problems and Solutions. O'Reilly Media, Inc., ISBN: 9781098130923, Fourth Edition.

T4: CUDA by Example: An Introduction to General-Purpose GPU Programming. CUDA by Example: An Introduction to General-Purpose GPU Programming. Addison-Wesley Professional, 2010.

References

R1: Clarke, Rachel Ivy. Design Thinking. Series: Library Futures, Vol. 4. Chicago: ALA Neal-Schuman, 2020. eBook. Database: eBook Collection (EBSCOhost).

R2: Neerparaj Rai. Arduino Projects for Engineers. BPB Publishers, First Edition, 2016.

R3: Stewart Watkiss. Learn Electronics with Raspberry Pi. Apress, Berkeley, CA. Second Edition, 2020. ISBN 978-1-4842-6348-8.

R4: . Jo Prusa. Basics of 3D Printing. Prusa Research, 3rd Edition.

R5: Volker Ziemann. A Hands-On Course in Sensors Using the Arduino and Raspberry Pi (Series in Sensors). CRC Press, 1st Edition, 2018.

R6: Professional CUDA C Programming. Professional CUDA C Programming. Wrox Press, 2014.

E-Resources/Web Resources

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
4. Raspberry Pi Projects - https://magpi.raspberrypi.com/articles/category/tutorials/
5. Introduction to internet of thingshttps://nptel.ac.in/courses/106105166>
6. Getting Started with Jetson Nano - https://www.youtube.com/watch?v=DVfmw3Ftu3I

E-content:

Tim Brown, "Design Thinking," Harvard Business Review, Vol. 86, No. 6, pp. 84–92, June 2008.

Rolf Faste, "Ambidextrous Thinking," in Innovations in Mechanical Engineering Curricula for the 1990s, American Society of Mechanical

Engineers, 1994, pp. 1–6.
M. H. Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, and Pragya Singh, "IoT Based Smart Security System Using Arduino," Journal of Emerging Technologies and Innovative Research (JETIR), Vol. 8, No. 8, August 2021.
Basil and Eliza Sawant, S. D., "IoT-Based Traffic Light Control System Using Raspberry Pi," in Proceedings of ICECDS 2017, 2017. DOI: 10.1109/ICECDS.2017.8389604.
Espressif Systems, ESP32 Series Datasheet, 2024.
Josef Průša, "Open-Source 3D Printers and the RepRap Project," RepRap Magazine, 2018.

Topics Relevant to the Development of "SKILL" System design for achieving Sustainable Development Goals.

Course Code: PHY2504	Course Name: Optoelectronics and Quantum Physics Lab Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The 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 Objective	The objective of the course is to familiarize the learners with the concepts of " Applied Physics for Computer Science Cluster "and attain Skill Development through Experiential Learning techniques		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Understand electrical and optical properties of materials. Level 2 – Understand **CO2:** Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. Level 2 – Understand		

Course Content:

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 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. 8: 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. 9: 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. 10: 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.

Experiment No. 11: Dielectric constant
Level 1: Determination of Dielectric constant of given material
Level 2: compare the obtain results with other materials

Experiment No. 12: determine the wavelength of monochromatic light, such as sodium light, using Newton's rings.
Level 1: Determination of wavelength
Level 2: determine the radius of curvature of the Plano-convex lens.

Targeted Applications & Tools:
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. Origin, excel and Mat lab soft wares for programming and data analysis.

Skill-Building Activities through Experiential Learning:

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

References

E-Resources/Web Resources

Course Code: PPS1025	Course Title: Industry Readiness Program – I Type of Course: Practical Only Course	L-T- P - C	0	0	2	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 to set SMART goals, form professional & personal ethics for success, and learn various email writing techniques. 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 "Employability for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.
Course Outcomes	On successful completion of the course the students shall be able to: **CO1:** Define their career goals [Level 1 - Remember] **CO2:** Practice ethical habits for better career success [Level 3 - Apply] **CO3:** Demonstrate effective email writing techniques [Level 3 - Apply]

Course Content:			
Module 1	Goal Setting & Grooming	Classroom activities	10 Sessions
Topics: SMART Goals, formal grooming through self-introduction activity Activity: Real world scenarios			
Module 2	Habit Formation	Role plays	10 Sessions
Topics: Professional and Personal ethics for success and activity-based practice Activity: Students to present 2 min video on building professional ethics			
Module 3	Email Etiquettes	Individual and group presentation	10 Sessions
Topics: Types of prompts to generate effective or desired results for email etiquettes Activity: Individual student presenting various search prompts			
Targeted Applications & Tools: TED Talks; You Tube Links; Activities			
Assignment proposed for this course Assignment 1: SMART Goal Assignment 2: AI tools for prompt search			
Continuous Individual Assessment Module 1: Presentation Module 2: Activity based assessment Module 3: Class assessment			

Course Code: ECE2052	Course Name: Digital Design Lab Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	ECE2022		
Anti-requisites	NIL		
Course Description	This course gives knowledge through the simulation software for design and implementation of various digital logic circuit. The theoretical concepts and working principles of combinational and sequential logic circuits are verified through implementation using openCV. This course provides necessary learning for fundamental concepts of computer and communication engineering. The purpose of this course is to support the students to exhibit the design and analysis skills. The course enhances the Design and Implementation abilities through laboratory tasks. Additionally, it provides an opportunity to verify the theoretical knowledge.		
Course Objective	The objective of the course is to familiarize the learners with the design concepts of digital logic circuit and attain Skill Development through Experiential Learning by simulation-based laboratory Assessments.		
Course Outcomes	On successful completion of the course the students shall be able to		

	CO1: Interpret Boolean laws and the logic gates functionality using available circuit elements in simulator platforms. [Level 3 - Apply] **CO2**: Apply the fundamental laws and rules of Boolean algebra for simplified circuit simulation using any simulator tool. [Level 3 – Apply] **CO3:** Develop combinational logic circuits by connecting offered gates for basic arithmetic operation [Level 3 – Apply] **CO4:** Make use of circuit elements for ensuring the digital logic circuit's truth table perfection. [Level 3 – Apply] **CO5:** Examine the performance of sequential logic circuit simulation using flip-flop and latch elements [Level 3 – Apply] **CO6:** Demonstrate the operation of clocked and edge-triggered sequential components in an open-source simulation environment [Level 3 – Apply]

Course Content:

List of Laboratory Tasks:

- **Experiment 1: Logic Gates**.
  Study and verify the operation of basic logic gates such as AND, OR, NOT, NAND, NOR, XOR, and XNOR.
- **Experiment 2: Boolean Algebra**

  Implement and verify Boolean algebra laws and simplification techniques using logic circuits.
- **Experiment 3: Adder**

  Design and analyze half adder and full adder circuits for binary addition.
- **Experiment 4: Subtractor**

  Design and verify half subtractor and full subtractor circuits for binary subtraction.
- **Experiment 5: Magnitude Comparator**

  Design a circuit to compare two binary numbers and determine equality or greater/less conditions.
- **Experiment 6: Design of Combinational Circuits**

  Design and implement combinational logic circuits using Boolean expressions and K-maps.
- **Experiment 7: Multiplexer, Demultiplexer & Applications of MUX**

  Study the working of multiplexers and demultiplexers and implement logic functions using MUX.
- **Experiment 8: Flip-Flops**

  Implement and verify the operation of SR, JK, D, and T flip-flops.
- **Experiment 9: Shift Registers**

  Design and analyze serial and parallel shift registers for data storage and transfer.
- **Experiment 10: Counter Design**

  Design and implement synchronous and asynchronous counters using flip-flops.

Targeted Applications & Tools:

CIRCUIT VERSE	An online digital circuit simulation platform used for designing and testing logic circuits and combinational/sequential circuits.

HDL	Hardware Description Language used to model, design, and simulate digital electronic systems and circuits.
VHDL	Very High-Speed Integrated Circuit Hardware Description Language used for designing, simulating, and implementing digital systems in FPGA and ASIC design.

Skill-Building Activities through Experiential Learning:

- Design and simulation of digital circuits using CircuitVerse/HDL tools.
- Hands-on implementation of combinational and sequential circuits.
- Mini exercises on logic simplification and circuit optimization.
- Team-based circuit design and debugging activities.
- Real-time verification of flip-flops, counters, and shift registers.

Text Book

T1: Mano, M. Morris and Ciletti Michael D., "Digital Design", Pearson Education, 6th edition

T2: Thomas L. Floyd "DIGITAL LOGIC DESIGN" , Pearson Education, fourth edition.

References

R1: Jain, R. P., "Modern Digital Electronics", McGraw Hill Education (India), Fourth Edition

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

E-Resources/Web Resources

1. https://circuitverse.org/
2. https://ocw.mit.edu/courses/6-111-introductory-digital-systems-laboratory-fall-2006/
3. https://nptel.ac.in/courses/108105132
4. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
5. https://www.tutorialspoint.com/digital_electronics/index.htm
6. https://github.com/logisim-evolution/logisim-evolution
7. https://www.javatpoint.com/digital-electronics

Course Code: MAT1212	Course Title: Mathematical foundations for Machine Learning and Data Analysis Type of Course:1] School Core	- P- C	3	1	0	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides a comprehensive foundation in advanced mathematical concepts essential for engineering and scientific applications. It covers integral calculus and special functions, linear transformations and matrix decompositions, vector spaces and inner product spaces, and probability theory with random variables and standard probability distributions. The course emphasizes mathematical modeling, analytical problem-solving, data analysis techniques, and engineering					

	applications, enabling students to apply mathematical tools to solve real-world engineering problems.	
Course Objective	The course aims to develop a strong conceptual understanding of vector spaces, linear algebra, and vector calculus. It introduces mathematical techniques used in engineering analysis and modelling, enabling students to apply these concepts effectively in solving engineering problems. The course also enables students to apply probability distributions and statistical methods in practical situations involving uncertainty and data analysis. Further, it strengthens analytical and problem-solving skills through applications of differential equations and statistical inference. In addition, the course familiarizes students with computational tools for solving engineering mathematics problems, thereby enhancing their ability to address real-world engineering challenges.	
Course Outcomes	On successful completion of the course the students shall be able to: **CO1:** Apply integral calculus and special functions to solve engineering problems. (L3) **CO2:** Solve problems involving linear transformations and matrix techniques. (L3) **CO3:** Apply concepts of vector spaces, basis, dimension, and orthogonality in mathematical applications. (L3) **CO4:** Apply probability concepts and random variable distributions to solve problems involving uncertainty and stochastic phenomena (L3) **CO5:** Examine discrete and continuous random variables using probability distributions such as Binomial, Poisson, Uniform, Exponential, and Normal distributions. (L3) **CO6:** Utilize computational tools such as MATLAB, Python, or similar software for mathematical computation, data analysis, and engineering applications. (L3)	
Course Content:		
Module 1	Integral Calculus and Special Functions	(8L+3T=11 Sessions)
Definite and indefinite integrals, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Surface areas, volumes, Sterlin approximation theorem.		
Module 2	Vector Spaces and Inner Product Spaces	(12L+4T=16 Sessions)
Vector Space, Examples, Properties, Subspaces, Linear Combinations, Spanning Set of a Vector Space, Linear Dependence and Independence, Basis and Dimension, Change of Basis; Normed Linear Spaces, Inner Products Spaces, Orthogonality, Orthogonal and Orthonormal Bases, Gram-Schmidt Orthogonalization Process, Orthogonal Complements, Orthogonal Projections. Applications to Difference Equations, Markov Chains.		
Module 3	Linear Transformations and Matrix Decompositions	(10L+3T=13 Sessions)
Linear Transformations, Algebra of Transformations, Singular and Nonsingular Linear Mappings, Isomorphisms, Matrix Representation of Linear Transformations, The Range and Null Space, Rank-Nullity Theorem. Least Squares Approximation, Singular Value Decomposition: Singular Values, Computing Singular Value		

Decomposition, Data Compression Using Singular Value Decomposition and Introduction to Principal Component Analysis.

Module 4	Probability and Random Variables for machine learning	(15L+5T =20 Sessions)

Introduction to Probability, Conditional Probability, Bayes' Theorem and Problems. Random Variables (discrete and continuous), Probability Mass/Density Functions, Mathematical Expectations, discrete probability distributions - Binomial distribution, Poisson distribution, Continuous uniform distribution - Exponential distribution, Normal distribution.
Machine learning: large language models

Targeted Applications & Tools that can be used:

- Evaluation of definite and improper integrals for computing areas, volumes, surface areas, engineering design calculations, and scientific modeling using Beta and Gamma functions.
- Representation and analysis of high-dimensional vector spaces, feature extraction, orthogonal projections, signal processing, computer graphics, pattern recognition, and machine learning.
- Least-squares regression, image compression, recommendation systems, dimensionality reduction, Principal Component Analysis (PCA), data mining, and machine learning applications.
- Probabilistic modeling, Bayesian inference, uncertainty quantification, predictive analytics, classification algorithms, statistical learning, and foundations of large language models (LLMs).

Software: MATLAB, Mathematica, Maple, Python, GeoGebra, Octave, R, Scilab.

Text Book

1. E. Kreyszig, *Advanced Engineering Mathematics*, 10th ed. Hoboken, NJ, USA: John Wiley & Sons, 2015.
2. B. S. Grewal, *Higher Engineering Mathematics*, 45th ed. New Delhi, India: Khanna Publishers, 2017.sley Publishing Company.

Assignment:

Assignments will involve theoretical problem-solving and computational implementation using suitable programming tools. The assignments may be undertaken individually or in groups, as decided by the instructor.

References:

1. G. Strang, *Introduction to Linear Algebra*, 6th ed. Wellesley, MA, USA: Wellesley-Cambridge Press, 2023.
2. D. C. Lay, S. R. Lay, and J. J. McDonald, *Linear Algebra and Its Applications*, 6th ed. Harlow, U.K.: Pearson, 2021.
3. E. Kreyszig, *Advanced Engineering Mathematics*, 10th ed. Hoboken, NJ, USA: John Wiley & Sons, 2015.
4. B. S. Grewal, *Higher Engineering Mathematics*, 45th ed. New Delhi, India: Khanna Publishers, 2017.
5. C. D. Meyer, *Matrix Analysis and Applied Linear Algebra*, 2nd ed. Philadelphia, PA, USA:

SIAM, 2023. E-resources/ Web links: 1. https://open.umn.edu/opentextbooks/textbooks/24 2. https://open.umn.edu/opentextbooks/textbooks/introduction-to-probability 3. https://open.umn.edu/opentextbooks/textbooks/linear-transformations-on-vector-spaces
Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving. This is attained through the assessment component mentioned in course handout.

Catalogue prepared by	Dr. Pavithra Sivaprakasam
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CIV1200	Course Name: Foundations of Integrated Engineering Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	CSEXXXX		
Course Description	This interdisciplinary course introduces first-year engineering students to foundational principles and practices across key engineering domains, emphasizing real-world problem-solving, sustainability, and ethical innovation. Students explore how civil, mechanical, electrical, and IT systems intersect with emerging technologies like IoT, AI, and geomatics to address global challenges. Through case studies, learners gain deeper understanding of smart infrastructure, prototyping mechanical/electronic systems, and securing IT solutions. Topics include bioinformatics for environmental monitoring, GIS-enabled urban planning, renewable energy integration, and cybersecurity fundamentals. The course cultivates a holistic understanding of engineering's role in sustainable development, safety, and ethical decision-making, preparing students to contribute meaningfully to multidisciplinary projects in a technology-driven world.		
Course Objective	The objective of the course is skill development of student by using Participative Learning techniques.		
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Recall key principles of Agile, DevOps, and bioinformatics used in interdisciplinary engineering contexts. — L1– Remember CO2: Explain the role of GIS, LiDAR, and sustainable materials in designing smart infrastructure and disaster management systems. — L2– Understand CO3: Describe core components of mechanical systems and their real-world applications. — L3 – Apply		

	CO4: Describe the functionality of IoT-enabled wearable devices, embedded systems, and renewable energy integration in smart grids.	L4 – Analyze
	CO5: List foundational IT concepts such as cloud computing architectures, cybersecurity threats, and blockchain applications.	L5 – Evaluate

Course Content:

Module 1	Foundations of Engineering Practice	Assignment	Case studies	6 Sessions
Real-world problem-solving using data logic and practical applications, Collaboration and Innovation through multi-domain project, Engineering Ethics & Environmental Impact Emerging Fields: Automation, and Introduction to bioinformatics and its application Sustainability & Safety: Circular economy principles, carbon footprint analysis.				
Module 2	Civil Engineering & Geomatics	Assignment	Article Review	6 Sessions
Smart Infrastructure & Geomatics: GIS mapping, LiDAR, drone surveys for urban planning, Geospatial data analysis for disaster management. Sustainable Construction: 3D-printed structures, self-healing concrete, Digital twins for infrastructure monitoring. Green Innovations: Net-zero energy buildings, rainwater harvesting systems.				
Module 3	Mechanical Engineering in Action	Assignment & Quiz	Data Collection	6 Sessions
Advanced Manufacturing: Collaborative robots (cobots), additive manufacturing and 3D printing, Reverse engineering and prototyping. Energy Systems: Solar/wind energy harvesting, piezoelectric applications. Biomechanics: Prosthetics design, ergonomic product lifecycle.				
Module 4	Electrical & Electronics Engineering	Assignment & Quiz	Data Collection and visualization	6 Sessions
Smart Devices & Systems: Embedded systems, Wearable technology, Edge computing and hardware platforms Energy Innovations: EV charging infrastructure, wireless power transfer, Smart grid integration with renewables.				
Module 5	Fundamentals of IT	Assignment & Quiz	Case studies	6 Sessions
Core IT Topics: Networking basics, Cloud computing Cybersecurity & Data: Encryption, phishing prevention, zero-trust models, Database management. Emerging Tech: Blockchain for supply chains, AI/ML basics, IoT integration with cloud platforms				

Targeted Application & Tools that can be used:

Application Areas include Interdisciplinary problem-solving, Smart city planning, disaster management, Robotics prototyping, renewable energy systems, Wearable health tech, smart grids, Secure cloud systems.
Tools: 3D Printers, Autocad, Tinkercad, ArcGIS / QGIS, Arduino/Raspberry Pi

Text Book:

T1: William Oakes & Les Leone, "Engineering Your Future: An Introduction to Engineering", Oxford University Press, 9th Edition, 2021
T2: Barry F. Kavanagh, “Introduction to Geomatics”, Pearson, 5th Edition, 2021**T3:** Giuseppe Bonaccorso, “Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning”, Packt Publishing, 2017.
T3: Ian Gibson, David Rosen, & Brent Stucker, “Additive Manufacturing Technologies”, Springer, 3rd Edition, 2021
T4: Sudip Misra, "The Internet of Things: Enabling Technologies, Protocols, and Use Cases", Wiley, 2nd Edition, 2022
T5: James Kurose & Keith Ross, “Computer Networking: A Top-Down Approach”, Pearson, 8th Edition, 2020

References

R1: Supratim Choudhuri, “Bioinformatics for Beginners: Genes, Genomes, and Molecular Evolution", Academic Press, 1st Edition, 2023,
R2: Robert McGinn, "The Ethical Engineer: Contemporary Concepts and Cases", Princeton University Press, 1st Edition, 2020
R3: Charles J. Kibert, “Sustainable Construction: Green Building Design and Delivery”, Wiley, 5th Edition, 2022
R4: Anthony M. Townsend, "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", W.W. Norton & Company, 1st Edition, 2020
R5: David Buchla, "Renewable Energy Systems: A Smart Energy Systems Approach", Pearson, 2nd Edition, 2023
R6: Charles Platt, "Make: Electronics: Learning Through Discovery", Make Community, 3rd Edition, 2021
R7: Charles J. Brooks, Christopher Grow, & Philip Craig, “Cybersecurity Essentials", Wiley, 2nd Edition, 2021

E-Resources/Web Resources

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

2. Smart Cities : Introducing Digital Innovation to Cities
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site=ehost-live
3. 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
4. Additive Manufacturing: Opportunities, Challenges, Implications
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&site=ehost-live

Course Code: CHE2501	Course Name: Chemistry of Smart Materials Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	NIL		
Co-requisites	CHE2501		
Anti-requisites	CSEXXXX		
Course Description	The objective of the course is to introduce the students to concepts and applications of chemistry of smart materials. The course also aims to enhance the knowledge of smart materials associated with memory system, display devices, , sensors, energy devices and environment. It will also cultivate an ability to identify chemistry in each of smart engineered materials and interpret solutions for the challenges connected to memory, display, energy, smart, green and sustainable technologies. It targets to strengthen the fundamental concepts behind chemistry of smart materials and then builds an interface with their industrial applications. **This course is designed to cater to Environment and Sustainability**		
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using Participative learning techniques.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Relate the knowledge of chemistry to computational approaches to identify materials functionalities and properties — **L1**– Remember **CO2**:Recognize and interpret solutions for the challenges connected to memory, display, smart, green and sustainable technologies. — **L2**– Understand **CO3:**Explain the quality parameters of engineering materials associated with environment and sensors. — **L3** – Apply **CO4:**Interpret the knowledge of sustainable chemistry for E- waste management. — **L4** – Analyze **CO5:**Analyse the importance of various electrochemical sources in energy systems. — **L5** – Evaluate		

Course Content:

Module 1	Computational Chemistry	Assignment	Data Collection and analysis	**09 Sessions**

Topics:
Fundamental particles of atom – their mass, charge and location – atomic number and mass number, Stabilizing interactions: Bonded and non-bonded interactions. Chemistry of weak interactions – van der Waals force and hydrogen bonding, Density functional theory. 3D co-ordinate generation for small molecules, geometry optimization by Molview. Chemical Databases: Chemoinformatics, MSDS
Self- learning topics: Scope, cost and efficiency of computational modeling.

Module 2	Materials for Memory and Display Systems	Assignment	Data Collection and analysis	**09 Sessions**

Topics:

Memory Systems : Introduction, classification of electronic memory devices- Transistor, capacitor, charge -transfer and Resistor, types of materials - organic, polymeric and hybrid materials, and applications, manufacturing of semiconductor chips.

Display Systems: photo and electroactive materials , materials for display -Principle, Properties and applications: Liquid crystals for LCD-Liquid crystals display, Basics of LED: OLED-organic light emitting diode and light emitting electrochemical cells.

Self- learning topics: Green computing: Biocomposite based memory devices

Module 3	Nanomaterials based Smart Sensors and Devices	Assignment	Data Collection and analysis	**09 Sessions**

Topics:
Nanomaterials- Introduction, classification based on dimensionality, quantum confinement. Size dependent properties, Synthesis, Properties of CNT and Graphene and their application as **Materials for data analysis and packaging** -RFID and IONT.
Sensors: Introduction, types, Principle and applications- electrochemical sensor: nanomaterials for sensing applications - Glucose, VOC sensing.

Self-learning topics: Fullerene, biomolecules in sensing, Strain sensors

Module 4	Sustainable Materials and Development	Quiz/Seminar	Data Collection and analysis	**09 Sessions**

Topics:
E waste: Introduction, E waste Hazards, E- waste management, Recovery of precious metal- Cu by Hydrometallurgy.
Green Chemistry: Fundamentals and 12 principles with examples, Carbon footprint and sequestration

Sustainable Chemistry: -Introduction to Biomaterials- PLA , polymers in bio-compatible and bio-degradable materials - Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) PHBV, synthesis and applications in drug delivery.

Self-learning topics: circular economy- case studies.

Module 5	Energy Science	Quiz/Seminar	Data Collection and analysis	**09 Sessions**

Topics:
Battery technology: Fundamentals of electrochemistry, Introduction to electrochemical storage devices: battery (Lithium-ion battery- $LiMnO_2$, $LiCoO_2$, metal air batteries- LiO_2) and supercapacitors-Introduction, Principle, Types - EDLC, pseudo and asymmetric capacitor.
Photovoltaic: Solar cells - Construction and working principle; types- Inorganic, Organic and quantum dot sensitized (QDSSC's).

Self -learning topics: Battery technology for e-mobility, Green hydrogen

Targeted Application & Tools that can be used:
Application areas are Data storage and analysis, logistics, Biomedicine, Energy, Environment and sustainability
Tools: Molview, chemdraw, excel etc

Project work/Assignment:

Assessment Type

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

Text Book

T1: Wiley, "Engineering Chemistry", Wiley.

T2: G.A. Ozin and A.C. Arsenault, Nanochemistry: A chemical approach to nanomaterials, Royal Society of Chemistry, 2009

Reference Books

R1: Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, ISBN: 978-036-727-510-5.
R2: E-waste recycling and management: present scenarios and environmental issues, Khan, Anish, and Abdullah M. Asiri. 2019, Springer, Vol. 33. ISBN: 978-3-030-14186-8.
R3: Essentials of computational chemistry: theories and models, Christopher J Cramer, 2013, John Wiley & Sons. ISBN: 978-0-470-09182-1.
R4: Energy storage and conversion devices: Supercapacitors, batteries and hydroelectric cells, Anurag Gaur, L. Sharma, Anil Arya. 2021, CRC press, 1st edition, ISBN: 978-1-003-14176-1.
R5: Fundamentals of analytical chemistry: An introduction, Douglas A. Skooget etal., 2004 Thomson Asia pte Ltd., 8th, ISBN: 978-0-495-55828-6
R6: Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press, ISBN: 978-036-727-510-5.
R7: Electrical and electronic devices, circuits and materials: Technological challenges and solutions. Tripathi, L., Alvi, P. A., & Subramaniam, U, 2021, John Wiley & Sons, ISBN: 978-0367564261.
R8: F. Jensen, Introduction to Computational Chemistry, 3rd edition, Wiley, 2017.

E-Resources/Web Resources

1. https://presiuniv.knimbus.com/user#/searchresult?searchId=computational%20chemistry&_t=1738054970142
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_48504
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_147967
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_130301
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_87297
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_67006
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_137261
8. 8.https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_86712

Skill Sets
All topics in theory component are relevant to Environment and Sustainability.

Course Code: CSS2200	Course Name: Program Solving Using C Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	CAI2501		
Anti-requisites	CSEXXXX		
Course Description	The course is designed to provide a strong foundation in the C programming language and problem-solving techniques. It enables students to develop logical thinking and programming skills required to design and implement applications using C. By understanding fundamental programming concepts such as algorithms, control structures, arrays, functions, pointers, and data handling, students will be prepared to learn and adapt to other programming languages and advanced computing technologies in the future.		
Course Objective	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 the course the students shall be able to:** **CO1:** Explain problem-solving techniques using algorithms, pseudo code, and flowcharts for developing programs [Level 2 – Understand] **CO2:** Apply fundamental C programming constructs such as data types, operators, decision-making, and looping statements to develop simple programs. [Level 3 – Apply] **CO3:** Develop programs using arrays and strings to solve computational problems effectively [Level 3 – Apply] **CO4:** Implement modular and reusable programs using functions, recursion, and pointers. [Level 3 – Apply] **CO5:** Design applications using structures, unions, file handling concepts, and demonstrate the role of C programming in emerging technologies. [Level 3 – Apply]

Course Content:

Module 1	Introduction to C Language	Assessment: (Algorithms, Flowcharts, and Basic C Programs)	6 Sessions

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	Assessment : Programming Assignment (Arrays, Sorting, Searching, and String Handling in C)	6 Sessions

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	Assessment : Programming Assignment (Functions, Recursion, and Pointer Implementation in C)	6 Sessions

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 and File Handling	Assessment : Assignment (Structures, Unions, and File Operations in C)	6 Sessions

Topics:
Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.- File handling: Defining and Opening a File – Closing a File – Input / Output Operations on File.

Module 5	Application of C Programming in Emerging CSE Specializations	Assessment : Mini Project (C Programming Applications in Cyber Security, Blockchain, and AI)	6 Sessions

Topics:
Applications of C Programming in modern technologies – Cyber Security: Simple password checking programs and basic security concepts – Blockchain: Secure data storage and transaction concepts – Artificial Intelligence and Machine Learning: Basic data processing programs.

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

Text Book **T1:** E. Balaguruswamy, “Programming in ANSI C”, 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.
References **R1:** Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. **R2:** Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016. **R3:** Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2015 **R4:** Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014. **R5:** Stephen G. Kochan, “Programming in C”, Addison-Wesley Professional, 4th Edition, 2014.
E-Resources/Web Resources 1.NPTEL – Programming in C 2.NPTEL – Problem Solving Through Programming in C 3.GeeksforGeeks – C Programming Language

Course Code: ENG2030	Course Name: Communication in Practice Type of Course: Integrated	L- T-P- C	1-0-2-2
Version No.	1.0		
Course Pre-requisites	ENG XXXX – Fundamentals of Communication (Semester I)		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	Communication in Practice is the second-semester course in sequence designed for first-year undergraduate students in engineering and computer science programmes. This course puts those foundations under professional pressure. The question is no longer what communication is, but how to deploy it when it counts: in a job interview, a pitch to a client, a negotiation with a colleague, a professional report directed at a real reader, or a leadership communication challenge that affects a team. The course is organised around four modules, each of which explicitly upgrades the work done in semester one. Assessment is 100% Continuous Assessment. There is no end-semester examination. The centrepiece is a capstone Professional Communication Portfolio that the student could realistically share with an employer.		
Course Objective	The course aims to articulate the foundational tenets of professional communicative identity, discourse ethics, and analytical text evaluation and apply them to high-stakes institutional scenarios and complex professional ecosystems. It also focuses on cultivating advanced oral communication strategies and persuasive vocal mechanics, including structured rhetorical delivery and spontaneous adaptive responses, for collaborative, hierarchical, and leadership contexts. Furthermore, it aims to refine technical authorship capabilities and artificial intelligence-mediated workflows to produce precise, highly structured, and audience-centric professional artifacts across formal engineering, computational, and cross-functional corporate domains.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the principles governing professional communication identity, communicator ethics, and context-sensitive self-presentation across workplace, hierarchical, and digital contexts. [Level 3 - Understand] **CO2**: Demonstrate advanced vocal, rhetorical, and adaptive strategies across high-stakes spoken communication genres, including interviews, pitches, negotiations, and leadership scenarios.. [Level 3 – Apply] **CO3:** Demonstrate advanced vocal, rhetorical, and adaptive [Level 3 – Apply]		

	strategies across high-stakes spoken communication genres, including interviews, pitches, negotiations, and leadership scenarios. **CO4:** Execute the production of professional-grade written artifacts across high-demand genres—including formal reports, business proposals, data communications, and advocacy briefs—meeting real-world standards of clarity, structure, and audience appropriateness. **CO5:** Implement AI-assisted communication workflows in professional contexts, including systematic prompt design for high-stakes outputs, validation protocols for synthetic materials, and the application of ethical frameworks at individual and organizational levels.	[Level 3 – Apply] [Level 3 – Apply]

Course Content:

Module 1	Words that Work: Vocabulary, Register, and Precision	Assessment: CA1 +Register Switching Activity	9 Sessions

Topics:
The topics will be explored through vocabulary games, role-play activities, communication challenges, case-based tasks, and workplace simulations:

- Why Words Matter in Professional and Technical Communication
- Choosing the Right Words for Different Situations
- Understanding Meaning: Positive, Negative, and Neutral Word Choices
- Commonly Confused Words and Miscommunication in Professional Contexts
- Using Clear, Precise, and Concise Language
- Explaining Technical Terms to Non-Technical Audiences
- Building and Using Personal/Professional Vocabulary

Module 2	Listening, Processing, and Structured Response Writing	Assessment : CA2+ Rapid Listening and Response	12 Sessions

Topics:
The topics will be explored through podcasts, interviews, workplace recordings, collaborative listening tasks, discussions, and real-time writing activities:

- Identifying Key Information from Spoken Inputs
- Organizing Information from Discussions and Conversations
- Converting Spoken Communication into Clear and Structured Written Responses
- Writing Summaries from Audio and Discussion Inputs
- Writing Follow-Up Responses Based on Spoken Communication
- Writing Action Notes, Instructions, and Task Updates from Listening Inputs
- Converting Meetings and Discussions into Structured Written Outputs

Module 3	High-Stakes Spoken Communication	Assessment :CA+Mock Professional Interview, Pitching an Idea Pitch	12 Sessions

Topics:

- Speaking as a professional: identity, presence, and the first impression
- Vocal authority, physical presence, and communication across hierarchies
- Interview communication: structure, composure, and the STAR framework
- Pitching ideas: the 3-minute and 10-minute pitch architecture
- Negotiation and principled disagreement
- Communicating in leadership positions: chairing, facilitating, and giving direction
- Managing communication under pressure: hostile questions, silence, and contradiction

Module 4	Adaptive Communication	Assessment : CA+Communication Strategy Plan	12 Sessions

Topics:
The topics will be explored through leadership simulations, AI-assisted scenario practice, ethical debate exercises, case analysis, peer feedback sessions, and reflective portfolio activities:

- Communication Strategy: Audiences, Channels, Timing, and Feedback Loops
- What Emotional Intelligence Actually Does in High-Stakes Conversations
- Reading the Room: Adapting Style Across Personalities, Contexts, and Power Gaps
- Giving and Receiving Developmental Feedback as a Professional Practice

- Navigating Difficult Conversations: Disagreement, Criticism, and Bad News
- Repairing Communication Breakdowns: Apology, Accountability, and Recovery
- AI as a Strategic Communication Tool: Capabilities, Limits, and What Professionals Must Decide

Targeted Applications & Tools:

Otter.ai, Microsoft Word/PowerPoint/Teams/Clipchamp/Whiteboard/OneNote/Forms/Copilot, Miro, Padlet, Canva, Mentimeter, AllSides Media Bias Ratings, Ad Fontes Media Bias Chart, Snopes/factcheck.rog, Zotero, NotebookLM, Canva, Adobe Express, CapCut, OBS Studio, Claude, ChatGPT, Gemini, DeepSeek, Google Docs

Skill-Building Activities through Experiential Learning:

Project Work / Assignment::

1. Register Switching Activity (Individual): Students receive a single professional scenario and must communicate the same core message to three different audiences — a peer, a manager, and a non-specialist outsider — switching register, vocabulary, and tone appropriately for each. Delivered live in class. Graded on accuracy of register shift, vocabulary choices, and adaptability under in-the-moment feedback from the assessor.

2. Word in the Wild Log (Individual): Over four weeks, students maintain a running log of 25 words or phrases encountered in professional contexts — podcasts, workplace conversations, news, interviews — that they did not fully understand or could not have used confidently themselves. For each entry, students record the source, the meaning in context, an alternative they might have used, and one original sentence demonstrating precise use. Submitted as a structured document at the end of Module 1. Graded on range, contextual accuracy, and quality of reflection.

3. Rapid Listening and Response (Individual): Students listen to an unedited workplace audio recording — a meeting excerpt, a briefing, or a professional conversation — played once, without transcripts. Under timed conditions, they produce a structured written response that captures key information, identifies the communication purpose, and drafts an appropriate follow-up action note. Graded on accuracy, organisation, and quality of written response.

4. Mock Professional Interview (Individual): Each student undergoes a 10-minute mock professional interview conducted by faculty or a peer panel. No prepared scripts permitted. Graded on composure, structure, vocal authority, and use of the STAR framework. Written self-evaluation of 200 words submitted within 48 hours.

5. Idea Pitch (Individual): Students deliver a 3-minute pitch of a solution to a real or simulated professional problem, to a panel that includes at least one hostile or sceptical questioner. Immediately after the pitch, the panel asks two minutes of unscripted questions. Graded on clarity of argument, persuasive structure, handling of pressure, and vocal presence.

6. Difficult Conversation Simulation (Pair): Pairs of students are assigned roles in a scripted conflict scenario — a performance issue, a missed deadline, a broken professional agreement. Each student must navigate the conversation toward a constructive resolution without a script. Immediately after, both students complete a structured individual debrief identifying what communication choices they made, what they would change, and what they observed in their partner. Graded individually on communication behaviour during the simulation and quality of the debrief.

7. Communication Strategy Plan — Presentation and Portfolio Submission (Group): Students select a real or realistic professional scenario — a team conflict, a stakeholder disagreement, a leadership announcement, or a crisis communication moment. They develop a communication strategy plan that maps the audience, chooses appropriate channels and timing, anticipates likely responses, and identifies where AI tools could assist and where they must not. The plan is delivered as a 5-minute structured presentation to a simulated panel, followed by two minutes of unscripted Q&A. The portfolio submission includes the written plan, a one-page reflection on their communication growth across all four modules, and one piece of evidence from each module that demonstrates that growth. Graded on strategic thinking, clarity of presentation, quality of reflection, and coherence of the portfolio as a whole.

Text Book

T1: Treasure, J. (2017). How to be Heard: Secrets for Powerful Speaking and Listening. Mango Publishing.

T2: Beebe, S. A., Beebe, S. J., & Ivy, D. K. (2019). Communication: Principles for a Lifetime (7th ed.). Pearson.

References

R1: Goleman, D. (1995). Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books.

R2: Patterson, K., Grenny, J., McMillan, R., & Switzler, A. (2011). Crucial Conversations: Tools for Talking When Stakes Are High (2nd ed.). McGraw-Hill.

R3: Cuddy, A. (2015). Presence: Bringing Your Boldest Self to Your Biggest Challenges. Little, Brown and Company.

R4: Fisher, R., Ury, W., & Patton, B. (2011). *Getting to Yes: Negotiating Agreement Without Giving In* (3rd ed.). Penguin Books. R5: Stone, D., Patton, B., & Heen, S. (2010). Difficult Conversations: How to Discuss What Matters Most (2nd ed.). Penguin Books.
E-Resources/Web Resources • ted.com/topics/communication • ted.com/topics/leadership • hbr.org (Harvard Business Review — communication and leadership articles) • psychologytoday.com/us/basics/emotional-intelligence • learnprompting.org • unesco.org/en/artificial-intelligence/ethics • yoodli.ai (AI speech coaching) • themuse.com (professional communication and career resources) • mindtools.com (communication skills and workplace tools)
Topics relevant to "SKILL DEVELOPMENT": Vocabulary building and register awareness; precise and concise language use; explaining technical terms to non-specialist audiences; active listening and information processing; converting spoken inputs into structured written responses; writing action notes and follow-up communications; professional presence and vocal authority; interview communication and the STAR framework; idea pitching and persuasive speaking; negotiation and principled disagreement; chairing and facilitating discussions; managing communication under pressure; communication strategy and audience mapping; emotional intelligence in professional contexts; adapting communication style across personalities and power gaps; giving and receiving developmental feedback; navigating difficult conversations; repairing communication breakdowns; AI as a strategic communication tool; ethics of AI in professional communication.

Course Code: EEE1200	Course Name: Basics of Electrical and Electronics Engineering. Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	2.0		
Course Pre-requisites	NIL		
Co-requisites	EEE1251		
Anti-requisites	NIL		
Course Description	This is a fundamental Course which is designed to know the use of basics of electrical and electronics engineering principles occurs in various fields of Engineering. The course emphasises on the characteristics and applications of electrical and electronic devices. The course also emphasizes on the working, analysis and design of electrical circuits using both active & passive components. Additionally, this course creates a foundation for the future courses such as Electrical machines, power system, power electronics Linear Integrated Circuits, Analog Communication and Digital Communication etc.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain Skill Development through Participative Learning techniques		
Course Outcomes	**On successful completion of the course the students shall be able to:** CO1: Apply basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits. [Level 3 - Apply] CO2: Discuss various fundamental parameters appearing in the characteristics of semiconductor devices and their applications. [Level2– Understand] CO3: Summarize the operations of different biasing configurations of BJTs and amplifiers. [Level2– Understand] CO4 : Discuss the performance characteristics and applications of various electrical Machines. [Level2– Understand]] CO5: Apply basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits. [Level 3 – Apply]		
Course Content:			
Module 1	Introduction to Electrical Circuits	Assignment/ Quiz	10 Sessions
Topics:			

DC Circuits: Concept of Circuit and Network, Types of elements, Network Reduction Techniques- Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, Nodal Analysis, Numerical examples.
AC Circuits: Fundamentals of single phase circuits - Series RL, RC and R-L-C Circuits, Concept of active power, reactive power and Power factor, Numerical examples.
Introduction to three phase system and relation between line and phase values in Star & Delta connection, Numerical examples.

Module 2	Semiconductor and Diode applications	Assessment : Quiz + Assignment	10 Sessions

Topics:

Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal and practical behaviour, Modelling the Diode Forward Characteristic, and Diode applications like rectifiers, Clipping and clamping circuits. Zener diode, characteristics and its applications like voltage regulator.

Module 3	Transistors and its Applications	Assessment : Assignment/ Quiz	10 Sessions

Topics:

Transistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing & stabilization techniques: Fixed Bias, Voltage divider bias and its stability factor and load line analysis. Single and multistage amplifier, Darlington pair.
JFET (Construction, principal of Operation and Volt –Ampere characteristics). Pinch- off voltage, Comparison of BJT and FET. MOSFET (Construction, principal of Operation and symbol), MOSFET characteristics in Enhancement and Depletion modes.

Module 4	Fundamentals of Electrical Machines	Assessment : Assignment/ Quiz	10 Sessions

Topics:

Electrical Machines: Single phase transformers: principle of operation and EMF equation, Numerical examples. DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation of Induction Motors and its Applications.
Special Machines: Introduction to special electrical machines and its applications.

Targeted Applications & Tools:

Multisim	An electronic circuit simulation software used for designing, testing, and analyzing analog and digital circuits.
PSpice	A simulation tool used to analyze the behavior and performance of electronic circuits.
Multimeter	An electronic measuring instrument used to measure voltage, current, and resistance in circuits.
Function Generator	A device used to generate different electrical waveforms for circuit testing and analysis.
Power Supplies	Equipment used to provide regulated electrical power to electronic circuits and devices.

Skill-Building Activities through Experiential Learning:

- Hands-on experiments on electrical circuits and electronic components.
- Measurement and analysis of voltage, current, resistance, and waveform characteristics using electrical instruments.
- Simulation and testing of electronic circuits using software tools such as Multisim and PSpice.
- Practical study of semiconductor devices, BJTs, amplifiers, and electrical machines.
- Team-based troubleshooting and circuit debugging activities to enhance problem-solving skills.

Text Book

T1: Kothari D. P. & Nagrath I. J., “Basic Electrical and Electronics Engineering”, Tata McGraw-Hill Education
T2: Theraja B.L. and Theraja A.K., “A Textbook of Electrical Technology: Basic Electrical Engineering” in S.I. System of Units, 23rd ed., New Delhi: S. Chand, 2002.
T3: J. Millman, C. C. Halkias and C. D. Parikh, “Millman’s Integrated Electronics”, McGraw Hill Education, 2nd Edition.
Basics of Electrical & Electronics Laboratory Manual.

References

R1: Re John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
R2: Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India,

2007.
R3: K Uma Rao, A Jaya Lakshmi, “Basic Electrical engineering” IK International publishing house Pvt. Ltd
R4: R. L. Boylestad and L. Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education India 7th Edition.

E-Resources/Web Resources

1. https://www.digimat.in/nptel/courses/video/108105112/L01
2. https://nptel.ac.in/courses/108/105/108105153/
3. https://nptel.ac.in/courses/108/102/108102095

Course Code: CSS2201	Course Name: Program Solving Using C Lab Type of Course: Laboratory Course	L- T-P-C	0-0-4-2
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The course is designed to provide a strong foundation in the C programming language and problem-solving techniques. It enables students to develop logical thinking and programming skills required to design and implement applications using C. By understanding fundamental programming concepts such as algorithms, control structures, arrays, functions, pointers, and data handling, students will be prepared to learn and adapt to other programming languages and advanced computing technologies in the future.		
Course Objective	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:** **CO1:** Explain algorithms, flowcharts, and basic programming concepts used in C programming. [Level 2 – Understand] **CO2:** Implement C programs using decision-making, looping statements, arrays, and strings to solve computational problems. [Level 3 – Apply] **CO3:** Construct modular programs using functions, recursion, and pointers for effective problem solving.. [Level 3 – Apply] **CO4:** Develop applications using structures, unions, and file handling concepts in C programming. [Level 3 – Apply] **CO5:** Design and implement simple real-world applications in areas such as Cyber Security and Artificial Intelligence using C programming concepts. [Level 3 – Apply]		
Course Content:			

List of Practicals: 60 Sessions

Lab Sheet 1: 10 Sessions

Program 1: Sum of Two Numbers
Program 2: Find the Greatest of Three Numbers
Program 3: Check Even or Odd using Conditional Operator
Program 4: Print Multiplication Table using Loop
Program 5: Count Digits in a Number using While Loop
Program 6: Demonstration of Preprocessor Directives
Program 7: Simple Calculator using Switch Case

Lab Sheet 2: 10 Sessions

Program 1: Check Whether a Number is Positive, Negative or Zero
Program 2: Find the Sum of First N Natural Numbers

Program 3: Check Whether a Number is Prime or Not
Program 4: Find Factorial of a Number
Program 5: Reverse a Number
Program 6: Simple Number Guessing Game

Lab Sheet 3: 10 Sessions
Program 1: Linear Search in a One-Dimensional Array
Program 2: Bubble Sort on an Integer Array
Program 3: Matrix Addition (2D Arrays)
Program 4: Count Vowels in a String
Program 6: Selection Sort on an Array

Lab Sheet 4: 10 Sessions
Program 1: Sum of Two Numbers Using User-Defined Function
Program 2: Factorial Using Recursion
Program 3: Swap Two Numbers Using Call by Value (No Swap)
Program 4: Swap Two Numbers Using Call by Reference (With Swap)
Program 5: Pointer Basics - Access and Modify Variable via Pointer
Program 6: Accessing Array Elements Using Pointers

Lab Sheet 5: 10 Sessions
Program 1: Basic Structure Usage
Program 2: Structure with Nested Structures (Date of Birth)
Program 3: Union Example and Member Access
Program 4: Write to a File (Text Mode)
Program 5: Read from a File (Text Mode)
Program 6: Append Data to a File

Lab Sheet 6: 10 Sessions
Program 1: Write a C program to check whether a password is strong or weak based on its length. If the password contains more than 8 characters, display "Strong Password"; otherwise display "Weak Password".
Program 2: Develop a simple login system using C. Store a predefined username and password in the program and verify the user input. Display "Login Successful" or "Invalid Credentials".
Program 3: Write a C program to input marks of 5 students and calculate the average marks. Display whether the class performance is "Good" or "Needs Improvement".
Program 4: Develop a C program to find the largest number in an array. This simulates basic data analysis used in AI systems.

Text Book(s):

T1: E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.

Reference Book(s):

R1: Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.

R2: ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
R3: Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015
R4: Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
R5: Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

Web Links and Video Lectures:

1. NPTEL – Programming in C
2. NPTEL – Problem Solving Through Programming in C
3. GeeksforGeeks – C Programming Language
4. Programiz – Learn C Programming

Course Code: CHE2502	Course Name: Chemistry of Smart Materials Lab Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The laboratory course aims to develop experimental skills and apply fundamental chemical principles to address chemistry-related problems in engineering. The experiments are carefully designed to complement the theoretical concepts covered in lectures, providing hands-on experience to deepen understanding and reinforce learning. 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 "Chemistry of Smart Materials Lab" and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.		
Course Outcomes	On successful completion of the course, students shall be able to: **CO1:** Recognize the basic techniques and instrumentation used in chemistry laboratories for quantitative analysis. [Level 3 - Apply] **CO2**: Estimate the presence of acids and metal ions in domestic and industrial waste using laboratory techniques. [Level 3 – Apply] **CO3:** Review the experimental results and demonstrate improved experimental skills through hands-on laboratory experience. [Level 3 – Apply] **CO4:** Classify laboratory techniques such as experimental setups for synthesis, purification, recovery and analysis. [Level 3 – Apply]		

Course Content:

Experiment 1	Experimental	Data Collection	Analysis and Interpretation
Determination of strength of strong acid in battery electrolyte using conductometric sensors.			
Experiment 2	Experimental	Data Collection	Analysis and Interpretation
Estimation of iron from e-waste using Electrochemical sensors.			
Experiment 3	Experimental	Data Collection	Analysis and Interpretation
Determination of pKa of organic acid of battery electrolyte using pH sensor.			
Experiment 4	Experimental	Data Collection	Analysis and Interpretation
Estimation of copper from PCBs by using colorimeter (Optical Sensor).			

Course Code: PPS1026	Course Title: Industry Readiness Program – II Type of Course: Practical Only Course	L-T- P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	Students are expected to understand basic English. Students should have desire and enthusiasm to get involved, participate, and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to enable students to set SMART goals, form professional & personal ethics for the success and learn various email writing techniques. 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 "Employability for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: **CO1:** Apply different communication skills for success in workplace [Level 3 - Apply] **CO2:** Practice team building skills for career success [Level 3 - Apply] **CO3:** Demonstrate ethical leadership skills in workplace [Level 3 - Apply]					
Course Content:						
Module 1	Effective Communication	Classroom activities	10 Sessions			
Topics: Practice effective communication skills (Verbal, Non-verbal, Written and Visual) Activity: Use social media prompts to prepare self-introduction videos						
Module 2	Team Building	Group Activity	10 Sessions			
Topics: Skills of an effective team player Activity: Student group activity to build class networking						
Module 3	Leadership	Case study	10 Sessions			
Topics: Types of leadership, using empathy in leadership Activity: Individual presentation by students on corporate leaders.						
Targeted Applications & Tools: TED Talks; You Tube Links; Activities						
Assignment proposed for this course Assignment 1: One minute reel Assignment 2: Team building assignment						
Continuous Individual Assessment Module 1: L-S-R-W class assessment Module 2: Team Presentation Module 3: Individual Assessment						

Course Code: EEE1251	Course Name: Basics of Electrical and Electronics Engineering Laboratory Type of Course: ESC - Laboratory	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This fundamental laboratory provides an opportunity to validate the concepts taught in the basics of electrical and electronics engineering and enhances the ability to visualize real system performance, using both hardware and simulation tools.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Basics of Electrical and Electronics Engineering and attain Skill Development through Experiential Learning techniques.		

Basic skill sets required for the laboratory	The students shall be able to develop: 1)An attitude of enquiry. 2)Confidence and ability to tackle new problems. 3)Ability to interpret events and results. 4)Ability to work as a leader and as a member of team. 5)Assess errors and eliminate them. 6)Observe and measure physical phenomenon. 7)Write Reports. 8)Select suitable equipment, instruments and materials. 9)Locate faults in systems. 10)Skills for setting and handling equipment. 11)The ability to follow standard test procedures. 12)An awareness of the need to observe safety precautions. 13)To judge magnitudes without actual measurement.
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:**Demonstrate the behavior of passive elements and fundamental electrical circuit laws [Level 3 – Apply] **CO2:**Determine the power factor, impedance, and phase relationship of R and RL loads under AC supply conditions. [Level 3 – Apply] **CO3:**Develop electrical circuits and three-phase supply systems using MATLAB/Simulink to study resistance, voltage, and current characteristics. [Level 3 – Apply] **CO4:**Analyze the performance characteristics of electrical machines, including single-phase transformers and three-phase induction motors, under different operating conditions. [Level 4 – Analyze] **CO5:**Examine the output characteristics and performance parameters of half-wave and full-wave rectifiers. [Level 3 – Apply] CO6:Illustrate the performance characteristics of Zener diode and MOSFET under different operating conditions. [Level 3 – Apply]

Course Content:

List of Laboratory Tasks:

Experiment No 1: Familiarization of passive elements.

Level 1: Identify and understand the function and ratings of basic passive elements.

Level 2: Study the behavior of passive elements in simple electrical circuits by measuring voltage, current, and impedance.

Experiment No 2: Experimental Verification of Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL).

Level 1: Study and Verify KVL and KCL for the given electrical Circuit.

Experiment No 3: Determination of Power Factor, and Impedance for R and RL Loads.

Level 1: Determine the power factor and impedance of R and RL loads under steady-state AC supply conditions.

Level 2: Analyze the effect of inductance on power factor, impedance, and phase angle for RL loads under varying load conditions.

Experiment No 4: Modeling and Simulation of effective resistances in different circuit connections Using Simulink.

Level 1: Model and simulate series and parallel resistor circuits in Simulink and determine their effective resistance.

Level 2: Analyze the effect of different resistor combinations on total resistance, current distribution, and voltage drop.

Experiment No 5: Simulation and analysis of line and phase voltages in Star-connected and Delta- connected supply systems.

Level 1: Model and simulate star-connected and delta-connected three-phase supply systems and observe line and phase voltages.

Level 2: Analyze and compare the relationship between line and phase voltages in star and delta connections.

Experiment 6: Determination of transformation ratio of a Single-Phase Transformer Under different tapping conditions.

Level 1: Determine the transformation ratio of a single-phase transformer under no-load condition for various tap settings.

Level 2: Analyze the effect of different tapping conditions on secondary voltage, regulation, and transformer performance.

Experiment No. 7: Study of the speed-torque characteristics of a Three-Phase Induction Motor.

Level 1: Study and analyze the speed–torque characteristics of a three-phase induction motor.

Level 2: Evaluate the effect of supply voltage and current on motor performance parameters such as slip, and torque.

Experiment 8: Performance Analysis of Half-Wave and Full-Wave Rectifier Circuits Using Simulink.

Level 1: Model and simulate half-wave and full-wave rectifier circuits in Simulink and analyze their output waveforms.

Level 2: Evaluate and compare rectifier performance parameters such as ripple factor, efficiency, and output voltage.

Experiment 9: Study of the characteristics of a Zener Diode.

Level 1: Study the forward and reverse V–I characteristics of a Zener diode using DC analysis.

Level 2: Analyze the Zener breakdown characteristics and determine the Zener voltage and regulation behavior.

Experiment 10: Study of the Output and Transfer Characteristics of a MOSFET.

Level 1: Study, analyze and implement the output characteristics of a MOSFET under different gate-source voltage conditions and observe their results.

Level 2: Analyze the transfer characteristics of a MOSFET and evaluate key parameters such as threshold voltage and transconductance.

Targeted Applications & Tools:

Targeted Applications: Application area includes all electrical and electronic circuits (power supply unit, regulator unit, embedded devices, hardware electronics etc.). The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: MATLAB SIMULINK

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.

Skill-Building Activities through Experiential Learning:

- Hands-on experiments on electrical circuits and electronic components.
- Measurement and analysis of voltage, current, resistance, and waveform characteristics using electrical instruments.
- Simulation and testing of electronic circuits using software tools such as Multisim and PSpice.
- Practical study of semiconductor devices, BJTs, amplifiers, and electrical machines.
- Team-based troubleshooting and circuit debugging activities to enhance problem-solving skills

Text Book

T1: D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 4th Edition, McGraw Hill Education, New Delhi, 2019.

T2: B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology, Volume-I: Basic Electrical Engineering in SI Units, 24th Edition, S. Chand Publishing, New Delhi, 2024.

References

R1: John Hiley, Keith Brown and Ian McKenzie-Smith, Hughes Electrical and Electronic Technology, 12th Edition, Pearson Education, 2016.

R2: S. K. Bhattacharya and D. Devaraj, Basic Electrical and Electronics Engineering, 2nd Edition, Pearson Education India, 2017.

R3: T. K. Nagsarkar and M. S. Sukhija, Principles of Basic Electrical Engineering, 1st Edition, Oxford University Press, 2018.

R4: Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 12th Edition, Pearson Education, 2019.

R5: A. K. Maini and Varsha Agrawal, Electronic Devices and Circuits, 2nd Edition, Wiley India, 2019.

R6: Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 8th Edition, Oxford University Press, 2019.

E-Resources/Web Resources

1. https://presidencyuniversity.linways.com
2. https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering - Basic Concepts, Examples"
3. Video lectures on "Electronic Devices" by Prof. Dr. A. N. Chandorkar, IIT Bombay http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html
4. NPTEL lectures on "Rectifiers", by Prof. G. Bhuvaneswari, IIT Delhi https://nptel.ac.in/courses/108102145
5. NPTEL Lectures on "Electrical Machines II", by Prof. G. Sridhara Rao, IIT Madras. https://nptel.ac.in/courses/108106072

Topics relevant to "EMPLOYABILITY SKILLS": All the experiments which are listed are for Skill Development through Experiential Learning Techniques. This is attained through the assessment component mentioned in course handout.

Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS": Standard test methods, safety procedure.

Course Code: MAT2311	**Course Name:** Vector Calculus, Numerical Methods and Sampling Distributions **[Type of Course:1] School Core**	**L-T- P- C**	**3**	**1**	**0**	**4**
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces the fundamental concepts and methods of ordinary differential equations, numerical techniques, and statistical inference used in engineering and scientific applications. The course covers analytical methods for solving differential equations, numerical methods for solving linear and nonlinear equations, interpolation, numerical differentiation and integration, and numerical solutions of ordinary differential equations. It also introduces sampling distributions and hypothesis testing for statistical decision-making. The course enables students to apply mathematical and statistical techniques to solve computational and real-world engineering problems.					
Course Objective	The objectives of this course are to develop the ability to solve ordinary differential equations arising in scientific and engineering applications. Introduce numerical techniques for solving systems of linear equations and nonlinear algebraic equations. Apply interpolation, differentiation, and integration methods for approximating mathematical functions and evaluating definite integrals. Employ numerical methods for obtaining approximate solutions of ordinary differential equations. Apply concepts of sampling distributions and statistical inference to estimate population parameters and support decision-making. Apply hypothesis testing techniques to real-world problems involving means, proportions, variances, and associations among variables.					
Course Outcomes	After successful completion of the course, students will be able to: **CO1:** Employ vector differential operators to solve problems involving scalar and vector fields and classify them as solenoidal or irrotational (L3) **CO2:** Apply vector integration techniques and integral theorems to a solve engineering problems. (L3) **CO3:** Use numerical methods to solve systems of linear and nonlinear equations. (L3) **CO4:** Implement numerical techniques for interpolation, differentiation, integration, and ordinary differential equations. (L3) **CO5:** Utilize sampling distributions and statistical inference techniques to solve statistical problems. (L3) **CO6:** Perform hypothesis testing for statistical decision-making. (L3)					
Course Content:						
Module 1	**Vector Calculus**					**(14L+5T=19 Sessions)**
Vector & Scalar Functions and Fields, Derivatives, Curve, Arc length, Curvature & Torsion, Gradient of Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Physical interpretation, Solenoidal and Irrotational Vector Fields. Problems. Line Integrals, Path Independence of Line Integrals, Surface and Volume Integrals, Green's Theorem in the plane, Divergence Theorem of Gauss, Stokes's Theorem. Problems on Image Edge Detection, Robot Path Planning and 3D Surface Modelling						
Module 2	**Solution of Linear Systems and non-linear of Equation**					**(9L+3T=12 Sessions)**
Introduction, Jacobi iteration method, Gauss-Seidel iteration method. Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method, Newton-Raphson method, secant method, fixed point iteration method. Page Ranking, Network Analysis, Circuit Simulation, Root Finding, Load Balancing, and Computational Optimization Problems.						
Module 3	**Numerical Interpolations and Differential Equations**					**(10L+3T=13 Sessions)**
Newton's method, Divided difference method, Lagrange's method, Numerical differentiation, Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Gaussian quadrature rule. Solution of ordinary differential equations: Taylor series method, modified Euler's method, Runge-Kutta method for 4th order. Problems on Signal Reconstruction, Sensor Data Interpolation and Trajectory Prediction.						
Module 4	**Sampling Distributions**					**(12L+4T=16 Sessions)**
Random sampling, sampling distributions, Standard Error, Type I & Type II errors, Testing of Hypothesis, Test of significance - Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations, Test for single mean, difference of means, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. A/B Testing, Fraud Detection, Spam Classification Evaluation, and Network Traffic Analysis.						

Targeted Applications & Mathematical Tools:

- Analysis of fluid flow in open channels and pipelines, groundwater movement, stress and strain fields, terrain modelling, and 3D surface representation in civil engineering projects.
- Structural analysis, load distribution in trusses and frames, hydraulic network analysis, foundation design computations, and optimization problems in transportation and water resource systems.
- Estimation of terrain elevations, survey data interpolation, rainfall-runoff modelling, settlement prediction, traffic flow analysis, and numerical solutions of engineering differential equations.
- Quality control of construction materials, reliability analysis, traffic studies, environmental data analysis, hydrological investigations, and hypothesis testing in engineering experiments.
- Analysis of vector fields in fluid flow, electromagnetics, and heat transfer; image edge detection, robot path planning, and 3D surface modelling using gradients, divergence, curl, and integral theorems.

Software: MATLAB, Python, Microsoft Excel Solver, LINDO/LINGO, AutoCAD, ETABS, Scilab.

Assignment:

Assignments will involve theoretical problem-solving and computational implementation using suitable programming tools. The assignments may be undertaken individually or in groups, as decided by the instructor.

Text Book

1. M. K. Jain, S. R. K. Iyengar, and R. K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 7th ed. New Delhi, India: New Age International Publishers, 2019.
2. B. S. Grewal, *Higher Engineering Mathematics*, 45th ed. New Delhi, India: Khanna Publishers, 2022.
3. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, 12th ed. New Delhi, India: Sultan Chand & Sons, 2020.

References:

1. M. K. Jain, S. R. K. Iyengar, and R. K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 7th ed. New Delhi, India: New Age International Publishers, 2019.
2. S. S. Sastry, *Introductory Methods of Numerical Analysis*, 5th ed. New Delhi, India: PHI Learning Pvt. Ltd., 2012.
3. J. Kiusalaas, *Numerical Methods in Engineering with Python 3*, 3rd ed. Cambridge, U.K.: Cambridge University Press, 2025.
4. D. C. Montgomery and G. C. Runger, *Applied Statistics and Probability for Engineers*, 8th ed. Hoboken, NJ, USA: John Wiley & Sons, 2023.
5. D. D. Wackerly, W. Mendenhall, and R. L. Scheaffer, *Mathematical Statistics with Applications*, 7th ed. Belmont, CA, USA: Cengage Learning, 2008.
6. E. Kreyszig, *Advanced Engineering Mathematics*, 10th ed. Hoboken, NJ, USA: John Wiley & Sons, 2011.
7. R. L. Burden, J. D. Faires, and A. M. Burden, *Numerical Analysis*, 11th ed. Boston, MA, USA: Cengage Learning, 2021.
8. S. C. Chapra, *Applied Numerical Methods with MATLAB for Engineers and Scientists*, 4th ed. New York, NY, USA: McGraw-Hill Education, 2018.

E-resources/ Web links:

1. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=CUSTOM_PACKAGE_EBSCO_29052023_53751
2. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=TEXTBOOK_LIBRARY01_06082022_117
3. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=DOAB_1_06082022_7313
4. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=CUSTOM_PACKAGE_EBSCO_29052023_228965
5. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=DOAB_1_06082022_8838
6. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=SPRINGER_OPEN_ACCESS_BOOKS_10022025_1861
7. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=DOAB_1_06082022_7312

Topics relevant to SKILL DEVELOPMENT: Identification and solution of differential equations, application of numerical methods for algebraic and differential equations, implementation of interpolation and numerical integration techniques, statistical data analysis and hypothesis testing, and use of Python/MATLAB for engineering problem solving.

Course Code: CSS2251	Course Name: Data Communications and Computer Networks Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The objective of this course is to provide knowledge in data communications and computer networks, its organization and its implementation, and gain practical experience in the installation, monitoring, and troubleshooting of LAN systems. The associated laboratory is designed to implement and simulate various networks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffics.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain Employability through Problem Solving Methodologies.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Illustrate The Basic Concepts Of Data Communication And Computer Networks. [Level 3 - Apply] **CO2**: Analyze the functionalities of the Data Link Layer. [Level 4 – Analyze] **CO3:** Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. [Level 3 – Apply] **CO4:** Demonstrate the working principles of the Transport layer and Application Layer. [Level 3 – Apply]		
Course Content:			
Module 1	Introduction and Physical layer	Assessment: Assignment (Problem Solving)	9 Sessions
Topics: Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media – Reference Models - TCP/IP Suite, OSI Model . Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.			
Module 2	Data Link Layer	Assessment: Assignment (Problem Solving)	12 Sessions
Topics: Data Link Layer - Error Detection and Correction– Parity, CRC, Hamming Distance Flow Control and Error Control, Stop and Wait, Multiple Access Protocols, CSMA/CD,CSMA/CA			
Module 3	Network Layer	Assessment: Assignment (Problem Solving)	13 Sessions
Topics: Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing, Link State Routing, RIP, OSPF, BGPV4.			
Module 4	Transport and Application Layer	Assessment: Assignment (Problem Solving)	11 Sessions
Topics: Transport Layers - Connection management – Flow control-Sliding Window, Go-Back N ARQ, Selective Repeat ARQ, UDP, TCP, congestion control, Congestion avoidance The Application Layer: Domain Name System (DNS), Domain Name Space, FTP, Electronic Mail (SMTP), HTTP.			

Targeted Applications & Tools: Cisco Packet Tracer, Wireshark, and NS2 Simulator.
Skill-Building Activities through Experiential Learning:
Text Book **T1:** T1. Behrouz A. Forouzan, "Data Communications and Networking with TCP/IP Protocol Suite", 6th Edition, Tata McGraw-Hil **T2:** Andrew S Tanenbaum, Nick Feamster & David J Wetherall, "Computer Networks" Sixth Edition, Pearson Publication, 2022.
References **R1:** "Computer Networking: A Top-Down Approach", Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021. **R2:** William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007. **R3:** Behrouz A. Forouzan, "Data Communications and Networking 5E", 5th Edition, Tata McGraw-Hill, 2012
E-Resources/Web Resources 1. https://www.geeksforgeeks.org/what-is-spread-spectrum/ 2. https://www.geeksforgeeks.org/difference-between-fdma-tdma-and-cdma/ 3. https://archive.nptel.ac.in/courses/106/105/106105183/ 4. http://www.nptelvideos.com/course.php?id=393 5. https://www.digimat.in/keyword/106.htmlhttps://puniversity.informaticsglobal.com/login

Course Code: CSS2252	Course Name: Data Communications and Computer Networks Lab Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites			
Anti-requisites	NIL		
Course Description	This lab-based course provides hands-on experience in the principles and practices of data communications and computer networking. It is designed to complement theoretical concepts covered in the associated lecture course. Through a series of structured experiments and practical exercises, students will gain proficiency in configuring, analyzing, and troubleshooting computer networks. Key topics include network topology design, IP addressing and subnetting, Ethernet and LAN technologies, routing and switching, TCP/IP protocol suite, and basic network security measures. Students will work with industry-standard tools and equipment, including routers, switches, protocol analyzers, and network simulation software such as Cisco Packet Tracer or Wireshark.		
Course Objective	The objective of this lab course is to provide students with practical, hands-on experience in the configuration, operation, and troubleshooting of data communication systems and computer networks. Through guided experiments and real-world scenarios, students will reinforce theoretical knowledge, develop essential technical skills, and gain a deeper understanding of networking concepts, protocols, and devices used in modern communication systems.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Design and configure basic network topologies using routers, switches, and end devices to meet specified requirements [Level 3 – Apply] . **CO2:** Analyze and troubleshoot network connectivity and performance issues using tools such as Wireshark and network simulators. [Level 4 – Analyze] **CO3:** Demonstrate understanding of key networking protocols (e.g., TCP/IP, ARP, ICMP, DHCP) through practical implementation and observation. [Level 3 – Apply] **CO4:** Apply IP addressing and subnetting techniques to efficiently allocate and manage network resources in various networking scenarios. [Level 3 – Apply]		

Course Content:

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 Applications & Tools:
Cisco Packet Tracer, Wireshark, and NS2.
Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4
Problem Solving: Choose and appropriate devices and implement various network concepts.
Programming: Simulation of any network using NS2.

Skill-Building Activities through Experiential Learning:

Text Book

T1: Behrouz A. Forouzan, "Data Communications and Networking 5E", 5 th Edition, Tata McGraw-Hill, 2017.

T2: Andrew S Tanenbaum, Nick Feamster & David J Wetherall, "Computer Networks" Sixth Edition, Pearson Publication, 2022

References

R1: "Computer Networking: A Top-Down Approach", Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.
R2: William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.
R3: Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

E-Resources/Web 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

6. **https://puniversity.informaticsglobal.com/login**

Course Code: CSS2253	Course Name: Data Structures Type of Course: Theory Course (PCC)	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces the fundamental concepts of data structures and emphasizes the importance of selecting appropriate data structures and techniques for efficient program development. The course includes both theory and laboratory components focusing on the implementation and applications of data structures using the Java programming language. It also introduces emerging applications of data structures in cybersecurity, Artificial Intelligence, Machine Learning, blockchain, and intelligent computing systems. With strong knowledge of data structure fundamentals and practical implementation skills, students will be able to design and develop efficient, secure, and intelligent software applications.		
Course Objective	To develop a strong foundation in data structures by enabling students to understand fundamental data structures and their operations, analyze algorithm efficiency, implement linear and non-linear data structures, and apply appropriate techniques to solve real-world problems, including applications in cybersecurity, AI/ML, blockchain, and intelligent systems, while evaluating trade-offs between different data structures.		

Course Outcomes	**On successful completion of the course the students shall be able to:**	
	CO1: Explain the concepts of basic data structures such as arrays, stacks, and queues and their operations.	Level 2 – Understand
	CO2: Apply linked list data structures to solve real-world problems.	Level 3 – Apply
	CO3: Utilize appropriate non-linear data structures such as trees and graphs for given problem scenarios.	Level 3 – Apply
	CO4: Implement and demonstrate various searching and sorting algorithms and analyze the efficiency of data structures and algorithms in terms of time and space complexity.	Level 3 – Apply
	CO5: Apply data structure concepts in cybersecurity, AI/ML, blockchain, and intelligent computing applications.	Level 3 – Apply

Course Content:

Module 1	Introduction to Data Structure and Linear Data Structure – Stacks and Queues	Assessment:	9 Sessions

Topics:
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	Assessment :	12 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.

Module 3	Non-linear Data Structures - Trees	Assessment :	12 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, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.

Module 4	Non-linear Data Structures – Graphs, Hashing, Searching and Sorting	Assessment :	6 Sessions

Topics:
Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure.
Hashing: Introduction, Static Hashing, Dynamic Hashing
Searching & Sorting Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.

Module 5	Security and AI/ML Applications of Data Structures	Assessment :	6 Sessions

Topics:
Secure Data Structures, Hashing Techniques, Secure Searching and Sorting, Trees and Graphs in Cybersecurity, Data Structures for AI & ML, Graph-based Intelligent Systems, Heaps in Machine Learning, Applications in Fraud and Intrusion Detection, Blockchain Data Structures, Quantum Computing Data Representation.

Targeted Applications & Tools:
Use of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.

Skill-Building Activities through Experiential Learning:

Project work/Assignment:

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

Text Book

T1: Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018.

T2: Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

References

R1: Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017.

R2: Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019.
Web resources:

E-Resources/Web Resources
1. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
2. https://puniversity.informaticsglobal.com/login

Topics relevant to development of "Skill Development":
Linked list and stacks
Topics relevant to development of "Environment and sustainability: Queues

Course Code: CSS2254	Course Name: Data Structures Lab Type of Course: Laboratory Course (PCC)	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
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	To develop programming and problem-solving skills by enabling students to implement various data structures, analyze their performance through experimentation and apply structured approaches to solve computational problems effectively.		
Course Outcomes	**On successful completion of the course the students shall be able to:** CO1: Explain the concepts of fundamental data structures such as arrays, stacks, and queues and their operations. [Level 2-Understand] CO2: Implement linear data structures such as linked lists to solve real-world problems. [Level 3 – Apply] CO3: Utilize appropriate non-linear data structures such as trees and graphs for given problem scenarios. [Level 3 – Apply] CO4: Implement and demonstrate various searching and sorting algorithms and analyze the efficiency of data structures and algorithms in terms of time and space complexity. [Level 3 – Apply] CO5: Apply data structure concepts in cybersecurity, AI/ML, blockchain, and intelligent computing applications. [Level 3 – Apply]		

Course Content:

List of Laboratory Tasks:

WEEK 1: Introduction & Arrays
Lab Sheet 1: Arrays Basics
Level 1: Write a program to create an array and perform insertion and deletion operations.
Level 2: Write a program to find largest, smallest, and average elements in an array.
Lab Sheet 2: Array Applications
Level 1: Write a program to reverse an array.
Level 2: Write a program to merge two arrays and remove duplicates.

WEEK 2: Stack
Lab Sheet 3: Stack Implementation
Level 1: Implement stack using array (push and pop operations).
Level 2: Write a program to check overflow and underflow conditions.

Lab Sheet 4: Stack Applications
Level 1: Write a program to convert infix expression to postfix.
Level 2: Write a program to evaluate postfix expression.

WEEK 3: Queue

Lab Sheet 5: Queue Implementation
Level 1: Implement queue using array (enqueue and dequeue).
Level 2: Implement circular queue.
Lab Sheet 6: Queue Applications
Level 1: Write a program to simulate a queue in real-life scenario (ticket booking).
Level 2: Implement priority queue.

WEEK 4: Linked List Basics

Lab Sheet 7: Singly Linked List
Level 1: Create a singly linked list and perform insertion.
Level 2: Perform deletion and display operations.
Lab Sheet 8: Linked List Applications
Level 1: Count number of nodes in a linked list.
Level 2: Reverse a linked list.

WEEK 5: Advanced Linked List

Lab Sheet 9: Circular Linked List
Level 1: Create and traverse a circular linked list.
Level 2: Perform insertion and deletion in circular linked list.
Lab Sheet 10: Linked List Problems
Level 1: Merge two linked lists.
Level 2: Detect loop in linked list.

WEEK 6: Recursion

Lab Sheet 11: Recursion Basics
Level 1: Write a recursive program for factorial.
Level 2: Write a recursive program for Fibonacci series.
Lab Sheet 12: Recursion Applications
Level 1: Solve Tower of Hanoi using recursion.
Level 2: Compare recursive and iterative approaches.

WEEK 7: Trees Basics

Lab Sheet 13: Binary Tree
Level 1: Create a binary tree and perform traversal.
Level 2: Implement preorder, inorder, and postorder traversal.
Lab Sheet 14: Tree Properties
Level 1: Count nodes and height of tree.
Level 2: Check if tree is balanced.

WEEK 8: Binary Search Tree

Lab Sheet 15: BST Implementation
Level 1: Insert elements into BST.
Level 2: Delete elements from BST.
Lab Sheet 16: BST Applications
Level 1: Search an element in BST.
Level 2: Find minimum and maximum elements.

WEEK 9: Advanced Trees

Lab Sheet 17: AVL Trees
Level 1: Implement AVL tree insertion.
Level 2: Perform rotations (LL, RR, LR, RL).
Lab Sheet 18: Heaps
Level 1: Implement max heap.
Level 2: Perform heap sort.

WEEK 10: Expression Trees & Red-Black Trees

Lab Sheet 19: Expression Tree

Level 1: Construct expression tree from postfix.
Level 2: Evaluate expression tree.
Lab Sheet 20: Red-Black Tree
Level 1: Understand insertion rules.
Level 2: Implement basic operations.

WEEK 11: Graph Basics
Lab Sheet 21: Graph Representation
Level 1: Represent graph using adjacency matrix.
Level 2: Represent graph using adjacency list.
Lab Sheet 22: Graph Traversal
Level 1: Implement BFS.
Level 2: Implement DFS.

WEEK 12: Graph Algorithms
Lab Sheet 23: Shortest Path
Level 1: Implement Dijkstra's algorithm.
Level 2: Analyze shortest path in weighted graph.
Lab Sheet 24: Minimum Spanning Tree
Level 1: Implement Prim's algorithm.
Level 2: Implement Kruskal's algorithm.

WEEK 13: Hashing
Lab Sheet 25: Hash Tables
Level 1: Implement hashing using division method.
Level 2: Handle collisions using chaining.
Lab Sheet 26: Advanced Hashing
Level 1: Implement linear probing.
Level 2: Compare static vs dynamic hashing.

WEEK 14: Searching
Lab Sheet 27: Searching Techniques
Level 1: Implement sequential search.
Level 2: Implement binary search.
Lab Sheet 28: Searching Applications
Level 1: Compare searching techniques.
Level 2: Analyze time complexity.
Lab Sheet 29: Basic Sorting
Level 1: Implement bubble sort and selection sort.
Level 2: Implement insertion sort.
Lab Sheet 30: Advanced Sorting
Level 1: Implement quick sort.
Level 2: Implement merge sort and compare performance

WEEK 15: Sorting
Lab Sheet 31: Secure Data Structures and Hashing
Level 1: Implement hashing techniques for secure data storage and retrieval.
Level 2: Demonstrate collision handling methods and simple password verification using hashing.
Lab Sheet 32: AI/ML and Intelligent Data Structure Applications
Level 1: Implement graph or tree-based data representation for intelligent systems.
Level 2: Develop a simple application using data structures for recommendation, prediction, or intrusion detection systems.

Targeted Applications & Tools:
Use of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.

Skill-Building Activities through Experiential Learning:

Project work/Assignment::

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

Text Book

T1: Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018. **T2:** Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
References **R1:** Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017. **R2:** Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019.
E-Resources/Web Resources 1. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview 2. https://puniversity.informaticsglobal.com/login
Topics relevant to development of "Skill Development": Linked list and stacks Topics relevant to development of "Environment and sustainability: Queues

Course Code: CSS2255	Course Name: Object Oriented Programming Using Java Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	2.0		
Course Pre-requisites	CSE1502		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces the core concepts of Object-Oriented Programming. The course includes both theory and laboratory components that emphasize the implementation and application of object-oriented programming paradigms using Java. It enables students to develop real-time, secure, and intelligent applications by applying object-oriented concepts for effective problem solving. The course also introduces modern concepts related to AI/ML-based application development, secure programming practices, and intelligent software systems. Students will understand the significance of object-oriented programming in designing scalable, reusable, secure, and intelligent applications.		
Course Objective	The objective of the course is to familiarize learners with problem-solving concepts using Java and to attain skill development through experiential learning techniques. The course also aims to develop the ability to design secure, scalable, and intelligent applications using object-oriented programming concepts with exposure to AI/ML-oriented programming practices and modern software development approaches.		
Course Outcomes	**On successful completion of the course the students shall be able to:** CO1: Describe the basic programming concepts. — L2 – Understand CO2: Apply the concept of classes, objects, and methods to solve problems. — L3 – Apply CO3: Apply the concept of arrays and strings. — L3 – Apply CO4: Implement inheritance and polymorphism for building secure applications. — L3 – Apply CO5: Apply Java I/O concepts for intelligent data processing, secure file handling, and AI/ML-based application development. — L3 – Apply		

Course Content:

Module 1	Basic Concepts of Programming and Java	Assessment: Assignment (Problem Solving)	9 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	Assessment: Assignment (Problem Solving)	10 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	Ensemble Learning and Model Aggregation	Assessment: Assignment (Problem Solving)	8 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	Assessment: Assignment (Problem Solving)	10 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	Advanced Java I/O, Security and AI/ML Applications	Assessment: Assignment (Problem Solving)	8 Sessions
Topics: Input/output Operation in Java (java.io Package), Streams and the New I/O Capabilities, Understanding Streams, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces, AI-based File Processing Concepts, Intelligent Data Stream Management, Machine Learning Applications in File and Data Handling.			
Targeted Applications & Tools:			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Herbert Schildt, “The Complete Reference Java 2”, Tata McGraw Hill Education, 11th Edition,2019.			
References **R1:** Cay S Horstmann and Cary Gornell, “CORE JAVA volume I-Fundamentals”, Tenth Edition, Pearson 2015. **R2:** James W. Cooper, “Java TM Design Patterns – A Tutorial”, Addison-Wesley Publishers.4th Edition, 2000. **R3:** E. Balagurusamy, “Programming with Java”, Tata McGraw Hill Education, 6th Edition, 2019. **R4:** E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf **R5:** E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)			
E-Resources/Web Resources https://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q			

https://puniversity.informaticsglobal.com:2229/login.aspx
Topics relevant to development of "Skill Development": Static Polymorphism Method overloading, constructors constructor overloading this keyword static keyword and Inner classes Inheritance and Polymorphism. for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSS2256	Course Name: Object Oriented Programming Using Java Lab Type of Course: Laboratory Course (PCC)	L-T- P- C	0	0	2
Version No.	2.0				
Course Pre-requisites	NIL				
Co-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course introduces the core concepts of Object-Oriented Programming. The course includes both theory and laboratory components that emphasize the implementation and application of object-oriented programming paradigms using Java. It enables students to develop real-time, secure, and intelligent applications by applying object-oriented concepts for effective problem solving. The course also introduces modern concepts related to AI/ML-based application development, secure programming practices, and intelligent software systems. Students will understand the significance of object-oriented programming in designing scalable, reusable, secure, and intelligent applications.				
Course Objective	The objective of the course is to familiarize learners with problem-solving concepts using Java and to attain skill development through experiential learning techniques. The course also aims to develop the ability to design secure, scalable, and intelligent applications using object-oriented programming concepts with exposure to AI/ML-oriented programming practices and modern software development approaches.				
Course Outcomes	On successful completion of the course, students shall be able to: CO1: Demonstrate fundamental programming concepts. — L3 – Apply CO2: Apply the concepts of classes, objects, and methods to solve problems. — L3 – Apply CO3: Apply the concepts of arrays and strings. — L3 – Apply CO4: Implement inheritance and polymorphism to develop secure applications. — L3 – Apply CO5: Apply Java I/O concepts for intelligent data processing, secure file handling, and AI/ML-based application development. — L3 – Apply				
Course Content:		30 Sessions			
List of Laboratory Tasks: Week 1: Lab Sheet 1: Java Program Structure & Basic I/O Level 1: Write a Java program to display "Hello, Java". Demonstrate use of variables and data types. Level 2: Write a Java program to take user input (name, age) and display formatted output.					

Week 2:

Lab Sheet 2: Operators and Expressions
Level 1:
Write a Java program to perform arithmetic operations (+, -, *, /, %).
Level 2:
Develop a program to evaluate a complex expression using relational and logical operators.

Week 3:

Lab Sheet 3: Control Statements – Branching
Level 1:
Write a Java program to check whether a number is even or odd using if-else.
Level 2:
Implement a menu-driven calculator using switch-case.

Week 4:

Lab Sheet 4: Control Statements – Looping
Level 1:
Write programs using loops:
1. Print numbers from 1 to N
2. Find factorial of a number
Level 2:
Generate Fibonacci series and check whether a number is prime.

Week 5:

Lab Sheet 5: Classes and Objects
Level 1:
Create a class Student with data members and display details using object.
Level 2:
Create multiple objects and demonstrate accessing members using reference variables.

Week 6:

Lab Sheet 6: Methods and Access Specifiers
Level 1:
Write a class with methods to perform addition and subtraction.
Level 2:
Demonstrate use of public, private, and protected access specifiers.

Week 7:

Lab Sheet 7: Constructors and Overloading
Level 1:
Implement a class with a default constructor and parameterized constructor.
Level 2:
Demonstrate constructor overloading and use of this keyword.

Week 8:

Lab Sheet 8: Static Keyword & Nested Classes
Level 1:
Write a program demonstrating static variables and static methods.
Level 2:

Create a nested class and access its members from the outer class.

Week 9:

Lab Sheet 9: Arrays (1D and 2D)
Level 1:

Write programs for:

1. Sum of array elements
2. Find largest element

Level 2:

Perform matrix addition and multiplication using 2D arrays.

Week 10:

Lab Sheet 10: Array of Objects
Level 1:

Create an array of objects (e.g., Employee class).

Level 2:

Perform operations like sorting objects based on a field.

Week 11:

Lab Sheet 11: Strings and StringBuffer
Level 1:

Perform basic string operations: Length, concatenation, comparison

Level 2:

Demonstrate mutable operations using StringBuffer and StringBuilder.

Week 12:

Lab Sheet 12: Inheritance
Level 1:

Create a base class and derived class using single inheritance.

Level 2:

Implement multilevel inheritance and demonstrate use of super keyword.

Week 13:

Lab Sheet 13: Polymorphism & Abstract Classes
Level 1:

Demonstrate method overriding (runtime polymorphism).

Level 2:

Create an abstract class and implement its methods in a subclass.

Week 14:

Lab Sheet 14: Exception Handling
Level 1:

Handle exceptions using try-catch-finally.

Level 2:

Create custom exceptions and demonstrate multiple catch blocks.

Week 15:

Lab Sheet 15: File Handling and Serialization
Level 1:

Write a Java program to Create a file & Write and read data using File I/O

Level 2:

Implement object serialization and deserialization.
Use File streams and buffered streams for efficient I/O.

Week 16.1: AI/ML and Secure File Processing

Lab Sheet 16: Intelligent File Handling and Data Processing
Level 1:
Implement a Java program for secure file handling using buffered streams and file channels.
Level 2:
Develop a simple application for intelligent data analysis or log monitoring using Java File I/O and serialization concepts.

Targeted Application & Tools that can be used : JDK /Eclipse IDE/Visual Studio Code / net Beans IDE.

Text Book

T1: Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education, 11th Edition,2019.

E-Resources/Web Resources

https://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q
https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to development of "Skill Development":

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

This is attained through assessment component mentioned in course handout.

Course Code: CCS2257	Course Name: Computer Organization and Architecture Type of Course: Theory Course (PCC)	L- T-P- C	3-0-0-3
Version No.	2.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
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 understanding the interaction between computer hardware and software. It equips students with the intuition behind assembly-level instruction set architectures and helps them interpret the operational concepts of computer technology and performance enhancement. The course also introduces emerging concepts in computer security, AI-enabled computing, intelligent processor optimization, and modern secure computing architectures.		
Course Objective	To develop a comprehensive understanding of computer system organization by enabling students to analyze processor architecture and instruction execution, explore memory hierarchy and cache mechanisms, examine input/output organization and interfacing, evaluate system performance and optimization techniques, and understand emerging applications in secure computing, AI-enabled architectures, and intelligent system design.		

Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the fundamental components of a computer system and their interconnections. [Level 1-Remember] **CO2:** Explain the concepts of Instruction Set Architecture (ISA) and memory organization. [Level 2 –Understand] **CO3:** Apply techniques to perform arithmetic and logical operations in computer systems. [Level 3 – Apply] **CO4:** Explain the organization and functioning of processor and memory subsystems. [Level 4 – Understand]		
Course Content:			
Module 1	Basic Structure of Computer	Assessment:	12 Sessions
Topics: Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.			
Module 2	Instruction Set Architecture and Memory Unit	Assessment:	12 Sessions
Topics: Instruction Set Architecture: Addressing Modes, Stacks and Subroutines. Memory System: Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.			
Module 3	Arithmetic And Input/output Design	Assessment :	10 Sessions
Topics: Arithmetic: Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations. Input/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits			
Module 4	BPU and Pipelining	Assessment :	5 Sessions
Topics: Basic Processing Unit: Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization. Pipelining: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards.			
Module 5	Security, AI and Intelligent Computing Architecture	Assessment :	6 Sessions
Topics: Computer Security Fundamentals, Secure Instruction Execution, Memory Security and Protection Techniques, Cache and Processor Security, Cryptographic Fundamentals in Computer Architecture, AI-assisted Processor Design, Machine Learning Concepts in Hardware Optimization, Intelligent Memory Management Techniques, AI-based Performance Optimization, Applications of AI and Security in Modern Computing Systems.			
Targeted Applications & Tools: 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			
Skill-Building Activities through Experiential Learning:			
Project work/Assignment::			
Each batch of students (self-selected batch mates – up to 4 in a batch) will be allocated case studies/assignments			
Text Book **T1:** Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Sixth Edition, McGraw-Hill Higher Education, 2 reprint. **T2:** William Stallings, “Computer Organization & Architecture – Designing for Performance”, 11th Edition, Pearson Education Inc., 20			
References			

R1: 1. David A. Patterson & John L. Hennessy, "Computer Organization and Design MIPS Edition- The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020.
E-Resources/Web Resources 1. https://nptel.ac.in/courses/106105163 2. https://nptel.ac.in/courses/106106092 3. https://puniversity.informaticsglobal.com:2229/login.aspx

Course Code: CSS2258	Course Name: Web Technologies Type of Course : Theory Course (PCC)	L-T-P- C	3 – 0 – 0 - 3
Version No.	2.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course highlights the fundamentals of 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 web technologies, enhancing web pages with layout techniques, text formatting, graphics, images, and multimedia. The course focuses on key technologies required to build Internet- and web-based applications that interact with databases and other applications. It also introduces concepts of secure web development, intelligent web applications, and AI-enabled web technologies.		
Course Objective	To develop a strong foundation in web technologies by enabling students to understand internet protocols, design and develop static and dynamic web applications, explore client-side scripting and frameworks, implement server-side programming with database integration, evaluate modern web application architectures, and develop secure and intelligent web applications using AI concepts.		
Course Outcomes	On successful completion of this course, students will be able to: CO1: Explain the fundamentals of web technologies, XHTML structure, and web architecture concepts. — Level 2 – Understand CO2: Apply CSS and advanced styling techniques to design responsive and interactive web pages. — Level 3 – Apply CO3: Develop dynamic web applications using JavaScript, DOM manipulation, and event handling techniques. — Level 3 – Apply CO4: Build server-side web applications using PHP and database connectivity concepts. — Level 3 – Apply CO5: Apply web technologies to develop secure and intelligent web applications using AI concepts. — Level 3 – Apply		

Course Content:

Module 1	Introduction to XHTML	10 Sessions
Topics: Basics: Web, WWW, Web browsers, Web servers, Internet. XHTML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML.		
Module 2	Advanced CSS	10 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	10 Sessions
Topics: JavaScript: Introduction to JavaScript, Basic JavaScript Instructions, Functions, Methods & Objects, Decisions and Loops, Document Object Model, Event handling, handling window pop-ups, JavaScript validation.		
Module 4	PHP – Application Level	08 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.		
Module 5	Web Security and AI Applications	07 Sessions
Web Security Basics, Secure Web Development, Input Validation and Session Handling, Secure PHP and Database Access, Introduction to AI in Web Applications, AI-based Chatbots, Intelligent User Interfaces, Smart Web Applications.		
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): **T1:** Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition,2015. **T2:** CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022) **T3:** Deitel, Deitel, Goldberg,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education,2021.		
References: **R1:** Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India,1st. Edition.2016. **R2:** Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.		
E-Resources/Web Resources 1. W3schools.com 2. Developer.mozilla.org/en-US/docs/Learn 3. docs.microsoft.com 4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking 5. https://presiuniv.knimbus.com/user#/home		
Topics related to development of "FOUNDATION": Web, WWW, Web browsers, Web servers, Internet. CSS, PHP. Designing for healthcare. For Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.		

Course Code: CSS2259	Course Name: Web Technologies Lab Type of Course: Laboratory Course (PCC)	L- T-P- C	0-0-2-1
Version No.	2.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		

Course Description	This course highlights the fundamentals of 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 web technologies, enhancing web pages with layout techniques, text formatting, graphics, images, and multimedia. The course focuses on key technologies required to build Internet- and web-based applications that interact with databases and other applications. It also introduces concepts of secure web development, intelligent web applications, and AI-enabled web technologies.
Course Objective	To develop a strong foundation in web technologies by enabling students to understand internet protocols, design and develop static and dynamic web applications, explore client-side scripting and frameworks, implement server-side programming with database integration, evaluate modern web application architectures, and develop secure and intelligent web applications using AI concepts.
Course Outcomes	On successful completion of this course, students will be able to: CO1: Explain the fundamentals of web technologies, XHTML structure, and web architecture concepts. — Level 2 – Understand CO2: Apply CSS and advanced styling techniques to design responsive and interactive web pages. — Level 3 – Apply CO3: Develop dynamic web applications using JavaScript, DOM manipulation, and event handling techniques. — Level 3 – Apply CO4: Build server-side web applications using PHP and database connectivity concepts. — Level 3 – Apply CO5: Apply web technologies to develop secure and intelligent web applications using AI concepts. — Level 3 – Apply

COURSE CONTENT:

List of Laboratory Tasks: 30 Sessions

WEEK 1: Introduction to Web & XHTML

Lab Sheet 1: Web Basics

- Level 1: Create a simple XHTML page explaining Web, WWW, browsers, and servers.
- Level 2: Design a webpage illustrating Internet architecture using text and images.

Lab Sheet 2: XHTML Structure

- Level 1: Create a basic XHTML document with proper syntax and structure.
- Level 2: Design a webpage using headings, paragraphs, and formatting tags.

WEEK 2: XHTML Elements

Lab Sheet 3: Lists and Links

- Level 1: Create ordered, unordered, and definition lists in XHTML.
- Level 2: Create hyperlinks for navigation between multiple pages.

Lab Sheet 4: Images and Tables

- Level 1: Insert images into a webpage.
- Level 2: Design a table with rows, columns, and formatting.

WEEK 3: XHTML Forms & Frames

Lab Sheet 5: Forms

- Level 1: Create a form with text fields and buttons.
- Level 2: Design a registration form with validation requirements.

Lab Sheet 6: Frames

- Level 1: Create a webpage using frames.
- Level 2: Design a multi-frame layout for a website.

WEEK 4: Introduction to CSS

Lab Sheet 7: CSS Basics

- Level 1: Apply inline and internal CSS styles.
- Level 2: Create an external stylesheet and apply it to multiple pages.

Lab Sheet 8: Selectors

- Level 1: Use element, class, and ID selectors.
- Level 2: Apply multiple selectors for styling complex pages.

WEEK 5: CSS Properties

Lab Sheet 9: Font and Text

- Level 1: Apply font properties (size, style, family).
- Level 2: Design a styled webpage using text formatting.

Lab Sheet 10: Box Model

Level 1: Demonstrate margin, padding, and border.
Level 2: Design layout using box model concepts.

WEEK 6: Advanced CSS
Lab Sheet 11: Positioning
Level 1: Use static and relative positioning.
Level 2: Design layout using absolute and fixed positioning.
Lab Sheet 12: Floating & Layout
Level 1: Apply float properties.
Level 2: Create a multi-column layout using float.

WEEK 7: Responsive Design
Lab Sheet 13: Responsive Web Design
Level 1: Use media queries.
Level 2: Design a responsive webpage.
Lab Sheet 14: CSS Frameworks
Level 1: Use a CSS framework (Bootstrap basics).
Level 2: Design responsive webpage using Bootstrap.

WEEK 8: XML Basics
Lab Sheet 15: XML Structure
Level 1: Create a simple XML document.
Level 2: Display XML data in webpage.
Lab Sheet 16: XML Applications
Level 1: Validate XML structure.
Level 2: Use XML for data representation in web pages.

WEEK 9: JavaScript Basics
Lab Sheet 17: JavaScript Introduction
Level 1: Write basic JavaScript program for output.
Level 2: Perform arithmetic operations using JavaScript.
Lab Sheet 18: Control Statements
Level 1: Use if-else statements.
Level 2: Implement loops in JavaScript.

WEEK 10: Functions & DOM
Lab Sheet 19: Functions
Level 1: Create and call functions.
Level 2: Use functions with parameters and return values.
Lab Sheet 20: DOM Manipulation
Level 1: Access HTML elements using DOM.
Level 2: Modify content dynamically using JavaScript.

WEEK 11: Events & Validation
Lab Sheet 21: Event Handling
Level 1: Handle click events.
Level 2: Create interactive webpage using events.
Lab Sheet 22: Form Validation
Level 1: Validate input fields using JavaScript.
Level 2: Create complete form validation system.

WEEK 12: Advanced JavaScript
Lab Sheet 23: Objects & Methods
Level 1: Create JavaScript objects.
Level 2: Use methods and object properties.
Lab Sheet 24: Pop-ups
Level 1: Implement alert and prompt.
Level 2: Create dynamic pop-up-based interaction.

WEEK 13: PHP Basics
Lab Sheet 25: PHP Introduction
Level 1: Write basic PHP script.

Level 2: Handle form input using PHP.
Lab Sheet 26: PHP Control Structures
Level 1: Use if-else in PHP.
Level 2: Implement loops in PHP.

WEEK 14: PHP Applications
Lab Sheet 27: PHP Forms
Level 1: Process form data using PHP.
Level 2: Create login system using PHP.
Lab Sheet 28: PHP File Handling
Level 1: Read/write files using PHP.
Level 2: Store and retrieve data dynamically.

WEEK 15: Integration & Mini Project
Lab Sheet 29: Web Integration
Level 1: Combine XHTML, CSS, JavaScript.
Level 2: Build dynamic webpage using all technologies.
Lab Sheet 30: Mini Project
Level 1: Design a complete website.
Level 2: Develop full web application using XHTML, CSS, JS, PHP.

WEEK 16.1: Secure and Intelligent Web Applications
Lab Sheet 31: Web Security and Smart Interfaces

Level 1: Implement secure form validation and session handling in web applications.
Level 2: Develop an intelligent web interface with chatbot or recommendation features.

Lab Sheet 32: AI-based Web Mini Project

Level 1: Design a secure responsive web application.
Level 2: Develop a smart web application integrating XHTML, CSS, JavaScript, PHP, and basic AI concepts.

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):

T1: Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition,2015.

T2: CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)
T3: Deitel, Deitel, Goldberg,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education,2021.

References:

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

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

E-Resources/Web Resources

1. W3schools.com
2. Developer.mozilla.org/en-US/docs/Learn
3. docs.microsoft.com
4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking
5. https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION": Web, WWW, Web browsers, Web servers, Internet.
CSS, PHP. Designing for healthcare For Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CIV7601	Course Name: Universal Human Values and Ethics Type of Course: MAC course	L-T-P-C	-	-	-	0
Version No.	1.0					
Course Pre-requisites	NIL					
Co-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of the course is to develop a holistic perspective in students' life. The course adopts a self-reflective methodology of teaching and is designed to equip the students to explore their role in all aspects of living as a part of the society. It presents a universal approach to value education by developing the right understanding of reality through the process of self-exploration. This self-exploration develops more confidence and commitment in students enabling them to critically evaluate their pre-conditioning and present beliefs. As an outcome of the holistic approach, the students will be able to practice the ethical conduct in the social and professional life. The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information. This course is designed to cater to Human Values and Professional Ethics.					
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'SELF LEARNING' techniques					
Course Outcomes	On successful completion of this course the students shall be able to: CO1: Understand the concepts of human values, self-exploration, and holistic development in personal and social contexts. [Level 2 – Understand] CO2: Apply principles of human values and ethical conduct in personal, social, and professional life situations. [Level 3 – Apply] CO3: Apply the concepts of harmony and ethical reasoning to address issues in family, society, and professional environments. [Level 3 – Apply] CO4: Analyze the relationship between self and body, and the role of values in maintaining harmony within individuals and society. [Level 4 – Analyze] CO5: Evaluate personal beliefs, behaviors, and professional practices based on universal human values and ethical principles. [Level 5 – Evaluate]					
Course Content:						
Module 1	Introduction to Value Education	Online Assessment	MCQ Quiz	5 Sessions		
Topics: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.						
Module 2	Harmony in the Human Being	Online Assessment	MCQ Quiz	5 Sessions		
Topics: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health						
Module 3	Harmony in the Family and Society	Online Assessment	MCQ Quiz	5 Sessions		
Topics:						

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Module 4	Implications of the Holistic Understanding – A Look at Professional Ethics	Online Assessment	MCQ Quiz	5 Sessions

Topics:

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Strategies for Transition towards Value-based Life and Profession

Targeted Application & Tools that can be used:

Application areas are Personal life, Education and Career, Workplace , Society and Environmental Responsibility

Tools: Online Tools – NPTEL and Swayam.

Project work/Assignment:

Assessment Type

- Online exams (MCQs) will be conducted by the Department of Civil Engineering through Linways.

Text Book

T1: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
T2: Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2019.
T3: Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

Reference Books

R1: E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

R2: Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
R3: Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
R4: A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
R5: P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
R6: A N Tripathy, 2003, Human Values, New Age International Publishers.
R7: E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
R8: M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
R9: B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
R10: William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.

E-Resources/Web Resources

1. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
2. https://onlinecourses.nptel.ac.in/noc25_mg141/preview
3. https://onlinecourses.swayam2.ac.in/ini25_hs52/preview
4. https://onlinecourses.nptel.ac.in/noc25_hs219/preview
5. https://onlinecourses.swayam2.ac.in/cec25_mg14/preview
6. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
7. https://onlinecourses.swayam2.ac.in/imb25_mg196/preview
8. UHV II - https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So&pp=0gcJCWMEOCosWNin
9. Lecture by Dr. Kumar Sambhav, NPTEL course: Universal Human Values, https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
10. Lecture by Dr. Padmavati, Dr Narendran Thiruthy, NPTEL Course: Biodiversity Protection, Farmers and Breeders Rights, https://nptel.ac.in/courses/129105008, 2024

Topics relevant to Skill Development: 1. An attitude of enquiry. 2. Write reports The topics related to Human values and Professional ethics: All topics in are relevant to Human values and Professional ethics.

Course Code: APT4002	Course Name: Introduction to Aptitude Type of Course: Practical Only Course	L- T-P- C	0-0-2-0
Version No.	1.0		
Course Pre-requisites	Students should know the basic Mathematics & aptitude along with understanding of English		
Co-requisites	NIL		
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. [Level 1 - Remember] **CO2**: Identify the principle concept needed in a question. [Level 2 –Understand] **CO3:** Solve the quantitative and logical ability questions with the appropriate concept. [Level3 – Apply] **CO4:** Analyze the data given in complex problems. [Level4 – Analyze] **CO5:** Rearrange the information to simplify the question [Level2 –Understand]		

Course Content:			
Module 1	Quantitative Ability	Assessment: Assignment	12 Sessions
Topics: Introduction to Aptitude, working of Tables, Squares, Cubes			
Module 2	Logical Reasoning	Assessment : Assignment	18 Sessions
Topics: Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars, Number Series, Wrong number series, Visual Reasoning			

Targeted Applications & Tools:	
Application area	Placement activities and Competitive examinations.
Tools	LMS
Skill-Building Activities through Experiential Learning:	
Text Book **T1:** Quantitative Aptitude by R S Aggarwal	

T2: Verbal & Non-Verbal Rea oning by R S Aggarwal
References
E-Resources/Web Resources 1. www.indiabix.com 2. www.youtube.com/c/TheAptitudeGuy/videos

Course Code: CHE7601	Course Name: Environmental Studies Type of Course:MOOC course	L- T-P- C	1-0-0-0
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	CSEXXXX		
Course Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. This course is designed to cater to Environment and Sustainability		
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'PARTICIPATIVE LEARNING' techniques		
Course Outcomes	On successful completion of the course the students shall be able to:		
	CO1: Describe the issues related to natural resources, ecosystems and biodiversity	L1– Remember	
	CO2: Identify environmental hazards affecting air, water and soil quality	L2– Understand	
	CO3:Recognize the importance of healthy environment and finding the sustainable methods to protect the environment	L3 – Apply	
	CO4: Convert skills to address immediate environmental concerns through changes in environmental processes, policies, and decisions	L4 – Analyze	
Course Content:			
Module 1	Understanding Environment, Natural Resources, and Sustainability		
Topics: Classification of natural resources, issues related to Population growth and their overutilization, and strategies for their conservation. Water, air, soil, mineral, energy and food source. Effect of human activities on natural resources. Concept of sustainability- Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Sustainable practices in managing resources, including deforestation, water conservation, Desalination – types, energy security, and food security issues, Life Cycle thinking and Circular Economy.			
Module 2	Ecosystems, Biodiversity, and Sustainable Practices		
Topics: Ecosystems and ecosystem services: Various natural ecosystems, Major ecosystem types in India and their basic characteristics; forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. The importance of biodiversity, Types of biodiversity, Biodiversity and Climate Change, the threats it faces, hotspots, and the methods used for its conservation. Strategies for in situ and ex situ conservation, mega diverse nation.			

Module 3	Environmental Pollution, Waste Management, and Sustainable Development		

Topics:
Types of pollution- Chemical, - Biological, Biomedical, noise, air, water, soil, thermal, radioactive and marine pollution, and their impacts on society. Urbanization and Urban environmental problems; effects, and mitigation.
Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management;

Sustainable Materials and Technologies: Biodegradable and compostable materials, Recycled and reclaimed materials (E-waste management), Sustainable manufacturing processes.

Module 4	Social Issues, Legislation, and Practical Applications		

Topics:
Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Hazardous waste Rule 1989, Biomedical Waste handling 1998, Fly Ash Rule 1999, Municipal Solid Waste Rule 2000, Battery Rules 2001, E- Waste Rules 2011, Plastic waste management Rules 2016, Construction Demolition waste Rules 2016 National Biodiversity Action Plan (NBAP)
Major International Environmental Agreements: Convention on Biological Diversity (CBD), The Biological Diversity (Amendment) Act, 2023, United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement.
Major International organisations and initiatives: United Nations Environment Programme (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC).

Targeted Application & Tools that can be used:
Application areas are Energy, Environment and sustainability
Tools: Online Tools – NPTEL and Swayam.

Project work/Assignment:

Assessment Type

- Online exams (MCQs) will be conducted by the department of Chemistry

Online Link*:

1. Lecure by Dr. Samik Chowdhury, Dr. Sudha Goel, NPTEL course: Environmental Science, https://nptel.ac.in/courses/109105203, 2024.
2. Lecture by Dr. Padmavati, Dr Narendran Thiruthy, NPTEL Course: Biodiversity Protection, Farmers and Breeders Rights, https://nptel.ac.in/courses/129105008, 2024.

* Other source links are available in below Resources link.

Text Book

1. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
2. Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
3. Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
4. Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
5. Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.
6. Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
7. Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
8. Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
9. Wright, R.T. & Boorse, D.F. Environmental Science: Toward A Sustainable Future (13th ed,). Pearson.

Reference Books

1. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022), Conservation through Sustainable Use: Lessons from India. Routledge.
2. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.
3. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
5. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press

Resources:

1. https://nptel.ac.in/courses/109105203

2. https://archive.nptel.ac.in/courses/120/108/120108004/ 3. https://nptel.ac.in/courses/127105018 4. https://onlinecourses.nptel.ac.in/noc23_lw06/preview 5. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview 6. https://archive.nptel.ac.in/courses/120/108/120108002/ 7. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview 8. https://nptel.ac.in/courses/102104088 9. https://nptel.ac.in/courses/124107165 10. https://nptel.ac.in/courses/109106200 11. https://archive.nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf 12. https://onlinecourses.swayam2.ac.in/nou25_ge19/preview 13. https://onlinecourses.swayam2.ac.in/ini25_hs01/preview 14. http://kcl.digimat.in/nptel/courses/video/105105184/L32.html 15. https://nptel.ac.in/courses/105105169
Topics relevant to Skill Development: 1. An attitude of enquiry. 2. Write reports The topics related to Environment and Sustainability : All topics in theory component are relevant to Environment and Sustainability.

Course Code: MAT2321	Course Title: Discrete Mathematical Structures Type of Course:1] School Core	L-T- P- C	3	1	0	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces the fundamental concepts of Discrete Mathematics, providing the mathematical foundations essential for computer science and related disciplines. It covers sets, relations, functions, closures, equivalence relations, and primitive recursive functions, followed by partially ordered sets, lattices, and Boolean algebras. The course also explores graph theory, including graph types, isomorphism, Euler and Hamiltonian paths, circuits, and graph coloring. In addition, students study algebraic structures such as semigroups, monoids, and groups, residue arithmetic, and group codes. Emphasis is placed on developing logical reasoning, mathematical modeling, and problem-solving skills applicable to computing, information systems, and network analysis.					
Course Objective	The primary objective of this course is to provide students with a strong foundation in discrete mathematical structures and logical reasoning that underpin computer science and related disciplines. It aims to develop the ability to construct mathematical arguments, analyze discrete problems, and apply formal methods to problem solving. The course introduces fundamental concepts of logic, sets, relations, functions, Boolean algebra, graph theory, and algebraic structures such as semigroups, monoids, and groups, while also exploring formal languages and grammar. Through these topics, students will acquire the analytical and mathematical skills necessary for applications in algorithm design, digital systems,					

	coding theory, cryptography, and other areas of computing.	
Course Outcomes	On successful completion of the course the students shall be able to: **CO1:** Apply propositional and predicate logic, logical equivalences, normal forms, inference rules, and proof techniques to analyze arguments and solve problems in mathematical reasoning and computer science. (L3) **CO2:** Apply the concepts of sets, relations, functions, closures, equivalence relations, and primitive recursive functions to model and solve problems in discrete mathematics and computer science. (L3) **CO3:** Employ partially ordered sets, lattices, Boolean algebras, and Boolean functions, and apply their properties to solve problems in discrete mathematical structures and logical systems. (L3) **CO4:** Apply the concepts of lattices, Boolean algebras, and Boolean functions to solve logical and computational problems. (L3) **CO5:** Apply graph theoretic concepts and techniques to solve problems in networks, connectivity, and optimization applications. (L3) **CO6:** Employ group theory and residue arithmetic techniques in coding, computation, and information processing. (L3)	
Course Content:		
Module 1	Fundamentals of Logic	(11L+4T=14 Sessions)
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. Compiler optimization and program correctness verification, Cybersecurity and cryptographic protocol verification.		
Module 2	Relations and Functions	(10L+3T=13 Sessions)
Sets and set-operations, Relations, Functions, Properties of Relations & Representations of Relation, closure of different types of relations, equivalence relations, primitive recursive function. Database Management Systems, Artificial Intelligence and Machine Learning.		
Module 3	Boolean Algebra and Graph Theory	(13L+4T=17 Sessions)
Partially Ordered Sets, Lattices, Boolean Algebras, Functions of Boolean Algebras, Boolean Functions as Boolean Polynomials. Computer Networks: Routing and switching logic. Robotics: Decision-making using Boolean logic. Graph Theory-Basic Concept of Graph Theory, Types of Graphs, Isomorphism, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Colouring of Graph. Social Networks (Facebook, Instagram, LinkedIn).and GPS & Navigation: Shortest path and route optimization.		
Module 4	Groups	(11L+4T=15 Sessions)
Semi Groups, Monoids, Groups, The applications of Residue Arithmetic to Computers, Group codes. Functional programming and distributed systems. Compiler design and programming languages.		
Targeted Application & Tools that can be used: • Compiler optimization, program correctness verification, cybersecurity protocol verification,		

automated reasoning, formal software verification.

- Database Management Systems (DBMS), Artificial Intelligence (AI), Machine Learning (ML), knowledge representation, data modeling and query processing.
- Digital circuit design, computer networks (routing and switching), robotics decision-making systems, logic controller design, social network analysis, GPS and navigation systems, route optimization, communication networks, and recommendation systems.
- Cryptography, error-correcting codes, compiler design, distributed systems, residue arithmetic in computer architecture.

Software: MATLAB, Lean 4, Mathematica, Maple, Python, GeoGebra, Octave, R, Scilab.

Assignment:

Assignments will involve theoretical problem-solving and computational implementation using suitable programming tools. The assignments may be undertaken individually or in groups, as decided by the instructor. Additionally, experiential learning activities will be conducted using Lean 4, enabling students to develop formal proofs, verify logical propositions, and gain hands-on experience in theorem proving and formal verification.

Text Book

6. K. H. Rosen, *Discrete Mathematics and Its Applications*, 8th ed. New York, NY, USA: McGraw-Hill Education, 2019.
7. F. Harary, *Graph Theory*. Reading, MA, USA: Addison-Wesley Publishing Company, 1969.

References:

1. S. Epp, *Discrete Mathematics with Applications*, 5th ed. Boston, MA, USA: Cengage Learning, 2019.
2. K. A. Ross and C. R. B. Wright, *Discrete Mathematics*, 6th ed. New Delhi, India: Pearson Education, 2018.
3. L. Mott, A. Kandel, and T. P. Baker, *Discrete Mathematics for Computer Scientists and Mathematicians*, 3rd ed. New Delhi, India: PHI Learning, 2016.

E-resources/ Web links:

4. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=TEXTBOOK_LIBRARY01_06082022_289
5. https://presiuniv.knimbus.com/portal/v2/default/viewDetail?searchResultType=ECATALOGUE_BASED&uniqueId=DOAB_1_06082022_8919
6. https://nptel.ac.in/courses/106108227
7. https://nptel.ac.in/courses/111106102
8. https://nptel.ac.in/courses/111106113

Topics relevant to SKILL DEVELOPMENT: The course develops skills in logical reasoning, mathematical modeling, problem-solving, algorithmic thinking, and graph analysis through the study of logic, relations, Boolean algebra, and graph theory. It also enhances computational and analytical skills by applying algebraic structures, formal languages, recursion, and coding techniques to real-world computing problems.

Catalogue prepared by	Dr. Obbu Ramesh
Recommended by the	

Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSS2502	Course Name: Cryptography and Network Security Type of Course: Program Core & Theory only	L- T-P- C	3-0-0-3
Version No.	1		
Course Pre requisites	CSE1507 Data Communication and Computer Networks		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The Course covers the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet. 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.		
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: CO1: Extrapolate cryptography fundamentals and security architecture [Level 2 - Understand] CO2: Classify classical encryption techniques [Level 3 - Apply] CO3: Examine symmetric key cryptography algorithms [Level 3 - Apply] CO4: Determine number theory concepts in cryptography [Level 3 - Apply] CO5: Demonstrate public key cryptography and authentication methods [Level 3 - Apply] CO6: Compare network security protocols and applications [Level 4 - Analyze]		
Course Content:			
Module 1	**Introduction to Cryptography and types of Ciphers**	**Problem Solving**	Identify the basic concept of Cryptography	10 Sessions
Topics: Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: Active attacks, Passive attacks, Services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution techniques: Caesar cipher, Monoalphabetic cipher, Polyalphabetic cipher, Play-fair and Hill Cipher, Transposition techniques: Rail fence, Basics of Steganography.				
Module 2	**Symmetric Key Cryptography and Number Theory**	**Problem Solving & Participative Learning**	Apply the concepts of cryptographic algorithms	13 Sessions

Topics:
Introduction to Block Cipher and Stream Cipher, Feistel Structure, Symmetric Encryption Algorithms: Data Encryption Standard, Introduction to Galois Field, Advanced Encryption Standard, Modular Arithmetic, Prime numbers, Fermat's little theorem, Primality testing: Miller-Rabin algorithm, Euclidean and Extended Euclidean Algorithm, Euler Totient Function, Chinese Remainder Theorem

Module 3	**Public Key Cryptography and its Applications**	**Problem Solving & Participative Learning**	Describe the Public key Cryptographic Techniques for various applications.	12 Sessions

Topics:
Asymmetric Encryption and Decryption: Overview of Public Key Cryptography, Distribution of public keys, X.509 certificates, RSA, Diffie-Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature-case studies.

Module 4	**Network Security**	**Flip class**	Explain the network security concepts during their implementation of different applications	10 Sessions

Topics:
Network Security Applications: Authentication – Kerberos, PKI. E-mail Security – PGP, S/MIME. Web Security – Secure Socket Layer (SSL), Transport Layer Security (TLS). IP Security – IPSec Policy, Encapsulating Security Payload (ESP). AI/ML-based Security Applications – Intrusion Detection and Prevention Systems using Machine Learning, AI-based Malware Detection, Phishing and Spam Email Detection using Data Analytics, Anomaly Detection in Network Traffic.

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.

Skill-Building Activities through Experiential Learning:

PEDAGOGY PLANNED WITH TOPICS:

Problem Solving: Playfair and Hill cipher
Problem Solving & Participative Learning: DES, AES, RSA & Diffie Hellman
Self-learning: Man in the Middle attack.
Flip Class: Network security and Email security

Textbooks:

T1: William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall, 7th Edition, 2017.

References

R1: Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill, third edition, 2010.
R2: R.Rajaram, "Network Security and Cryptography" SciTech Publication.3rd Edition, 2014.
R3: AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2nd Edition, 2019.
R4: BruceSchneier, "Applied Cryptography", John Wiley and Sons Inc. Second Edition, 2015.

E-Resources/Web Resources
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: CSS2269	Course Name: Operating Systems Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces the concepts of Operating Systems operations, Operating System structure and its design and implementation. It covers the 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 Objective	To develop a comprehensive understanding of operating system principles by enabling students to analyze process management and scheduling algorithms, explore memory and virtual memory management, examine file systems and storage organization and evaluate synchronization mechanisms and deadlock handling techniques.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the fundamental concepts of operating systems and relevant case studies. [Level 2 - Understand] **CO2**: Apply various CPU scheduling algorithms for process management. [Level 3 – Apply] **CO3:** Apply synchronization techniques to handle concurrency problems. [Level 3 – Apply] **CO4:** Apply deadlock detection and recovery methods in operating systems. [Level 3 – Apply] **CO5:** Explain various memory management techniques used in operating systems. [Level 3 -Apply]		
Course Content:			
Module 1	Introduction to Operating Systems	Assessment: Assignment (Programming using Keras/Sklearn)	9 Sessions
Topics: Introduction to OS , Operating-System Operations, Operating Systems Services, , System Calls and its types, Operating Systems Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source Operating Systems			

Module 2	Process Management	Assessment : Quiz + Assignment (Sklearn/Statsmodels)	12 Sessions
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**	Assessment : Assignment (Programming using Keras/Sklearn)	12 Sessions
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	Assessment : Programming Assignment (Keras/TensorFlow)	12 Sessions
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.			

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].

Targeted Applications & Tools:

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

Skill-Building Activities through Experiential Learning:

- Comparative Analysis of Ensemble Techniques
  Learners experiment with ensemble models like Random Forest, AdaBoost, and Gradient Boosting, conducting comparative studies on model variance, bias, and robustness. Through group assignments, students simulate real-world decision-making scenarios where ensemble strategies outperform individual models.

- Neural Network Construction Using Keras
  Using the Keras API, students build and train basic feedforward neural networks. They gain practical experience in selecting activation functions, configuring loss functions, tuning hyperparameters (e.g., learning rate, epochs), and applying backpropagation using optimizers like SGD and Adam.

- Unsupervised Learning for Pattern Discovery
  Through clustering algorithms such as K-Means, Hierarchical Clustering, DBSCAN, and Gaussian Mixture Models (GMM), learners segment real-world datasets and visualize clusters. They apply evaluation methods like the Elbow Method and Silhouette Score to validate clustering quality.

Text Book

T1: Silberschatz A, Galvin P B and Gagne G , "Silberschatz's Operating System Concepts", Paperback, Global Edition Wiley, 2019

References

R1: Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 10th edition Wiley, 2018.

R2: William Stallings, "Operating Systems",Ninth Edition, By Pearson Paperback ,1 March 2018.
R3: Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, " Cracking the Operating System skills", Dreamtech, paperback, 2020.
R4: Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , "Operating Systems: Three Easy Pieces, Amazon digital Services", September 2018.

E-Resources/Web Resources

1. https://www.os-book.com/OS9/
2. https://pages.cs.wisc.edu/~remzi/OSTEP/
3. https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: CSS2270	Course Name: **Operating Systems Lab** Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	NIL		
Co-requisites	CAI2500		
Anti-requisites	NIL		
Course Description	This laboratory course provides hands-on experience with the core concepts of operating systems through practical assignments, simulations, and case studies. It covers foundational aspects such as system calls, process and thread management, inter-process communication, synchronization, deadlocks, memory management, and file systems. Students will implement and simulate real-time OS components and scheduling algorithms, fostering deeper understanding of OS architecture and design. The lab also introduces modern OS tools, programming interfaces, and the basics of open-source OS environments.		
Course Objective	To develop practical skills in operating systems by enabling students to implement scheduling and memory management algorithms, simulate process synchronization and deadlock handling, and build system-level programming capabilities.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Demonstrate system-level programming using system calls and operating system structures. [Level 3 – Apply] **CO2:** Simulate process scheduling and multithreading techniques. [Level 3 – Apply] **CO3:** Apply synchronization techniques using semaphores and shared memory to handle concurrency problems. [Level 3 – Apply] **CO4:** Demonstrate memory management and file system concepts using simulation or scripting tools. [Level 3 – Apply] **CO5:** Analyze the performance of operating system algorithms related to scheduling, synchronization and memory management. . [Level 4 – Analyze]		

Course Content:

List of Laboratory Tasks:

- **Experiment 1: Introduction to OS**

  OS Basics

  Level 1: Write a program to demonstrate basic system calls (file operations like open, read, write).

  Level 2: Analyze different OS services with real-time examples.

  OS Structure

  Level 1: Illustrate OS structures (monolithic, layered, microkernel).

  Level 2: Compare open-source OS (Linux) with proprietary OS.

- **Experiment 2: System Parameters**

Linkers & Loaders

Level 1: Demonstrate compilation process (preprocessing, compiling, linking).

Level 2: Analyze object files and executable generation.

System Utilities

Level 1: Write simple shell commands using system calls.

Level 2: Implement a mini shell program.

- **Experiment 3: Process Concept**

Process Creation
Level 1: Write a program using fork() system call.
Level 2: Demonstrate parent-child communication.
Process Operations
Level 1: Implement process states and transitions.
Level 2: Simulate process control block (PCB).

- **Experiment 4: Inter Process Communication**
Pipes:

Level 1: Implement communication using pipes.
Level 2: Implement bidirectional communication using pipes.
Sockets/RPC
Level 1: Write a client-server program using sockets.
Level 2: Simulate RPC communication.

- **Experiment 5: Threads**
Thread Creation

Level 1: Create threads using pthread library.
Level 2: Compare multi-threading vs multi-processing.
Thread Issues
Level 1: Demonstrate thread synchronization issues.
Level 2: Solve race condition problem.

- **Experiment 6: CPU Scheduling**
FCFS & SJF

Level 1: Implement FCFS scheduling.
Level 2: Implement SJF and compare results.
Advanced Scheduling
Level 1: Implement Round Robin scheduling.
Level 2: Implement Priority scheduling and analyze performance.

- **Experiment 7: Synchronization**

Critical Section
Level 1: Implement Peterson's solution.
Level 2: Analyze critical section problem.
Semaphores
Level 1: Implement semaphore operations
Level 2: Solve producer-consumer problem using semaphores.

- **Experiment 8: Classical Problems**
Reader-Writer

Level 1: Implement Reader-Writer problem.
Level 2: Analyze starvation issues.
Dining Philosophers
Level 1: Implement Dining Philosophers problem.
Level 2: Avoid deadlock using strategies.

- **Experiment 9: Dead Locks**
  Deadlock Detection

  Level 1: Implement Resource Allocation Graph.
  Level 2: Detect deadlock using algorithm.
  Deadlock Avoidance
  Level 1: Implement Banker's algorithm.
  Level 2: Analyze safe and unsafe states.
- **Experiment 10: Memory Management Basics**

  Memory Allocation
  Level 1: Implement First Fit, Best Fit, Worst Fit.
  Level 2: Compare memory utilization.
  Paging
  Level 1: Simulate paging mechanism.
  Level 2: Analyze page table structure.
- **Experiment 11: Virtual Memory**

  Page Replacement
  Level 1: Implement FIFO page replacement.
  Level 2: Implement LRU and Optimal algorithms.
  Page Faults
  Level 1: Calculate page faults.
  Level 2: Analyze thrashing condition.
- **Experiment 12: Advanced Memory Management**

  Segmentation
  Level 1: Implement segmentation.
  Level 2: Compare segmentation vs paging.
  Demand Paging
  Level 1: Simulate demand paging.
  Level 2: Analyze copy-on-write mechanism.
- **Experiment 13: File System**

  File Operations
  Level 1: Implement file operations (create, read, write).
  Level 2: Simulate directory structure.
  File Allocation
  Level 1: Implement file allocation methods.
  Level 2: Compare allocation techniques.
- **Experiment 14: File System Implementation**

  File System Design
  Level 1: Design simple file system.
  Level 2: Analyze file system performance.
  Access Methods
  Level 1: Implement sequential access.
  Level 2: Implement indexed access.
- **Experiment 15: Integration & Simulation**

  OS Simulation
  Level 1: Simulate OS components (process + memory).
  Level 2: Integrate scheduling and memory management.

  Mini Project
  Level 1: Implement OS concept-based project.

Level 2: Analyze performance and optimization.

Project Work/Assignments

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]

Targeted Applications & Tools:

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

Skill-Building Activities through Experiential Learning:

- **Data Preprocessing with Real-World Datasets**
  Learners perform hands-on preprocessing of real-world datasets (e.g., UCI, Kaggle) by handling missing values, scaling features, and encoding categorical variables. This foundational step helps them understand the impact of clean data on model performance.

- **Exploratory Data Analysis and Visualization**
  Using libraries such as Matplotlib and Seaborn, students conduct exploratory data analysis through plots like scatter plots, heatmaps, and pair plots. Visualizations are used to identify patterns, correlations, and anomalies before model building.

- **Model Building with Supervised Learning Algorithms**
  Students implement regression and classification algorithms—Linear Regression, Logistic Regression, Naïve Bayes, and SVM—on structured datasets. They analyze model predictions using decision boundaries, ROC curves, and learning curves.

Text Book

T1: Silberschatz A, Galvin P B and Gagne G , “Silberschatz's Operating System Concepts”, Paperback, Global Edition Wiley, 2019

References

R1: Silberschatz A, Galvin P B and Gagne G, “Operating System Concepts”, 10th edition Wiley, 2018.

R2: William Stallings, “Operating Systems”,Ninth Edition, By Pearson Paperback ,1 March 2018.
R3: Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, “ Cracking the Operating System skills”, Dreamtech, paperback, 2020.
R4: Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , “Operating Systems: Three Easy Pieces, Amazon digital Services”, September 2018.

E-Resources/Web Resources

1. https://www.os-book.com/OS9/
2. https://pages.cs.wisc.edu/~remzi/OSTEP/
3. https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: CSS2260	Course Name: Database Management Systems Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces the foundational principles of database management systems, including data models, schemas, and architecture. This course provides a solid foundation on the relational model of data and the use of relational algebra. It develops skills in SQL for data definition, manipulation, and control, enabling students to construct and execute complex queries. The course also introduces the concept of object oriented and object relational databases and modern database technologies like NoSQL. The also course allows the students to gain insights into data storage structures and indexing strategies for optimizing query performance.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain Employability through Problem Solving Methodologies.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the fundamental elements of relational database management systems. [Level 2 - Understand] **CO2**: Examine databases using SQL query processing and Optimization. [Level 3 – Apply] **CO3:** Design simple database systems applying the normalization constraints and demonstrate the database transaction processing, recovery, and security. [Level 3 – Apply] **CO4:** Interpret the concept of advanced databases and its applications. [Level 3 – Apply]		
Course Content:			
Module 1	Introduction to Database Modelling and Relational Algebra	Assessment: Assignment (Problem Solving)	10 Sessions
Topics: Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model. Relational Algebra with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.			
Module 2	Fundamentals of SQL and Query Optimization	Assessment : Assignment (Programming)	11 Sessions
Topics: SQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers. Database programming issues and techniques: Embedded SQL, Dynamic SQL; SQL / PSM and NoSQL. Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.			
Module 3	Relational Database Design & Transaction Management	Assessment: Assignment (Problem Solving)	12 Sessions
Topics: Relational database design: Problems in schema design, redundancy and anomalies, Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions, Database De-normalization. Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.			
Module 4	Advanced DBMS Topics	Assessment : Assignment (Case Study)	12 Sessions
Topics:			

Advanced topics: Object oriented database management systems, Deductive databasemanagement systems, Spatial database management systems, Temporal database management systems, Constraint database management systems. New database applications and architectures such as Data warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, Statistical databases.
Targeted Applications & Tools: 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.
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.
Skill-Building Activities through Experiential Learning:
Text Book **T1:** Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018. **T2:** RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education. **T3:** W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.
References **R1:** Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019. **R2:** M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.
E-Resources/Web Resources

Course Code: CSS2261	Course Name: Database Management Systems Lab Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites			
Anti-requisites	NIL		
Course Description	The Database Management Systems (DBMS) Laboratory is designed to provide students with hands-on experience in database design, implementation, and management using SQL and database management tools such as MySQL. The lab complements theoretical concepts learned in database courses by allowing students to practice database creation, querying, and optimization techniques. The DBMS Lab enables students to develop industry-relevant skills in database management, preparing them for careers in software development, data engineering, and database administration.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain Employability through Problem Solving Methodologies.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Demonstrate the database concepts, practice, and SQL queries. [Level 3 – Apply] **CO2:** Design and implement database schemas while applying normalization techniques to optimize structure. [Level 3 – Apply] **CO3:** Develop and implement stored procedures, triggers, and views for automation and efficiency. [Level 3 – Apply] **CO4:** Design and build database applications for real world problems. [Level 3 – Apply]		
Course Content:			
List of Laboratory Tasks: Create Employee, Student, Banking and Library databases and populate them with required data. Do the following experiments of different lab sheets on those databases.			

Labsheet-1 [3 Practical Sessions]

Experiment No 1: [1 Session]

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

Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.
Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]

Experiment No. 2: [2 Sessions]

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

Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.
Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical Sessions]

Experiment No. 3: [1 Session]

3. mplement complex queries in SQL.

Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database. Level 2: Implement MySQL DB queries on library database using appropriate clauses and aggregate functions. Also order the data either in ascending and descending order using corresponding clause. [Library databases].

Experiment No. 4: [2 Session]

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

Level 1: Demonstrate different types of Set Operations (UNION, UNION ALL, INTERSECT, MINUS) and Join Operations (INNER JOINs, OUTER JOINS, CROSS JOIN, NATURAL JOIN) on two or more tables of Airline Database. Level 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given
scenario. [Airline Database]

Labsheet-3 [2 Practical Sessions]

Experiment No. 5: [2 sessions]

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

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

Labsheet-4 [2 Practical Sessions]

Experiment No. 6: [2 Sessions]

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

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

Labsheet-5 [2 Practical Sessions]

Experiment No. 7: [2 Sessions]

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

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

Labsheet-6 [4 Practical Sessions]

Experiment No. 8: [2 Sessions]

8. To implement the concept of forms and reports.

Level 1: Implement the concept of forms and reports.
Level 2: Examine the schema relationship.

Experiment No. 9: [2 Sessions]

9. Create the database using the given schema. (Flight Management)

Level 1: Implement a relational database based on the provided schema for the Flight Management system, including the creation of tables, relationships, and constraints.
Level 2: Demonstrate schema relationships by defining primary and foreign keys to ensure data integrity within the Flight Management database.

Labsheet-7 [4 Practical Sessions]

Experiment No. 10: [2 Sessions]

10. Create the database using the given schema. (Company database)

Level 1: Implement the database schema by defining tables, relationships, and constraints according to the given Company Database schema.
Level 2: Demonstrate the schema's relationships and data integrity by creating and linking tables as per the specified requirements.

Experiment No. 11: [2 Sessions]

11. Create the database using the given schema. (Student Library)

Level 1: Implement forms and reports based on the provided Student Library database schema, ensuring effective data entry and reporting mechanisms.
Level 2: Demonstrate the schema relationships within the Student Library database, demonstrating how these relationships influence the creation and functionality of forms and reports.

Labsheet-8 [1 Sessions]

12. Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc.

Level 1: Implement the real time database.
Level 2: Analyze the working of database in real time.

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

Text Book

T1: Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018.

T2: RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.
T3: W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.

References

R1: Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.

R2: M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.

E-Resources/Web Resources

Course Code: CCS2512	Course Name: Ethical Hacking Type of Course: Core Subject	L- T-P- C	2-0-0-2
Version No.	1.3		
Course Pre-requisites	Basic networking tools		
Co-requisites	NIL		
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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the fundamental principles of ethical hacking and reconnaissance. [Level2-Understand] **CO2**: Analyze network scanning and enumeration techniques to identify system vulnerabilities. [Level4– Analyze] **CO3:** Examine methods for sniffing and evading network security controls. [Level4– Analyze] **CO4:** Illustrate common attack vectors against web applications, wireless networks, and mobile platforms. [Level2 -Understand]		
Course Content:			
Module 1	**Introduction to Hacking**	Assessment: Programming activity	11Sessions
Topics: Introduction to Ethical Hacking, Footprinting and Reconnaissance, Scanning Networks, Enumeration, Vulnerability Analysis, System Hacking.			
Module 2	**Linux Basics**	Assessment: Programming activity	10 Sessions
Topics: Malware Threats, Sniffing, Social Engineering, Denial-of-Service, Session Hijacking, Evading IDS, Firewalls, and Honeypots			
Module 3	**Information Gathering Techniques**	Assessment : Programming activity	9 Sessions
Topics: Hacking Web Servers, Hacking Web Applications, SQL Injection, Hacking Wireless Networks, Hacking Mobile Platforms, IoT Hacking.			
Targeted Applications & Tools:			
Skill-Building Activities through Experiential Learning:			
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/Web Resources (1) Ethical Hacking in 12 Sessions - Full Course - Learn to Hack! - YouTube			

Course Code: CCS2505	Course Name: Ethical Hacking Lab Type of Course: Laboratory Course	L- T-P- C	0-0-4-2
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2251 - Data Communication and Computer Networks		
Co-requisites	Nil		
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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Perform network traffic analysis and vulnerability analysis. [Level 3 – Apply] **CO2:** Make use of various tools to perform passive and active reconnaissance [Level 3 – Apply] **CO3:** Identify vulnerabilities in web applications using security scanners. [Level 4 – Analyze] **CO4:** Analyze the strength of passwords using password cracking tools. [Level 4 – Analyze]		

Course Content:

1. Introduction to Wireshark for Network Traffic Analysis
2. Basic Linux/Windows Commands for Security Operations
3. Network Scanning using NetScanTools
4. Port Forwarding and External IP Lookup using YouGetSignal
5. Network Mapping and Scanning using Zenmap (Nmap GUI)
6. Network Utility Tools using NetTools/OptiUtil Suite
7. Web Application Vulnerability Scanning with OWASP ZA
8. Host and Port Discovery using Angry IP Scanner
9. Email Tracking and Analysis using ReadNotify
10. Network Forensics with Sam Spade
11. Network Path Tracing using NeoTrace
12. Web Security Testing using Burp Suite
13. IoT and Device Enumeration using Shodan Search Engine
14. Open Source Intelligence (OSINT) Analysis using Maltego
15. Vulnerability Scanning using Intruder (Cloud-based Tool
16. Real-time Packet Analysis using CAPSA Network Analyzer
17. Website Mirroring and Recon using HTTrack Website Copier
18. Open Source Intelligence Techniques and Tools
19. Password Cracking using John the Rippe
20. SQL Injection Testing using SQLMap

Targeted Applications & Tools:

1. Wireshark
2. Netscantool
3. NMAP
4. Brupsuit

Skill-Building Activities through Experiential Learning:

- Hands-on Tool Usage – Applying cybersecurity tools (Wireshark, Nmap, Burp Suite, etc.) in real-time scenarios.

- Case Study Simulations – Analyzing past cyberattack cases and reproducing investigative methods.
- Problem-Based Tasks – Solving real-world security challenges such as log analysis, intrusion detection, or password cracking.
- Mini-Projects – Developing small but practical solutions like secure communication scripts or phishing detection tools.
- Role-Play Exercises – Simulating Red Team (attackers) vs. Blue Team (defenders) scenarios to understand adversarial thinking.
- Capture the Flag (CTF) Challenges – Applying learned concepts in competitive problem-solving environments.
- Peer-to-Peer Learning – Group assignments where students present findings or teach specific tool usage to classmates.

Text Book

T1: Rafay Baloch, 2014: "Ethical Hacking and Penetration Testing Guide" Apple Academic Press Inc.

References

R1: Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security Testing, Penetration Testing, and Basic Security".
R2: James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and Network Defense", 2nd Edition, Cengage Learning.

E-Resources/Web Resources

1. Ethical Hacking in 12 Hours - Full Course - Learn to Hack! - YouTube

Course Code: CSS2262	Course Name: Analysis of Algorithms Type of Course: Theory Course (PCC)	L- T-P- C	3-1-0-4
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of application. The course discusses classic algorithm design approaches such as Divide and Conquer, Dynamic Programming, and Greedy Methods. It also covers strategies for searching solution spaces using Backtracking and Branch-and-Bound techniques. The course emphasizes the analysis of algorithms and their classification into various complexity classes. In addition, it introduces emerging concepts in AI-based optimization, intelligent search techniques, and algorithmic approaches for secure and smart computing applications.		
Course Objective	To develop the ability to design and analyze efficient algorithms by enabling students to evaluate time and space complexity, apply various algorithmic paradigms such as divide-and-conquer, greedy, dynamic programming, backtracking, and branch-and-bound, compare different approaches for solving computational problems, and understand intelligent optimization techniques used in AI-enabled and secure computing systems.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the efficiency of algorithms in terms of time and space complexity. [Level 2 - Understand] **CO2**: Apply divide-and-conquer and decrease-and-conquer techniques to solve searching and sorting problems. [Level 3 – Apply] **CO3:** Apply dynamic programming and greedy techniques to solve computational problems. [Level 3 – Apply] **CO4:** Apply time–space trade-off techniques and analyze the limitations of algorithms for problem solving. [Level 3 – Apply] **CO5:** Analyze problems using backtracking, branch-and-bound, and AI-based optimization techniques to develop optimal solutions. [Level 3 – Analyze]		

Course Content:

Module 1	Introduction	Assessment:	14 Sessions

Topics:
Introduction: Notion of algorithm, Importance of algorithm, Important Problem Types, Fundamentals of analysis of algorithm

efficiency: General equation, Order of growth, basic efficiency classes, asymptotic notations, mathematical analysis of recursive & non-recursive algorithms, Brute Force technique: Bubble sort, selection sort, linear search, brute force string matching, Exhaustive search: Travelling salesperson problem, knapsack problem.			
Module 2	Divide-and-conquer	Assessment :	11 Sessions
Topics: Divide & Conquer technique: General Method, General recursive equation, Masters Theorem, Binary search, Merge sort, quick sort. Decrease & Conquer technique: General method, insertion sort, topological sorting			
Module 3	Dynamic programming	Assessment :	13 Sessions
Topics: Dynamic Programming: General method, Warshall algorithm, Floyd algorithm, 0/1 knapsack, Greedy method: General method, prim's algorithm, Kruskal algorithm, Dijkstra's algorithm, Huffman coding			
Module 4	Space and time tradeoff:	Assessment :	11 Sessions
Topics: Space and time tradeoff: introduction, Input enhancement in string matching: Horspool algorithm and Boyer-Moore algorithm, Limitations of algorithm power: Introduction, lower bound arguments, decision trees, P, NP and NP-complete problems			
Module 5	Coping with Limitations of Algorithm Power and Intelligent Optimization	Assessment :	11 Sessions
Topics: Introduction to limitations of algorithm power, Backtracking: n-Queens Problem, Subset Sum Problem, Hamiltonian Circuit Problem, Branch and Bound: Travelling Salesperson Problem, Knapsack Problem, Job Assignment Problem, AI-based Search and Optimization Techniques, Machine Learning Approaches for Optimization Problems, Intelligent Decision-Making Algorithms, Applications in Secure and Smart Computing Systems.			
Targeted Applications & Tools:			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd edition, Pearson Education, 2018. **T2:** Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 4th edition, MIT Press, 2022.			
References **R1:** AV Aho, J Hopcroft, JD Ullman, "The Design and Analysis of Algorithms", Addison-Wesley, 1974 **R2:** Tim Roughgarden, "Algorithms Illuminated" (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyourself Publishing, 2017-2019. **R3:** J. Kleinberg and E. Tardos, "Algorithm Design", Addison-Wesley, 2005			
E-Resources/Web Resources 1.EBook: https://presiuniv.knimbus.com/user#/home 2.https://onlinecourses.nptel.ac.in/noc26_cs67/ 3.www.youtube.com/watch?v=so4zT-u09LM&list=PL8GCet93Cu1iRF611mrUu-Rhy12fMwZOf			
Topics relevant to "SKILL DEVELOPMENT": knapsack, prim's, kruskal's algorithm, quick sort, binary search for **Skill Development** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.			

Course Code: CSS2263	Course Name: Analysis of Algorithms Lab Type of Course: Laboratory Course (PCC)	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		

Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of application. The course discusses classic algorithm design approaches such as Divide and Conquer, Dynamic Programming, and Greedy Methods. It also covers strategies for searching solution spaces using Backtracking and Branch-and-Bound techniques. The course emphasizes the analysis of algorithms and their classification into various complexity classes. In addition, it introduces emerging concepts in AI-based optimization, intelligent search techniques, and algorithmic approaches for secure and smart computing applications.
Course Objective	To develop the ability to design and analyze efficient algorithms by enabling students to evaluate time and space complexity, apply various algorithmic paradigms such as divide-and-conquer, greedy, dynamic programming, backtracking, and branch-and-bound, compare different approaches for solving computational problems, and understand intelligent optimization techniques used in AI-enabled and secure computing systems.
Course Outcomes	On successful completion of this course, students will be able to: CO1: Compute the efficiency of algorithms in terms of time and space complexity. — Level 3 – Apply CO2: Apply divide-and-conquer techniques to solve searching and sorting problems. — Level 3 – Apply CO3: Apply dynamic programming techniques to solve computational problems. — Level 3 – Apply CO4: Apply greedy techniques for solving optimization problems. — Level 3 – Apply CO5: Analyze problems using backtracking, branch-and-bound, and AI-based optimization techniques to develop optimal solutions. — Level 4 – Analyze

Course Content

List of Laboratory Tasks: 30 Sessions

WEEK 1: Algorithm Basics & Analysis
Lab Sheet 1: Algorithm Fundamentals
- Level 1: Write an algorithm and program to find minimum and maximum elements in a list.
- Level 2: Analyze the number of comparisons and derive time complexity.

Lab Sheet 2: Asymptotic Notations
- Level 1: Write programs to demonstrate linear and quadratic time complexity.
- Level 2: Compare growth rates of different functions using Big-O, Ω, and Θ.

WEEK 2: Efficiency Analysis
Lab Sheet 3: Recursive Algorithms
- Level 1: Write a recursive program for factorial.
- Level 2: Solve recurrence relations for recursive algorithms.

Lab Sheet 4: Non-Recursive Analysis
- Level 1: Write programs with nested loops and count operations.
- Level 2: Derive general equations and order of growth.

WEEK 3: Brute Force Techniques
Lab Sheet 5: Sorting Algorithms
- Level 1: Implement Bubble Sort and Selection Sort.
- Level 2: Compare their time complexity experimentally.

Lab Sheet 6: Searching & String Matching
- Level 1: Implement Linear Search.
- Level 2: Implement brute-force string matching algorithm.

WEEK 4: Exhaustive Search
Lab Sheet 7: Knapsack Problem
- Level 1: Solve 0/1 Knapsack using brute force.
- Level 2: Analyze solution space complexity.

Lab Sheet 8: Travelling Salesperson Problem
- Level 1: Solve TSP using brute force approach.
- Level 2: Compare performance for different inputs.

WEEK 5: Divide and Conquer
Lab Sheet 9: Binary Search
- Level 1: Implement Binary Search.
- Level 2: Analyze recurrence relation.

Lab Sheet 10: Merge Sort
- Level 1: Implement Merge Sort.

Level 2: Analyze using Master's Theorem.

WEEK 6: Advanced Divide & Conquer
Lab Sheet 11: Quick Sort
Level 1: Implement Quick Sort.
Level 2: Compare best and worst cases.
Lab Sheet 12: Master's Theorem
Level 1: Solve recurrence equations.
Level 2: Apply Master's Theorem to different cases.

WEEK 7: Decrease and Conquer
Lab Sheet 13: Insertion Sort
Level 1: Implement Insertion Sort.
Level 2: Compare with Bubble Sort.
Lab Sheet 14: Topological Sorting
Level 1: Implement Topological Sort.
Level 2: Apply on real-world dependency graph.

WEEK 8: Dynamic Programming
Lab Sheet 15: Warshall Algorithm
Level 1: Implement Warshall algorithm.
Level 2: Compute transitive closure.
Lab Sheet 16: Floyd Algorithm
Level 1: Implement Floyd's algorithm.
Level 2: Compare with Dijkstra.

WEEK 9: DP Applications
Lab Sheet 17: Knapsack DP
Level 1: Solve 0/1 Knapsack using DP.
Level 2: Compare with brute force approach.
Lab Sheet 18: DP Optimization
Level 1: Identify overlapping subproblems.
Level 2: Convert recursive solution to DP.

WEEK 10: Greedy Algorithms
Lab Sheet 19: MST Algorithms
Level 1: Implement Prim's algorithm.
Level 2: Implement Kruskal's algorithm.
Lab Sheet 20: Shortest Path
Level 1: Implement Dijkstra's algorithm.
Level 2: Compare greedy vs DP approach.

WEEK 11: Huffman Coding
Lab Sheet 21: Huffman Tree
Level 1: Construct Huffman Tree.
Level 2: Analyze compression efficiency.
Lab Sheet 22: Greedy Analysis
Level 1: Demonstrate greedy choice property.
Level 2: Prove correctness of greedy algorithms.

WEEK 12: String Matching Optimization
Lab Sheet 23: Horspool Algorithm
Level 1: Implement Horspool algorithm.
Level 2: Compare with brute-force method.
Lab Sheet 24: Boyer-Moore Algorithm
Level 1: Implement Boyer-Moore algorithm.
Level 2: Analyze efficiency improvements.

WEEK 13: Complexity Theory
Lab Sheet 25: Lower Bounds
Level 1: Analyze decision tree for sorting.
Level 2: Derive lower bounds.

Lab Sheet 26: NP Problems
Level 1: Classify problems as P or NP.
Level 2: Analyze NP-complete problems.

WEEK 14: Backtracking
Lab Sheet 27: N-Queens
Level 1: Solve N-Queens problem.
Level 2: Analyze search tree.
Lab Sheet 28: Subset Sum
Level 1: Solve subset sum problem.
Level 2: Compare with DP solution.

WEEK 15: Branch & Bound
Lab Sheet 29: TSP
Level 1: Solve TSP using Branch & Bound.
Level 2: Compare with brute-force approach.
Lab Sheet 30: Job Assignment
Level 1: Solve assignment problem.
Level 2: Analyze pruning efficiency.

WEEK 15.1: AI-Based Optimization and Intelligent Search
Lab Sheet 31: Intelligent Optimization Techniques
Level 1: Implement AI-based heuristic search for optimization problems.
Level 2: Compare heuristic search with Branch & Bound approach for performance analysis.
Lab Sheet 32: Smart Decision-Making Applications
Level 1: Implement a simple recommendation or path optimization system using graph/search techniques.
Level 2: Analyze intelligent pruning and optimization efficiency in real-world problem solving.

Targeted Application & Tools that can be used :
PyTorch/Jupyter Notebook – For Python programming

Text Book :

T1: Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd edition, Pearson Education, 2018.

T2: Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 4th edition, MIT Pres 2022.

References

R1: J. Kleinberg and E. Tardos, "Algorithm Design", Addison-Wesley, 2005.

R2: Tim Roughgarden, "Algorithms Illuminated" (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyo Publishing, 2017-2019.
R3: AV Aho, J Hopcroft, JD Ullman, "The Design and Analysis of Algorithms", Addison-Wesley, 1974.
R4: Donald E. Knuth, "The Art of Computer Programming", Volumes 1and 3 Pearson.

E-Resources/Web Resources
W1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
W2. Coursera: Analysis of Algorithms by Princeton University
W3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses).
W4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University

Topics relevant to "EMPLOYABILITY SKILLS": The lab experiments and assessments enable the student to acquire Skill Development through Experiential Learning techniques

Course Code: APT4004	Course Name: Aptitude Training- Intermediate Type of Course: Practical Only Course	L- T-P- C	0-0-2-0
Version No.	1.0		

Course Pre-requisites	Students should have the basic concepts of Quantitative aptitude along with its applications in real life problems.
Co-requisites	NIL
Anti-requisites	NIL
Course Description	This is a skill-based training program for the students. 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:** Recall all the basic mathematical concepts. [Level -] **CO2**: Identify the principle concept needed in a question. [Level –] **CO3:** Solve the quantitative and logical ability questions with the appropriate concept. [Level –] **CO4:** Analyze the data given in complex problems. [Level –]

Course Content:			
Module 1	Quantitative Ability 1	Assessment: Assignment	16 Sessions
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss			
Module 2	Quantitative Ability 2	Assessment : Assignment	14 Sessions
Topics: Time Speed and Distance, Boats and Streams, Simple Interest, Compound Interest, Probability, Permutation and Combination			

Targeted Applications & Tools:	
Application area	Placement activities and Competitive examinations.
Tools	LMS

Skill-Building Activities through Experiential Learning:

Text Book
T1: Fast Track Objective by Rajesh Verma **T2:** R S Aggarwal **T3:** Rakesh Yadav

References
E-Resources/Web Resources 1. www.indiabix.com 2. www.youtube.com/c/TheAptitudeGuy/videos 3. www.testbook.com

Course Code: CSS2266	Course Title: Theory of Computation Type of Course: Theory Course (PCC)	L- T-P- C	3-0-0-3
Version No.	2.0		
Course Pre-requisites	NIL		

Anti-requisites	NIL
Course Description	This course introduces the theoretical foundations of computation through the study of formal languages and automata. It covers the design and analysis of finite automata and regular languages, context-free grammar and pushdown automata, and Turing machines as models of computation. The course further explores key concepts such as ambiguity, normal forms, computability, decidability, and complexity theory including classes like P and NP. It also highlights the relevance of Theory of Computation in modern computing domains such as artificial intelligence, natural language processing, cybersecurity, compilers, and intelligent systems.
Course Objective	To build a strong foundation in formal languages and automata by enabling students to model and analyze computational systems using finite automata, pushdown automata, and Turing machines; to evaluate computability and complexity of problems; and to apply theoretical concepts to modern domains such as AI, cybersecurity, NLP, and intelligent systems.
Course Outcomes	On successful completion of this course, students will be able to: **CO1:** Explain fundamental concepts of automata, formal languages, and finite state machines. — Level 2-Understand **CO2:** Design and analyze deterministic and nondeterministic finite automata and regular expressions for language recognition. — Level 3-Apply **CO3:** Construct and evaluate context-free grammar and pushdown automata, including ambiguity removal and normal forms. — Level 3-Apply **CO4:** Design Turing machines and interpret their role in solving computational problems and language recognition. — Level 3-Apply **CO5:** Explain the applications of Theory of Computation concepts in real-world domains such as AI/ML, NLP, cybersecurity, compilers, and robotics. — Level 2-Understand

Course Content:

Module 1	Introduction to automata theory	7 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, Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages, and DFA's

Module 2	Finite Automata and Regular languages	12 Sessions

Topics:
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. 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

Module 3	Context Free Grammar and Pushdown automata	12 Sessions

Topics:
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. 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 4	Turing Machines	06 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

Module 5	Complexity and Modern Applications of ToC	08 Sessions

Topics:
Complexity Theory - Time and Space Complexity, Complexity Classes: P, NP, NP-Complete (introductory), Intractability and Hard Problems-Applications of ToC in AI/ML/DL - Computability and Learnability (basic idea), Role of algorithms and complexity in ML, Expressive power of neural networks, NLP & Compilers -Regular Languages in Tokenization, CFG in Syntax Parsing, Ambiguity in Natural Language Processing-Cybersecurity & Blockchain- Hardness assumptions in cryptography, Automata in intrusion detection systems, Smart contracts as state machines, Decidability limits in security.

Robotics & Intelligent Systems - Finite State Machines in robot control, Planning as a computational problem, Real-time decision constraints
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. Its interactive educational software written in Java to experiment topics in automata theory. 2. Turing machine Online simulators.
Skill-Building Activities through Experiential Learning:
Text Book **T1:** Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6th Ed, 2018. **T2:** Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, 3rd Ed,2012
References **R1:** Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008. **R2:** Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014.
E-Resources/Web Resources 1. NPTEL 2. Opencourseware 3. TOC Notes

Course Code: CCS2500	Course Name: Cyber Forensics Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2251		
Co-requisites	Nil		
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 this course is to equip learners with a comprehensive understanding of cyber forensic principles, digital investigation methodologies, and evidence handling frameworks. The course enables students to apply forensic tools and analytical techniques to real-world cybercrime scenarios, interpret data from diverse modern storage media, and evaluate the legal and procedural standards governing		

	digital evidence, fostering critical thinking and skill development through experiential learning.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain digital forensic concepts, investigation processes, legal frameworks, and the role of digital evidence in cybercrime cases. [Level 2 - Understand] **CO2**: Apply knowledge of file systems, data storage structures, file formats, and file signatures to extract forensic artifacts from modern storage media, including SSDs [Level 3 – Apply] **CO3:** Apply digital forensic tools and methodologies to collect, preserve, and document digital evidence during investigations. [Level 3 – Apply] **CO4:** Analyze cybercrime scenarios such as information warfare, identity theft, and organized crime using established forensic techniques [Level 4 – Analyze] **CO5:** Analyze data recovery methods, evidence handling procedures, and chain of custody protocols to ensure integrity and admissibility of digital evidence [Level 4 – Analyze]		
Course Content:			
Module 1	Digital Investigation	Assessment: Quiz + MCQ Based on Investigation process	9 Sessions
Topics: 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	Assessment : Quiz + MCQ Based on file format	9 Sessions
Topics: 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	Assessment : Assignment	9 Sessions
Topics: 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			
Module 4	Computer Forensic Evidence and Data Recovery	Assessment : Assignment	9 Sessions
Topics: 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.			
Skill-Building Activities through Experiential Learning:			
• Cyber Forensics techniques for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.			
Text Book **T1:** John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2019.			

References

R1: Ravi Kumar & B Jain,2006," Cyber Forensics - Concepts and Approaches", icfai university press .
R2: ChristofPaar, Jan Pelzl," Understanding Cryptography: A Textbook for Students and Practitioners", Springer's, Second Edition, 2010.
R3: Ali Jahangiri," Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts", First edition, 2009.
R4: Computer Forensics: Investigating Network Intrusions and Cyber Crime", Ec-Council Press, 2010.
R5: C. Altheide& H. Carvey," Digital Forensics with OpenSource Tools, Syngress", 2011, ISBN: 781597495868.,https://esu.desire2learn.com

E-Resources/Web Resources

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

Course Code: CCS2501	Course Name: Cyber Forensics Lab Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2251		
Co-requisites	Nil		
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 this course is to provide hands-on proficiency in cyber forensic investigation by enabling learners to operate industry-standard forensic tools, conduct structured evidence acquisition and analysis across disk, network, and device domains, and synthesize forensic findings into professional investigation reports — fostering technical competence and analytical thinking through experiential and project-based learning.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the operational principles and investigative workflows of digital forensic tools such as FTK, Autopsy, EnCase, and Kali Linux utilities. [Level 2 – Understand] **CO2:** Apply structured forensic procedures for evidence acquisition, authentication, preservation, and analysis across various storage media including disks, mobile devices, and cloud environments. [Level 3 – Apply] **CO3:** Apply network and memory forensic techniques to collect and examine logs, RAM dumps, and intrusion data for identifying security incidents. [Level 3 – Apply] **CO4:** Analyze digital artifacts from disk, network, and device forensics to identify attack patterns, anomalies, and traces of malicious activity. [Level 4 – Analyze] **CO5:** Analyze forensic findings from multi-source evidence to prepare structured and technically sound investigation reports. [Level 4 – Analyze]		

Course Content:

List of Laboratory Tasks:

- **Experiment 1: Case Studies of Opensource Forensic Tools**

- **Experiment 2: FTK Forensic Tool kit for taking mirror image**

Disk Forensics:

- **Experiment 3: Identify digital evidence**
- **Experiment 4: Acquire the evidence**
- **Experiment 5: Authenticate the evidence**
- **Experiment 6: Preserve the evidence**
- **Experiment 7: Analyze the evidence**
- **Experiment 8: Report the findings**

Network Forensics:

- **Experiment 9: Intrusion detection**
- **Experiment 10: Logging**
- **Experiment 11: Correlating intrusion detection and logging**

Device Forensics

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

Targeted Applications & Tools:

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.

Skill-Building Activities through Experiential Learning:

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

Text Book **T1:** John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2019.
References **R1:** Ravi Kumar & B Jain,2006," Cyber Forensics - Concepts and Approaches", icfai university press **R2:** ChristofPaar, Jan Pelzl," Understanding Cryptography: A Textbook for Students and Practitioners", Springer's, Second Edition, 2010. **R3:** Ali Jahangiri," Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts", First edition, 2009. **R4:** Computer Forensics: Investigating Network Intrusions and Cyber Crime", Ec-Council Press, 2010. **R5**: C. Altheide& H. Carvey," Digital Forensics with OpenSource Tools, Syngress", 2011, ISBN: 781597495868.,https://esu.desire2learn.com
E-Resources/Web Resources 1. NPTEL: https://onlinecourses.swayam2.ac.in/cec21_ge10/preview 2. Udemy: https://www.udemy.com/topic/digital-forensics/ 3. E-book Link: http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14073&query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC

Course Code: CCS2502	Course Name: Cyber threats for IOT and Cloud Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2502-Cryptography and Network Security		
Co-requisites	Nil		
Anti-requisites	Nil		
Course Description	The 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 Objective	The objective of the course is to familiarize the learners with the concepts of Cyber threats for IOT and Cloud and attain Employability through Participative Learning techniques.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the fundamental concepts of IoT and Cloud. [Level 2 - Understand] **CO2**: Summarize and familiarize with various types of cyber-attacks, cybercrimes, vulnerabilities, and remedies [Level 2 - Understand] **CO3:** Demonstrate different types of Cyber threats using tools. [Level 3 – Apply] **CO4:** Illustrate cyber security mechanisms for the protection of information technology assets [Level 3 – Apply] **CO5:** Apply appropriate security controls to address major cyber security threats in cloud computing and demonstrate their impact on protecting cloud workloads, identities, APIs, and compliance [Level 3 – Apply]		
Course Content:			
Module 1	Introduction to IOT and Cloud computing	Assessment: Assignment + Programming Task	9 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			
Module 2	Cyber Threats	Assessment : Quiz + Case study	10 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			
Module 3	Cyber Threats in Internet of Things	Assessment : Assignment + Programming Task	13 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.			
Module 4	Cyber Threats in Cloud computing	Assessment : Assignment + Data analysis task	13 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.			
Skill-Building Activities through Experiential Learning:			
• Cyber threats in IoT and Cloud Computing for skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.			
Text Book **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:** 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.			
E-Resources/Web Resources 1. https://www.coursera.org/learn/cloud-security-basics 2. https://www.imperva.com/learn/application-security/cyber-security-threats/ 3. https://presiuniv.knimbus.com/user#/home			

Course Code: CSS2264	Course Name: Essentials of AI Type of Course: -Theory Course (ESC)	L-T-P-C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		

Anti-requisites	NIL
Course Description	This course introduces the fundamentals of Artificial Intelligence, AI tools, and prompt engineering techniques. It covers AI applications, evaluation of AI tools, ethical and responsible AI usage, and the social and economic impacts of AI. The course also introduces advanced AI technologies such as chatbots, voice assistants, image recognition, robotics, and intelligent automation through practical activities and case studies.
Course Objectives	The course aims to introduce the fundamentals and applications of Artificial Intelligence, popular AI tools, and basic prompt engineering techniques. It also helps students evaluate AI tools, understand ethical and responsible AI usage, and gain knowledge of advanced AI technologies through practical examples and case studies.
Course Outcomes	On successful completion of this course, students will be able to: **CO1:** Explain the fundamentals of Artificial Intelligence, its evolution, types, key concepts, and applications across various domains. . [Level 2 – Understand] **CO2:** Apply basic prompt engineering techniques for generating effective AI responses. [Level 3 – Apply] **CO3:** Evaluate and compare AI tools based on suitability, functionality, ethical considerations, privacy, and security requirements.. [Level 4 – Analyze] **CO4:** Understand the social, ethical, and economic impacts of AI technologies and their influence on society, industries, and employment. [Level 2 – Understand] **CO5:** Analyze advanced AI technologies and their real-world applications through case studies and practical scenarios. [Level 4 – Analyze]

Course Content:

Module 1	Introduction to Artificial Intelligence	Assignment (Fundamentals and Applications of Artificial Intelligence)	9 Sessions
Topics: Introduction to Artificial Intelligence – Definition and History of AI; Evolution of AI; Goals and Scope of AI; Types of AI – Narrow AI, General AI, Super AI. **Key Concepts in AI** – Machine Learning, Deep Learning, Neural Networks, Natural Language Processing (NLP), Computer Vision, Generative AI. AI vs Human Intelligence. AI Development Lifecycle. Applications of AI across domains – Healthcare, Education, Finance, Agriculture, Cybersecurity, and E-Commerce.			
Module 2	AI Tools and Effective Prompting Techniques	Practical Assignment (AI Tools and Prompt Engineering Techniques)	9 Sessions
Topics: **Introduction to Popular AI Tools –** Introduction to AI Tools – Overview of popular AI tools and their applications. AI tools for text generation, image generation, predictive analysis, and chatbot interactions. **Prompt Engineering-**Introduction to prompts and AI-generated responses. Importance of clear instructions and effective questioning techniques. Understanding how AI interprets prompts.			
Module 3	Suitability and Evaluation of AI Tools	Quiz + Assignment (Evaluation and Ethical Use of AI Tools)	9 Sessions
Topics: Introduction to AI Tool Evaluation, Evaluating Tool Suitability, AI Tools for Different Purposes, Comparison of AI Tools, Ethical Use of AI, Bias and Fairness in AI, Data Privacy and Security, Ethical Guidelines for Responsible AI Use			
Module 4	Social, Ethical, and Economic Impacts of AI	Assignment (Social, Ethical, and Economic Impact Analysis of AI)	9 Sessions
Topics: Social, Ethical, and Economic Effects of AI – Ethical issues in AI, future challenges and opportunities, impact of AI on the economy and employment, and responsible use of AI technologies.			
Module 5	Advanced AI Technologies case study	Mini Project / Case Study (AI Technologies and Real-World Applications)	9 Sessions
AI Technologies – Voice assistants, image recognition applications, AI chatbots, robotic and intelligent automation systems, recommendation systems, and recent advancements and future trends in AI technologies.			

Targeted Application & Tools that can be used:	
ChatGPT, Google Gemini, Hugging Face	Implementation of AI-based content generation and chatbot interaction using prompt engineering techniques.
Canva AI, DALL·E, Adobe Firefly	Implementation of image generation and creative AI applications using generative AI tools.

Google Colab, TensorFlow, Kaggle	Implementation of predictive analytics and machine learning models for simple real-world datasets.
NLTK, spaCy, Hugging Face Transformers	Implementation of NLP-based applications such as sentiment analysis, text summarization, and language translation.
IBM Watson, Microsoft Azure AI, Teachable Machine	Development of AI-based mini projects for solving real-world problems in healthcare, education, finance, agriculture, and cybersecurity.

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

1. Group project on one of the topics mentioned above (Eg. Adversarial search).

Textbook(s):

T1: Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson Education, 2022.
T2: Elaine Rich and Kevin Knight, *Artificial Intelligence*, 3rd Edition, McGraw Hill Education, 2009.
T3: Tom Taulli, *Artificial Intelligence Basics: A Non-Technical Introduction*, 1st Edition, Apress, 2019.

References:

R1: Ethem Alpaydin, *Introduction to Machine Learning*, 4th Edition, MIT Press, 2020.
R2: Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, 1st Edition, MIT Press, 2016.
R3: Melanie Mitchell, *Artificial Intelligence: A Guide for Thinking Humans*, 1st Edition, Farrar, Straus and Giroux, 2019.
R4: Pedro Domingos, *The Master Algorithm*, 1st Edition, Basic Books, 2015.
R5: Kai-Fu Lee, *AI Superpowers*, 1st Edition, Houghton Mifflin Harcourt, 2018.

E-Resources/Web Resources

1. OpenAI
2. Google AI
3. IBM Artificial Intelligence
4. Microsoft AI Learning
5. Coursera – AI Courses
6. NPTEL – Introduction to Artificial Intelligence
7. NPTEL – Artificial Intelligence: Search Methods for Problem Solving

Course Code: CSS2265	Course Name: Essentials of AI Lab Type of Course: Laboratory Course (PCC)	L-T-P-C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces students to the fundamentals and practical applications of Artificial Intelligence through hands-on laboratory exercises. Students will explore AI tools, prompt engineering, generative AI, Natural Language Processing (NLP), basics of Machine Learning, chatbot development, recommendation systems, ethical AI, and voice assistant simulation. The course concludes with the development of AI-based mini projects for real-world applications.		
Course Objectives	To develop practical skills in Artificial Intelligence by enabling students to explore AI tools, apply prompt engineering techniques, implement basic NLP and Machine Learning tasks, develop intelligent AI-based applications, and analyze ethical and real-world aspects of AI systems.		
Course Outcomes	On successful completion of this course, students will be able to: **CO1:** Apply AI tools and prompt engineering techniques for generating effective AI-based outputs..[Level 3 – Apply] **CO2:** Implement AI-based applications for text generation, image generation, and chatbot development. .[Level 3 – Apply] **CO3:** Apply Natural Language Processing and basic Machine Learning techniques for solving simple real-world problems..[Level 3 – Apply] **CO4:** Analyze datasets and AI model outputs using preprocessing,[Level 4 – Analyze]		

	visualization, and evaluation techniques. **CO5:** Analyze ethical issues, bias, and the impact of AI systems in practical applications [Level 4 – Analyze]

Course Content:

Lab Sheet 1: Introduction to AI Tools

- **Problem Statement:**
- Explore different AI platforms such as ChatGPT, Gemini, and Hugging Face, and compare their outputs for various tasks based on relevance and accuracy.

Lab Sheet 2: Prompt Engineering Basics

- *(Using AI tools explored in Lab 1)*
- **Problem Statement:**
- Design effective prompts for text generation and summarization, and analyze how prompt structure influences AI-generated responses.

Lab Sheet 3: Advanced Prompt Engineering

- *(Continuing Lab 2)*
- **Problem Statement:**
- Develop role-based and instruction-based prompts to optimize AI outputs for accuracy, detail, and contextual understanding.

Lab Sheet 4: AI Content Generation

- *(Using prompts designed in previous labs)*
- **Problem Statement:**
- Generate blogs, emails, resumes, and reports using AI tools and improve the outputs through iterative prompt refinement.

Lab Sheet 5: AI Image Generation

- *(Extending prompt engineering concepts)*
- **Problem Statement:**
- Generate AI-based posters, logos, and advertisements using generative AI tools and compare outputs generated using different prompt styles.

Lab Sheet 6: Dataset Collection & Preprocessing

- **Problem Statement:**
- Collect textual datasets from reviews or social media platforms and perform preprocessing techniques such as tokenization, stemming, and stopword removal.

Lab Sheet 7: Sentiment Analysis using NLP

- *(Using dataset prepared in Lab 6)*
- **Problem Statement:**
- Implement sentiment analysis on textual datasets using NLP libraries and analyze sentiment classification performance.

Lab Sheet 8: Text Summarization & Translation

- *(Continuing NLP tasks from Lab 6 & 7)*

- **Problem Statement:**
- Implement AI-based text summarization and language translation techniques and compare generated outputs with original content.

Lab Sheet 9: Introduction to Machine Learning

- *(Using processed datasets from previous labs)*
- **Problem Statement:**
- Understand supervised and unsupervised learning concepts by loading, splitting, training, and testing datasets using Scikit-learn.

Lab Sheet 10: Data Visualization & Feature Analysis

- *(Continuing Lab 9 using same dataset)*
- **Problem Statement:**
- Visualize datasets using Matplotlib and analyze feature relationships and data distributions using graphical techniques.

Lab Sheet 11: AI Chatbot Development

- *(Using NLP and prompt engineering concepts)*
- **Problem Statement:**
- Develop a rule-based chatbot using Python and integrate contextual AI-generated responses for interactive communication.

Lab Sheet 12: Recommendation System

- *(Using prediction concepts from previous labs)*
- **Problem Statement:**
- Implement a content-based recommendation system and analyze recommendation accuracy using similarity metrics.

Lab Sheet 13: Ethical AI and Bias Analysis

- *(Evaluating outputs generated in previous labs)*
- **Problem Statement:**
- Identify bias, hallucination, and ethical issues in AI-generated outputs and analyze their impact on responsible AI systems.

Lab Sheet 14: Voice Assistant Simulation

- *(Using NLP and chatbot concepts from previous labs)*
- **Problem Statement:**
- Develop a basic voice assistant using Python speech libraries and implement voice commands for search, greetings, and simple automation tasks.

Lab Sheet 15: AI Mini Project

- *(Combining concepts from all previous labs)*
- **Problem Statement:**
- Develop and demonstrate an AI-based application integrating concepts such as NLP, machine learning, chatbot systems, or recommendation systems.

Targeted Applications & Tools:

ChatGPT, Gemini, Hugging Face, Canva AI, Python

Python IDEs like PyCharm-Jupyer Notebook /Google Collab
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course The course is a lab-based course with all the assessments centrally evaluated. Every experiment consists of two sessions. The first session involves exploring a solution to the problem. The second session involves solving a particular problem.
Textbook(s): **T1:** Stuart Russel and Peter Norvig. Artificial Intelligence: A Modern Approach. 4th Edition. Pearson Education. 2022. **T2:** Prateek Joshi and Alberto Artasanchez. Artificial Intelligence with Python. 2nd Edition. Packt. 2020. **T3:** Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 2022
References: **R1:** Deepak Khemani. *A First Course in Artificial Intelligence*. 1st Edition. 6th Reprint, 2018. **R2:** Munesh Chandra Trivedi. *A Classical Approach to Artificial Intelligence*. 2nd Edition. Khanna Publishers. 2018.

Course Code: CCS3405	Course Name: Vulnerability Assessment and Penetration Testing Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	CSE2502		
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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain information gathering and vulnerability detection. [Level 3 - Understand] **CO2**: Analyze security threats and vulnerabilities in SDN networks and web applications [Level 3 – Analyze] **CO3:** Apply exploits in mobile applications and wireless networks [Level 3 – Apply] **CO4:** Perform penetration testing using Metasploit framework. [Level 3 – Apply] **CO5:** Utilize Meterpreter for post-exploitation and system interaction [Level 3 – Apply]		
Course Content:			
Module 1	Information Gathering, Host Discovery and Evading Techniques	Assessment: Assignment	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	Assessment : Quiz	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	Assessment : Quiz	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	Assessment : Quiz	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 Applications & Tools: This course helps the students to understand the threats and vulnerabilities using NMAP.			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015. ISBN : 78-1-4822-3161-8. **T2:** 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. **T3:** 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 **R1:** Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 PacktPublishing. **R2:** SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication **R3:** Web resources: https://onlinecourses.nptel.ac.in/noc19_cs68/preview - IIT Kharagpur, Prof. Indranil Sen Gupta			
E-Resources/Web Resources			
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: CSS7000	Course Name: Internship Type of Course: PRW	L- T-P- C	0-0-0-2
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 methods of scientific experimentation, and often get opportunities to see, study, and operate sophisticated and costly equipment. They also get opportunities to work with advanced software tools and modern technologies used in industries and research environments. Students use tools and technologies from emerging fields such as Artificial Intelligence (AI), Machine Learning (ML), Cyber Security, Blockchain, and Data Science to develop solutions for real-world and industry-related problems. They also learn about the implementation of management principles taught in the classroom		

	by observing multidisciplinary teams of experts from engineering, science, economics, operations research, and management dealing with techno-economic problems at both micro and macro levels. The course further enables students to develop and refine their language, communication, teamwork, and interpersonal skills through various activities such as seminars, group discussions, project presentations, and report preparation. The broad-based core education, supported by strong foundations in mathematics, science, and analytical tools, provides the necessary background for students to properly understand and solve practical real-life problems. Students have the flexibility to pursue this course either as Project Work and Dissertation within the university, as Project Work in an Industry, Company, or Research Laboratory, or through Internship Programs in industries and organizations.
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, students shall be able to: CO1: Identify engineering problems related to local, regional, national, and global needs. [Level 2 - Understand] CO2: Apply appropriate techniques and modern tools to solve engineering problems. [Level 3 - Apply] CO3: Design experiments in accordance with standard procedures and specifications. [Level 4- Analyze] CO4: Conduct experiments and collect relevant data for analysis. [Level 3 - Apply] CO5: Interpret experimental results and draw meaningful conclusions. [Level 6 - Create]

Course Code: FIN1002	Course Name: Essentials of Finance Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	This course is designed to be accessible to all students, regardless of their prior financial knowledge.		
Co-requisites			
Anti-requisites	NIL		
Course Description	This course is designed to equip students with a foundational understanding of key financial concepts and principles. It will enable them to comprehend the core functions of finance, delve into the intricacies of financial management within organizations, and gain insights into the fundamental aspects of taxation. The course aims to develop students' abilities to interpret financial statements, evaluate investment opportunities, understand capital structure decisions, and navigate the basics of tax implications.		
Course Objective	Understand the basic forms of business organization and their financial implications. Understand the fundamental principles and concepts that influence financial decision-making in various contexts. Analyse and interpret financial statements to assess the financial health and performance of an organization. Identify income under various heads of income as per Income Tax Act, 1961 and determine the tax liability.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Understand the basic concepts of finance and financial markets and organizations. [Level 2 - Understand] **CO2**: Apply and interpret financial information for business decision making. [Level 3 – Apply] **CO3:** Identify various heads of income and deduction under Income Tax Act, 1961. [Level 2 – Understand]		
Course Content:			

Course Code: APT4006	Course Title: Logical and Critical Thinking Type of Course: Audited	L- T-P- C	0-0-2-0

Module 1	Introduction to Finance	Assessment: Assignment / Quiz	10 Sessions
Topics: Definition and Scope of Finance, Areas of Finance: Corporate Finance, Investments, Financial Institutions, International Finance; Types of Financial Markets: Money Markets vs. Capital Markets, Primary vs. Secondary Markets; Forms of Business Organization and Financial Goals: Shareholder Wealth Maximization vs. Profit Maximization; Understanding Financial Statements: Balance Sheet and Income Statement- Simple Numerical.			
Module 2	Financial Management	Assessment : Assignment / Quiz	13 Sessions
Topics: Capital Budgeting Decisions: Payback Period, Net Present Value (NPV), Profitability Index (PI), Internal Rate of Return (IRR); Leverage- Basic Numerical; Capital Structure Decisions: Optimal Capital Structure, Trade-off Theory of Capital Structure; Cost of Capital: Equity, Debt, WACC; Dividend Policy: Factors influencing Dividend Policy.			
Module 3	Taxation	Assessment : Assignment / Quiz	17 Sessions
Topics: Principles of a Good Tax System: Equity, Certainty, Convenience, Economy; Direct vs. Indirect Taxes; Residential Status of an Individual- Basic Problems; Heads of Income; Salary, House Property- Basic Numerical; Deductions under Chapter VI-A; Computation of Taxable Income and Tax Liability; E-Filing procedure			
Targeted Applications & Tools:			
Textbooks, PPT, Spreadsheet Software (e.g., Microsoft Excel), Official Website of Income Tax Department.			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Dr. Vinod K. Singhania & Dr. Monica Singhania. (Latest Assessment Year Edition). Students' Guide to Income Tax including GST. Taxmann Publications. **T2:** Pandey, I. M. (2025). Financial Management. Vikas Publishing House.			
References **R1:** Bhole, L.M., & Mahakud, J. (Current Edition). Financial Institutions and Markets: Structure, Growth and Innovations. McGraw Hill Education India. **R2:** Mehrotra, H.C., & Goyal, S.P. (Latest Assessment Year Edition). Income Tax Law & Practice. Sahitya Bhawan Publications. **R3:** Gordon, E., & Natarajan, K. (Current Edition). Financial Markets and Services. Himalaya Publishing House.			
E-Resources/Web Resources 1. https://presidencyuniversity.linways.com 2. https://onlinecourses.nptel.ac.in/noc24_ec01/preview 3. https://www.incometax.gov.in/iec/foportal/			

Version No.	1.0		
Course Pre-requisites	Students should have the basic concepts of Logical reasoning and Critical thinking, along with its applications in real life problems.		
Anti-requisites	Nil		
Course Description	This is a skill-based training program for the engineering students (Undergraduate). This course is designed to enable the students to enhance their skills in Logical reasoning and Critical thinking.		
Course Objective	The objective of the course is to familiarize the learners with concepts in in Logical reasoning and Critical thinking through problem solving techniques suitable for their career development.		
Course Outcomes	On successful completion of the course the students shall be able to:		
	CO1: **Understand** all the concepts. [Level 2- Understand]		
	CO2: **Apply** the concepts in problem solving (Bloom's taxonomy Level 3) [Level 3- Apply]		
	CO3: **Analyze** and structure the reasoning techniques and spatial visualization skills [Level 4- Analyze]		
Course Content:			
Module 1	Logical Thinking	Assignment	**16 Hours**
Topics: Syllogisms, Cubes and Dices, Mirror and Water images, Paper cutting and Folding, Embedded figures & Completion of figures, Data Interpretation, Data sufficiency			
Module 2	Critical Thinking	Assignment	**14 Hours**
Topics: Analogy, Symbol and Notations, Statement and assumption, Cause of action, Statement and conclusion, Puzzles			
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS			
Evaluation	**Continuous Evaluation**		
	· Topic wise evaluation		
	· Internal Assessments		

Text Book

1. A new approach to reasoning verbal, non-verbal & analytical by BS Sijwali
2. R S Aggarwal
3. Kiran publications

References

1. www.indiabix.com
2. www.testbook.com
3. www.youtube.com/c/TheAptitudeGuy/videos

Topics relevant to Skill Development Logical reasoning and Critical thinking for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

Course Code: LAW7601	Course Name: : Indian Constitution Type of Course: Theory Course	L- T-P- C	1-0-0-0
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course aims to familiarize students with fundamentals of Indian Constitution concepts and their relevance to 75+ Years of Republic of India (https://constitution75.com/) as well as #AzaadiKaAmrutMahotsav / Azadi Ka Amrit Mahotsav (https://amritmahotsav.nic.in). It is designed to equip students with the knowledge about the Constitution of India. This course aims to introduce the constitutional law of India to students from all walks of life and help them understand the constitutional principles as applied and understood in everyday life. The objective of making the Constitution of India, familiar to all students, and not only to law students, this course aims and objectifies legal understanding in the simplest of forms. This course is designed to cater to Constitutional Studies.		
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'PARTICIPATIVE LEARNING' techniques		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the basic understanding of the Indian Constitution and the concepts and issues relevant to day-to-day life of the nation and to equip the Citizen with the zeal of capacity building. Recognizing and identify the values of the Constitution of India. [Level 2 - Understand] **CO2**: Enabling the Citizen-centric Awareness of Rights and Responsibilities of the State. [Level 2 – Understand] **CO3:** 3. Explain the role of the State actors in building India. [Level 2 – Understand] **CO4: 4.** Understanding the Gandhian vision over the power of the LSG (Local Self-Governance) [Level 2 – Understand]		
Course Content:			
Module 1	Understanding the Making of the Constitution: The Constituent Assembly & The Constitution of India	Assessment: Quiz	5 sessions
Topics: Historical Context of Constituent Assembly - Compositions & Functions of Constituent Assembly What is a Constitution? – Why have a Constitution? – Constitutional Change - Features of Indian Constitution – Preamble of Indian			

Constitution			
Module 2	Citizen's Fundamental Rights and State's Responsibilities (Directive Principles)	Assessment	5 Sessions
Topics: Topics: Introduction to Fundamental Rights - Right to Equality – Facets of Right to Equality - Right to Freedom - Constitutional Position of Some Democratic Rights - Right Against Exploitation - Right to Freedom of Religion - Right to Constitutional Remedies Directive Principles of the State Policy			
Module 3	Organs Of the Government	Assessment : Presentation	5 Sessions
Topics: Executive: The President of India - Powers and Functions of President of India - Emergency Powers and the Position of the President Legislature: Union Council of Ministers - Prime Minister - The Rajya Sabha - The Lok Sabha - Relation between the Lok Sabha & Rajya Sabha - Office of the Speaker – Important Parliamentary Committees Judiciary: The Structure and Organization of the Judiciary & the High Court - The Supreme Court - Role of The Supreme Court - Judicial Activism in India - Basic Structure Doctrine & PIL			
Module 4	Federalism & Decentralization		6 sessions
Topics: What is Federalism? - Centre-State Legislative Relations - Centre-State Administrative Relations - Centre-State Financial Relations The 5th & 6th Schedules - Municipality- (History of Indian Municipality, Organization & Functions) – Panchayat 1 (Idea of Panchayat, Organization and Powers of Panchayats in India)			
Text Book **T1:** Durga Das Basu --- Introduction to the Constitution of India, 23rd Edition (Gurgaon; LexisNexis, 2018**).** **T2:** MP Jain's Constitutional Law of India, Lexis Nexis			
References **R1**: Himangshu Roy and M.P.Singh – Indian Political System, 4th Edition (Bengaluru; Pearson Education, 2018) **R2**: Vidya Bhushan & Vishnoo Bhagwan--- Indian Administration (S. Chand, 2011)			
E-Resources/Web Resources 1. https://openFullText.html?DP=https://legislative.gov.in/constitution-of-india/ 2. https://openFullText.html?DP=https://nptel.ac.in/courses/109104074 3. https://openFullText.html?DP=https://www.indiacode.nic.in/			

Course Code: CSS2271	Course Name: Software Design and Development Type of Course: Theory Course (PCC)	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		

Course Description	This course introduces foundational concepts of software engineering and emphasizes a practical, structured approach to software system development. It spans software requirement analysis, process modeling, system design, Agile principles, DevOps culture, testing strategies, quality assurance, and software maintenance. Hands-on assignments and problem-solving activities foster understanding of contemporary software practices and industry tools such as CASE tools, GitHub, and Selenium. The course also introduces secure software engineering practices, DevSecOps concepts, and AI-enhanced tools for documentation, automation, intelligent testing, and software quality prediction workflows.		
Course Objective	To develop a comprehensive understanding of software engineering by enabling students to analyze software development life cycle models, apply design principles and patterns, develop modular and maintainable software systems, perform testing and quality assurance, manage software projects effectively, and understand secure and AI-driven software development practices.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain software engineering principles, ethics, and various software development life cycle models. [Level 2 – Understand] **CO2:** Identify software requirements and develop design models, including Software Requirement Specification (SRS) documents. [Level 3 – Apply] **CO3:** Apply Agile development practices and DevOps principles in software development. [Level 3 – Apply] **CO4:** Apply software testing strategies, configuration management, and maintenance techniques. [Level 3 – Apply] **CO5:** Evaluate secure and AI-driven software engineering practices to ensure software quality, reliability, scalability, and intelligent automation. [Level 5 – Evaluate]		
Course Content:			
Module 1	Introduction to Software Engineering and Process Models	Assessment:	9 Sessions
Topics: 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	Assessment :	9 Sessions
Topics: 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	Assessment :	9 Sessions
Topics: 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	Assessment :	9 Sessions
Topics: 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.			
Module 5	Secure, Intelligent and AI-Driven Software Engineering	Assessment :	9 Sessions
Topics: Secure Software Development Practices, Software Security Testing, AI in Software Engineering, Intelligent Requirement Analysis, AI-based Testing and Debugging, DevSecOps Concepts, Machine Learning for Software Quality Prediction, Smart Project Management Tools, Applications of AI in Modern Software Development.			
Targeted Applications & Tools:			
Git hub/Lambda/Taskade/Bit.ai/Testsigma/TestRogor			
Skill-Building Activities through Experiential Learning:			

Text Book

T1: Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 2017.

T2: Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 2018.

References

R1: Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2015.

R2: Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.

R3: Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002

R4: Journals / Magazines

- IEEE Software
- ACM Transactions on Software Engineering and Methodology
- Journal of Systems and Software

SWAYAM / NPTEL / MOOCs

- NPTEL – Software Engineering (Prof. Rajib Mall, IIT KGP)
- Coursera – Agile Development (University of Virginia)
- Udemy – DevOps Masterclass
- EdX – Software Testing Fundamentals (TUM)

E-Resources/Web Resources

Topics Relevant to "Skill Development"

Black box Testing, White box Testing, AI tools for design, modelling, testing and document Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout

Course Code: CCS2507	Course Name: Web Security Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	Data Communication and Computer networks Web Technology		
Co-requisites	Nil		
Anti-requisites	Nil		
Course Description	The purpose of this course this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web encryption.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.		

<table>
<tr><td>Course Outcomes</td><td colspan="3">On successful completion of the course the students shall be able to:

CO1: Explain the structure of a web application and common security issues in web applications. [Level 2 - Understand]
CO2: Explain different web authentication methods and identify weaknesses in authentication mechanisms [Level 2 - Understand]
CO3: Implement session management and access control mechanisms for the web applications. [Level 3 – Apply]
CO4: Use appropriate techniques to detect common web application vulnerabilities in databases and backend systems. [Level 3 – Apply]
CO5: Apply basic security measures to prevent common client-side attacks such as XSS, CSRF, and cookie-based attacks [Level 3 – Apply]</td></tr>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>Module 1</td><td>Introduction</td><td>Assessment: Programming Task</td><td>8 Sessions</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>Module 2</td><td>Web Application Authentication</td><td>Assessment : Programming Task</td><td>8 Sessions</td></tr>
<tr><td colspan="4">Topics:
Authentication Fundamentals- Two Factor and Three Factor Authentication, Web Application Authentication- Password Based, Built-in, HTTP, Single Sign-on, Custom Authentication, Validating credentials - Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity - Design Flaws in Authentication Mechanisms - Implementation Flaws in Authentication Mechanisms - Securing Authentication.</td></tr>
<tr><td>Module 3</td><td>Session Management &Web Security Principles</td><td>Assessment : Programming Ttask</td><td>8 Sessions</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>Module 4</td><td>Web Application Vulnerability</td><td>Assessment : Programming Ttask</td><td>6 Sessions</td></tr>
<tr><td colspan="4">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.
AI-Driven Web Application Vulnerability Detection-Automated identification of XSS, SQL Injection, CSRF, and zero-day threats.</td></tr>
<tr><td colspan="4">List of Laboratory Tasks:</td></tr>
<tr><td colspan="4">Task 01: Practical knowledge of known vulnerabilities in CGI, LAMP stacks, REST APIs cross-site scripting
Task 02: HTTP and setting up stacks, the various types of databases Access Controls, Vulnerabilities
Task 03: SQL injection and prevention
Task 04: Study of web authoring Tools
Task 05: Testing web applications
Task 06: Cross site request forgery attack lab
Task 07: Web tracking</td></tr>
<tr><td colspan="4">Project work/Assignment:</td></tr>
<tr><td colspan="4">Group assignment to identify and write different web exploits to demonstrate vulnerabilities in web applications.</td></tr>
<tr><td colspan="4">Targeted Application & Tools that can be used</td></tr>
</table>

1. Wordpress 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. Burp Suite Academy for virtual labs

Skill-Building Activities through Experiential Learning:

- Session Management &Web Security Principles and Web Application vulnerability for Skill Development through Experiential Learning Techniques. This is attained through the assessment component mentioned in the Course Plan.

Text Book

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, by Andrew Hoffman, 2020.

E-Resources/Web Resources

1. https://www.oreilly.com/library/view/web-application-security/9780071776165/
2. https://www.oreilly.com/library/view/web-application-security/9781492053101/
3. https://nptel.ac.in/courses/106106129
4. https://www.coursera.org/learn/security-and-authentication

Course Code: CCS2508	Course Name: Web Security Lab Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	**Data Communication and Computer Networks**		
Co-requisites			
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 the course the students shall be able to:** **CO1:** Execute network scanning tools to identify open ports and running services in computer networks. [Level 3 – Apply] **CO2:** Use vulnerability assessment tools to identify security weaknesses in network and web infrastructures [Level 3 – Apply] **CO3:** Implement secure configuration and intrusion detection mechanisms using standard security tools. [Level 3 – Apply] **CO4:** Analyze web application architecture, protocols, and databases to identify common vulnerabilities such as SQL injection, XSS, CSRF, and access control flaws. [Level 4– Analyze] **CO5:**. Analyze security testing results and tracking mechanisms to recommend suitable security controls and best practices [Level 4 – Analyze]		

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

iii. Role-Based Access Control (RBAC)
iv. 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 Applications & Tools:	
Burp Suite (Community/Professional)	Intercepting HTTP/HTTPS traffic, analyzing client–server communication, identifying insecure client-side controls
OWASP ZAP	Application mapping, spidering, enumerating application content and functionality
Browser Developer Tools (Chrome/Firefox DevTools)	Inspecting client-side scripts, data transmission, input handling and validation
CyberChef	Encoding and decoding data formats (Base64, URL, Hex) to understand encoding schemes
OWASP Threat Dragon	Threat modeling, attack surface analysis, classifying and prioritizing threats.
Burp Suite – Authentication Analyzer	Testing authentication workflows and identifying credential validation flaws
OWASP Broken Web Applications (BWA)	Hands-on practice with insecure authentication mechanisms

Hydra / Medusa	Demonstrating brute-force and credential stuffing attacks in controlled environments
JWT.io Debugger	Analyzing JSON Web Tokens and identifying weak token signing and validation
Google Authenticator / Authy	Demonstrating two-factor and three-factor authentication mechanisms
Burp Suite – Session Handling Rules	Analyzing session token generation, handling, fixation, and hijacking issues
OWASP ZAP – CSRF Scanner	Detecting CSRF vulnerabilities and origin policy violations
Postman	Testing role-based access control and authorization bypass scenarios
BeEF (Browser Exploitation Framework)	Demonstrating client-side and browser-based attacks
DirBuster / Gobuster	Identifying forceful browsing and directory traversal vulnerabilities
SQLMap	Detecting and exploiting SQL injection vulnerabilities
NoSQLMap	Testing NoSQL injection attacks on backend data stores
Burp Suite – Repeater & Intruder	Manual exploitation of injection flaws, cookie manipulation, and header injection
Nikto	Web server vulnerability scanning and misconfiguration detection
Splunk with Machine Learning Toolkit	Log analysis and AI-based anomaly detection
Wazuh	AI-assisted intrusion detection and monitoring
Darktrace (Case Study/Demo)	Understanding AI-driven behavioral analysis in web security

Skill-Building Activities through Experiential Learning:

Text Book

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, by Andrew Hoffman, 2020.

E-Resources/Web Resources

1. **https://www.oreilly.com/library/view/web-application-security/9780071776165/**
2. **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 web vulnerability/attacks.

Topics related to development of "Experimental Learning":

Writing different web exploits to demonstrate vulnerabilities in web applications.

Course Code: CCS2506	Course Name: Intrusion Detection and Prevention System Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	Fundamental knowledge in Operating Systems		
Co-requisites	Nil		
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 Analyse intrusion detection alerts and logs to distinguish attack types from false alarms		
Course Objective	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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe intrusion detection and prevention fundamentals, types, and detection techniques. [Level 2 - Understand] **CO2**: Explain intrusion prevention systems, architectures, and response strategies [Level 2 - Understand] **CO3:** Implement IDS/IPS tools for network monitoring and attack detection. [Level 3 – Apply] **CO4:** Analyze IDS/IPS tools, configurations, and rule-based detection mechanisms. [Level 4 – Analyze] **CO5:** Evaluate legal issues, standards, and compliance in intrusion detection systems [Level 4 – Analyze]		
Course Content:			
Module 1	Introduction to Intrusion Detection and Prevention System	Assessment: 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. I nternal and external threats to data, Need and types of IDS, Information sources,Host based information sources, Network based information sources. Assignment: Demonstrating the skills to capture and analyze network packets using network packet analyzer.			
Module 2	Intrusion Prevention System	Assessment : : Programming Task	10 Sessions
Topics: Intrusion Prevention Systems, Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis, techniques, Responses, requirement of responses, Types of responses, mapping responses to policy Vulnerability analysis, credential analysis, non-credential analysis. Architecture models of IDs and IPs. Assignment: Applying Intrusion detection in security applications.			
Module 3	Applications and tools	Assessment : : Programming/Data analysis task	12 Sessions
Topics: Tool Selection and Acquisition Process – Bro Intrusion Detection – Prelude Intrusion Detection – Cisco Security IDS– Snorts Intrusion Detection – NFR security. Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes Assignment: Demonstrate the working with Snort Rules, Rule Headers, Rule Options and The Snort Configuration File.			
Module 4	Legal issues and organizations standards	Assessment : Programming/Data analysis task	12 Sessions
Topics:			

Law Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and Standardizations. Assignment: Addressing common legal concerns and myths about Intrusion Detection system
Skill-Building Activities through Experiential Learning: • Agent development for intrusion detection for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.
Text Book **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
E-Resources/Web Resources 4. https://www.youtube.com/watch?v=RYB4cG8G2xo 5. https://www.coursera.org/lecture/detecting-cyber-attacks/intrusion-detection-systems-UeDqJ

Course Code: CSS2274	Course Name: Competitive Programming and Problem Solving Type of Course: Laboratory Course	L- T-P- C	0-0-4-2
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course equips students with efficient problem-solving skills for competitive programming and real-world computational challenges. Starting with brute-force approaches, students learn to optimize time and space complexity using advanced techniques such as greedy algorithms, dynamic programming, backtracking, graph algorithms, and heuristic optimization methods. Hands-on practice using platforms such as CodeChef and Codeforces helps students solve problems related to number theory, data structures, and algorithmic paradigms. The course also introduces intelligent problem-solving strategies, AI-assisted coding concepts, and optimization techniques for competitive programming. By understanding competitive programming constraints and developing a strategic problem-solving mindset, students gain confidence for coding competitions, technical interviews, and real-world applications		
Course Objective	The objective of the course is to familiarize learners with the concepts of Competitive Programming and Problem Solving, enabling them to develop efficient coding, optimization, and analytical skills through experiential learning techniques and intelligent problem-solving approaches.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Understand the challenges of online competitive programming platforms, interpret problem constraints, and understand brute-force solution approaches used in competitive programming. [Level 2 – Understand]		

	CO2: Analyze the time and space complexity of number-theoretic solutions to determine the need for optimization under competitive programming constraints.	[Level 4 – Analyze]
	CO3: Apply appropriate algorithmic paradigms and data structures to solve problems within defined time and memory constraints.	[Level 3 – Apply]
	CO4: Analyze execution failures and identify algorithmic inefficiencies in solutions involving advanced data structure concepts to redesign optimized solutions within given time and memory constraints.	[Level 4 – Analyze]
	CO5: Analyze advanced problem-solving and intelligent optimization techniques using dynamic programming, greedy methods, backtracking, and heuristic approaches for large-scale competitive programming problems.	[Level 4 – Analyze]

Course Content:

Module 1	Introduction to Competitive Programming

Topics:

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.

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.

Module 2	Introduction to Competitive Programming

Topics:

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

Topics:

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

Topics:

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

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:

WEEK 1

- **Experiment 1: Sorting & Ranking**

Level 1: Write a program to find the runner who finished in the third position from the given finishing times of N runners.

Level 2: Write a program to find the top 10 runners along with their bib numbers efficiently for large datasets.

- **Experiment 2**: Searching Techniques

Level 1: Write a program to check whether a given book ID exists in a library database.

Level 2: Design and implement a system to search books efficiently by title using an appropriate data structure.

WEEK 2

- **Experiment 3**: Cost Calculation

Level 1: Write a program to calculate the total cost of products in a shopping cart.

Level 2: Design an algorithm to apply multiple discount rules and compute the final bill.

- **Experiment 4**: Modular Arithmetic

Level 1: Write a program to compute (a^m \mod p).

Level 2: Implement binary exponentiation for efficient computation of large powers modulo p.

WEEK 3

- **Experiment 5**: Combinatorics

Level 1: Write a program to calculate the number of ways to choose K cards from N cards.

Level 2: Design an algorithm to calculate probabilities of drawing specific card combinations.

- **Experiment 6**: Graph Connectivity

Level 1: Write a program to determine if a path exists between two nodes in a network.

Level 2: Design an algorithm to detect anomalies in a network using XOR-based comparison techniques.

WEEK 4

- **Experiment 7**: Array Processing

Level 1: Write a program to find the minimum time required for cars to pass a point based on their speeds.

Level 2: Implement a two-pointer approach to simulate movement of cars with different lengths.

- **Experiment 8:** String Matching

Level 1: Write a program to count occurrences of a substring in a given string.

Level 2: Implement the KMP algorithm to efficiently find all occurrences of a pattern in a text.

WEEK 5

- **Experiment 9**: Priority Queue

Level 1: Write a program to track the highest bid in an auction system.

Level 2: Design a system to handle concurrent bids efficiently and update the highest bid.

- **Experiment 10:** Shortest Path

Level 1: Write a program to check if two users are connected in a social network.

Level 2: Implement Dijkstra's algorithm to find the shortest path between users.

WEEK 6

- **Experiment 11:** Tree Traversal

Level 1: Write a program to traverse a file system and display all files and directories.

Level 2: Design a file system supporting operations like create, delete, and search.

- **Experiment 12**: Tree Applications

Level 1: Write a program to calculate the total price of items in a shopping cart represented as a tree.

Level 2: Design a system to apply discounts efficiently in a hierarchical shopping cart.

WEEK 7

- **Experiment 13**: Disjoint Set

Level 1: Write a program to check whether all users in a group are connected.

Level 2: Find the minimum number of connections required to connect all users.

- **Experiment 14**: Greedy Algorithms

Level 1: Write a program to find the cheapest path to reach a destination.

Level 2: Design an algorithm to find the fastest path considering time constraints.

WEEK 8

- **Experiment 15**: BFS Applications

Level 1: Write a program to find the minimum number of moves for a rook to reach a target square.

Level 2: Implement BFS to find shortest path in a grid.

- **Experiment 16**: Game Algorithms

Level 1: Represent a game state using a tree structure.

Level 2: Implement minimax algorithm with alpha-beta pruning.

WEEK 9

- **Experiment 17**: Sorting Algorithms

Level 1: Write a program to implement insertion sort.

Level 2: Write a program to implement merge sort or quick sort.

- **Experiment 18**: Searching Algorithms

Level 1: Write a program to perform linear search.

Level 2: Write a program to perform binary search efficiently.

WEEK 10

- **Experiment 19**: Algorithm Analysis

Level 1: Write a program to compare execution time of two algorithms.

Level 2: Optimize a given algorithm to improve performance.

- **Experiment 20**: Recursion

Level 1: Write a program to solve Tower of Hanoi.

Level 2: Compare recursive and iterative solutions for a problem.

WEEK 11

- **Experiment 21**: Graph Representation

Level 1: Represent a graph using adjacency list.

Level 2: Represent a graph using adjacency matrix.

- **Experiment 22**: Graph Traversal

Level 1: Implement Depth First Search (DFS).

Level 2: Implement Breadth First Search (BFS).

WEEK 12

- **Experiment 23**: Data Structure Integration

Level 1: Combine arrays and lists to solve a problem.

Level 2: Use multiple data structures (tree + hash table) in one solution.

- **Experiment 24**: Real-world Application

Level 1: Design a simple recommendation system.

Level 2: Optimize it for large-scale data.

WEEK 13

- **Experiment 25**: String Algorithms

Level 1: Write a program for basic string matching.

Level 2: Implement efficient pattern matching algorithm.

- **Experiment 26**: Network Algorithms

Level 1: Check connectivity in a network.

Level 2: Detect anomalies using data comparison techniques.

WEEK 14

- **Experiment 27**: Algorithm Design

Level 1: Solve a problem using brute-force approach.

Level 2: Improve the solution using greedy or dynamic approach.

- **Experiment 28**: Performance Evaluation

Level 1: Analyze runtime of a program.

Level 2: Compare different algorithmic approaches.

WEEK 15

- **Experiment 29**: Case Study

Level 1: Implement a real-world problem solution.

Level 2: Optimize and document the solution.

- **Experiment 30**: Mini Project

Level 1: Combine multiple algorithms to build a system.

Level 2: Present optimized solution with performance analysis.

Targeted Applications & Tools:	
C or C++ Compiler (g++):	The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).
IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar	These provide debugging capabilities, code completion, and other helpful features.

IDEs.	
Online Judges (CodeChef, Codeforces, LeetCode, HackerRank):	Essential for practicing and submitting solutions.
Debugger (gdb):	Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
Number Theory Libraries:	Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).
Wolfram Alpha	A useful tool for verifying number theory calculations and exploring concepts.
String Libraries:	Familiarize students with the string manipulation functions available in C++.

Skill-Building Activities through Experiential Learning:

- Solving coding challenges and algorithmic problems on competitive programming platforms.
- Hands-on implementation of data structures and algorithms for real-world problem solving.
- Participation in coding contests, hackathons, and programming competitions.
- Debugging and optimizing programs to improve efficiency and performance.
- Collaborative problem-solving and peer code review activities.
- Developing logical thinking and analytical skills through timed programming exercises.
- Practice sessions on online judges such as CodeChef, LeetCode, HackerRank, and Codeforces.
- Mini-projects involving algorithm design, implementation, and performance analysis

Text Book

T1: Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition), Antti Laaksonen, springer, 2024

T2: Data Structures and Algorithms in Java: A Project-Based Approach" – Dan S. Myers, Cambridge University Press

References

R1: Data Structures and Algorithmic Thinking with Python/C++/Java", Narasimha Karumanchi, 5th Edition, Career Monk, 2017.

R2: Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022 ..

E-Resources/Web Resources

1. https://openFullText.html?DP=https://codeforces.com/
2. https://openFullText.html?DP=https://www.codechef.com/
3. https://openFullText.html?DP=https://leetcode.com/
4. https://openFullText.html?DP=https://www.hackerrank.com/

5.	https://openFullText.html?DP=https://atcoder.jp/

Course Code: APT4005	Course Name: Aptitude For Employability Type of Course: Practical Only	L- T-P- C	0-0-2-1
Version No.	1.0		
Course Pre-requisites	Students should have the basic concepts of Quantitative aptitude, Verbal ability along with its applications in real life problems.		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course is designed to enable the students to enhance their skills in quantitative aptitude and verbal ability skills.		
Course Objective	The objective of the course is to familiarize the learners with concepts in Quantitative Aptitude and Verbal ability through problem solving techniques suitable for their career development.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Recall all the basic mathematical concepts [Level - Remember] **CO2**: Identify the principle concept needed in a question [Level – Understand] **CO3:** Solve the quantitative and logical ability questions with the appropriate concept. [Level –Apply]		
Course Content:			
Module 1	Quantitative Ability	Assessment:	20 Sessions
Topics: Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss, Time Speed and Distance, Simple Interest and Compound Interest, Probability, Permutation and Combination.			
Module 2	Verbal Ability	Assessment :	10 Sessions
Topics: Parts of Speech, Subject Verb Agreement, Spotting Error, Cloze Test, Verbal Analogies, Reading Comprehension, Idioms & Phrases, Para Jumbles			
Targeted Applications & Tools:			
Application area	Placement activities and Competitive examinations. Tools: LMS		
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Fast track objective by Rajesh Verma. **T2:** R S Aggarwal **T3:** S. P Bakshi			
References			
E-Resources/Web Resources 1. www.indiabix.com 2. www.testbook.com 3. www.youtube.com/c/TheAptitudeGuy/videos			

Course Code: PPS3018	Course Name: Preparedness for Interview 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.		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course is designed to enable students to understand soft skills concepts to be corporate ready. The modules are set to improve self-confidence, communicate effectively and Prepare for the Interview to assist in employability. It helps the students to get a glimpse of the acceptable corporate readiness and equip them with the fundamental necessities of being able to confidently deal with the highly competitive corporate environment and helps in crafting different types of resumes. The pedagogy used will be group discussions, flipped classrooms, continuous feedback, role-play and mentoring.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Preparing for Interview" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Develop professional Resumes [Level - Apply] **CO2**: Illustrate Resumes effectively [Level – Apply] **CO3:** Apply skills and knowledge learnt for active and effective Group Discussions and Interview [Level – Apply]		
Course Content:			
Module 1	Resume Building	Assessment:	10 Sessions
Topics: Resume structure, use of templates, Do's and Don'ts, ATS methods, Cover Letter and Video Resume Activity: Real world scenarios			
Module 2	Group Discussion	Assessment :	9 Sessions
Topics: Group discussion as a placement process, GD techniques like Keyword. SPELT & POV of affected parties. Do & Don't of GD, Case-lets and topics for GD, practice session and evaluation Activity:- Real world scenarios			
Module 3	Personal Interview	Assessment :	9 Sessions
Topics: Placement process, Different interview rounds, HR interviews, Interview questions and desired answers, Different types of interviews, Do's and Don'ts. Activity: - Role Play & Real-world scenario			
Module 4	Recap/Revision /Feedback Session	Assessment :	2 Sessions
Topics:			
Targeted Applications & Tools:			
TED Talks			
You Tube Links			
Role Play activities			
Skill-Building Activities through Experiential Learning:			
Text Book			
References			
E-Resources/Web Resources			

Course Code: CSS7100	Course Name: Mini Project Type of Course: Project Work (PRW)	L- T-P- C	0-0-0-4
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	Knowledge and Skills related to all the courses studied in previous semesters.		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	Students observe science and technology in action, develop an awareness of the methods of scientific experimentation, and often get opportunities to see, study, and operate sophisticated and costly equipment. They also get opportunities to work with advanced software tools and modern technologies used in industries and research environments. Students use tools and technologies from emerging fields such as Artificial Intelligence (AI), Machine Learning (ML), Cyber Security, Blockchain, and Data Science to develop solutions for real-world and industry-related problems. They also learn about the implementation of management principles taught in the classroom by observing multidisciplinary teams of experts from engineering, science, economics, operations research, and management dealing with techno-economic problems at both micro and macro levels. The course further enables students to develop and refine their language, communication, teamwork, and interpersonal skills through various activities such as seminars, group discussions, project presentations, and report preparation. The broad-based core education, supported by strong foundations in mathematics, science, and analytical tools, provides the necessary background for students to properly understand and solve practical real-life problems. Students have the flexibility to pursue this course either as Project Work and Dissertation within the university, as Project Work in an Industry, Company, or Research Laboratory, or through Internship Programs in industries and organizations.		
Course Objective	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 the course the students shall be able to:** **CO1:** Identify engineering problems related to local, regional, national, and global needs. [Level 2 - Understand] **CO2**: Apply appropriate techniques and modern tools to solve the intended problems. [Level 3 – Apply] **CO3:** Design experiments in accordance with standards and specifications. [Level 4 –Analyze] **CO4:** Interpret events and results to derive meaningful conclusions. [Level 5 – Evaluate] **CO5:** Appraise project findings and communicate effectively through scholarly publications. [Level 6 – Create]		

Course Code: CSS7300	Course Name: Capstone Project Type of Course: Project Work (PRW)	L- T-P- C	0-0-0-10
Version No.	1.0		
NCrF Level-	5.0		

Course Pre-requisites	Knowledge and skills related to all courses studied in previous semesters
Co-requisites	NIL
Anti-requisites	NIL
Course Description	Students learn by observing science and technology in real-life applications and gain knowledge through practical experimentation and hands-on activities. They get opportunities to study and work with advanced equipment, software tools, and modern technologies. Students use tools and technologies from emerging fields such as Artificial Intelligence (AI), Machine Learning (ML), Cyber Security, Blockchain, and Data Science to develop solutions for real-world and industry-related problems. The course helps students understand how engineering, science, economics, operations research, and management work together to solve technical and business-related challenges. By working on projects, seminars, group discussions, and report preparation, students improve their communication, teamwork, presentation, and interpersonal skills. The strong foundation in mathematics, science, and analytical thinking helps students understand and solve practical problems effectively. Students can complete the course through Project Work and Dissertation within the university, by doing projects in industries or research laboratories, or through internship programs in companies and organizations.
Course Objective	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 the course the students shall be able to:** **CO1:** Identify engineering problems at various societal levels. [Level 2 - Understand] **CO2**: Apply tools and techniques for problem solving. [Level 3 – Apply] **CO3:** Design and plan experiments as per industry standards. [Level 3 – Apply] **CO4:** Interpret the events and results for meaningful conclusions. [Level 5 – Evaluate] **CO5:** Appraise project findings and communicate effectively through scholarly publications [Level 6 – Create]

Discipline Electives:

Course Code: CCS2510	Course Name: Security Assessment and Testing Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1.0		
Course Pre-requisites	CSS2251		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The purpose of this course is to introduce you to the field of penetration testing and its associated tools. It aims to provide exposure to the Metasploit exploitation tool, Linux exploits, and Windows exploits. Additionally, it focuses on building knowledge of web application security vulnerabilities, vulnerability analysis, and malware analysis.		

Course Objective	The objective of the course is to familiarize the learners with the concepts of **Security Assessment and Testing** and attain **Skill Development** through **Experiential Learning** techniques.
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain ethical and legal aspects of ethical hacking. [Level2- Understanding] **CO2**: Apply automated penetration testing techniques for attack simulation. [Level 3 – Apply] **CO3:** Demonstrate penetration testing processes and exploit techniques. [Level 3 – Apply] **CO4:** Analyze web application vulnerabilities for security assessment. [Level4– Analyze] **CO5:** Analyze penetration testing findings to generate security reports. [Level4– Analyze]

Course Content:

Module 1	Introduction	Assessment: Comprehension based Quiz on web fundamentals	10 Sessions

Topics:

Introduction to Ethics of Ethical Hacking: Why You Need to Understand Your Enemy's Tactics, Recognizing the Gray Areas in Security, Vulnerability Assessment and Penetration Testing. **Penetration Testing and Tools: Social Engineering Attacks:** How a Social Engineering Attack Works, Conducting a Social Engineering Attack, Common Attacks Used in Penetration Testing, Preparing Yourself for Face-to-Face Attacks, Defending Against Social Engineering Attacks.

Module 2	Physical Penetration Attacks	Assessment : Comprehensive based assignment on Web authentication	8 Sessions

Topics:

Physical Penetration Attacks: Need of Physical Penetration, Conducting a Physical Penetration, Common Ways into a Building, Defending Against Physical Penetrations.
Insider Attacks: Conducting an Insider Attack, Defending Against Insider Attacks.
Metasploit: The Big Picture, Getting Metasploit, Using the Metasploit Console to Launch Exploits, Exploiting Client-Side Vulnerabilities with Metasploit, Penetration Testing with Metasploit's Meterpreter, Automating and Scripting Metasploit, Going Further with Metasploit.

Module 3	Web Application Security Vulnerabilities	Assessment : Comprehension based Quiz on web security techniques.	6 Sessions

Topics:

Web Application Security Vulnerabilities: Overview of Top Web Application Security Vulnerabilities, Injection Vulnerabilities, Cross-Site Scripting Vulnerabilities, The Rest of the OWASP Top Ten, SQL Injection Vulnerabilities.

Module 4	Malware Analysis	Assessment : Comprehension based assignment on web vulnerabilities	6 Sessions

Topics:

Client-Side Browser Exploits: Why Client-Side Vulnerabilities are Interesting, Internet Explorer Security Concepts, History of Client- Side Exploits and Latest Trends, Finding New Browser-Based Vulnerabilities, Heap Spray to Exploit, Protecting Yourself from Client-Side Exploit.
Malware Analysis: Collecting Malware and Initial Analysis: Malware, Latest Trends in Honeynet Technology, Catching Malware: Setting the Trap, Initial Analysis of Malware

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

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Text Book

T1 : Gray Hat Hacking - The Ethical Hackers Handbook, Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and

Terron Williams, 5th Edition, Tata McGraw-Hill, 2018.
References **R1.** The Web Application Hacker's Hand Book - Discovering and Exploiting Security flaws, Dafydd Suttard, Marcuspinto,2nd Edition, Wiley Publishing, 2011. **R2.** Penetration Testing: Hands-on Introduction to Hacking, Georgia Weidman, 1st Edition, Notarch Press, 2014. **R3.** The Pen Tester Blueprint - Starting a Career as an Ethical Hacker, L. Wylie, Kim Crawly,1st Edition, Wiley Publications, 2021.
E-Resources/Web Resources NPTEL / Swayam Link : Introduction to Information Security I,IIT Madras : https://nptel.ac.in/courses/106106129 PU Library Link :https://puniversity.informaticsglobal.com/login

Course Code: CCS3403	Course Name: AI and ML for Cyber Security Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2264		
Co-requisites	NIL		
Anti-requisites	CSEXXXX		
Course Description	This course provides an in-depth exploration of how Artificial Intelligence (AI) and Machine Learning (ML) techniques are applied to modern cybersecurity challenges. Students will learn about various cyber threats, attack classifications, and vulnerabilities while developing hands-on experience with ML-based threat detection and anomaly detection. The course covers supervised and unsupervised learning techniques for malware classification, time-series analysis for behavior monitoring, deep learning models for intrusion detection, and adversarial AI threats. Through case studies, research paper discussions, and practical implementations, learners will develop a solid foundation in AI-powered cybersecurity solutions.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of machine learning in cybersecurity, malware classification, anomaly detection, intrusion detection systems, and adversarial machine learning, and to attain employability through participative learning techniques.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the fundamentals of machine learning concepts in cybersecurity, including types of threats, attacks, vulnerabilities, and malware. [Level 2 -Understand] **CO2:** Describe adversarial attacks on machine learning systems, including model poisoning, black-box, and white-box attacks [Level 2 -Understand] **CO3:** Apply supervised and unsupervised learning techniques to classify malware using signature-based and behavioral data. [Level 3 -Apply] **CO4:** Implement anomaly detection and ensemble learning methods to identify deviations and intrusions in network systems. [Level 3 -Apply] **CO5:** Use deep learning techniques and security tools to develop intrusion detection systems and analyze cybersecurity threats. [Level 3 -Apply]		

Course Content:

Module 1		Assessment: Theory	10 Sessions

Topics:

Overview of cybersecurity, threats, attacks, vulnerabilities, malware, trojans, introduction to machine learning, supervised learning, unsupervised learning, reinforcement learning, data preprocessing, feature engineering, classification, clustering, regression, security datasets, intrusion detection, malware detection, phishing detection, imbalanced data, concept drift

Module 2		Assessment : Programming Activity	12 Sessions

Topics:

Types of malware, static analysis, dynamic analysis, signature-based detection, behavior-based detection, feature extraction, decision trees, random forest, support vector machines, K-means clustering, DBSCAN, model training, model validation, accuracy, precision, recall, F1-score, context-based detection, imbalanced datasets, hybrid detection

Module 3		Assessment : Programming Activity	12 Sessions

Topics:

Anomaly detection, statistical methods, time series analysis, behavioral analysis, deviation detection, ensemble learning, bagging, boosting, stacking, reconnaissance detection, intrusion detection systems, network traffic analysis, Wireshark, artificial neural networks, convolutional neural networks, recurrent neural networks, IDS design, IDS implementation

Module 4		Assessment : Programming Activity	11 Sessions

Topics:

Adversarial machine learning, evasion attacks, poisoning attacks, black-box attacks, white-box attacks, threat models, attack lifecycle, adversarial training, secure model design, mitigation strategies, phishing detection using NLP, fake news detection, social engineering detection, deep learning in cybersecurity, research trends

Targeted Applications & Tools:

Microsoft PowerPoint	Used for preparing and presenting lecture slides effectively for teaching and demonstrations.
Jupyter Notebook	Interactive environment used for coding, data analysis, visualization, and executing Python programs.
Scikit-Learn	Machine learning library used for implementing classification algorithms and anomaly detection techniques.
Wireshark	Network protocol analyzer used for network traffic analysis, packet inspection, and troubleshooting.

Project work/Assignment:

Assignment:

AI-Based Intrusion Detection System (IDS).

Phishing URL & Email Detection Using NLP.

AI-Powered Fake News & Social Engineering Detection.

Text Books:

T1. S. Halder and S. Ozdemir, Hands-On Machine Learning for Cybersecurity: Safeguard Your System by Making Your Machines Intelligent Using the Python Ecosystem, 1st ed. Packt Publishing, 2018 ISBN139781788992282

References

R1. Machine Learning and Security by David Freeman, Clarence Chio Publisher: O'Reilly Media, Inc. Release Date: February 2018 ISBN: 9781491979891

R2. Malware Data Science by Joshua Saxe with Hillary Sanders, ISBN-10: 1-59327-859-4 ISBN-13: 978-1-59327-859-5 Publisher: William Pollock

Course Code: CCS3404	Course Name: Incident Response with Threat Intelligence Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2502		
Co-requisites	NIL		
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 The Hive, 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 the course the students shall be able to:** CO1: Describe incident response concepts, threat intelligence, and cyber-attack techniques. [Level 2 -Understand] CO2: Explain the incident response lifecycle and TTPs. [Level 2 -Understand] CO3: Investigate and respond to cybersecurity incidents using appropriate tools. [Level 3 -Apply] CO4: Document cybersecurity incidents using standard procedures and frameworks. [Level 3 -Apply]		
Course Content:			
Module 1	Foundations of Incident Response and Threat Landscape	Assessment:	15 Sessions
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	Assessment :	13 Sessions
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	Assessment :	15 Sessions
Topics:			

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 Books: T1. Roberto Martínez, Incident Response with Threat Intelligence: A practical guide to catching attackers and defending your organization, Packt Publishing, 2022.
References 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.
E-Resources/Web Resources 1.https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii 2. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live
Topics 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: CCS3406	Course Name: Cyber Digital Twin Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2502		
Co-requisites	Nil		
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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe fundamentals, architecture, and components of digital twin technology. [Level 2 - Understand] **CO2**: Explain data modeling environments and development considerations for digital twins [Level 2 – Understand] **CO3:** Apply digital twin technologies with IoT, cloud, and simulation techniques. [Level 3 – Apply] **CO4:** Analyze optimization techniques and cybersecurity aspects in digital twin systems. [Level 4 – Analyse] **CO5:** Analyze risk management strategies and applications of digital twins across industries. [Level 4 – Analyse]

Course Content:

Module 1	Introduction	Assessment : Assignment	11 Sessions

Topics:

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	Assessment : Assignment	10 Sessions

Topics:

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	Assessment : Assignment	12 Sessions

Topics:

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	Assessment : Assignment	12 Sessions

Topics:

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 Applications & Tools:

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.

Skill-Building Activities through Experiential Learning:

Text Book

T1: 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.

T2: 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
R1: Michael E. AuerKalyan Ram B. Digital," Cyber-physical System and Digital Twins - Part of the Lecture Notes in Networks and Systems book series". **R2:** Nassim Khaed, Bibin Pattel and Affan Siddiqui," Development and Deployment on the Cloud", Elsevier, 2020
E-Resources/Web Resources
1.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 2. https://www.udemy.com/course/digital-twin-a-comprehensive-overview/

Course Code: CCS3408	Course Name: Privacy and Security in Online Social Media Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2502		
Co-requisites	Nil		
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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain key privacy threats, data vulnerabilities, and user-related issues in online social media platforms [Level 2 - Understand] **CO2**: Describe cryptographic techniques, decentralized architectures, and anonymity models used in social networks [Level 2 – Understand] **CO3:** Apply anonymity models and privacy-preserving techniques to evaluate protection mechanisms in social networks [Level 3 – Apply] **CO4:** Implement link prediction, feature extraction, and de-anonymization techniques to analyze social network data [Level 3 – Apply] **CO5:** Use countermeasures and security strategies to mitigate threats such as misinformation, deepfakes, and privacy attacks in online social media [Level 3 – Apply]		
Course Content:			
Module 1	Analysis of Privacy In Social Network	Assessment: Assignment	8 Sessions
Topics: Introduction to privacy in online social networks, three-layered framework for analyzing social web privacy, characteristics used to analyze privacy in social media, privacy issues related to social web users, privacy concerns associated with service providers, security and privacy challenges in digital identities, identifiable facets and private facets, privacy risk assessment in social platforms, real-world case studies on			

privacy breaches			
Module 2	Encryption For Peer - to - Peer Social Networks	Assessment : Assignment	8 Sessions
Topics: Overview of peer-to-peer (P2P) social networks, essential criteria for secure P2P encryption systems, architectures of existing P2P online social networks, evaluation of encryption schemes based on performance and security criteria, broadcast encryption techniques, predicate encryption mechanisms, secure data sharing in decentralized social networks, challenges in implementing encryption in OSNs			
Module 3	Stealing Reality And K- Anonymity	Assessment : Quiz	11 Sessions
Topics: Stealing reality attacks and their implications, social attack models and threat scenarios, social learnability concepts, k-anonymity and its variants (k-degree anonymity, k-neighborhood anonymity), graph-based anonymity techniques (k-automorphism, k-isomorphism), l-diversity and privacy guarantees, attack models on anonymized data, insights from ℓ-diversified graphs, evaluation of anonymity effectiveness in social networks			
Module 4	Privacy In Social Networks- Links Reconstruction Attack	Assessment : Assignment / Case study	11 Sessions
Topics: Privacy issues in social networks, link prediction and reconstruction attacks, feature extraction techniques for social network analysis, community-based datasets, anonymity in electronic currencies, Bitcoin system overview, transaction network and user network analysis, anonymity analysis in cryptocurrency systems, integration of off-network information, privacy-preserving record linkage techniques, threat models and real-world use cases, traffic analysis including TCP/IP layer information, context discovery, flow and temporal analysis			
Targeted Applications & Tools:			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Yaniv Altshuler, Yuval Elovici, Armin B. Cremers Nadav Aharony, Alex Pentland," Security and Privacy in Social Networks", Springer Publisher,2012,1st Edition			
References			
E-Resources/Web Resources 1.https://presiuniv.knimbus.com/user#/searchresult?searchId=Privacy%20and%20Security%20in%20Online%20Social%20Media%20&curPage=0&layout=list&sortFieldId=none&topresult=false 2. https://onlinecourses.nptel.ac.in/noc21_cs28/preview			

Course Code: CCS3409	Course Name: Machine Learning for Cyber Security Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2264		
Co-requisites			
Anti-requisites	Nil		
Course Description	Advancements in Artificial Intelligence (AI) and Machine Learning (ML) have allowed for a surge in adoption of AI & ML solutions to address problems across numerous domains. With this rising reliance on AI & ML in many organizations, it is critical that such systems are protected from malicious activities. This course will discuss AI & ML cybersecurity issues, explore case studies of AI & ML cyber incidents, present AI & ML adversarial techniques, and demonstrate secure design approaches to protect AI & ML systems. With an emphasis on machine learning, the course will focus on secure machine learning systems development approaches and secure machine learning operations (MLOps). Students are expected to have knowledge of fundamental statistics and the ability to program in Python.		
Course Objective			
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain machine learning concepts and their relevance to cybersecurity applications. [Level 2 - Understand] **CO2**: Apply statistical techniques to analyze cybersecurity datasets [Level 3 – Apply] **CO3:** Analyze supervised and unsupervised models for cyber threat detection. [Level 4 – Analyze] **CO4:** Analyze ML-based techniques for detecting spam, phishing, intrusion, and fraud. [Level 4 – Analyze] **CO5:** Apply machine learning algorithms to develop models for malware and phishing detection. [Level 3 – Apply]		
Course Content:			
Module 1	Introduction to cyber security and Machine Learning	Assessment: Assignment	8 Sessions
Topics: Overview of Cybersecurity, Role of Machine Learning in Security, Types of Cyber Threats, ML based security solutions			
Module 2	Foundations of Statistical Analysis: Probability, Estimation, Testing, and Regression	Assessment : Assignment	12 Sessions
Topics: Binomial, Poisson, Normal, Exponential, other distributions , Sampling, Estimation, Hypothesis testing, Uni- and multi-variate regression, logistic regression			
Module 3	ML Fundamentals	Assessment : Assignment	12 Sessions
Topics: Supervised Learning : Linear Classifiers, Decision Trees, Ensemble Learning, Random Forest; Unsupervised Learning: Clustering, Manifold Discovery, Diffusion map, Dimensionality reduction spectral embedding			

Module 4	Detecting spam/phishing, intrusion, fraud, DDoS attacks, malware analysis.	Assessment : Assignment	10 Sessions

Topics:

Spam/Phishing Detection : Training Models and Measuring Efficacy; Intrusion Detection: Network Intrusion Detection ; Fraud Detection: Machine Learning Models for Outlier detection; DDoS Detection: Models with Statistical regression combined with distance metric Anomaly detection, outliers; Malware Analysis; Static and Dynamic Analysis.

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

Text Book

T1: Machine Learning and Security: Clarence Chio, David Freeman O'Reilly Media (2018)

T2:"Machine Learning and Cybersecurity: Principles, Algorithms, and Applications" by Siddharth Bhatia and Himanshu Gupta(1st edition 2019).
T3: "An Introduction to Statistical Learning" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani is available in the (2nd edition, 2022)

References

R1: "Hands-On Unsupervised Learning using Python" by Ankur A. Patel.

R2: "Supervised Machine Learning: A Review of Classification Techniques" by S. S. Salankar and M. S. Gaikwad.
R3: "Pattern Recognition and Machine Learning" by Christopher M. Bishop

E-Resources/Web Resources

1. https://www.journals.elsevier.com/journal-of-information-security-and-applications/forthcoming-special-issues/machine-learning-techniques-for-cyber-security- challenges-and-future-trends.
2. International Journal of Machine Learning and Cybernetics: https://link.springer.com/journal/13042.
3. Machine Learning and Deep Learning Approaches for CyberSecurity: A Review: https://ieeexplore.ieee.org/document/9712274

Course Code: CCS3411	Course Name: Security Information and Event Management (SIEM) Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	2.0		
NCrF Level-	5.5		
Course Pre-requisites	CSE2502		
Co-requisites	Nil		
Anti-requisites	Nil		

Course Description	This course offers a practical and contemporary understanding of Security Information and Event Management (SIEM), emphasizing real-time threat detection, log correlation, SOC operations, and incident response. It integrates modern tools like Splunk, QRadar, and Azure Sentinel, with hands-on exposure to MITRE ATT&CK, threat intelligence, and cloud-native SIEM strategies.		
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 the course the students shall be able to:** **CO1:** Describe SIEM fundamentals, threat intelligence, and compliance requirements. [Level 2 - Understand] **CO2**: Explain SIEM architecture, components, and incident response processes. [Level 2– Understand] **CO3:** Implement SIEM tools for monitoring and threat detection. [Level 3 – Apply] **CO4:** Examine SIEM platforms and query techniques for security analytics. [Level 4 – Analyse] **CO5:** Evaluate SIEM integration and dashboard development for SOC operations. [Level 4 – Analyse]		
Course Content:			
Module 1	Introduction to SIEM: Threat Intelligence for IT Systems	Assessment: Quiz / Conceptual Case Study etc	13 Sessions
Topics: Introduction to SIEM: Threat Intelligence for IT Systems - Business Models - Threat Models - Regulatory Compliance			
Module 2	IT Threat Intelligence Using SIEM Systems	Assessment : Quiz / Conceptual Case Study etc	10 Sessions
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	Assessment : Quiz / Conceptual Case Study etc	10 Sessions
Topics: AlienVault OSSIM Implementation - AlienVault OSSIM Operation - Cisco Security: MARS Implementation - Cisco MARS Advanced Techniques			
Module 4	Tools & Ecosystem Integration	Assessment : Quiz / Conceptual Case Study etc	12 Sessions
Topics: Comparative overview of major SIEM tools: Splunk, QRadar, Elastic SIEM - SIEM query languages: SPL (Splunk), Lucene (Elastic), AQL (QRadar) - Integration with asset inventory, AD, vulnerability scanners - Dashboards, visualizations, and alert prioritization Use-case: Creating KPI dashboard for SOC - Lab Task: Configure Kerberos-based authentication logging in SIEM			
Targeted Applications & Tools:			
Syslog, Winlogbeat, Filebeat, Logstash, Elastic Agent	Configure a log ingestion pipeline to collect and normalize events from endpoints, firewalls, and servers		

Splunk, QRadar, Sigma Rules, MITRE ATT&CK Navigator	Detect lateral movement and privilege escalation attempts using real-time correlation rules

Skill-Building Activities through Experiential Learning:

- Log Collection & Parsing Simulation
  Participants simulate log ingestion from various sources like firewalls, Windows event logs, and Linux syslogs using a virtualized environment. They will then parse and normalize these logs using tools like Logstash or Fluentd, preparing them for SIEM ingestion.

- Real-Time Alert Generation & Rule Tuning
  Using Splunk or QRadar, learners create basic detection rules (e.g., failed login attempts, port scans). They test the alerts, tune false positives, and refine correlation logic to improve detection accuracy.

- Compliance Dashboard Design
  Design and deploy a SIEM dashboard for compliance monitoring (e.g., GDPR or HIPAA). Use sample logs andmetrics (e.g., access logs, login time, data access patterns) to visualize compliance KPIs.

Text Book

T1: Security Information and Event Management (SIEM) Implementation by David R. Miller, Shon Harris, Allen Harper, Stephen VanDyke, and Chris Blask, McGrawHill.

T2: Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2015.

References

R1: Joseph Muniz, Security Information and Event Management (SIEM) Fundamentals, Cisco Press.

R2: Matthew Hubbard, The Security Analyst's Guide to SIEM, Apress.

E-Resources/Web Resources

1.https://www.ibm.com/think/topics/siem

2.https://www.coursera.org/articles/siem

3.https://aws.amazon.com/marketplace/solutions/security/siem

Course Code: CCS3412	Course Name: Blockchain Security Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSS2502		
Co-requisites	NIL		
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 the course the students shall be able to: **CO1:** Explain fundamental concepts of blockchain technology, including decentralization and types of blockchains. [Level 2-Understand] **CO2:** Describe cryptographic techniques such as symmetric cryptography, hash functions, and public key cryptography used in blockchain systems. [Level 2-Understand] **CO3:** Apply the structure and work of Bitcoin, including digital keys, transactions, blockchain architecture, and network operations. [Level 3 – Apply] **CO4:** Analyze blockchain security threats such as 51% attacks, Sybil attacks, and private key vulnerabilities. [Level 3 – Apply] **CO5:** Analyze security mechanisms and best practices used to protect blockchain systems, smart contracts, and decentralized applications [Level 4 – Analyze]

Course Content:

Module 1	Introduction to Blockchain	Assessment:	15 Sessions

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	Assessment:	13 Sessions

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	Introduction to Bitcoin	Assessment:	15 Sessions

Topics:

Introducing Bitcoin - Digital keys and addresses – Blockchain - Bitcoin Network and Payments - Bitcoin Clients and APIs - Alternative Coins.

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

Text Book

T1: Imran Bashir, Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, Packt Publishing, 4th Edition, 2023.

References

R1: Andreas M. Antonopoulos and Gavin Wood, Mastering Ethereum: Building Smart Contracts and D Apps, O'Reilly Media, 2018.

R2: Joseph Bonneau, Andrew Miller, Jeremy Clark, Arvind Narayanan, Joshua Kroll, and Edward Felten, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.

R3: Narayan Prusty, Blockchain for Enterprise: Build Scalable Blockchain Applications with Privacy, Interoperability, and Permissioned Features, Packt Publishing, 2021.

E-Resources/Web Resources

1. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-

live&ebv=EB&ppid=pp_xiii 2. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live

Course Code: CCS3407	Course Name: Quantum Cryptography Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2502		
Co-requisites			
Anti-requisites	Nil		
Course Description	This course offers a well-rounded exploration of theoretical concepts, practical applications, and security considerations in the field of quantum information theory and quantum communication. It covers topics from the basics of quantum information to the implementation of secure quantum-cryptographic networks in real-life scenarios.		
Course Objective			
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Understand the fundamentals of quantum information theory, entropy, and quantum channels in secure communication. [Level 2 - Understand] **CO2**: Understand the principles of quantum key distribution (QKD) and the working of adaptive cascade protocols. [Level 2 – Understand] **CO3:** Apply QKD concepts such as gain, public channel usage, and finite resources to evaluate secure key generation. [Level 3 – Apply] **CO4:** Apply adaptive cascade protocols and block-size selection techniques to perform error correction in QKD systems. [Level 3 – Apply] **CO5:** Apply knowledge of attack strategies, statistical analysis, and quantum cryptographic network models to assess and design secure QKD-based communication systems. [Level 3 – Apply]		
Course Content:			
Module 1	Advancements in Quantum Secure Communication	Assessment: Assignment	12 Sessions
Topics: Quantum Information Theory, Unconditional Secure Authentication, Entropy, Quantum Key Distribution, Quantum Channel, Public Channel, QKD Gain, Finite Resources			
Module 2	Adaptive Cascade Protocols	Assessment : Assignment	12 Sessions
Topics: Adaptive Cascade Introduction, Error Correction and the Cascade Protocol, Adaptive Initial Block-Size Selection, Fixed Initial Block-Size, Dynamic Initial Block-Size, Examples			
Module 3	Security Challenges in Quantum Key Distribution (QKD)	Assessment : Assignment	12 Sessions

	Protocols		
Topics: Attack Strategies on QKD Protocols: Introduction, Attack Strategies in an Ideal Environment, Individual Attacks in an Realistic Environment QKD Systems: Introduction, QKD Systems. Statistical Analysis of QKD Networks in Real-Life Environment: Statistical Methods, Statistical Analysis QKD Networks Based on Q3P: QKD Networks, PPP, Q3P, Routing, Transport			
Module 4	Advancing Quantum Cryptographic Networks	Assessment : Assignment	9 Sessions
Topics: Quantum-Cryptographic Networks from a Prototype to the Citizen: The SECOQC Project, How to Bring QKD into the "Real" Life The Ring of Trust Model: Introduction, Model of the Point of Trust, Communication in the Point of Trust Model, Exemplified Communications, A Medical Information System Based on the Ring of Trust.			
Targeted Applications & Tools:			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Kollmitzer C., Pivk M. (Eds.), Applied Quantum Cryptography, Lect. Notes Phys. 797 (Springer, Berlin Heidelberg 2010).			
References **R1:** Gerald B. Gilbert, Michael Hamrick, and Yaakov S. Weinstein, Quantum Cryptography, World Scientific Publishing. **R2:** Gilles Van Assche, Quantum Cryptography and Secret-Key Distillation, Cambridge University Press.			
E-Resources/Web Resources 1. "Terahertz Quantum Cryptography": https://ieeexplore.ieee.org/document/8976167 2. Introduction Post-Quantum' Cryptography Scheme Is Cracked on a Laptop: https://onlinecourses.nptel.ac.in/noc23_cs127/preview, Offers an overview of security concepts relevant to AI and CI applications. 3. Quantum Computing:https://www.mooc-list.com/tags/quantum-computing . 4. Quantum Cryptography:https://www.mooc-list.com/tags/quantum-cryptography			

Course Code: CCS3410	Course Name: Digital Watermarking and Steganography Type of Course: Theory Course	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		
Co-requisites			
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 Objective	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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe digital watermarking fundamentals, classification, and applications. [Level 2 - Understand] **CO2**: Implement spatial domain watermarking techniques. [Level 3 – Apply] **CO3:** Utilize frequency domain watermarking techniques. [Level 3 – Apply] **CO4:** Examine steganography principles and compare with watermarking [Level 4 – Analyze] **CO5:** Embed secret data using steganographic techniques. [Level 3 – Apply]

Course Content:

Module 1	Introduction to digital watermarking	Assessment: Assignment	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	Assessment : Assignment	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	Assessment : Assignment)	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,).Hands-on: Implement ensemble models and compare performance

Module 4	Techniques of Steganography	Assessment : Assignment	7 Sessions

Topics:

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.

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

Text Book **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.
E-Resources/Web Resources 1. Digital Watermarking | ScienceDirect (informaticsglobal.com) 2. Digital Watermarking and Steganography | ScienceDirect (informaticsglobal.com)

Course Code: CCS3400	Course Name: Digital and Mobile Forensics Type of Course: Theory Course	L- T-P- C	2-0-2-3
Version No.	2.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2251		
Co-requisites	NIL		
Anti-requisites	CSEXXXX		
Course Description	As the global reliance on mobile devices and wireless technologies accelerates, these systems have become prime targets for security breaches and critical repositories of digital evidence. This course explores the foundational principles and advanced methodologies of digital and mobile forensics used in modern investigations. Students will gain a comprehensive understanding of how to legally and securely identify, acquire, analyze, and report on digital artifacts. The curriculum covers the entire investigative lifecycle, including digital examination processes, cryptographic validation of evidence, wireless network vulnerabilities, GSM interception, and the systematic extraction of data from mobile device memory, SIM cards, and applications.		
Course Objective	The objective of this course is to equip learners with the foundational principles and practical techniques of digital and mobile forensics. Students will develop the technical and analytical skills required to securely acquire, preserve, and analyse digital evidence from computers, wireless networks, and mobile devices while maintaining legal and investigative integrity.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain cybercrime investigation principles and forensic process models. [Level 2 -Understand] **CO2**: Apply forensic protocols for securing digital evidence. [Level 3 -Apply] **CO3:** Analyze wireless communication vulnerabilities and threats. [Level 3 -Apply] **CO4:** Utilize mobile forensic techniques for artifact extraction and analysis. [Level 3 -Apply] **CO5:** Evaluate digital forensic reports based on analyzed evidence. [Level 4 -Analyze]		

Course Content:			
Module 1	Cybercrime and Digital Forensic Principles	Assessment: Assignment, Seminar	10 Sessions
Topics: Introduction to Cybercrime: Definition, nature, and scope. Categories and types of cybercrimes, including case studies on modern digital crimes. The Digital Society: Digital devices in society and the evidential potential of open versus closed systems. Foundations of Digital Forensics: Overview and phases of digital forensics. Investigating cybercrime and preventing digital offenses. Digital Investigation Process Models: Comparative analysis of the Staircase Model, Evidence Flow Model, and a developmental model of digital systems.			
Module 2	Digital Forensics examination process	Assessment : Case Studies, Case Studies	11 Sessions
Topics: Preparation and Seizure: Preparing a Digital Forensics Investigation, evidence locations, handling device usage, and avoiding contamination. Forensic Examination Principles: The core processes of previewing, forensic imaging, maintaining chain of custody, and cryptographic hashing (e.g., SHA-256 validation) for evidence continuity. Analysis Challenges: Profiling, cyber-writing, and detecting hidden data or manipulated files. The Seven-Element Security Model. Documentation and Presentation: The language of computer crime investigation, drafting formal investigation reports, and presenting digital evidence.			
Module 3	Wireless technologies and Wireless threats	Assessment : Practical, Quiz	12 Sessions
Topics: Modern Wireless Technology: Overview of wireless networks, protocols, and wireless crime prevention techniques. Wi-Fi Vulnerabilities: Wireless threats including War-Driving, War-Chalking, and War-Flying. Cellular Network Interception: GSM architecture, Voice SMS vulnerabilities, and identification data interception in GSM networks. Network-Level Mobile Threats: Cell phone hacking, phreaking, tracking methodologies, and the mechanics of cellular fraud.			
Module 4	Mobile phone Forensics	Assessment : Quiz, Forensic Tools	10 Sessions
Topics: Introduction to Mobile Forensics: The importance and motivation behind mobile forensics, crime involving mobile phones, and general handling instructions. Forensic Rules and Procedures: Standard forensic procedures for cellular phones, including flowchart processes using forensic platforms. Data Extraction Targets: The SIM Card (files present and architecture), device memory dumps, SMS spam, and understanding what data is natively available. Advanced Mobile Artifacts: Analyzing mobile phone databases (SQLite), utilizing specific mobile phone forensic tools and methods, and conducting social media forensics on mobile devices.			

Targeted Applications & Tools:	
Python (Hashlib)	Core programming language and libraries used for data manipulation, cleaning, and preprocessing throughout the course.
FTK Imager	A digital forensics tool used to create forensic disk images and preview data without altering the original evidence.
Autopsy / The Sleuth Kit	Open-source digital forensic tools used to analyze disk images, recover files, and investigate system activity.
Wireshark	A network packet analyzer used to capture and inspect network traffic for troubleshooting and forensic investigations.
Aircrack-ng	A suite of tools for assessing Wi-Fi security, including packet capture, monitoring, and password auditing.
DB Browser for SQLite	A lightweight graphical tool used to view, edit, and analyze SQLite database files.
Paraben's E3	A comprehensive forensic platform for acquiring and analyzing evidence from computers, mobile devices, and cloud sources.
MOBILedit Forensic	A forensic tool used to extract, analyze, and report data from mobile devices and SIM

	cards.
Santoku Linux	A Linux distribution designed for mobile forensics, malware analysis, and security testing.

Text Books:

T1. Richard Boddington, Practical Digital Forensics, Packt Publishers, May 2016.

T2. Andre Arnes, Digital Forensics, John Wiley& Sons Ltd, 2018.

T3. 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.
R4. R.C. Joshi, Emmanuel S. Pilli, "Fundamentals of Network Forensics: A Research Perspective", 1st Edition, Springer, 2016.
R5. Marjie T. Britz, "Computer Forensics and Cyber Crime": An Introduction" 3rd Edition, Prentice Hall, 2013

E-Resources/Web Resources

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

2. https://www.youtube.com/watch?v=giv0DQDSsjQ

3. https://www.eccouncil.org/train-certify/digital-forensics-essentials-dfe/

Course Code: CCS3416	Course Name: Cryptocurrency Technologies Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE3078		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	The course is designed to provide an introductory understanding of decentralized digital currencies (cryptocurrencies) such as bitcoin, a basic understanding of its underlying technology 'Blockchain' and why this new and innovative technology is so important, since it has the potential to disrupt a number of industries in the immediate near future. In particular, the course will survey the theory and principles by which cryptocurrencies operate, practical examples of basic cryptocurrency transactions, the likely interaction of cryptocurrencies with the banking, financial, legal and regulatory systems, and how cryptocurrencies could be viewed within a framework of innovation and development.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cryptocurrency Technology and attain Employability through Participative Learning techniques.		

Course Outcomes	On successful completion of the course the students shall be able to: **CO1**: Understand the fundamentals of cryptography, digital signatures, cryptographic hash functions, and cryptographic data structures such as blockchain and Merkle trees. [Level 2-Understand] **CO2:** Understand the working principles of Bitcoin protocol, distributed consensus, mining mechanisms, and anonymity techniques in cryptocurrencies. [Level 2-Understand] **CO3:** Apply cryptographic techniques and data structures to analyze secure and tamper-resistant digital transaction systems. [Level 3-Apply] **CO4:** Implement concepts of Bitcoin engineering, key management, and anonymity mechanisms to evaluate security and privacy in cryptocurrency systems. [Level 3 – Apply] **CO5:** Use cryptocurrency technologies such as smart contracts, micropayments, escrow, and decentralized applications to design real-world blockchain-based solutions. [Level 3 – Apply]		
Course Content:			
Module 1	Introduction to Cryptography	Assessment: Assignment	8 Sessions
Topics: Cryptography, Digital Signatures, Cryptographic Hash Functions. Cryptographic Data Structures: Hash Pointers, Append-Only Ledgers (BlockChains), Merkle Trees.			
Module 2	Bitcoin's Protocol	Assessment: Assignment	10 Sessions
Topics: Bitcoin's Protocol Keys as Identities, Simple Cryptocurrencies, Decentralization through Distributed Consensus, Incentives, Proof of Work (Mining), Application-Specific Integrated Circuit (ASIC) Mining and ASIC-resistant Mining, Virtual Mining (Peer coin).			
Module 3	Bitcoin Engineering	Assessment: Quiz	10 Sessions
Topics: Engineering Details, Bitcoin Blocks, Hot and Cold Storage, Splitting and Sharing Keys, Proof of Reserve Proof of Liabilities. Anonymity, Pseudonymity, Unlinkability: Statistical Attacks (Transaction Graph Analysis), Network-layer De-anonymization, Chaum's Blind Signatures, Single Mix and Mix Chains, Decentralized Mixing, Zero-Knowledge Proof Cryptocurrencies.			
Module 4	Cryptocurrency Technologies	Assessment: Quiz	10 Sessions
Topics: Cryptocurrency Technologies, Smart Property, Efficient micro-payments, Coupling Transactions and Payment (Interdependent Transactions,) Public Randomness Source, Prediction Markets, Escrow transactions, Green addresses, Auctions and Markets, Multi-party Lotteries.			
Targeted Applications & Tools: A cryptocurrency is a digital or virtual currency, it is secured by cryptography which makes it impossible to simulate or double-spend. Many cryptocurrencies are decentralized networks based on blockchain technology. Cryptocurrency caters to the promise of making the easier transaction of funds directly between two groups or parties without the need for any third party like bank or credit card company. Applications are Money transfer, Smart contracts, Internet of Things (IoT), Personal identity security, Healthcare, Logistics. **Tools:** Messari, Glass node, Lunar Crush, Coin Metrics, Coin Market Cal.			
Skill-Building Activities through Experiential Learning:			

Text Book **T1:** Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. **T2:** Schar, Fabian, and Aleksander Berentsen. Bitcoin, Blockchain, and Cryptoassets: A Comprehensive Introduction. MIT press, 2020. **T3:** Karame, Ghassan O., and Elli Androulaki. Bitcoin and blockchain security. Artech House, 2016.
References **R1:** Antonopoulos, Andreas M., and Gavin Wood. Mastering ethereum: building smart contracts and dapps. O'reilly Media, 2018. **R2:** Antonopoulos, Andreas M. Mastering Bitcoin: unlocking digital cryptocurrencies. " O'Reilly Media, Inc.", 2014. **R3:** Day, Mark Stuart. Bits to bitcoin: how our digital stuff works. MIT Press, 2018.
E-Resources/Web Resources: 1. http://fincen.gov/statutes_regs/guidance/html/FIN-2013-G001.html 2. http://www.scribd.com/doc/212058352/Bit-Coin 3. http://www.usv.com/posts/bitcoin-as-protocol 4. http://startupboy.com/2013/11/07/bitcoin-the-internet-of-money/ 5. http://startupboy.com/2014/03/09/the-bitcoin-model-for-crowdfunding/ 6. http://www.hmrc.gov.uk/briefs/vat/brief0914.html

Course Code: CCS3402	Course Name: Identity and Access Management Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	2.0		
NCrF Level-	5.0		
Course Pre-requisites	CSE2251		
Co-requisites	NIL		
Anti-requisites	CSEXXXX		
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 the course the students shall be able to:** **CO1:** Understand concepts of identity, authentication, authorization, and access control models. [Level 2 -Understand] **CO2:** Explain the components and workflow of IAM systems, including identity lifecycle management and federation protocols. [Level 2 -Understand] **CO3:** Demonstrate the use of identity federation (SAML, OAuth, OpenID Connect), Single Sign-On (SSO), and Multi-Factor Authentication (MFA) in securing enterprise systems. [Level 3 -Apply] **CO4:** Apply IAM technologies such as Single Sign-On (SSO), Multi-Factor Authentication (MFA), and directory services to secure user access. [Level 3 -Apply] **CO5:** Apply IAM governance, risk, and compliance (GRC) frameworks by performing auditing, access reviews, and reporting to support regulatory adherence and organizational security. [Level 3 -Apply]		
Course Content:			
Module 1	Introduction to IAM and Access Control Models	Assessment: Assignment, Seminar	15 Sessions
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	Assessment : Case Studies	13 Sessions
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	Wireless technologies and Wireless threats	Assessment : Practical, Quiz	12 Sessions
Topics: 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 Books: **T1.** Ertem Osmanoglu, Identity and Access Management: Business Performance Through Connected Intelligence, Syngress, 2013.			
References **R1.** David B. Stirling, Effective Cybersecurity: A Guide to Using Best Practices and Standards, Apress, 2020.			
E-Resources/Web Resources 1.https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-			

live&ebv=EB&ppid=pp_xiii 2.https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live 3.Topics related to development of "FOUNDATION": Introduction to IAM 4.Topics related to development of "EMPLOYABILITY": SSO & MFA

Course Code: CCS3414	Course Name: Security In IOT Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2251		
Co-requisites	NIL		
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.		
Course Objective	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.		
Course Outcomes	On successful completion of the course the students shall be able to: **CO1**: Understand the core security challenges associated with IoT and cloud computing environments [Level 2-Understand] **CO2:** Explain the architecture of IoT systems, including their hardware and software components. [Level 2-Understand] **CO3:** Analyze IoT communication protocols and the functioning of various system layers. [Level 4 – Analyze] **CO4:** Apply cryptographic methods and network security techniques to secure IoT systems. [Level 3 – Apply] **CO5:** Apply knowledge of security threats, authentication mechanisms, and countermeasures in IoT and cloud-based systems. [Level 3 – Apply]		
Course Content:			
Module 1	Fundamentals Of IOT Ecosystem	Assessment:	9 Sessions
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.			
Module 2	Overview of Cloud Computing and Its Services	Assessment:	9 Sessions

Topics: Cloud Computing Fundamental: Cloud computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS.			
Module 3	Challenges In Cloud Computing	Assessment:	9 Sessions
Topics: Benefits and challenges of cloud computing - Public vs. Private clouds, Role of virtualization in enabling the cloud.			
Module 4	Security Concepts In Context to IOT Devices	Assessment:	9 Sessions
Topics: Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, Virtualization.			
Module 5	IOT Security Threats and Countermeasures	Assessment:	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 Applications & Tools:			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** David Etter, " IoT Security: Practical guide book " Create Space, 1st Edition, 2016.			
References **R1:** Drew Van Duren, Brian Russell, "Practical Internet of Things Security", Packt, 1st Edition, 2016. **R2:** Sean Smith, "The Internet of Risky Things", O'Reilly Media, 1st Edition, 2017. **R3:** Brian Russell, Drew Van Duren, "Practical Internet of Things Security: Design a security framework for an Internet connected ecosystem", 2nd Edition, 2018.			
E-Resources/Web Resources			

Course Code: CCS3405	Course Name: Vulnerability Assessment and Penetration Testing Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2502		
Co-requisites			
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 Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain information gathering and vulnerability detection. [Level 2 - Understand] **CO2**: Analyze security threats and vulnerabilities in SDN networks and web applications. [Level 4 – Analyse] **CO3:** Apply exploits in mobile applications and wireless networks. [Level 3 – Apply] **CO4:** Perform penetration testing using Metasploit framework. [Level 3 – Apply] **CO5:** Utilize Meterpreter for post-exploitation and system interaction. [Level 3 – Apply]

Course Content:

Module 1	Information Gathering, Host Discovery and Evading Techniques	Assessment: Assignment	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	Assessment : Quiz	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	Assessment : Quiz	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	Assessment : Quiz	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 Applications & Tools:

This course helps the students to understand the threats and vulnerabilities using NMAP.
Skill-Building Activities through Experiential Learning:
Text Book **T1:** Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015. ISBN : 78-1-4822-3161-8. **T2:** 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. **T3:** 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 **R1:** Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 PacktPublishing. **R2:** SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication
E-Resources/Web Resources 1. https://onlinecourses.nptel.ac.in/noc19_cs68/preview - IIT Kharagpur, Prof. Indranil Sen Gupta

Course Code: CCS3413	Course Name: Security Auditing and Governance Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2502		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course covers security auditing principles, governance frameworks, and compliance regulations essential for organizational cyber security. 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 the course the students shall be able to: **CO1:** Explain the fundamental principles of auditing, risk management, and the five pillars of security. [Level 2-Understand] **CO2:** Interpret information security laws and regulatory compliance requirements relevant to organizational security [Level 2-Understand] **CO3:** Analyze information security governance frameworks [Level 4 – Analyze]		

	and standards for evaluating security controls. **CO4:** Apply auditing tools, techniques, and testing frameworks [Level 3 – Apply] to verify the integrity of security technologies. **CO5:** Analyze organizational security infrastructure and [Level 3 – Analyze] policies to recommend compliance improvements.

Course Content:

Module 1	The Principles of Auditing	Assessment:	12 Sessions
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	Assessment:	12 Sessions
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	Assessment:	11 Sessions
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	Assessment:	10 Sessions
Topics: Auditing Cisco Security Solutions - Policy, Compliance, and Management - Infrastructure Security.			

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

Text Book

T1: Chris Jackson, Network Security Auditing, Cisco Press, 2010

References

R1: Russell Dean Vines, Wireless Security Audit Methods and Tools, McGraw-Hill, 2002.

R2: Eric Cole, Ronald Krutz, and James Conley, Network Security Bible, Wiley, 2009.

R3: Richard Bejtlich, The Practice of Network Security Monitoring: Understanding Incident Detection and Response, No Starch Press, 2013.

R4: William Stallings, Network Security Essentials: Applications and Standards, Pearson, 2020.

E-Resources/Web Resources

1. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii
2. https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live

Course Code: CCS3415	Course Name: Cloud Security Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSS2502		
Co-requisites	NIL		
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 Software.		
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 the course the students shall be able to: **CO1:** Describe cloud computing fundamentals. [Level 2-Understand] **CO2:** Explain cloud security architecture and challenges. [Level 2-Understand] **CO3:** Discuss cloud software security essentials. [Level 2-Understand] **CO4:** Implement infrastructure security mechanisms in cloud environments. [Level 3 – Apply] **CO5:** Secure data using protection and mitigation techniques in cloud computing. [Level 3 – Apply]		
Course Content:			
Module 1	Fundamentals of Cloud Computing	Assessment: 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	Assessment:	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	Assessment:	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	Assessment:	9 Sessions

	Security		
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 Applications & Tools: Cloud Sim simulator			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, July 2017. **T2:** Roland L Krutz and Russell Dean Vines, "Cloud Security - A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, Inc. 2010.			
References **R1:** Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, "Secure Cloud Computing", Springer, ISBN 978-1-4614-9278-8 (eBook). **R2:** John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press, 2010. **R3:** Tim Mather, Subra Kumaraswamy and Shahed Latif", "Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance", Oreily Publication, 2009.			
E-Resources/Web Resources: 1. https://presiuniv.knimbus.com/user#/home			

Course Code: CCS3417	Course Name: Security and Privacy in Cloud Type of Course: Theory Course	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	CSS2502		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course provides an in-depth understanding of the security and privacy challenges in cloud computing environments. It explores the fundamental principles, architectures, and service models of cloud computing while emphasizing the risks, vulnerabilities, and threats associated with cloud-based systems. Students will learn about key topics such as identity and access management, encryption techniques, secure cloud storage, data isolation, and compliance with privacy regulations. The course also covers emerging trends, industry standards, and security best practices for public, private, and hybrid cloud infrastructures. Through real-world case studies and practical exposure, students will develop the skills necessary to evaluate and implement secure cloud solutions.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Security and Privacy in Cloud and attain Employability through Experiential learning techniques		

Course Outcomes	On successful completion of the course the students shall be able to: **CO1:** Explain cloud security concepts, services, and basic cryptographic techniques. [Level 2-Understand] **CO2:** Analyze security design principles and architectures for securing cloud environments. [Level 4-Analyse] **CO3:** Illustrate the identity and access management mechanisms in cloud systems. [Level 2-Understand] **CO4:** Apply risk assessment, auditing, and monitoring techniques in cloud security. [Level 3 – Apply] **CO5:** Apply cloud security design patterns and incident response strategies in cloud security. [Level 3 – Apply]

Course Content:

Module 1	Fundamentals of Cloud Security Concepts	Assessment: Assignment	7 Sessions

Topics:

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

Module 2	Security Design and Architecture for Cloud	Assessment: Assignment	6 Sessions

Topics:

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

Module 3	Access Control And Identity Management	Assessment: Quiz	10 Sessions

Topics:

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

Module 4	Cloud Security Design Patterns	Assessment: Quiz	8 Sessions

Topics:

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts.

Targeted Applications & Tools: Cloud Sim

List of Experiments:

1.Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
2. simulate resource management using cloud sim
3. simulate log forensics using cloud sim
4. simulate a secure file sharing using a cloud sim
5. Implement data anonymization techniques over the simple dataset (masking, kanonymization, etc)
6. Implement any encryption algorithm to protect the images
7. Implement any image obfuscation mechanism
8. Implement a role-based access control mechanism in a specific scenario

9. implement an attribute-based access control mechanism based on a particular scenario 10. Develop a log monitoring system with incident management in the cloud
Skill-Building Activities through Experiential Learning:
Text Book **T1:** Raj Kumar Buyya , James Broberg, andrzejGoscinski, "Cloud Computing, Wiley 2013. **T2:** Dave shackleford, "Virtualization Security, SYBEX a wiley Brand 2013. **T3:** Mather, Kumaraswamy and Latif, "Cloud Security and Privacy, OREILLY 2011.
References **R1:** Mark C. Chu-Carroll "Code in the Cloud‖, CRC Press, 2011. **R2:** Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi.
E-Resources/Web Resources:

rse Code: S3426	rse Title: Security Operations and Threat Hunting e of Course: Program Core & Theory only	-P- C		0	1	3
sion No.						
rse Pre-requisites	CSE2502 - Cryptography and Network Security					
i-requisites						
rse Description	This course provides a comprehensive understanding of Security Operations Center (SOC) functions, cyber threat detection, incident response, digital forensics, and cloud security operations. It focuses on security monitoring, log analysis, SIEM technologies, threat intelligence, threat hunting, malware analysis, and cloud-native security monitoring. Through practical exposure to industry-standard tools and methodologies, students will develop the skills required to detect, investigate, analyze, and respond to cybersecurity incidents in enterprise and cloud environments.					
rse Objective	The objective of the course is **SKILL DEVELOPMENT** of student by using **PARTICIPATIVE LEARNING** techniques.					
rse Outcomes	On successful completion of this course the students shall be able to: **CO1:** Identify cyber threats and security events. [Level 3 - Apply] **CO2**: Investigate security incidents using SOC techniques. [Level 3 – Apply] **CO3:** Analyze digital evidence and malware artifacts. [Level 3 – Analyze] **CO4:** Assess organizational and cloud security posture. [Level 3 – Evaluate]					
rse Content:						
dule 1	**urity Operations, Cyber**	**blem Solving**	ntify the basic concept of			10 Sessions

	Threats and SIEM Fundamentals		Cryptography	
ics: Introduction to SOC and Security Operations SOC People, Processes, and Technologies Cyber Threat Landscape and Attack Lifecycle Indicators of Compromise (IoCs) and Indicators of Attack (IoAs) MITRE ATT&CK Framework Log Sources and Log Management SIEM Architecture and Components Event Correlation and Alerting Incident Detection and Alert Triage Use Case Development and Reporting				
dule 2	**Incident Detection, Threat Hunting and Incident Response**	**blem Solving & Participative Learning**	ply the concepts of cryptographic algorithms	13 Sessions
ics: Threat Intelligence Fundamentals Threat Intelligence Platforms and Feeds Threat Hunting Methodologies Detection Engineering Incident Response Lifecycle SOC and Incident Response Team (IRT) Collaboration Evidence Collection and Preservation Digital Forensics Fundamentals Memory and Disk Analysis Malware Analysis Techniques Incident Documentation and Reporting				
dule 3	**ensics, Malware Analysis and Cloud SOC Operations**	**blem Solving & Participative Learning**	cribe the Public key Cryptographic Techniques for various applications.	12 Sessions
ics: Introduction to Cloud Security Cloud SOC Architecture AWS CloudTrail and Azure Monitor Cloud Logging and Monitoring Cloud Incident Detection and Investigation Cloud Threat Hunting Security Automation and SOAR Automated Incident Response Advanced Security Monitoring Techniques Future Trends in SOC Operations				

List of Laboratory Experiments

1. Study of Security Operations Center (SOC) Architecture and Workflow
   - Understand SOC tiers, roles, responsibilities, and incident management processes.
2. Network Traffic Analysis using Wireshark
   - Capture and analyze network packets to identify suspicious activities.
3. Identification of Indicators of Compromise (IoCs)
   - Detect malicious indicators from system, network, and application logs.
4. Attack Mapping using MITRE ATT&CK Framework
   - Analyze cyberattacks and map adversarial TTPs to ATT&CK techniques.
5. Windows Event Log Collection and Analysis
   - Investigate security-related events using Windows Event Viewer.
6. Linux Log Analysis
   - Analyze system and authentication logs for detecting suspicious activities.
7. Deployment and Configuration of SIEM
   - Configure Wazuh/Splunk for centralized log collection and monitoring.
8. Log Correlation and Alert Generation using SIEM
   - Create correlation rules and generate alerts for security incidents.
9. Threat Intelligence Integration and IOC Enrichment
   - Integrate threat feeds and enrich security events with intelligence data.
10. Threat Hunting using SIEM
    - Perform proactive threat hunting using logs, indicators, and behavioral analysis.
11. Incident Response and Ransomware Investigation
    - Detect, analyze, contain, and document a simulated ransomware attack.
12. Cloud Security Monitoring and Incident Detection
    - Monitor AWS CloudTrail/Azure logs and investigate cloud security incidents.

geted Application & Tools that can be used:

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

l-Building Activities through Experiential Learning:

agogy Planned With Topics::

blem Solving: SOC **blem Solving & Participative Learning:** MITRE ATT&CK Framework **-learning:** Collaboration Evidence Collection **Class:** Monitoring Cloud Incident Detection
Text Book **T1:** EC-Council, "Certified SOC Analyst (CSA) Official Courseware", EC-Council Press, Latest Edition. **T2:** Joseph Muniz and Gary McIntyre, "Security Operations Center: Building, Operating, and Maintaining your SOC", Pearson Education, 1st Edition, 2015. **T3:** Don Murdoch, "Blue Team Handbook: SOC, SIEM and Threat Hunting", Security Blue Team Publications, 2nd Edition, 2023.
References **R1:** steve Anson, Steve Bunting, Ryan Johnson and Scott Pearson, "Applied Incident Response", Wiley Publications, 1st Edition, 2020. **R2:** Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident Detection and Response", No Starch Press 1st Edition, 2013. **R3:** Valentina Costa-Gazcón, "Practical Threat Intelligence and Data-Driven Threat Hunting", Packt Publishing, 1st Edition, 2021. R4: Gerard Johansen, "Digital Forensics and Incident Response", Packt Publishing, 3rd Edition, 2024. R5: Alan J. White and Ben Clark, "Blue Team Field Manual (BTFM)", Defensive Security Publications, 2nd Edition, 2022. R6: Vic (J.R.) Winkler, "Cloud Security Handbook", Wiley Publications, 2nd Edition, 2020.
E-Resources/Web Resources 1.MITRE ATT&CK Framework – https://attack.mitre.org/ 2. NIST Computer Security Resource Center – https://csrc.nist.gov/ 3. OWASP Foundation – https://owasp.org/ 4. CISA Cybersecurity Resources – https://www.cisa.gov/ 5. EC-Council Learning Resources – https://www.eccouncil.org/ 6. Wazuh Documentation – https://documentation.wazuh.com/ 7. Security Onion Documentation – https://docs.securityonion.net/ 8. Microsoft Security Documentation – https://learn.microsoft.com/security/
Topics relevant to "Skill Development": SOC

Course Code: CCS3427	Course Name: Advanced Penetration Testing and Offensive Security Type of Course: Program Core & Theory only	-P- C	2	0	1	3
Version No.						
Course Pre-requisites	CSE2502 - Cryptography and Network Security					
Anti-requisites						
Course Description	This course introduces advanced penetration testing and offensive security techniques, including reconnaissance, vulnerability assessment, exploitation, privilege escalation, web application security, and Active Directory attacks. Through practical exercises and real-world scenarios, students develop the skills necessary to identify and assess security vulnerabilities and recommend effective countermeasures.					
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: **CO1:** Perform reconnaissance and vulnerability assessment activities. [Level 3 - Apply] **CO2**: Demonstrate exploitation and privilege escalation techniques. [Level 3 – Apply] **CO3:** Investigate security vulnerabilities and attack paths. [Level 3 – Analyze] **CO4:** Assess security risks and mitigation measures. [Level 3 – Evaluate]			
Course Content:				
Module 1	**ormation Gathering and Vulnerability Assessment**	**blem Solving**	ntify the basic concept of Cryptography	10 Sessions
ics: Penetration Testing Methodology - Footprinting and Reconnaissance - Active and Passive Information Gathering - Network Scanning using Nmap - Service Enumeration - Vulnerability Assessment - SMB, FTP, SSH Enumeration - Web Application Enumeration				
dule 2	**Exploitation and Privilege Escalation**	**blem Solving & Participative Learning**	ply the concepts of cryptographic algorithms	10 Sessions
ics: Exploitation Fundamentals - Metasploit Framework - Manual Exploitation Techniques - Web Application Attacks - Password Attacks - Linux Privilege Escalation - Windows Privilege Escalation Lateral Movement Fundamentals - Post-Exploitation Enumeration				
dule 3	**ive Directory, Web Application Security and Advanced Attacks**	**blem Solving & Participative Learning**	cribe the Public key Cryptographic Techniques for various applications.	10 Sessions
ics: Active Directory Fundamentals - Kerberos Attacks - Credential Attacks - Pass-the-Hash - Web Application Security Testing - SQL Injection - Cross-Site Scripting (XSS) - File Upload Vulnerabilities - Authentication Attacks - Report Writing and Documentation - Professional Penetration Testing Methodology				

List of Laboratory Experiments

1.Network Discovery and Host Enumeration using Nmap.
2.Service Enumeration and Vulnerability Identification.
3.Web Application Enumeration using Gobuster and Burp Suite.
4.Exploitation of Vulnerable Services using Metasploit.
5.Manual Exploitation of Linux-based Vulnerabilities.
6.Linux Privilege Escalation Techniques.
7.Windows Privilege Escalation Techniques.
8.Password Cracking using John the Ripper and Hashcat.
9.SQL Injection Exploitation and Mitigation.
10Cross-Site Scripting (XSS) Exploitation.
11.Active Directory Enumeration and Attacks.
12.End-to-End Penetration Test and Professional Report Writing.

l-Building Activities through Experiential Learning:

agogy Planned With Topics::

Problem Solving: MITRE ATT&CK Mapping - Security Incident Classification
Problem Solving & Participative Learning: Security Information and Event Management (SIEM)
-learning: Indicators of Compromise (IoCs)
Class: Malware Analysis Techniques

tbooks:

T1: EC-Council, "Certified SOC Analyst (CSA) Official Courseware", EC-Council Press, Latest Edition.

T2: Don Murdoch, "Blue Team Handbook: SOC, SIEM and Threat Hunting", Security Blue Team Publications, 2nd Edition, 2023.
T3: Joseph Muniz and Gary McIntyre, "Security Operations Center: Building, Operating, and Maintaining your SOC", Pearson Education, 1st Edition, 2015..

References

R1: .Steve Anson, Steve Bunting, Ryan Johnson, and Scott Pearson, "Applied Incident Response", Wiley Publications, 1st Edition, 2020.
R2: Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident Detection and Response", No

Starch Press, 1st Edition, 2013.
R3: Valentina Costa-Gazcón, "Practical Threat Intelligence and Data-Driven Threat Hunting", Packt Publishing, 1st Edition, 2021.
R4: Gerard Johansen, **"Digital Forensics and Incident Response"**, Packt Publishing, 3rd Edition, 2024.
R5: Alan J. White and Ben Clark, "Blue Team Field Manual (BTFM)", Defensive Security Publications, 2nd Edition, 2022.
R6: Vic (J.R.) Winkler, "Cloud Security Handbook", Wiley Publications, 2nd Edition, 2020.

E-Resources/Web Resources

1. **MITRE ATT&CK Framework**
   - MITRE ATT&CK
2. **National Institute of Standards and Technology (NIST)**
   - NIST Computer Security Resource Center
3. **Cybersecurity and Infrastructure Security Agency (CISA)**
   - CISA Cybersecurity Resources
4. **OWASP Foundation**
   - OWASP
5. **EC-Council Learning Resources**
   - EC-Council
6. **Security Onion Documentation**
   - Security Onion Documentation
7. **Wazuh Documentation**
   - Wazuh Documentation
8. **Splunk Documentation**
   - Splunk Documentation
9. **Microsoft Security Documentation**
   - Microsoft Security Documentation
10. **AWS Security Documentation**
    - AWS Security Documentation

MOOCs / Online Learning References

1. TryHackMe SOC Analyst Path
2. Hack The Box Academy
3. Blue Team Labs Online

Topics relevant to "Skill Development": SIEM, SOC.

Course Code: CSS3426	Course Name: Front-end Full Stack Development Type of Course: Theory Course	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	HTML, CSS		
Co-requisites			
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 Objective	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:** **CO1:** Discuss the need for HTML5 tags for designing web page using CSS [Level 2 - Understand] **CO2**: Develop responsive web pages using CSS, JavaScript and bootstrap. [Level 3 – Apply] **CO3:** Demonstrate the concepts of Angular.js to develop a web front-end. [Level 3 – Apply] **CO4:** Illustrate the concepts of React.js to develop a web front-end. [Level 3 – Apply]

Course Content:

Module 1	Introduction to web technology	Assessment: Programming	7 Sessions
Topics: HTML5 – Syntax,Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform			
Module 2	Responsive web design	Assessment : Programming	8 Sessions
Topics: BootStrap for Responsive Web Design; JavaScript – Core syntax,JavaScript – Core syntax, HTML DOM, objects, classes,HTML DOM, objects, classes, Async; Ajax ,jQuery Introduction Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society.			
Module 3	JavaScript Frameworks	Assessment : Programming	14 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;Angular Animations;Adding Offline Capabilities with Service Workers; React.js ; Developing single page application Assignment: Develop a software tool to do inventory management in a warehouse.			
Module 4	Fundamentals of DevOps and Project Management	Assessment : Programming	9 Sessions
Topics: Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals;DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes. Review of GIT source control. Deploying an Angular/React App; Unit Testing in Angular Apps (Jasmine, Karma). Assignment: Develop a web-based application to book movies/events (like bookmyshow).			

Targeted Applications & Tools:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Replit

Skill-Building Activities through Experiential Learning:

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
E-Resources/Web Resources 1. https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2

Course Code: CSS3427	Course Name: Java Full Stack Development Type of Course: Theory Course	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites			
Anti-requisites	NIL		
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 Objective	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:** **CO1:** Practice the use of Java for full stack development. [Level 3 - Apply] **CO2**: Implement web applications using Java EE. [Level 3 – Apply] **CO3:** Solve simple applications using Java Persistence and Hibernate [Level 3 – Apply] **CO4:** Apply concepts of Spring to develop a Full Stack application. [Level 3 – Apply] **CO5:** Demonstrate automation tools like Maven, Selenium for Full Stack development. [Level 3 – Apply]		
Course Content:			
Module 1	Introduction	Assessment: Programming	12 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	Assessment : Programming	12 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	Assessment : Programming	12 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	Assessment : Programming	12 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 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	Assessment : Programming	9 Sessions
Topics: Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup – Command line 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 Applications & Tools:			
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.			
Skill-Building Activities through Experiential Learning:			
Text Book **T1:** Mayur Ramgir, "Full Stack Java Development with Spring MVC, Hibernate, jQuery , and Bootstrap", 1st Edition, Wiley Publication, 2020.			
References **R1:** Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Developer", 1st edition, APress,2018. **R2:** Herbert Schildt, "Java The complete reference" , 11th Edition, ORACLE, 2020			
E-Resources/Web Resources			

CSS3428

Course Code: CAI3427	Course Name: Language Models for Text Mining Type of Course: Theory Laboratory Integrated	L- T-P- C	2-0-2-3
Version No.	1.0		
NCrF Level-	5.5		
Course Pre-requisites	CAI2504		
Co-requisites	NIL		
Anti-requisites	CSEXXXX		
Course Description	This course introduces text mining and natural language processing using statistical and neural techniques. It covers preprocessing, text representation, language modeling, and deep learning methods. Emphasis is placed on practical applications such as classification, topic modeling, and sequence labeling using modern tools like Keras for hands-on NLP system development.		
Course Objective	To equip students with fundamental and advanced concepts of text mining and natural language processing, and enable them to apply statistical and deep learning techniques to analyze textual data through experiential learning.		

Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the fundamental concepts of text mining and natural language processing. [Level 2 - Understand] **CO2**: Illustrate the techniques of text preprocessing, including tokenization, stemming, and encoding. [Level 2 – Understand] **CO3:** Apply text representation models such as Bag-of-Words, TF-IDF, and N-Grams for analytical tasks. [Level 3 – Apply] **CO4:** Analyze machine learning-based classification and topic modeling techniques for text datasets. [Level 4 – Analyze] **CO5:** Analyze the performance of advanced NLP models, including transformer-based approaches, using appropriate evaluation metrics [Level 4 – Analyze]		
Course Content:			
Module 1	Foundations of Text Mining and NLP	Assessment: Adversarial Quiz, Module Test	7 + 6 Sessions
Topics: Overview of text mining and its relationship with NLP Text mining pipeline: extraction, preprocessing, analysis, evaluation Corpus creation and lexical resources Basics of string manipulation and cleaning techniques Introduction to sequential data and sequence labeling Viterbi algorithm and Hidden Markov Models (HMMs) Handling unknown words in sequence models			
Module 2	Text Preprocessing Techniques	Assessment : Adversarial Quiz, Module Test	6 + 6 Sessions
Topics: Tokenization, stop-word removal, lemmatization, and stemming Part-of-Speech (PoS) tagging Integer encoding, padding, and one-hot encoding Preprocessing workflows for structured text input			
Module 3	Text Representation and Modeling	Assessment : Adversarial Quiz, Module Test	7 + 6 Sessions
Topics: Statistical language modeling: N-Grams, Bag-of-Words Term-Document Matrix, TF, IDF, and TF-IDF Cosine similarity for document comparison Naïve Bayes classifier for text classification Introduction to topic modeling: LSA, SVD, Truncated SVD Latent Dirichlet Allocation (LDA) for topic discovery			
Module 4	Neural NLP with Keras	Assessment : Adversarial Quiz, Module Test	4 + 6 Sessions
Topics: Word embeddings: CBOW, Skip-gram Comparison of one-hot vs. dense embeddings Deep learning models for document classification Using Keras for building and training NLP models			
Module 5	Advanced NLP Techniques and Applications	Assessment : Adversarial Quiz, Module Test	6 + 6 Sessions
Topics: Introduction to Transformer-based models (BERT, GPT – overview) Attention mechanisms in NLP Fine-tuning pre-trained language models Text generation and summarization			
List of laboratory tasks:			
• **Experiment No. 1: File Handling and Text Extraction** Level 1: Read and extract meaningful content from raw text, CSV, and JSON files using Python. Level 2: Parse structured and unstructured files, clean data using regular expressions, and prepare the text for NLP tasks like classification or translation. • **Experiment No. 2: NLP Toolkit Familiarization** Level 1: Install and explore basic text processing with NLTK—tokenization, frequency analysis, and stop-word removal. Level 2: Perform advanced tasks using SpaCy—PoS tagging, Named Entity Recognition (NER), and syntactic			

dependency visualization on real-world text.

- **Experiment No. 3: Corpus Cleaning and Preprocessing**

Level 1: Implement end-to-end cleaning pipelines—tokenization, lemmatization, and noise removal with NLTK/SpaCy.
Level 2: Prepare cleaned datasets suitable for downstream machine learning tasks and visualize token distributions and word clouds.

- **Experiment No. 4: Word Embeddings and Semantic Similarity**

Level 1: Download and explore pre-trained word vectors (Word2Vec, GloVe, FastText) for word similarity tasks.
Level 2: Visualize word embeddings using dimensionality reduction (e.g., t-SNE) and perform analogy tasks like king - man + woman = queen.

- **Experiment No. 5 & 6: Language Identification and Multilingual Analysis**

Level 1: Build a basic language detector using Bag-of-Words features and Scikit-learn.
Level 2: Extend the language identifier to support multiple languages using character-level features and evaluate performance on noisy text.

- **Experiment No. 7 & 8: Lexical Simplification for Readability Enhancement**

Level 1: Implement a rule-based lexical simplifier replacing complex terms with simpler synonyms.
Level 2: Use word embeddings or transformer models (e.g., BERT) for context-aware lexical simplification preserving semantic meaning.

- **Experiment No. 9 & 10: Sentiment Analysis and Comparison of Approaches**

Level 1: Implement sentiment classifiers using rule-based approaches (VADER, TextBlob) on social media or review data.
Level 2: Build and compare ML-based or transformer-based sentiment models, evaluating with accuracy, F1-score, and confusion matrix.

- **Experiment No. 11: Named Entity Recognition (NER) with Classical and Neural Approaches**

Level 1: Perform basic NER using NLTK for person, location, and organization detection.
Level 2: Use SpaCy or transformer-based models for robust NER on large text datasets and compare extraction quality.

- **Experiment No. 12 & 13: Hidden Markov Models (HMM) for Sequence Modeling**

Level 1: Implement a generic HMM for basic sequence prediction tasks.
Level 2: Apply HMM for PoS tagging or NER and evaluate model performance using real-world tagged corpora.

- **Experiment No. 14: Linguistic HMM for Structured Prediction**

Level 1: Design an HMM specifically for PoS tagging using annotated corpora.
Level 2: Evaluate tagging accuracy, compare with baseline models, and discuss limitations of HMMs versus modern sequence models (e.g., Bi-LSTM).

- **Experiment No. 15: Machine Translation with Modern Pre-trained Models**

Level 1: Use Hugging Face Transformers to implement Machine Translation on English-Indian language pairs.
Level 2: Evaluate translation quality using BLEU scores and Round-Trip Translation. Explore translation errors and suggest improvements.

Targeted Applications & Tools:	
Python (Anaconda / Jupyter Notebook)	General NLP development, text processing, and experimentation
Google Colab	Cloud-based environment for running NLP experiments and deep learning models
NLTK (Natural Language Toolkit)	Text preprocessing, tokenization, stop-word removal, PoS tagging, and Named Entity Recognition
SpaCy	Advanced NLP tasks such as tokenization, PoS tagging, NER, and dependency parsing
Scikit-learn	Machine learning models for text classification and topic modeling
Gensim	Implementation of topic modeling techniques like LDA and text similarity analysis

Keras with TensorFlow backend	Development and training of deep learning models for document classification and embeddings
Hugging Face Transformers	Access to pre-trained models for advanced NLP tasks like machine translation
Matplotlib / Seaborn	Visualization of text data, model outputs, and analysis results

Skill-Building Activities through Experiential Learning:

- Text Preprocessing with Real Datasets

Learners will perform comprehensive text cleaning on real-world datasets such as tweets or product reviews. Activities include tokenization, stop-word removal, stemming, and lemmatization using NLTK and SpaCy. The focus is on preparing high-quality input for downstream NLP tasks, ensuring noise reduction and consistency in text data for effective analysis.

- Topic Modeling using Gensim LDA

Participants will apply Latent Dirichlet Allocation (LDA) with Gensim to discover hidden topics in a large corpus. Through preprocessing, dictionary creation, and model training, learners will explore dominant themes in news articles or research papers. The activity enhances understanding of unsupervised learning and interprets real-world text datasets effectively.

- Document Classification with Deep Learning

Students will build document classification models using Keras with pre-trained word embeddings. The activity involves preparing labeled text data, constructing deep learning models, and evaluating performance. Learners gain practical experience in applying neural approaches to classify reviews, news articles, or sentiment data, emphasizing end-to-end NLP system development.

Text Book

T1: Daniel Jurafsky, James H. Martin. "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech, Pearson Publication, 2025 (3rd Edition Draft).

T2: Aditya Joshi, Pushpak Bhattacharyya. "Natural Language Processing", Wiley Publication, 2023 (1st Edition).

T3: Vajjala, S., Majumder, B., Gupta, A., Surana, H. (2020). Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems. United States: O'Reilly Media.

References

R1: D. Manning, C., Schütze, H. (2016). Foundations of Statistical Natural Language Processing. (n.p.): CreateSpace Independent Publishing Platform.

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

E-Resources/Web Resources

1. E-Book: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view

2. Speech and Language Processing (Jurafsky & Martin): https://web.stanford.edu/~jurafsky/slp3/

3. NPTEL Courses:
https://nptel.ac.in/courses/106106211
https://nptel.ac.in/courses/106105158
https://nptel.ac.in/courses/106101007
https://nptel.ac.in/courses/106105572

Course Code: CAI3428	Course Name: Practical Deep Learning with TensorFlow Type of Course: Theory Course / Laboratory Course	L- T-P- C	2-0-2-3
Version No.	1.0		
NCrF Level-	5.5		
Course Pre-requisites	CSE2264		
Co-requisites	Nil		
Anti-requisites	Nil		

Course Description	This course provides hands-on experience in building deep learning models using TensorFlow and Keras. It covers foundational neural network concepts, backpropagation, and model optimization. Focus areas include image classification, sequence modelling, and transfer learning, emphasizing practical implementation of deep learning solutions in real-world contexts through structured modules and tool-based exploration
Course Objective	To provide students with fundamental and practical knowledge of deep learning and enable them to design, implement, and evaluate deep learning models using TensorFlow and Keras.
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain the basic principles of neural networks, including perceptron, backpropagation, and gradient descent [Level 2 - Understand] **CO2**: Describe the architecture, components, and functionalities of TensorFlow and Keras for deep learning applications. . [Level 2 – Understand] **CO3:** Apply deep learning techniques to build and train models for tasks such as image classification and sequence modeling. [Level 3 – Apply] **CO4:** Analyze convolutional and recurrent neural network models implemented using TensorFlow and Keras for real-world datasets. . [Level 4 – Analyze] **CO5:** Analyze transfer learning approaches to fine-tune pre-trained models for domain-specific deep learning tasks. [Level 4 – Analyze]

Course Content:

Module 1	Foundations of Neural Networks	Assessment: Quiz / Conceptual Case Study etc	6 + 6 Sessions
Topics: Understanding Perceptron with Excel, Understanding Multilayer Perceptron with Excel, From Multilayer Perceptron to Deep Learning, Error Backpropagation and Gradient Descent to reduce errors, Activation Functions, Deep Learning, Problems with Deep Learning with solutions.			
Module 2	Getting Started with TensorFlow	Assessment : Quiz / Conceptual Case Study etc	6 + 6 Sessions
Topics: TensorFlow fundamentals and architecture, Working with TensorFlow datasets and pipelines, Defining, compiling, and training basic models, Tensor operations and data flow graphs, Visualization with TensorBoard			
Module 3	Deep Learning Architectures using TensorFlow and Keras	Assessment : Quiz / Conceptual Case Study etc	6 + 6 Sessions
Topics: Overview of Keras and its integration with TensorFlow, designing sequential and functional API models, Building models for image classification (CNNs), Recurrent neural networks (RNNs) for sequence modelling, Transfer learning and model fine-tuning.			
Module 4	Advanced Deep Learning Architectures	Assessment : Quiz / Conceptual Case Study etc	6 + 6 Sessions
Topics: Convolutional Neural Networks (CNNs) , Recurrent Neural Networks (RNNs, LSTM, GRU) Model evaluation techniques ,Hyperparameter tuning			
Module 5	Transfer Learning and Applications	Assessment : Quiz / Conceptual Case Study etc	6 + 6 Sessions
Topics: Transfer learning concepts, Fine-tuning pre-trained models, Real-world applications (image classification, NLP tasks), Model optimization and deployment basics			

List of laboratory tasks:

Lab 1: Exploring Deep Learning Frameworks
Objective: Familiarize with popular deep learning frameworks and their capabilities.
Tasks: Compare features of Keras, TensorFlow, and PyTorch for model development.
Activity: Install frameworks, explore official documentation, run simple demo models, and summarize differences in approach, syntax, and ecosystem.

Lab 2: Building a Basic Artificial Neural Network (ANN)
Objective: Design and train a simple ANN for binary classification.
Tasks: Use Keras with TensorFlow to create an ANN for predicting diabetes using the Pima Indians dataset.
Activity: Implement data preprocessing, model building, training, and basic evaluation using accuracy and a confusion matrix.

Lab 3: Multilayer Perceptron (MLP) for Regression
Objective: Develop an MLP for predicting continuous values.
Tasks: Build and fine-tune an MLP for predicting house prices using a real-world dataset (e.g., the Boston Housing dataset).

Activity: Train the model, visualize training curves, and compare performance with/without feature scaling.

Lab 4: Tensor Operations in TensorFlow
Objective: Understand tensor creation and manipulation using lists and NumPy arrays.
Tasks: Create tensors from different sources, apply reshaping and slicing operations.
Activity: Demonstrate creation, reshaping, and slicing of tensors using TensorFlow functions with practical examples.

Lab 5: Mathematical Operations on Tensors
Objective: Perform arithmetic and advanced mathematical operations on tensors.
Tasks: Apply element-wise operations like addition, multiplication, square, square root, and exponentials.
Activity: Visualize operations and explore broadcasting in TensorFlow for operations on mismatched tensor shapes.

Lab 6: Combining and Manipulating Tensors
Objective: Explore tensor concatenation, stacking, and splitting.
Tasks: Combine multiple tensors along different axes and split tensors for parallel processing.
Activity: Implement concatenation, stacking, and splitting operations to prepare data for neural network inputs.

Lab 7: Loading and Processing Datasets from Local Files
Objective: Build a dataset pipeline from CSV files using TensorFlow.
Tasks: Load real-world datasets (e.g., Titanic dataset), preprocess them, and convert to TensorFlow Dataset objects.
Activity: Perform feature scaling, batching, and shuffling to prepare data for model training.

Lab 8: Working with TensorFlow Datasets (TFDS)
Objective: Utilize pre-loaded datasets from TFDS for experimentation.
Tasks: Load datasets like MNIST or CIFAR-10, split into training/testing sets, and preprocess them.
Activity: Visualize samples, normalize images, and prepare batches for model training.

Lab 9: Image Classification with Convolutional Neural Networks (CNN)
Objective: Develop and evaluate a CNN for image classification tasks.
Tasks: Build a CNN to classify images from the Dogs vs. Cats dataset or Fashion-MNIST.
Activity: Train the model, plot learning curves, evaluate performance, and visualize feature maps.

Lab 10: Sequence Modeling with RNN and LSTM
Objective: Build models for sequential data using RNNs and LSTMs.
Tasks: Develop a sentiment analysis model for movie reviews using the IMDB dataset with RNN/LSTM layers.
Activity: Preprocess text data, implement the model, evaluate with accuracy and loss curves, and experiment with GRU layers.

Lab 11: Transfer Learning for Image Classification
Objective: Apply transfer learning to fine-tune pre-trained models.
Tasks: Use a pre-trained model like MobileNet or VGG16 for classifying custom image datasets.
Activity: Freeze base layers, add new classification head, fine-tune the model, and compare results with baseline models.

Targeted Applications & Tools:

Python (Anaconda / Jupyter Notebook)	General deep learning development, model building, experimentation
TensorFlow	Building and training deep learning models for real-world tasks
Keras	High-level API for designing neural network architectures
Google Colab	Cloud-based platform for running TensorFlow and Keras experiments without local setup
Matplotlib / Seaborn	Visualization of model performance, loss curves, and data distributions
TensorBoard	Visualizing model architecture, training metrics, and debugging deep learning workflows
Pandas and NumPy	Data manipulation, preprocessing, and tensor creation
Scikit-learn	Preprocessing pipelines and basic machine learning comparison with deep learning models
Hugging Face Datasets (Optional)	Access to curated datasets for experimentation and model evaluation

Skill-Building Activities through Experiential Learning:

- Visualizing Neural Networks with TensorBoard

Learners will build simple neural network models using Keras and visualize their architecture, loss curves, and training metrics using TensorBoard. This activity helps develop intuition about model behavior during training, identifying issues like overfitting or vanishing gradients through real-time interactive visualizations.

- Image Classification with Transfer Learning

Participants will fine-tune a pre-trained Convolutional Neural Network (e.g., MobileNet or VGG16) using a small, custom dataset for image classification tasks. This activity provides practical exposure to leveraging transfer learning for improving model performance with minimal data, a crucial real-world deep learning application.

- Sentiment Analysis using RNNs

Learners will implement a Recurrent Neural Network with LSTM layers to perform sentiment analysis on movie reviews from the IMDB dataset. This task introduces sequence modeling for text data, enabling participants to understand how RNNs capture temporal dependencies for tasks like language understanding.

Text Book

T1: François Chollet, *Deep Learning with Python*, 2nd Edition, Manning, 2022
T2: Goodfellow, Bengio, Courville, *Deep Learning*, MIT Press, 2016
T3: Anjanava Biswas, Wrick Talukdar, *Building Agentic AI Systems*, Packt, 2025

References

R1: Amlan Chakrabarti Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra , "Deep Learning", Pearson Publication, 2021.
R2: David Foster, "Generative Deep Learning" O'Reilly Publishers, 2020.
R3: John D Kellehar, "Deep Learning", MIT Press, 2020.

E-Resources/Web Resources

1. **IEEE Transactions on Neural Networks: https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385**
2. **IEEE Transactions on Pattern Analysis: https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34**
3. **International Journal of Intelligent Systems: https://onlinelibrary.wiley.com/journal/1098111x**
4. **NPTEL – Deep Learning (IIT Ropar): https://onlinecourses.nptel.ac.in/noc21_cs35/preview**
5. **Coursera – Neural Networks and Deep Learning (Andrew Ng)**
6. **Coursera – Neural Networks for Machine Learning (Geoffrey Hinton)**

Course Code: CAI3429	Course Name: Deep Learning for Computer Vision Type of Course: Theory Course / Laboratory Course	L- T-P- C	2-0-2-3
Version No.	1.0		
NCrF Level-	5.5		
Course Pre-requisites	CAI2500		
Co-requisites	Nil		
Anti-requisites	Nil		
Course Description	This course explores deep learning techniques for solving computer vision problems, including image classification, object detection, segmentation, and generative modeling. Emphasis is placed on practical implementation using TensorFlow and PyTorch, with applications in real-world scenarios and deployment on edge devices, highlighting model robustness, explainability, and contemporary vision architectures.		
Course Objective	To provide students with fundamental and advanced concepts of deep learning for computer vision and enable them to design, implement, and evaluate vision-based models using modern frameworks.		

Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Explain key components of deep learning models used in computer vision [Level 2 - Understand] **CO2**: Describe the working of CNNs, object detection, and segmentation techniques . [Level 2 – Understand] **CO3:** Apply Vision Transformers and GANs for basic image processing tasks. [Level 3 – Apply] **CO4:** Analyze the use of pre-trained models for deployment on mobile or embedded devices. . [Level 4 – Analyze] **CO5:** Analyze model behavior, robustness, and explainability in computer vision applications. [Level 4 – Analyze]

Course Content:

Module 1	Foundations of Deep Learning for Vision	Assessment: Assignment	6 + 6 Sessions

Topics:

Deep learning vs traditional image processing, Architecture of CNNs: convolution, pooling, fully connected layers, Backpropagation, activation functions, and optimizers, Transfer learning with pretrained models (ResNet, VGG, EfficientNet)

Module 2	Object Detection and Image Segmentation	Assessment : Assignment	8 + 6 Sessions

Topics:

Object Detection: R-CNN, SSD, YOLOv5, YOLOv8, and Faster R-CNN, Region Proposal Networks (RPNs), Semantic and instance segmentation: U-Net, Mask R-CNN, Datasets: COCO, Pascal VOC, custom datasets, Use cases: face detection, autonomous vehicles

Module 3	Advanced Techniques for Vision	Assessment : Assignment	6 + 6 Sessions

Topics:

Vision Transformers (ViTs), Attention Mechanisms, Generative Adversarial Networks (GANs): DCGAN, StyleGAN, Self-supervised Learning: SimCLR, BYOL, Multi-modal Learning: CLIP, DALL·E, Prompt engineering basics for vision tasks

Module 4	Deployment and Edge Optimization	Assessment : Assignment	4 + 6 Sessions

Topics:

Deploying models using TensorFlow Lite, ONNX, and OpenVINO, Adversarial attacks and model robustness, Explainability: Grad-CAM, SHAP, Edge/embedded vision applications: mobile apps, Raspberry Pi, Jetson Nano, Industrial case studies: surveillance, retail, healthcare

Module 5	Advanced Vision Applications and Case Studies	Assessment : Assignment	6 + 6 Sessions

Topics:

Real-time computer vision applications (surveillance, healthcare, retail) , OCR and document analysis using deep learning ,Gesture and face recognition systems , Case studies of deployed vision systems

List of laboratory tasks:

Lab Sheet 1: Neural Network Models with Keras APIs

Objective: Build and compare models using Sequential and Functional APIs.

- Load and explore a dataset (e.g., Fashion-MNIST).
- Build a basic MLP model using Keras Sequential API.
- Configure and apply optimizers, loss functions, and callbacks.
- Build a custom model with skip connections using Functional API.

- Train both models and evaluate their performance metrics.
- Compare the learning curves and confusion matrices.

Lab Sheet 2: Softmax Regression and Model Evaluation

Objective: Apply softmax regression for multi-class classification.

- Load and preprocess multi-class image data.
- Design and train a softmax regression model using Keras.
- Plot accuracy, precision, and recall per class.
- Use confusion matrix and classification report for evaluation.
- Apply dropout and observe impact on generalization.

Lab Sheet 3: CNNs for Grayscale Image Classification

Objective: Develop a CNN for grayscale image datasets (e.g., MNIST).

- Preprocess images (reshape, normalize).
- Define a CNN with multiple convolution and pooling layers.
- Apply data augmentation using Keras ImageDataGenerator.
- Train and evaluate performance using test dataset.
- Visualize learned filters and activation maps.

Lab Sheet 4: CNNs for Color Image Classification

Objective: Train CNNs on RGB images (e.g., CIFAR-10).

- Load and explore dataset.
- Build deeper CNNs and compare training with and without batch normalization.
- Visualize feature maps from intermediate layers.
- Perform transfer learning using a pre-trained model (e.g., VGG16).

Lab Sheet 5: Time Series Forecasting with RNNs

Objective: Forecast future values using RNNs.

- Use a real-world dataset (e.g., temperature or stock prices).
- Preprocess and reshape time series data.
- Train Exponential Smoothing model and compare with a simple RNN.
- Predict future values and visualize performance using MAE/RMSE.

Lab Sheet 6: Document Classification with LSTM

Objective: Classify news/text using an LSTM-based classifier.

- Load and clean a text dataset (e.g., IMDB, 20Newsgroups).

- Tokenize, pad sequences, and convert text to embeddings.
- Build and train an LSTM classifier.
- Evaluate performance and visualize ROC curve.

Lab Sheet 7: Binary Document Classification with LSTM

Objective: Build and evaluate a binary classifier for sentiment analysis.

- Repeat preprocessing steps for binary labeled dataset.
- Train LSTM model and test it on unseen reviews.
- Add dropout and L2 regularization to prevent overfitting.
- Use Grad-CAM or LIME for interpretability.

Lab Sheet 8: Hybrid LSTM + CNN Text Classifier

Objective: Integrate CNNs with LSTM for improved feature extraction.

- Design a hybrid architecture combining CNN (feature extraction) + LSTM (temporal pattern).
- Train on labeled dataset.
- Compare performance with standalone CNN or LSTM.
- Visualize embedding vectors with t-SNE.

Lab Sheet 9: Handwritten Digit Recognition

Objective: Implement Softmax and MLP for MNIST classification.

- Use Softmax regression to classify digits.
- Build and evaluate a multi-layer perceptron (MLP).
- Compare confusion matrices and visualize misclassifications.
- Fine-tune hyperparameters (activation, optimizer).

Lab Sheet 10: Object Detection using YOLOv5

Objective: Detect objects in real-time using YOLOv5.

- Install YOLOv5 and configure environment.
- Run detection on images and video streams.
- Train YOLOv5 on a small custom dataset (if feasible).
- Evaluate precision, recall, mAP.

Lab Sheet 11: Image Segmentation with U-Net

Objective: Segment medical or satellite images using U-Net.

- Load and preprocess image-mask pairs.
- Train a U-Net model for pixel-wise segmentation.
- Visualize prediction masks.

- Compute IoU, Dice coefficient for evaluation.

Lab Sheet 12: Vision Transformers and Generative Models

Objective: Classify images using Vision Transformers and generate images with GANs.

- Implement Vision Transformer using pre-trained weights (e.g., ViT from HuggingFace).
- Train and test DCGAN or StyleGAN on a small image dataset.
- Visualize generated images and compare with training set.
- Perform latent space interpolation.

Group Project Options

- **Gesture Recognition System**
  - Detect and classify hand gestures using CNNs or MediaPipe.
  - Build dataset with webcam feed.
  - Apply preprocessing and classification.
- **OCR Pipeline**
  - Build end-to-end OCR system using OpenCV + Tesseract/CNN.
  - Detect text regions, perform segmentation, and recognize characters.
- **Custom Object Detection**
  - Train a Faster R-CNN model using custom annotated data (via LabelImg).
  - Evaluate detection using IoU and real-time testing with a webcam.

Targeted Applications & Tools:

OpenCV 4, Python 3.7	Real-time face detection using webcam
Python 3.7 (Keras, TensorFlow), MATLAB	Image segmentation for medical images
OpenCV 4, Python 3.7 (Tesseract), MATLAB	Optical Character Recognition (OCR) on scanned documents
OpenCV 4, Python 3.7	Gesture recognition using hand tracking
OpenCV 4, Python 3.7	Vehicle number plate detection
Python 3.7 (Keras/TensorFlow)	Image classification using CNNs
Python 3.7, OpenCV 4	Custom object detection with YOLOv5
Python 3.7 (TensorFlow), MATLAB	Time series forecasting of sensor data
OpenCV 4, Python 3.7	Face recognition using eigenfaces or deep embeddings
MATLAB	Simulating convolutional operations on images

Skill-Building Activities through Experiential Learning:

- **Real-Time Sign Language Translator**

  Develop a deep learning model to detect hand gestures and translate them into text in real time. The activity builds skills in data annotation, video processing, and deep learning for gesture recognition using Python, OpenCV, and TensorFlow, fostering practical understanding of real-world computer vision applications.

- **AI-Based Art Generator Using GANs**

  Use Generative Adversarial Networks (GANs) to generate artistic images by applying style transfer to real-world photos.

Participants gain hands-on experience with adversarial learning, dataset preparation, and image generation techniques, using Python and deep learning frameworks to explore creativity in AI applications.

- **Explainable Image Classifier for Medical Diagnosis**

  Build a deep learning image classifier for medical images and integrate explainability tools like Grad-CAM or LIME. This activity enhances understanding of model interpretability, trustworthiness, and critical analysis, providing exposure to AI applications in healthcare using Python, Keras, and open-source medical datasets.

Text Book

T1: "Deep Learning for Computer Vision Image Classification, Object Detection and Face Recognition in Python" Jason Brownlee (2019)

T2: "Deep Learning for Computer Vision with python" Adrian Rosebrock (2017)

T3: Goodfellow, I., Bengio, Y., Courville, A., *Deep Learning*, MIT Press, **2016**.

T4: Adrian Rosebrock, *Deep Learning for Computer Vision with Python*, PyImageSearch, **2019** (latest available edition).

References

R1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
A foundational book covering deep learning principles, including CNNs, optimization, and generative models.

R2. Raschka, S., & Mirjalili, V. (2022). Machine Learning with PyTorch and Scikit-Learn. Packt Publishing.
Covers practical deep learning techniques using PyTorch, including CNNs and transfer learning.

R3. Geron, A. (2022). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Edition). O'Reilly Media.
Provides hands-on implementations of deep learning for computer vision using TensorFlow and Keras.

R4. Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J. (2021). Dive into Deep Learning. Available online (https://d2l.ai).
Open-access book covering CNNs, object detection, and advanced vision techniques with PyTorch and TensorFlow.

R5. Chollet, F. (2021). Deep Learning with Python (2nd Edition). Manning Publications.
Explains deep learning fundamentals and applications with Keras, including image classification and segmentation.

R6. Ballé, J., Laparra, V., & Simoncelli, E. P. (2017). Deep Learning for Computer Vision: A Brief Introduction.
A concise introduction to CNNs, object detection, and generative models.

E-Resources/Web Resources

1. https://www.geeksforgeeks.org/computer-vision/deep-learning-for-computer-vision/
2. https://www.coursera.org/learn/advanced-deep-learning-techniques-computer-vision
3. https://onlinecourses.nptel.ac.in/noc20_cs88/preview

Course Code: CCS3418	Course Name: System Security Design and Threat Surface Analysis Type of Course: Theory Course	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	CSEXXXX		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course explores the design and evaluation of secure systems from an architectural standpoint. Students will examine the various threat surfaces in modern computing environments — including on-premise, virtualized, and hybrid infrastructures — and learn to model, measure, and reduce system-level risk exposure through secure architectural patterns, hardening techniques, and design review practices. Topics include threat modeling frameworks (e.g., STRIDE, DREAD), attack surface mapping, hardware root-of-trust, firmware validation, and secure boot architectures.		

Course Objective	To equip students with the ability to analyze, design, and review secure system architectures, identify and quantify threat surfaces, and implement mitigations at the infrastructure and OS level.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Identify and classify threat surfaces in diverse system architectures [Level - Understand] **CO2**: Design security controls for systems at hardware, OS, and middleware layers [Level –Apply] **CO3:** Apply architectural hardening practices to reduce exploitable vulnerabilities [Level –Apply] **CO4:** Evaluate system components for exposure to specific classes of attacks [Level –Evaluate]		
Course Content:			
Module 1	Evaluate system components for exposure to specific classes of attacks	Assessment: Quiz	9 Sessions
Topics: Monolithic vs microkernel design, secure boot, BIOS/UEFI vulnerabilities, TPM-based trust, attack surface classification Tools: Binwalk, CHIPSEC, Intel Boot Guard / AMD PSP diagnostic tools Use Cases: • Analyze BIOS integrity in commodity hardware • Compare attack surface between a legacy Linux monolith vs modular RTOS			
Module 2	Threat Modeling Frameworks and Design Review	Assessment : Quiz	9 Sessions
Topics: STRIDE, DREAD, PASTA, threat trees, data flow diagrams (DFD), trust boundaries Tools: OWASP Threat Dragon Use Cases: • Perform STRIDE analysis for a payment gateway backend • Draw threat model for a university intranet system			
Module 3	Infrastructure-Level Hardening	Assessment : Quiz	9 Sessions
Topics: CIS/NIST hardening benchmarks, OS control layers (AppArmor, SELinux), secure BIOS/boot configs, USB and firmware lockdown Tools: CIS-CAT Pro, Lynis Use Cases: • Apply hardening benchmarks to a Linux-based firewall appliance • Lock down Windows endpoints in a corporate office to prevent USB malware			
Module 4	Exposure in Virtualized and Hybrid Environments	Assessment : Quiz	9 Sessions
Topics: Hypervisor risk, snapshot leakage, shared memory, enclave computing, rollback protection, VM sprawl Tools: VIRL / GNS3 , QEMU/KVM & VMware Workstation Use Cases: • Simulate VM snapshot attack in a cloud lab • Identify memory leakage between two containers			
Module 5	Compliance & Capstone	Assessment : Quiz	9 Sessions
Topics: RBI/ISO27001-based risk design, zero-day simulation blueprints, layered defense evaluation, architecture compliance audits Tools: Archimate, SCAP Compliance Checker Use Cases:			

• Conduct architecture compliance assessment for a FinTech mobile backend • Simulate multi-layered defense in a smart grid SCADA system
Targeted Applications & Tools:
Skill-Building Activities through Experiential Learning:
Text Book **T1:** Co-branded Zell and Paytm Textbook for System Security Design and Threat Surface Analysis
References **R1:** Shostack, A. – Threat Modeling: Designing for Security, Wiley **R2:** NIST SP 800-160 – Systems Security Engineering **R3:** Michael Sikorski – Practical Malware Analysis, No Starch Press
E-Resources/Web Resources 1. https://docs.aws.amazon.com/s3/ 2. https://cloud.google.com/storage/docs 3. https://azure.microsoft.com/en-in/products/storage/ 4. https://cloud.google.com/security
Topics relevant to SKILL DEVELOPMENT: This course trains students to become industry-grade security architects and risk engineers. Students gain Expertise in architectural security reviews, Proficiency in threat modeling frameworks, Familiarity with CIS/NIST/ISO security standards, Hands-on experience with firmware-level security tools and Skills in producing audit-ready documentation.
Project work/Assignment: Perform a full threat model and risk exposure analysis on a real-world system (e.g., hospital record server, bank POS network).

Course Code: CCS3419	Course Name: Encryption Systems and Protocol Design for Secure Communication Type of Course: PCC– Theory & Practical	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	CSEXXXX		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course focuses on real-world encryption systems and secure protocol design practices used in contemporary enterprise and infrastructure security. Students will explore encryption standards, key management systems, symmetric/asymmetric algorithm implementation, and secure messaging protocols. The course emphasizes engineering decisions and architectural context — how encryption interacts with applications, systems, and compliance standards. Key focus areas include TLS, IPSec, VPNs, email encryption, hardware security modules (HSMs), and identity-based encryption in communication networks.		
Course Objective	To provide in-depth technical knowledge of modern encryption systems, and the ability to design and evaluate secure communication protocols in infrastructure and enterprise environments.		

<table>
<tr><td>Course Outcomes</td><td colspan="3">On successful completion of the course the students shall be able to:

CO1: Analyze and compare modern symmetric and asymmetric encryption systems [Level -Analyze]
CO2: Design and evaluate secure communication protocols using real-world standards [Level –Apply]
CO3: Implement cryptographic systems for confidentiality, integrity, and authenticity. [Level –Apply]
CO4: Apply secure key management and exchange practices [Level –Apply]</td></tr>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>Module 1</td><td>Core Encryption Systems and Infrastructure-Level Integration</td><td>Assessment: Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Block vs stream ciphers, AES, 3DES, RSA, ECC, hybrid encryption in system design, entropy & randomness, padding & modes
Tools:

OpenSSL, CrypTool

Use Cases:

• Encrypt and decrypt secure files using AES-GCM in Linux systems
• Simulate a hybrid RSA-AES email encryption system</td></tr>
<tr><td>Module 2</td><td>Key Management and Exchange Protocols</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Public Key Infrastructure (PKI), Certificate Authorities, HSMs, KMS (AWS/GCP/Azure), Diffie-Hellman, ECDH, forward secrecy
Tools:
Keytool/JKS, AWS KMS Console, GnuPG, HashiCorp Vault
Use Cases:
• Generate and deploy self-signed CA for internal org
• Set up cloud-based envelope encryption with KMS</td></tr>
<tr><td>Module 3</td><td>Secure Communication Protocols and Architecture</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
TLS 1.3 handshake, IPSec tunnels and transport, VPN architecture, S/MIME, HTTPS stack breakdown, certificate pinning
Tools:
OpenVPN, StrongSwan, OpenSSL Cert Management, Burp Suite (for TLS inspection)
Use Cases:
• Set up secure IPSec tunnel between two Linux servers
• Deploy a test VPN server with TLS auth</td></tr>
<tr><td>Module 4</td><td>Protocol Vulnerabilities and Cryptographic Attacks</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Man-in-the-middle, downgrade attacks, replay attacks, weak key entropy, hash collisions, attacks on TLS/SSL, side-channels
Tools:
TestSSL.sh, TLS-Scan, CryptoLint, Scapy, ZAP Proxy
Use Cases:
• Analyze certificate pinning behavior in a mobile banking app
• Simulate SSL stripping on a misconfigured TLS handshake</td></tr>
<tr><td>Module 5</td><td>Compliance & Capstone</td><td>Assessment : Mini Project (Programming using Sklearn/Keras)</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Cryptographic requirements in GDPR, PCI-DSS, RBI circulars, secure messaging audits, protocol compliance checklist creation
Tools:
Nmap scripts, OWASP Crypto Standards Project, SSLLabs scanner
Use Cases:
• Audit encryption compliance in an online payment workflow</td></tr>
</table>

• Develop a protocol checklist for TLS deployments in FinTech system
Targeted Applications & Tools:
Skill-Building Activities through Experiential Learning:
Text Book **T1:** Co-branded Zell and Paytm Textbook for Encryption Systems and Protocol Design for Secure Communication
References **R1:** Ferguson, Schneier, Kohno – Cryptography Engineering, Wiley **R2:** William Stallings – Cryptography and Network Security, Pearson **R3:** Wichert, A. M., Sa-couto, L. (2021). Machine Learning - A Journey To Deep Learning: With Exercises And Answers. Singapore: World Scientific Publishing Company. Ivan Ristic – Bulletproof SSL and TLS
E-Resources/Web Resources 1. OpenSSL: https://www.openssl.org/ 2. SSL Labs: https://www.ssllabs.com/ 3. GnuPG Documentation: https://gnupg.org/documentation/ 4. OWASP Cryptography Cheat Sheet: https://cheatsheetseries.owasp.org 5. Mozilla TLS Observatory: https://observatory.mozilla.org/
Topics relevant to SKILL DEVELOPMENT: This course builds core technical competencies in designing and evaluating cryptographic systems and secure communication protocols. Students develop the ability to integrate encryption into real-world infrastructures such as financial platforms, enterprise networks, and web services. Through applied labs, audits, and protocol simulations, learners gain hands-on experience with key generation, secure key exchange, TLS configuration, and vulnerability assessment — all essential for careers in cybersecurity, secure infrastructure, or cryptographic engineering.
Project work/Assignment: Students will design and document an end-to-end secure communication protocol for a use case such as secure email exchange, encrypted financial transaction over VPN, or a secure backup channel for an enterprise server. They will build a threat model, choose encryption systems, implement the architecture, and present a security analysis aligned with global standards.

Course Code: CCS3420	Course Name: Network Defense Infrastructure and Real-Time Threat Inspection Type of Course: PCC– Theory & Practical	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	CSEXXXX		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course focuses on the design, configuration, and deployment of enterprise-grade network defense systems. It trains students to implement and monitor real-time threat inspection using both perimeter and internal security tools. The course covers layered defense strategies, intrusion detection and prevention systems (IDS/IPS), packet-level threat analysis, anomaly tracking, and log correlation. Practical labs are built around common attack signatures, evasion tactics, and the forensic response cycle.		
Course Objective	To equip students with the skills to build and manage resilient network defense systems and detect and respond to real-time threats using industry-grade monitoring, packet inspection, and log correlation tools.		

<table>
<tr><td>Course Outcomes</td><td colspan="3">On successful completion of the course the students shall be able to:

CO1: Deploy and configure IDS/IPS systems in enterprise networks [Level - Apply]
CO2: Monitor real-time network traffic for indicators of compromise (IOCs) [Level – Understand]
CO3: Analyze and classify attack vectors based on packet-level forensics [Level –Analyze]
CO4: Detect lateral movement and stealth attacks using layered monitoring tools [Level – Apply]</td></tr>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>Module 1</td><td>Network Defense Layers and Infrastructure Design</td><td>Assessment: Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
DMZ segmentation, firewalls (stateless vs stateful), network zoning, air-gapped networks, micro segmentation, traffic isolation models
Tools:
pfSense, OPNsense, Cisco Packet Tracer, FirewallD
Use Cases:
• Build a secure DMZ for web and app server isolation
• Implement firewall rules for segmented production and testing zones</td></tr>
<tr><td>Module 2</td><td>Packet Inspection and Protocol-Level Threat Analysis</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Deep Packet Inspection (DPI), signature-based vs behavior-based rules, TCP handshake abuse, malicious payload signatures, protocol tunnelling
Tools:
Wireshark, tcpdump, Snort, Suricata
Use Cases:
• Detect abnormal DNS tunneling in a compromised endpoint
• Analyze HTTP headers for command-and-control signatures</td></tr>
<tr><td>Module 3</td><td>IDS/IPS Configuration and Deployment</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Inline vs passive modes, rules tuning, false positive/negative reduction, evasion techniques, alert triaging, threat feeds (ET, EmergingThreats)
Tools:
Snort 3, Suricata, Zeek (Bro), Security Onion
Use Cases:
• Deploy Suricata inline and simulate SQL injection attack
• Fine-tune Snort rules to reduce false positives in a web-heavy network</td></tr>
<tr><td>Module 4</td><td>Real-Time Monitoring and Log Correlation</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
NetFlow monitoring, log aggregation, threat hunting basics, event normalization, correlation rules, time-series threat mapping
Tools:
ELK Stack (Elasticsearch, Logstash, Kibana), Graylog, Splunk Free, NetFlow Analyzer, Sysmon
Use Cases:
• Track brute-force attack attempts across user logins
• Use ELK to visualize port scan trends from foreign IPs</td></tr>
<tr><td>Module 5</td><td>Compliance & Capstone</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
SIEM audit requirements (PCI-DSS, RBI, ISO27001), log retention policies, incident documentation, real-time response workflows
Tools:
Wazuh, Elastic SIEM, SOF-ELK, MITRE ATT&CK correlation mapping
Use Cases:
• Simulate a real-world ransomware beacon detection scenario
• Build a multi-log source attack story (firewall + NetFlow + endpoint logs)</td></tr>
<tr><td colspan="4">Targeted Applications & Tools:</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

Skill-Building Activities through Experiential Learning:
Text Book **T1:** Co-branded Zell and Paytm Textbook for Network Defense Infrastructure and Real-Time Threat Inspection
References **R1:** Richard Bejtlich – The Practice of Network Security Monitoring, No Starch Press **R2:** Chris Sanders – Applied Network Security Monitoring, Syngress **R3:** NIST SP 800-94 – Guide to Intrusion Detection and Prevention Systems (IDPS)
E-Resources/Web Resources 1. https://nmap.org/ 2. https://www.snort.org/ 3. https://www.kali.org/tools/ 4. https://owasp.org/www-project-top-ten/ 5. https://www.hackthebox.com/
Topics relevant to SKILL DEVELOPMENT: This course builds deep, hands-on skills required for roles in network security monitoring, SOC operations, and incident response. Students will gain exposure to deploying and tuning real-world IDS/IPS tools, conducting packet-level threat analysis, and managing security events across large networks. Through simulations and forensic review, they will learn how to track evolving threats and design proactive detection strategies aligned with enterprise compliance standards and red team defense models.
Project work/Assignment: Students will build and simulate a full network defense and monitoring pipeline. They must configure firewalls, deploy IDS/IPS, simulate a controlled intrusion (e.g., port scan, brute-force, C2 traffic), collect and visualize logs, and submit a full incident report with traffic capture, IOC list, and remediation plan.

Course Code: CSS3421	Course Name: Secure Code Architecture and Exploit Mitigation Engineering Type of Course: PCC– Theory & Practical	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	CSEXXXX		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course focuses on advanced techniques for architecting secure software systems and systematically mitigating exploit pathways at the application layer. It covers vulnerability classes, exploit vectors, and the secure-by-design principles used in hardening codebases against real-world threats. Students will work with memory safety techniques, control-flow integrity, secure API patterns, static/dynamic analysis tools, and compiler-level security features. Emphasis is placed on eliminating security design flaws and preventing post-deployment exploitation through architectural safeguards.		
Course Objective	To train students in designing software systems that resist exploitation, using modern code architecture strategies and hardening techniques adopted in enterprise-grade development and secure DevSecOps pipelines		

<table>
<tr><td>Course Outcomes</td><td colspan="3">On successful completion of the course the students shall be able to:

CO1:Analyze source code and architecture for exploitable patterns [Level -Analyze]

CO2:Apply secure-by-design principles in developing critical software components [Level –Apply]
CO3:Implement compiler-level mitigations and runtime hardening techniques [Level –Apply]
CO4:Perform secure code reviews and threat analysis for large-scale systems [Level –Apply]</td></tr>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>Module 1</td><td>Secure Software Design Principles</td><td>Assessment: Quiz)</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Least privilege, fail-safe defaults, secure dependency management, API design patterns, input validation frameworks, architectural trust zones
Tools:
ThreatSpec, SonarQube, OWASP Dependency-Check
Use Cases:
• Analyze an insecure microservice for excessive privilege or trust misuse
• Redesign a vulnerable REST API for secure token-based access</td></tr>
<tr><td>Module 2</td><td>Vulnerability Classes and Exploitation Techniques</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Memory corruption (buffer overflows, use-after-free), command injection, directory traversal, logic flaws, deserialization vulnerabilities
Tools:
Ghidra, Cutter, Radare2, Valgrind, AddressSanitizer
Use Cases:
• Replicate a buffer overflow exploit on a C binary
• Identify insecure file path handling in a Linux CLI utility</td></tr>
<tr><td>Module 3</td><td>Code Hardening and Compiler-Level Security</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Stack canaries, ASLR, DEP/NX-bit, Control Flow Integrity (CFI), compiler flags (-fstack-protector, -D_FORTIFY_SOURCE), sandboxing
Tools:
GCC/Clang hardening flags, Grsecurity, Seccomp, Firejail
Use Cases:
• Harden a Linux binary against memory-based exploits
• Enable and test stack canaries in a custom compiled app</td></tr>
<tr><td>Module 4</td><td>Secure Code Review and Dynamic Analysis</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Code review frameworks, taint tracking, symbolic execution, runtime instrumentation, fuzzing, unsafe input path detection
Tools:
Semgrep, CodeQL, AFL (American Fuzzy Lop), LibFuzzer, Burp Suite Pro
Use Cases:
• Use CodeQL to detect unsafe object casting in a Java service
• Review input sanitation flaws in a public REST endpoint</td></tr>
<tr><td>Module 5</td><td>Compliance & Capstone</td><td>Assessment : Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Secure SDLC integration, threat modeling in agile development, OWASP ASVS mapping, secure commit hygiene, dev pipeline hardening
Tools:
OWASP ASVS, Pre-commit, Checkmarx, Veracode CLI
Use Cases:
• Perform secure architecture review of a fintech payments module
• Implement a secure coding policy into a DevSecOps CI/CD pipeline</td></tr>
<tr><td colspan="4">Targeted Applications & Tools:</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

Skill-Building Activities through Experiential Learning:
Text Book **T1:** Co-branded Zell and Paytm Textbook for Secure Code Architecture and Exploit Mitigation Engineering
References **R1:** Michael Howard – Writing Secure Code, Microsoft Press **R2:** Ben Watson – Practical .NET Code Security, Pearson **R3:** OWASP Application Security Verification Standard (ASVS)
E-Resources/Web Resources 1. https://www.wireshark.org/ 2. https://github.com/OWASP/ASVS 3. https://www.snort.org/ 4. https://suricata.io/ 5. https://owasp.org/ 6. https://www.elastic.co/what-is/elk-stack
Topics relevant to SKILL DEVELOPMENT: This course builds advanced skills in secure coding, vulnerability mitigation, and exploit-aware application architecture. Students develop hands-on expertise in identifying unsafe coding patterns, integrating compiler-level defenses, and embedding secure practices into modern development pipelines. By the end of the course, they are equipped to function as secure software architects, application security reviewers, or exploit analysts in enterprise security and development teams.
Project work/Assignment: Students will select or be assigned a vulnerable application and perform a full-cycle security re-architecture. They will Identify vulnerabilities through static/dynamic analysis, Redesign the module using secure design principle, Apply code-level mitigations and test against common exploits, Document risk reduction with traceable controls (OWASP/NIST mapping)

Course Code: CCS3422	Course Name: Cloud-Native Security, Zero-Trust, and Virtualized Infrastructure Defense Type of Course: PCC– Theory & Practical	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course provides an in-depth study of advanced cloud-native security architecture, virtualization-layer hardening, and zero-trust models in enterprise-scale environments. It addresses infrastructure-as-code (IaC) security, virtual machine and container-level threats, policy enforcement, and multi-tenant risk containment. Students will explore network segmentation in the cloud, secure workload isolation, control plane protection, and compliance-oriented design for hybrid and multi-cloud deployments.		
Course Objective	To equip students with skills to design, implement, and manage secure cloud-native infrastructures using virtualization and zero-trust security models suitable for regulated, high-stakes environments.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** 1. Implement defense-in-depth strategies for virtualized cloud environments [Level 3 - Apply] **CO2**: 2. Apply zero-trust principles across users, devices, and services [Level 3 – Apply] **CO3:** 3. Secure workloads using container and VM-level policy enforcement [Level 3 – Apply] **CO4:** 4. Analyze misconfigurations and enforce compliance at [Level 3 –		

	runtime Analyze]		
Course Content:			
Module 1	Cloud Infrastructure Security Architecture	Assessment: Knowledge-based Quiz	9 Sessions
Topics: IaaS/PaaS risk surfaces, cloud control plane security, secure VPCs, VM lifecycle hardening, metadata service abuse Tools: AWS IAM Analyzer, Azure Defender, Google Cloud Policy Troubleshooter Terraform security modules, Open Policy Agent (OPA) Use Cases: • Securely configure cloud VPC with network segmentation • Detect over-permissive roles in AWS IAM			
Module 2	Zero-Trust Security Models in the Cloud	Assessment: Knowledge-based Quiz	9 Sessions
Topics: Identity-centric access, microsegmentation, policy-as-code, continuous authentication, workload identity, conditional access Tools: HashiCorp Vault, Azure Conditional Access, Google BeyondCorp Enterprise SPIFFE/SPIRE, Istio Authorization Policies Use Cases: • Implement policy-based access control for cross-region Kubernetes clusters • Deploy zero-trust mesh for microservices communication			
Module 3	Container and Virtual Machine Security	Assessment: Knowledge-based Quiz	9 Sessions
Topics: Image signing and scanning, container hardening, VM escape vulnerabilities, kernel namespaces, rootless execution, resource isolation Tools: Docker Bench, Trivy, Kube-Bench, Sysdig Falco SELinux, gVisor, Firecracker MicroVM Use Cases: • Prevent use of vulnerable container images in CI/CD pipelines • Simulate VM escape detection and kernel namespace attacks			
Module 4	Multi-Cloud Compliance and Configuration Monitoring	Assessment: Knowledge-based Quiz	9 Sessions
Topics: Cloud security posture management (CSPM), CIS cloud benchmarks, RBAC/ABAC review, secrets management, security misconfiguration detection Tools: Bridgecrew, Checkov, AWS Config, Azure Security Center, Kubernetes Policy Controller Use Cases: • Create IaC scanning pipelines to enforce security policies • Visualize cloud misconfiguration drift			
Module 5	Capstone and Enterprise Scenario Simulation	Assessment: Knowledge-based Quiz	9 Sessions
Topics: Cloud threat modeling, cross-cloud logging and alerting, resilience in hybrid deployments, audit report preparation Tools: Wazuh, SIEM (Elastic or Splunk), CloudTrail, Azure Monitor, GCP Chronicle Use Cases: • Perform an end-to-end audit of a cloud-native FinTech system • Simulate and respond to misconfigured IAM with privilege escalation			
Targeted Applications & Tools:			
Skill-Building Activities through Experiential Learning:			

Project work/Assignment:
Students will implement a secure multi-tenant cloud environment simulating a modern SaaS deployment. They must deploy containerized applications with policy-based controls, enforce zero-trust network segmentation, perform configuration scans, and document a post-deployment audit report highlighting compliance and runtime protections.
Text Book **T1:** Co-branded Zell and Paytm Textbook for Cloud-Native Security, Zero-Trust, and Virtualized Infrastructure Defense .
References **R1:** Liz Rice – Container Security, O'Reilly **R2:** Brendan Burns – Designing Distributed Systems, Microsoft Press **R3:** NIST 800-207 – Zero Trust ArchitectureR4: . Jo Prusa. Basics of 3D Printing. Prusa Research, 3rd Edition.
E-Resources/Web Resources • OWASP Official: https://owasp.org/ • MITRE ATT&CK Framework: https://attack.mitre.org/ • Microsoft Threat Modeling Tool: https://aka.ms/threatmodeling • RBI Cyber Security Guidelines: https://rbidocs.rbi.org.in • MobSF (Mobile Security Framework): https://mobsf.github.io/
Topics relevant to SKILL DEVELOPMENT: This course prepares students for industry roles such as cloud security engineer, DevSecOps architect, and virtualization defense specialist. Through real-world tooling, students learn to enforce access control, audit deployments, and manage compliance across containerized and virtualized systems in public, private, and hybrid clouds. With hands-on exposure to zero-trust principles, workload isolation, and policy automation, they develop practical capabilities to secure dynamic, large-scale cloud infrastructures in regulated industries.

Course Code: CCS3423	Course Name: Cyber Risk Strategy, Regulatory Engineering, and Breach Response Operations 1 Type of Course: PCC– Theory & Practical	L- T-P- C	2-0-2-3
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course prepares students to manage cyber risk from a strategic, operational, and regulatory standpoint. It focuses on building risk models, implementing governance frameworks, auditing cybersecurity controls, and executing structured breach response workflows. Emphasis is placed on real-world regulatory regimes (RBI, GDPR, ISO 27001), internal audit reporting, and cross-functional coordination during security incidents. Students also learn how to quantify security risks, simulate data breaches, and manage communication with regulatory and business stakeholders during crises.		
Course Objective	To develop proficiency in designing enterprise-level cyber risk strategies, implementing regulatory control frameworks, and managing end-to-end response operations for security breaches in compliance-critical industries.		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Assess and quantify cyber risk using enterprise risk management models [Level 3 - Apply] **CO2**: Map controls to regulatory frameworks and compliance standards [Level 3 – Apply] **CO3:** Design and simulate incident response plans for large-scale breaches [Level 3 – Apply] **CO4:** Evaluate audit readiness and control effectiveness in real organizations [Level 5 – Evaluate]		

<table>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>Module 1</td><td>Risk Modeling and Enterprise Risk Governance</td><td>Assessment: Knowledge-based Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Cyber risk lifecycle, threat likelihood vs impact, control classes (prevent/detect/respond), quantitative vs qualitative risk scoring, risk registers, risk acceptance frameworks
Tools: RiskLens, FAIR Toolkit, ISO 27005 Templates, RSA Archer
Use Cases:
• Develop a quantified risk register for a digital insurance platform
• Perform a FAIR model risk calculation for ransomware impact</td></tr>
<tr><td>Module 2</td><td>Regulatory Mapping and Control Engineering</td><td>Assessment: Knowledge-based Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
RBI circulars (Cyber Security Framework for Banks), GDPR technical controls, ISO/IEC 27001 Annex A, NIST CSF, control testing plans
Tools: Cloud Compliance Manager, ComplianceForge, CyberSaint, Control Mapping Templates

Use Cases:
• Map an existing control set to RBI/ISO requirements
• Design technical controls to fulfill GDPR encryption/storage mandates</td></tr>
<tr><td>Module 3</td><td>Security Audit and Posture Review</td><td>Assessment: Knowledge-based Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Internal audit cycles, risk control self-assessment (RCSA), vulnerability tracking dashboards, evidence collection, control maturity models
Tools: AuditBoard, Vanta, Wiz, Open-Audit, OSQuery
Use Cases:
• Create an audit checklist and evidence plan for an ed-tech startup
• Analyze SOC 2 posture using control health dashboards</td></tr>
<tr><td>Module 4</td><td>Breach Simulation and Incident Handling</td><td>Assessment: Knowledge-based Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Breach lifecycle phases, MITRE ATTCCK alignment, containment planning, forensic triage, business continuity handoff, post-breach RCA
Tools:
• Velociraptor, GRR Rapid Response, Red Canary Atomic Simulations, Cyber Triage Use Cases:
• Simulate credential compromise and response containment
• Use memory forensics to triage a malware-infected endpoint</td></tr>
<tr><td>Module 5</td><td>Capstone and Operational Risk Response Planning</td><td>Assessment: Knowledge-based Quiz</td><td>9 Sessions</td></tr>
<tr><td colspan="4">Topics:
Breach communication protocols (internal/external), board-level reporting, regulatory notification timelines, SLA enforcement, vendor breach escalation
Tools: Tabletop Exercise Toolkits, IBM Resilient IR Platform, IR Playbook Generator
Use Cases:
• Draft a real-time response and communication plan for a third-party vendor breach
• Run a breach simulation exercise across finance, legal, and IT teams</td></tr>
<tr><td colspan="4">Targeted Applications & Tools:</td></tr>
<tr><td colspan="4">Skill-Building Activities through Experiential Learning:</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Project work/Assignment:</td></tr>
<tr><td colspan="4">Students will conduct a simulated enterprise breach, developing risk registers, compliance control mappings, and a full incident response plan. They will deliver board-facing executive summaries, a root cause analysis, and a mitigation roadmap including compliance recovery.</td></tr>
<tr><td colspan="4">Text Book
T1: Co-branded Zell and Paytm Textbook for Cyber Risk Strategy, Regulatory Engineering, and Breach Response Operations</td></tr>
</table>

.

References

R1: Alexander B. – Enterprise Cybersecurity Risk Management Handbook, Wiley

R2: NIST SP 800-61r2 – Computer Security Incident Handling Guide
R3: ISACA – COBIT for Risk Framework

E-Resources/Web Resources

- https://owasp.org/
- https://csrc.nist.gov/
- https://attack.mitre.org/
- https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-61r2.pdf

Topics relevant to SKILL DEVELOPMENT:
This course builds core competencies in regulatory compliance, enterprise risk governance, and live breach response. Students acquire practical skills in risk modeling, control mapping, security audit preparation, and forensic containment strategy. By working with live breach simulation tools and policy frameworks, they become well-equipped to lead security posture evaluations, communicate with regulators, and coordinate post-incident recovery across technical and business teams.

Course Code: LAW7601	Course Name: : Indian Constitution Type of Course: Theory Course	L- T-P- C	1-0-0-0
Version No.	1.0		
Course Pre-requisites	NIL		
Co-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course aims to familiarize students with fundamentals of Indian Constitution concepts and their relevance to 75+ Years of Republic of India (https://constitution75.com/) as well as #AzaadiKaAmrutMahotsav / Azadi Ka Amrit Mahotsav (https://amritmahotsav.nic.in). It is designed to equip students with the knowledge about the Constitution of India. This course aims to introduce the constitutional law of India to students from all walks of life and help them understand the constitutional principles as applied and understood in everyday life. The objective of making the Constitution of India, familiar to all students, and not only to law students, this course aims and objectifies legal understanding in the simplest of forms. This course is designed to cater to Constitutional Studies.		
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'PARTICIPATIVE LEARNING' techniques		
Course Outcomes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the basic understanding of the Indian Constitution and the concepts and issues relevant to day-to-day life of the nation and to equip the Citizen with the zeal of capacity building. Recognizing and identify the values of the Constitution of India. [Level 2 - Understand] **CO2**: Enabling the Citizen-centric Awareness of Rights and Responsibilities of the State. [Level 2 – Understand] **CO3:** 3. Explain the role of the State actors in building India. [Level 2 – Understand] **CO4: 4.** Understanding the Gandhian vision over the power of the LSG (Local Self-Governance) [Level 2 – Understand]		
Course Content:			
Module 1	Understanding the Making of the Constitution: The Constituent Assembly & The Constitution of India	Assessment: Quiz	5 sessions
Topics: Historical Context of Constituent Assembly - Compositions & Functions of Constituent Assembly What is a Constitution? – Why have a Constitution? – Constitutional Change - Features of Indian Constitution – Preamble of Indian			

Constitution			
Module 2	Citizen's Fundamental Rights and State's Responsibilities (Directive Principles)	Assessment	5 Sessions
Topics: Topics: Introduction to Fundamental Rights - Right to Equality – Facets of Right to Equality - Right to Freedom - Constitutional Position of Some Democratic Rights - Right Against Exploitation - Right to Freedom of Religion - Right to Constitutional Remedies Directive Principles of the State Policy			
Module 3	Organs Of the Government	Assessment : Presentation	5 Sessions
Topics: Executive: The President of India - Powers and Functions of President of India - Emergency Powers and the Position of the President Legislature: Union Council of Ministers - Prime Minister - The Rajya Sabha - The Lok Sabha - Relation between the Lok Sabha & Rajya Sabha - Office of the Speaker – Important Parliamentary Committees Judiciary: The Structure and Organization of the Judiciary & the High Court - The Supreme Court - Role of The Supreme Court - Judicial Activism in India - Basic Structure Doctrine & PIL			
Module 4	Federalism & Decentralization		6 sessions
Topics: What is Federalism? - Centre-State Legislative Relations - Centre-State Administrative Relations - Centre-State Financial Relations The 5th & 6th Schedules - Municipality- (History of Indian Municipality, Organization & Functions) – Panchayat 1 (Idea of Panchayat, Organization and Powers of Panchayats in India)			
Text Book **T1:** Durga Das Basu --- Introduction to the Constitution of India, 23rd Edition (Gurgaon; LexisNexis, 2018**).** **T2:** MP Jain's Constitutional Law of India, Lexis Nexis			
References **R1**: Himangshu Roy and M.P.Singh – Indian Political System, 4th Edition (Bengaluru; Pearson Education, 2018) **R2**: Vidya Bhushan & Vishnoo Bhagwan--- Indian Administration (S. Chand, 2011)			
E-Resources/Web Resources 2. https://openFullText.html?DP=https://legislative.gov.in/constitution-of-india/ 3. https://openFullText.html?DP=https://nptel.ac.in/courses/109104074 4. https://openFullText.html?DP=https://www.indiacode.nic.in/			

Course Code: CHE7601	Course Name: Environmental Studies Type of Course: MOOC course	L- T-P- C	1-0-0-0
Version No.	1.0		
NCrF Level-	5.0		
Course Pre-requisites	NIL		
Co-requisites	CHE7601		
Anti-requisites	CSEXXXX		
Course Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers.		

	This course is designed to cater to Environment and Sustainability
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'PARTICIPATIVE LEARNING' techniques
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Describe the issues related to natural resources, ecosystems and biodiversity — L1– Remember CO2: Identify environmental hazards affecting air, water and soil quality — L2– Understand CO3:Recognize the importance of healthy environment and finding the sustainable methods to protect the environment — L3 – Apply CO4: Convert skills to address immediate environmental concerns through changes in environmental processes, policies, and decisions — L4 – Analyze

Course Content:

Module 1	Understanding Environment, Natural Resources, and Sustainability		

Topics:

Classification of natural resources, issues related to Population growth and their overutilization, and strategies for their conservation. Water, air, soil, mineral, energy and food source. Effect of human activities on natural resources.

Concept of sustainability- Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Sustainable practices in managing resources, including deforestation, water conservation, Desalination – types, energy security, and food security issues, Life Cycle thinking and Circular Economy.

Module 2	Ecosystems, Biodiversity, and Sustainable Practices		

Topics:

Ecosystems and ecosystem services: Various natural ecosystems, Major ecosystem types in India and their basic characteristics; forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.

The importance of biodiversity, Types of biodiversity, Biodiversity and Climate Change, the threats it faces, hotspots, and the methods used for its conservation. Strategies for in situ and ex situ conservation, mega diverse nation.

Module 3	Environmental Pollution, Waste Management, and Sustainable Development		

Topics:

Types of pollution- Chemical, - Biological, Biomedical, noise, air, water, soil, thermal, radioactive and marine pollution, and their impacts on society. Urbanization and Urban environmental problems; effects, and mitigation.

Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management;

Sustainable Materials and Technologies: Biodegradable and compostable materials, Recycled and reclaimed materials (E-waste management), Sustainable manufacturing processes.

Module 4	Social Issues, Legislation, and Practical Applications		

Topics:

Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981. Hazardous waste Rule 1989, Biomedical Waste handling 1998, Fly Ash Rule 1999, Municipal Solid Waste Rule 2000, Battery Rules 2001, E- Waste Rules 2011, Plastic waste management Rules 2016, Construction Demolition waste Rules 2016 National Biodiversity Action Plan (NBAP)

Major International Environmental Agreements: Convention on Biological Diversity (CBD), The Biological Diversity (Amendment) Act, 2023, United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement.
Major International organisations and initiatives: United Nations Environment Programme (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC).

Targeted Application & Tools that can be used:

Application areas are Energy, Environment and sustainability

Tools: Online Tools – NPTEL and Swayam.

Project work/Assignment:

Assessment Type

- Online exams (MCQs) will be conducted by the department of Chemistry

Text Book

T1: G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA

T2: Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
T3: Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
T4: Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
T5: Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.
T6: Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
T7: Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
T8: Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
T9: Wright, R.T. & Boorse, D.F. Environmental Science: Toward A Sustainable Future (13th ed,). Pearson.

Reference Books

R1: Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022), Conservation through Sustainable Use: Lessons from India. Routledge.
R2: William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.
R3: Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
R4: Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
R5: Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press

E-Resources/Web Resources

1. https://nptel.ac.in/courses/109105203
2. https://archive.nptel.ac.in/courses/120/108/120108004/
3. https://nptel.ac.in/courses/127105018
4. https://onlinecourses.nptel.ac.in/noc23_lw06/preview
5. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
6. https://archive.nptel.ac.in/courses/120/108/120108002/
7. https://onlinecourses.swayam2.ac.in/ini25_bt02/preview
8. https://nptel.ac.in/courses/102104088
9. https://nptel.ac.in/courses/124107165
10. https://nptel.ac.in/courses/109106200
11. https://archive.nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf
12. https://onlinecourses.swayam2.ac.in/nou25_ge19/preview
13. https://onlinecourses.swayam2.ac.in/ini25_hs01/preview
14. http://kcl.digimat.in/nptel/courses/video/105105184/L32.html
15. Lecure by Dr. Samik Chowdhury, Dr. Sudha Goel, NPTEL course: Environmental Science, https://nptel.ac.in/courses/109105203, 2024.
16. Lecture by Dr. Padmavati, Dr Narendran Thiruthy, NPTEL Course: Biodiversity Protection, Farmers and Breeders Rights, https://nptel.ac.in/courses/129105008, 2024.

Topics relevant to Skill Development:

1. An attitude of enquiry.
2. Write reports

The topics related to Environment and Sustainability :

All topics in theory component are relevant to Environment and Sustainability.

Course Code: CIV7601	Course Name: Universal Human Values and Ethics Type of Course: MAC course		L-T-P-C	-	-	-	0
Course Prerequisites	NIL					
Co-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of the course is to develop a holistic perspective in students' life. The course adopts a self-reflective methodology of teaching and is designed to equip the students to explore their role in all aspects of living as a part of the society. It presents a universal approach to value education by developing the right understanding of reality through the process of self-exploration. This self-exploration develops more confidence and commitment in students enabling them to critically evaluate their pre-conditioning and present beliefs. As an outcome of the holistic approach, the students will be able to practice the ethical conduct in the social and professional life. The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information. This course is designed to cater to Human Values and Professional Ethics.						
Course Objective	The objective of the course is 'SKILL DEVELOPMENT' of the student by using 'SELF LEARNING' techniques						
Course Outcomes	On successful completion of this course the students shall be able to: CO1: Understand the concepts of human values, self-exploration, and holistic development in personal and social contexts. [Level 2 – Understand] CO2: Apply principles of human values and ethical conduct in personal, social, and professional life situations. [Level 3 – Apply] CO3: Apply the concepts of harmony and ethical reasoning to address issues in family, society, and professional environments. [Level 3 – Apply] CO4: Analyze the relationship between self and body, and the role of values in maintaining harmony within individuals and society. [Level 4 – Analyze] CO5: Evaluate personal beliefs, behaviors, and professional practices based on universal human values and ethical principles. [Level 5 – Evaluate]						
Course Content:							
Module 1	Introduction to Value Education	Online Assessment	MCQ Quiz	5 Sessions			
Topics: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.							
Module 2	Harmony in the Human Being	Online Assessment	MCQ Quiz	5 Sessions			
Topics: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health							
Module 3	Harmony in the Family and Society	Online Assessment	MCQ Quiz	5 Sessions			
Topics: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.							
Module 4	Implications of the Holistic Understanding – A Look at Professional Ethics	Online Assessment	MCQ Quiz	5 Sessions			
Topics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Strategies for Transition towards Value-based Life and Profession							
Targeted Application & Tools that can be used: Application areas are Personal life, Education and Career, Workplace , Society and Environmental Responsibility Tools: Online Tools – NPTEL and Swayam.							

Project work/Assignment:

Assessment Type

- Online exams (MCQs) will be conducted by the Department of Civil Engineering through Linways.

Text Book

T1: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
T2: Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2019.
T3: Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

Reference Books

R1: E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

R2: Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
R3: Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
R4: A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
R5: P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
R6: A N Tripathy, 2003, Human Values, New Age International Publishers.
R7: E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
R8: M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
R9: B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
R10: William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.

E-Resources/Web Resources

1. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
1. https://onlinecourses.nptel.ac.in/noc25_mg141/preview
3. https://onlinecourses.swayam2.ac.in/ini25_hs52/preview
4. https://onlinecourses.nptel.ac.in/noc25_hs219/preview
5. https://onlinecourses.swayam2.ac.in/cec25_mg14/preview
6. https://onlinecourses.swayam2.ac.in/imb25_mg195/preview
7. https://onlinecourses.swayam2.ac.in/imb25_mg196/preview
8. UHV II - https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So&pp=0gcJCWMEOCosWNin
9. Lecture by Dr. Kumar Sambhav, NPTEL course: Universal Human Values, https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
10. Lecture by Dr. Padmavati, Dr Narendran Thiruthy, NPTEL Course: Biodiversity Protection, Farmers and Breeders Rights, https://nptel.ac.in/courses/129105008, 2024.

Topics relevant to Skill Development:

1. An attitude of enquiry.
2. Write reports

The topics related to Human values and Professional ethics:

All topics in are relevant to Human values and Professional ethics.