PRESIDENCY UNIVERSITY

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

PRESIDENCY SCHOOL OF ARTIFICIAL INTELLIGENCE & ADVANCED COMPUTING

Program Regulations and Curriculum

2026-2030

BACHELOR OF TECHNOLOGY (B.Tech.) in COMPUTER SCIENCE AND ENGINEERING (Internet of Things)

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

Table of Contents

Clause No.	Contents	Page Number
PART A – PROGRAM REGULATIONS		
1.	Vision & Mission of the University and the School / Department	3
2.	Preamble to the Program Regulations and Curriculum	3
3.	Short Title and Applicability	4
4.	Definitions	6
5.	Program Description	6
6.	Minimum and Maximum Duration	7
7.	Programme Educational Objectives (PEO)	7
8.	Programme Outcomes (PO) and Programme Specific Outcomes (PSO)	8
9.	Admission Criteria (as per the concerned Statutory Body)	9
10.	Lateral Entry / Transfer Students requirements	10
11.	Change of Branch / Discipline / Specialization	11
12.	Specific Regulations regarding Assessment and Evaluation	13
13.	Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc.	14
PART B: PROGRAM STRUCTURE		
14.	Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements	18
15.	Minimum Total Credit Requirements of Award of Degree	18
16.	Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies	18
PART C: CURRICULUM STRUCTURE		
17.	Curriculum Structure – Basket Wise Course List	20
18.	Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project	22
19.	List of Elective Courses under various Specializations / Stream Basket	24
20.	List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters).	27
21.	List of MOOC (NPTEL) Courses	37
22.	Recommended Semester Wise Course Structure / Flow including the Program / Discipline Elective Paths / Options	38
23.	Course Catalogue of all Courses Listed including the Courses Offered by other School / Department and Discipline / Program Electives	42

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 2025-2029.
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 2025-2029 batch, and to all other Bachelor of Technology Degree Programs which may be introduced in future.

d. These Regulations shall supersede all the earlier Bachelor of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.

e. These Regulations shall come into force from the Academic Year 2024-2025.

4. Definitions

In these Regulations, unless the context otherwise requires:

a. "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;

b. "Academic Council" means the Academic Council of the University;

c. "Academic Regulations" means the Academic Regulations of the University;

d. "Academic Term" means a Semester or Summer Term;

e. "Act" means the Presidency University Act, 2013;

f. "AICTE" means All India Council for Technical Education;

g. "Basket" means a group of courses bundled together based on the nature/type of the course;

h. "BOE" means the Board of Examinations of the University;

i. "BOG" means the Board of Governors of the University;

j. "BOM" means the Board of Management of the University;

k. "BOS" means the Board of Studies of a particular Department/Program of Study of the University;

l. "CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;

m. "Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;

n. "COE" means the Controller of Examinations of the University;

o. "Course In Charge" means the teacher/faculty member responsible for developing and organizing 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, 2025-2029;

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 2025-2029 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 2025-2029 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**Error! Reference source not found.** of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

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

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.0 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: Utilize a thorough knowledge of computer science fundamentals to explain core concepts, assess computational problems using theoretical knowledge, and create reliable and

optimized computing systems.

PSO 02: Employ programming expertise, software development tools, and knowledge of Internet of Things to develop practical, real-world applications, paving the way for a plethora of career paths in software development, advanced studies, research, or entrepreneurship

PSO 03: Design and develop IoT-based solutions by integrating sensors, embedded systems, cloud platforms, while utilizing appropriate methods to acquire, transmit, and process data from IoT devices and perform data analytics techniques for real-world applications.

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, 2025-2029, 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-Internet of Things) 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 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-Internet of Things) Program Structure (2025-2029) totaling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: B.Tech. (Computer Science & Engineering-Internet of Things) 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)	12
2	Basic Science Courses (BSC)	24
3	Engineering Science Courses (ESC)	20
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 '6' 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-Internet of Things) program of four years' duration.

15. Minimum Total Credit Requirements of Award of Degree

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

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

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

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

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

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

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	ENG1030	Fundamentals of Communication	1	0	2	2	3	s	Nil
2	ENG2030	Communication in Practice	1	0	2	2	3	S	Nil
3	FIN1002	Essentials of Finance	3	0	0	3	3	S	Nil
4	APT4005	Aptitude for Employability	0	0	2	1	2	AT	Nil
5	PPS3018	Preparedness for Interview	0	0	2	1	2	S	Nil
6	ECE1512	Design Thinking in Practice	2	0	2	3	4	S/EM	Nil
		Total	7	0	10	12	17		

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	CSS2264	Essentials of AI	3	0	0	3	3	S/EM	Nil
9	CSS2265	Essentials of AI Lab	0	0	2	1	2	S/EM	Nil
10	CSS2274	Competitive Programming and Problem Solving	0	0	4	2	4	S/EM	Nil
		Total	**14**	**0**	**12**	**20**	**24**		

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	CSE2251
11	CSS2259	Web Technologies Lab	0	0	2	1	2	S	NIL
12	CIT2500	FoG Computing for IoT	3	0	0	3	3	S	CSE2251
13	CSS2260	Database Management Systems	3	0	0	3	3	S/EM	NIL
14	CSS2261	Database Management Systems Lab	0	0	2	1	2	S/EM	NIL
15	CSS2262	Analysis of Algorithms	3	1	0	4	4	S	NIL
16	CSS2263	Analysis of Algorithms Lab	0	0	2	1	2	**S**	Nil
17	CSS2266	Theory of Computation	3	0	0	3	3	**S**	Nil
18	CSS2502	Cryptography and Network Security	3	0	0	3	3	S	CSE2251
19	CIT2501	Wireless Communication in IoT	3	0	0	3	3	**S**	NIL
20	CIT2503	Mobile Application for IoT	3	0	0	3	3	**S**	NIL
21	CIT2505	Mobile Application for IoT Lab	0	0	2	1	2	S	NIL
22	CSS2269	Operating Systems	3	0	0	3	3	S	Nil
23	CSS2270	Operating Systems Lab	0	0	2	1	2	S	Nil
24	CIT2400	Cyber-Physical Systems	3	0	0	3	3	S	Nil
25	CSS2271	Software Design and Development	3	0	0	3	3	S/EM	Nil
26	CIT2504	AI and Deep Learning for IoT	3	0	0	3	3	S	Nil
27	CIT2502	Privacy and Security in IoT	3	0	0	3	3	S	Nil
Total No. of Credits			53	1	20	64	74		

Table 3.5: List of course in Project Work basket (PRW)

S.No	Course Code	Course Name	L	T	P	C
1	CSS7000	Internship	-	-	-	2

2	CSS7100	Mini Project	-	-	-	4
3	CSS7300	Capstone Project	-	-	-	10
					Total No. of Credits	**16**

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 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

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 01: Security and Industry Applications Basket

S.NO	Course Code	Course Name	L	T	P	C	Contact Hour	Type of Skill	Pre-Requisites
1	CIT3410	Secure IoT	3	0	0	3	3	S/EM	CSE2502
2	CIT3412	IoT for Healthcare and Wearable Technology	3	0	0	3	3	S/EM	CSE2251
3	CIT3413	Industrial IoT (IIoT)	3	0	0	3	3	S/EM	CSE2251
4	CIT3414	Energy-Efficient IoT Systems	3	0	0	3	3	S/EM	CSE2251

Track 02 : Networking and Infrastructure Basket

S.NO	Course Code	Course Name	L	T	P	C	Contact Hour	Type of Skill	Pre-Requisites
1	CIT3400	Architecting Smart IoT Devices	3	0	0	3	3	S/EM	ECE2010
2	CIT3401	Intelligent Sensors and Systems	3	0	0	3	3	S/EM	CSE2251
3	CIT3402	IoT Architecture and Protocols	2	0	2	3	4	S/EM	CSE2251
4	CIT3405	Edge and Fog Computing for IoT	3	0	0	3	3	S/EM	CIT2500
5	CIT3406	Cloud Computing for IoT	3	0	0	3	3	S/EM	CSE2506

Track 03: AI-Driven IoT Intelligence Basket

S.NO	Course Code	Course Name	L	T	P	C	Contact Hour	Type of Skill	Pre-Requisites
1	CIT3411	Big Data Analytics for IoT	2	0	2	3	4	S/EM	CSE2260
2	CIT3403	Embedded Systems for IoT	3	0	0	3	3	S/EM	CIT3400
3	CIT3404	IoT System Design and Development	3	0	0	3	3	S/EM	CIT3401
4	CIT3407	IoT Data Analytics and Machine Learning	3	0	0	3	3	S/EM	CSE2264
5	CIT3408	Digital Twins and Simulation in IoT	3	0	0	3	3	S/EM	CSE2502
6	CIT3409	Autonomous Systems and Robotics with IoT	3	0	0	3	3	S/EM	CSE2251
Track 04: Special Basket									
1	CSS3426	Front End Full Stack Development*	2	0	2	3	4	S/EM	CSE2260
2	CSS3427	Java Full Stack Development*	2	0	2	3	4	S/EM	CSE2260
3	CSS3428	.Net Full Stack Development*	2	0	2	3	4	S/EM	CSE2260
4	CAI3427	Language Models for Text Mining+	2	0	2	3	4	S/EM	CSE2264
5	CAI3428	Practical Deep Learning with TensorFlow+	2	0	2	3	4	S/EM	CSE2264
6	CAI3429	Deep Learning Techniques for Computer Vision+	2	0	2	3	4	S/EM	MAT1212
Track -5 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	-	F	Nil
2	CHE7601	Environmental Studies **	1	0	0	0	-	F	Nil
3	CIV7601	Universal Human Values and Ethics **	1	0	0	0	-	F	Nil
Track -6 Samsung Courses									
1	CIT3416	Foundations of IoT & Embedded Circuit Systems	2	0	2	3	-	S/EM	
2	CIT3417	Version Control & Collaborative IoT Software Development	2	0	2	3	-	S/EM	
3	CIT3418	IoT Platforms & AI Orchestration	2	0	2	3	-	S/EM	
*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

Course Code	Course Name	L	T	P	C	Type of Skill/ Focus	Course Caters to	Pre-requisites/ Co-requisites	Anti-requisites	Future Courses that need this as a Prerequisite
Chemistry Basket										
CHE1003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-
CHE1004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-
CHE1005	Computational Chemistry	2	0	0	2	S	ES	-	-	-
CHE1006	Introduction to Nano technology	3	0	0	3	S	ES	-	-	-
CHE1007	Biodegradable electronics	2	0	0	2	S	ES	-	-	-
CHE1008	Energy and Sustainability	2	0	0	2	S	ES	-	-	-
CHE1009	3D printing with Polymers	2	0	0	2	S	ES	-	-	-
CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	S	ES	-	-	-
CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	S	ES	-	-	-
CHE1012	Introduction to Composite materials	2	0	0	2	S	ES	-	-	-
CHE1013	Chemistry for Engineers	3	0	0	3	S	ES	-	-	-
CHE1014	Surface and Coatings technology	3	0	0	3	S	ES	-	-	-
CHE1015	Waste to Fuels	2	0	0	2	S	ES	-	-	-
CHE1016	Forensic Science	3	0	0	3	S	ES	-	-	-
Civil Engineering Basket										
CIV1001	Disaster mitigation and management	3	0	0	3	S	-	-	-	-
CIV1002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
CIV2001	Sustainability Concepts in Engineering	3	0	0	3	S	-	-	-	-

CIV2002	Occupational Health and Safety	3	0	0	3	S	-	-	-	-
CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-
CIV2004	Integrated Project Management	3	0	0	3	EN	-	-	-	-
CIV2005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-
CIV2044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
CIV2045	Environmental Meteorology	3	0	0	3	S	-	-	-	-
CIV3046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
CIV3059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-
Commerce Basket										
COM2001	Introduction to Human Resource Management	2	0	0	2	F	HP/GS	-	-	-
COM2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
COM2003	Contemporary Management	2	0	0	2	F	-	-	-	-
COM2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
COM2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
COM2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
COM2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Computer Science Basket (not to be offered for Computer Science and Engineering students)										
CSS2002	Programming in Java	2	0	2	3	S/EM	-	-	-	-
CSS2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
CSS2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
CSS2005	Web design fundamentals	2	0	2	3	S/ EM/EN	-	-	-	-
Design Basket										
DES1001	Sketching and Painting	0	0	2	1	S	-	-	-	-
DES1002	Innovation and Creativity	2	0	0	2	F	-	-	-	-
DES1121	Introduction to UX design	1	0	2	2	S	-	-	-	-
DES1122	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
DES1124	Spatial Stories	1	0	2	2	S	-	-	-	-

DES1125	Polymer Clay	1	0	2	2	S	-	-	-	-
DES2001	Design Thinking	3	0	0	3	S	-	-	-	-
DES1003	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
DES1004	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
DES1005	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
DES1006	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
DES2080	Art of Design Language	3	0	0	3	S	-	-	-	-
DES2081	Brand Building in Design	3	0	0	3	S	-	-	-	-
DES2085	Web Design Techniques	3	0	0	3	S	-	-	-	-
DES2089	3D Modeling for Professionals	1	0	4	3	S	-	-	-	-
DES2090	Creative Thinking for Professionals	3	0	0	3	S	-	-	-	-
DES2091	Idea Formulation	3	0	0	3	S	-	-	-	-
Electrical and Electronics Basket										
EEE1002	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-
EEE1003	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-
EEE1004	Fundamentals of Industrial Automation	3	0	0	3	S	-	-	-	-
EEE1005	Electric Vehicles & Battery Technology	3	0	0	3	S	-	-	-	-
EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	S	-	-	-	-
Electronics and Communication Basket										
ECE1003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-
ECE1004	Microprocessor based systems	3	0	0	3	F	-	-	-	-
ECE3089	Artificial Neural Networks	3	0	0	3	S	-	-	-	-
ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM	-	-	-	-
ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM	-	-	-	-
ECE3102	Consumer Electronics	3	0	0	3	F/EM	-	-	-	-
ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-
ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM	-	-	-	-
ECE3107	Machine Vision for Robotics	3	0	0	3	F/EM	-	-	-	-
English Basket										

ENG1008	Indian Literature	2	0	0	2	-	GS/ HP	-	-	-
ENG1009	Reading Advertisement	3	0	0	3	S	-	-	-	-
ENG1010	Verbal Aptitude for Placement	2	0	2	3	S	-	-	-	-
ENG1011	English for Career Development	3	0	0	3	S	-	-	-	-
ENG1012	Gender and Society in India	2	0	0	2	-	GS/ HP	-	-	-
ENG1013	Indian English Drama	3	0	0	3	-	-	-	-	-
ENG1014	Logic and Art of Negotiation	2	0	2	3	-	-	-	-	-
ENG1015	Professional Communication Skills for Engineers	1	0	0	1	-	-	-	-	-
DSA Basket										
DSA2001	Spirituality for Health	2	0	0	2	F	HP	-	-	-
DSA2002	Yoga for Health	2	0	0	2	S	HP	-	-	-
DSA2003	Stress Management and Well Being	2	0	0	2	F	-	-	-	-
Kannada Basket										
KAN1001	Kali Kannada	1	0	0	1	S	-	-	-	-
KAN1003	Kannada Kaipidi	3	0	0	3	S	-	-	-	-
KAN2001	Thili Kannada	1	0	0	1	S	-	-	-	-
KAN2003	Pradharshana Kale	1	0	2	2	S	-	-	-	-
KAN2004	Sahithya Vimarshe	2	0	0	2	S	-	-	-	-
KAN2005	Anuvadha Kala Sahithya	3	0	0	3	S	-	-	-	-
KAN2006	Vichara Manthana	3	0	0	3	S	-	-	-	-
KAN2007	Katha Sahithya Sampada	3	0	0	3	S	-	-	-	-
KAN2008	Ranga Pradarshana Kala	3	0	0	3	S	-	-	-	-
Foreign Language Basket										
FRL1004	Introduction of French Language	2	0	0	2	S	S	-	-	-
FRL1005	Fundamentals of French	2	0	0	2	S	S	-	-	-
FRL1009	Mandarin Chinese for Beginners	3	0	0	3	S	S	-	-	-
Law Basket										
LAW1001	Introduction to Sociology	2	0	0	2	F	HP		-	-
LAW2001	Indian Heritage and Culture	2	0	0	2	F	HP/GS		-	-
LAW2002	Introdcution to Law of Succession	2	0	0	2	F	HP/GS		-	-
LAW2003	Introduction to Company Law	2	0	0	2	F	HP		-	-
LAW2004	Introduction to Contracts	2	0	0	2	F	HP	-	-	-

LAW2005	Introduction to Copy Rights Law	2	0	0	2	F	HP	-	-	-
LAW2006	Introduction to Criminal Law	2	0	0	2	F	HP	-	-	-
LAW2007	Introduction to Insurance Law	2	0	0	2	F	HP	-	-	-
LAW2008	Introduction to Labour Law	2	0	0	2	F	HP	-	-	-
LAW2009	Introduction to Law of Marriages	2	0	0	2	F	HP/GS	-	-	-
LAW2010	Introduction to Patent Law	2	0	0	2	F	HP	-	-	-
LAW2011	Introduction to Personal Income Tax	2	0	0	2	F	HP	-	-	-
LAW2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
LAW2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
LAW2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
LAW2015	Cyber Law	3	0	0	3	F	HP	-	-	-
LAW2016	Law on Sexual Harrassment	2	0	0	2	F	HP/GS	-	-	-
LAW2017	Media Laws and Ethics	2	0	0	2	F	HP/GS	-	-	-
Mathematics Basket										
MAT2008	Mathematical Reasoning	3	0	0	3	S	-	-	-	-
MAT2014	Advanced Business Mathematics	3	0	0	3	S	-	-	-	-
MAT2041	Functions of Complex Variables	3	0	0	3	S	-	-	-	-
MAT2042	Probability and Random Processes	3	0	0	3	S	-	-	-	-
MAT2043	Elements of Number Theory	3	0	0	3	S	-	-	-	-
MAT2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-
Mechanical Basket										
MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-
MEC1002	Introduction to Matlab and Simulink	3	0	0	3	S/EM	-	-	-	-
MEC1003	Engineering Drawing	1	0	4	3	S	-	-	-	-
MEC2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-
MEC2002	Operations Research & Management	3	0	0	3	F	-	-	-	-
MEC2003	Supply Chain Management	3	0	0	3	S/ EM/ EN	-	-	-	-

MEC2004	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	MEC 2008	-
MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
MEC2006	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-
MEC2007	Additive Manufacturing	3	0	0	3	F/EM	-	-	-	-
MEC3069	Engineering Optimisation	3	0	0	3	S/EM	-	-	-	-
MEC3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-
MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	S/EM	ES	-	-	-
MEC3072	Thermal Management of Electronic Appliances	3	0	0	3	S/EM	-	-	-	-
MEC3200	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
MEC3201	Industry 4.0	3	0	0	3	S/EM	-	-	-	-
Petroleum Basket										
PET1011	Energy Industry Dynamics	3	0	0	3	FC	ES	-	NIL	-
PET1012	Energy Sustainability Practices	3	0	0	3	FC	ES	-	NIL	-
Physics Basket										
PHY1003	Mechanics and Physics of Materials	3	0	0	3	FC / SD				
PHY1004	Astronomy	3	0	0	3	FC				
PHY1005	Game Physics	2	0	2	3	FC / SD				
PHY1006	Statistical Mechanics	2	0	0	2	FC				
PHY1007	Physics of Nanomaterials	3	0	0	3	FC				
PHY1008	Adventures in nanoworld	2	0	0	2	FC				
PHY2001	Medical Physics	2	0	0	2	FC	ES			
PHY2002	Sensor Physics	1	0	2	2	FC / SD				
PHY2003	Computational Physics	1	0	2	2	FC				
PHY2004	Laser Physics	3	0	0	3	FC	ES			
PHY2005	Science and Technology of Energy	3	0	0	3	FC	ES			
PHY2009	Essentials of Physics	2	0	0	2	FC				
Management Basket- I										
MGT2007	Digital Entrepreneurship	3	0	0	3	S/EM/ EN	-	-	-	-
MGT2015	Engineering Economics	3	0	0	3	S	-	-	-	-

MGT2023	People Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Management Basket- II										
MGT1001	Introduction to Psychology	3	0	0	3	F	HP	-	-	-
MGT1002	Business Intelligence	3	0	0	3	EN	-	-	-	-
MGT1003	NGO Management	3	0	0	3	S	-	-	-	-
MGT1004	Essentials of Leadership	3	0	0	3	EM/ EN	GS/ HP	-	-	-
MGT1005	Cross Cultural Communication	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2001	Business Analytics	3	0	0	3	S/ EM/E N	-	-	-	-
MGT2002	Organizational Behaviour	3	0	0	3	F	HP	-	-	-
MGT2003	Competitive Intelligence	3	0	0	3	S	-	-	-	-
MGT2004	Development of Enterprises	3	0	0	3	S/EM/ EN	-	-	-	-
MGT2005	Economics and Cost Estimation	3	0	0	3	S/EM	-	-	-	-
MGT2006	Decision Making Under Uncertainty	3	0	0	3	S	-	-	-	-
MGT2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-
MGT2009	Management Consulting	3	0	0	3	S/EM/ EN	-	-	-	-
MGT2010	Managing People and Performance	3	0	0	3	S/EM/ EN	HP/G S	-	-	-
MGT2011	Personal Finance	3	0	0	3	F	-	-	-	-
MGT2012	E Business for Management	3	0	0	3	S/EM	-	-	-	-
MGT2013	Project Management	3	0	0	3	EN / EM	GS/H P/ES	-	-	-
MGT2014	Project Finance	3	0	0	3	EN / EM	HP	-	-	-
MGT2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
MGT2017	Principles of Management	3	0	0	3	S/EM/ EN	-	-	-	-
MGT2018	Professional and Business Ethics	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2019	Sales Techniques	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2020	Marketing for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2021	Finance for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2022	Customer Relationship Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Media Studies Basket										
BAJ3050	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-

BAJ3051	Digital Photography	2	0	2	3	EM	HP	-	-	-
BAJ3055	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-
Special Basket (NVIDIA)										
CSS3430	Introduction to NVIDIA Accelerated Computing and AI	2	0	2	3					
CSS3431	NVIDIA Applied Artificial Intelligence and Generative AI	2	0	2	3					
CSS3432	Advanced AI Systems and Generative Intelligence using NVIDIA Platforms	2	0	2	3					

21. List of MOOC 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 List of MOOC – B.Tech. Computer Science and Engineering Program(Internet of Things).

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
34	CAI3430	Responsible & Safe AI Systems	3	3-0-0-3
35	CCS3416	Practical Cyber Security for Cyber Security Practitioners	3	3-0-0-3
36	IST3409	Design & Implementation of Human-Computer Interfaces	3	3-0-0-3

21.3 MOOC - Open Elective Courses for B. Tech. (Computer Science and Engineering-Internet of Things)

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 Cont¯rol	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

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

Sl. No.	Course Code	Course Name	L	T	P	C	Contact hours	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	4	F		BSC
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	3	F		BSC
3	MEC1006	Engineering Graphics	2	0	0	2	2	S		ESC
4	ENG1030	Fundamentals of Communication	1	0	2	2	3	S		HSMC
5	CSS1500	Computational Thinking using Python	2	0	2	3	4	S		ESC

6	ECE2022	Digital Design	2	0	0	2	2	F/S		ESC
7	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	2	F		BSC
8	PPS1025	Industry Readiness Program – I	0	0	2	0	2	S		MAC
9	ECE2052	Digital Design Lab	0	0	2	1	2	F/S		ESC
10	ECE1512	Design Thinking in Practice	2	0	2	3	4	S/EM		HSMA
			15	1	12	21	28			
Semester 1 – Chemistry Cycle						**20**				
Sl. No.	Course Code	Course Name	L	T	P	C	Contact hours			
1	MAT1211	Linear Algebra, Differential Equations and Statistical Methods	3	1	0	4	4	F		BSC
2	CIV1200	Foundations of Integrated Engineering	2	0	0	2	2	S		ESC
3	CHE2501	Chemistry of Smart Materials	3	0	0	3	3	S		BSC
4	CSS2200	Problem Solving using C	2	0	0	2	2	S		PCC
5	ENG2030	Communication in Practice	1	0	2	2	3	S		HSMC
6	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	3	F/S		ESC
7	CSS2201	Problem Solving using C Lab	0	0	4	2	4	S		PCC
8	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	2	S		BSC
9	PPS1026	Industry Readiness Program – II	0	0	2	0	2	S		MAC
10	EEE1251	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	2	F/S		ESC
			14	1	12	20	27			

First year - CYCLE 2

Sl. No.	Course Code	Course Name	L	T	P	C	Contact hours	Type of Skill/ Focus	Course Caters to	Basket
Semester 1 – Chemistry Cycle						**20**				
Sl. No.	Course Code	Course Name	L	T	P	C	Contact hours			
1	MAT1212	Mathematical foundations for Machine Learning and Data Analysis	3	1	0	4	4	F		BSC
2	CIV1200	Foundations of Integrated Engineering	2	0	0	2	2	S		ESC
3	CHE2501	Chemistry of Smart Materials	3	0	0	3	3	S		BSC
4	CSS2200	Problem Solving using C	2	0	0	2	2	S		PCC
5	ENG2030	Communication in Practice	1	0	2	2	3	S		HSMC
6	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	3	F/S		ESC
7	CSS2201	Problem Solving using C Lab	0	0	4	2	4	S		PCC
8	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	2	S		BSC
9	PPS1026	Industry Readiness Program – II	0	0	2	0	2	S		MAC
10	EEE1251	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	2	F/S		ESC
			14	1	12	20	27			
Semester 2 - Physics Cycle						**21**				
1	MAT1212	Mathematical foundations for Machine Learning and Data Analysis	3	1	0	4	4	F		BSC
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	3	F		BSC
3	MEC1006	Engineering Graphics	2	0	0	2	2	S		ESC
4	ENG1030	Fundamentals of Communication	1	0	2	2	3	S		HSMC
5	CSS1500	Computational Thinking using Python	2	0	2	3	4	S		ESC
6	ECE2022	Digital Design	2	0	0	2	2	F/S		ESC
7	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	2	F		BSC
8	PPS1025	Industry Readiness Program – I	0	0	2	0	2	S		MAC
9	ECE2052	Digital Design Lab	0	0	2	1	2	F/S		ESC
10	ECE2152	Design Thinking in Practice	2	0	2	3	4	S/EM		ESC
			15	1	12	21	28			

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	0	0	2	1	2	S	Nil	PCC

		and Computer Networks Lab								
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	F	Nil	MAC
12	APT4002	Introduction to Aptitude	0	0	2	0	2	AT	Nil	MAC
Semester 4			**19**	**2**	**8**	**23**	**29**			
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	**CIT2500**	FoG Computing for IoT	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**	**PCC**
4	**CSS2260**	**Database Management Systems**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**	**PCC**
5	**CSS2261**	**Database Management Systems Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**	**PCC**
6	FIN1002	Essentials of Finance	**3**	**0**	**0**	**3**	**3**	S	Nil	HSMC
7	**CSS2262**	**Analysis of Algorithms**	**3**	**1**	**0**	**4**	**4**	**S**	**Nil**	**PCC**
8	**CSS2263**	**Analysis of Algorithms Lab**	**0**	**0**	**2**	**1**	**2**	**S**	**Nil**	**PCC**
9	**CSS2264**	**Essentials of AI**	**3**	**0**	**0**	**3**	**3**	**S/EM**	**Nil**	**ESC**
10	**CSS2265**	**Essentials of AI Lab**	**0**	**0**	**2**	**1**	**2**	**S/EM**	**Nil**	**ESC**
11	APT4004	Aptitude Training-Intermediate	0	0	2	0	2	AT	Nil	**MAC**
Semester 5			**21**	**0**	**6**	**25**	**27**			
1	**CSS2266**	**Theory of Computation**	**3**	**0**	**0**	**3**	**3**	**S**	**Nil**	**PCC**
2	CSS2502	Cryptography and Network Security	3	0	0	3	**3**	S	CSE2251	PCC
3	CIT2501	Wireless Communication in IoT	3	0	0	3	3	S	CSE2251	PCC

4	CIT2503	Mobile Application for IoT	3	0	0	3	3	S	CSS2255	PCC
	CIT2505	Mobile Application for IoT Lab	0	0	2	1	2	S	CSS2255	PCC
5	**CSS2269**	**Operating Systems**	3	0	0	3	3	S	Nil	PCC
6	**CSS2270**	**Operating Systems Lab**	0	0	2	1	2	S/EM	Nil	PCC
7	CIT2400	Cyber-Physical Systems	3	0	0	3	3	S	NIl	PCC
9	CSSXXXX	Professional Elective – I	3	0	0	3	3	S/EM	Nil	PEC
10	CSS7000	Internship	0	0	0	2	0	S/EM	Nil	PRW
11	APT4006	Logical and Critical Thinking	0	0	2	0	2	AT/EM	Nil	MAC
Semester 6			**19**	**0**	**6**	**21**	**25**			
1	**CSS2271**	Software Design and Development	3	0	0	3	3	**S**	**Nil**	**PCC**
2	CIT2504	AI and Deep Learning for IoT	3	0	0	3	3	S/EM	CSE2264	PCC
3	CIT2502	Privacy and Security in IoT	3	0	0	3	3	S	CSE2502	PCC
4	CSS2274	Competitive Programming and Problem Solving	0	0	4	2	4	**S/EM**	**Nil**	**ESC**
5	CSSXXXX	Professional Elective – II	3	0	0	3	3	S	Nil	PEC
6	CSSXXXX	Professional Elective – III	3	0	0	3	3	S	Nil	PEC
7	XXXXXXX	Open Elective – I	3	0	0	3	3	S	Nil	OEC
8	APT4005	Aptitude for Employability	0	0	2	1	2	S	Nil	HSMC
9	LAW7601	Indian Constitution	1	0	0	0	1	F	Nil	MAC
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	SS	Nil	HSMC
6	**CSS7100**	**Mini Project**	**0**	**0**	**0**	**4**	**0**	**S**	**Nil**	**PRW**
Semester 8			**0**	**0**	**0**	**10**	**0**			
1	**CSS7300**	**Capstone Project**	**0**	**0**	**0**	**10**	**0**	**S/EM**	**Nil**	**PRW**
			120	**4**	**56**	**160**	**180**			

24. 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 Resource

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**	**L-T- P- C**	**3**	**1**	**0**	**4**
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
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	**Fundamentals 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	**Differential 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	Ordinary 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	**Statistical 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.		

Targeted 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 Title: **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		
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 Out Comes	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 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 Content:			
Module 1	Electrical Conductivity Of Solids And Semiconducting Devices	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	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	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	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.			
Targeted Application & Tools that can be used: 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.
Text Book Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2024. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition
References: 1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002. 2. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011. 3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017. 4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012. 5. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019
E-Resourses: 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 Title: Engineering Graphics Type of Course: School Core & Theory Only	L- T- P- C	2-0-0-2
Version No.	1.2		
Course Pre- Requisites	NIL		

Anti-requisites	NIL
Course Description	The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Engineering Graphics" and attain SKILL DEVELOPMENT through Problem solving methodologies.
Course Outcomes	On successful completion of this course the students shall be able to: **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 2 – 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	Assignment	Standard technical drawing	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	Assignment	Projection methods Analysis	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	Assignment	Multi-view drawing Analysis	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)	Assignment	Spatial Visualization	8 Sessions
Topics: Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects. [8 Hours: Application Level]				
Text Book: 1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.				
References: K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill. Web resources: https://nptel.ac.in/courses/112103019				
Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for SKILL DEVELOPMENT through Problem Solving methodologies. This is attained through the assessment component mentioned in the course handout.				

Course Code: **ENG1030**	**Course Title: Fundamentals of Communication** **Type of Course: Integrated**	**L-T-P-C**	1	0	2	2
Version No.	1.0					
Course Pre-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 this course the students shall be able to:** 1. **Understand** the principles of interpersonal, intercultural, and professional communication in academic, social, and technical team contexts. 2. **Demonstrate** audience-centered spoken communication in individual presentations, group discussions, and simulated professional scenarios through vocal control, adaptive register, and collaborative engagement. 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. 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. 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.

Course Content: Fundamentals of Communication

Module 1	**Communication in a New World**	**CA1 + Project Milestone**	**Deep Listening and Contextual Response Lab**	**06 Sessions**

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**	**CA2, CA3, CA4**	**Narrative and Adaptive Oral Delivery**	**15 Sessions**

			Facilitated Stakeholder Group Discussion **Simulated Workplace Crisis Briefing**	
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**	**Project Milestone**	**Source Audit and Fallacy Brief**	**09 Sessions**
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**	**CA 5 + Project Milestone**	**Technical Translation and Annotated Script**	**09 Sessions**
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	**Communication in the Age of AI**	**CA 6 – Project Milestone**	**CA 6: Cross-Disciplinary Case Analysis and Defence**	**06 Sessions**
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 Application & Tools that can be used: 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

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(s):

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

Reference Book(s):

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.

Web Sources:

- 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.

Catalogue prepared by	Dr Ajith K and Dr Shahanas Punnilath Shanavas
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSS1500	**Course Title: 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
Anti-requisites	NIL
Course Description	This course efficiently introduces fundamental programming concepts including conditionals, loops, functions, lists, strings, tuples, and dictionaries through practical examples and problem-solving techniques. It also covers advanced programming concepts such as exception handling, file processing, modules, and packages using Python. The course emphasizes computational thinking, algorithm development, and implementation of searching and sorting techniques using Python data structures. Additionally, it introduces secure file handling, intelligent input validation, and AI-assisted data processing concepts for real-world applications.
Course Objective	To develop computational thinking and problem-solving skills using Python by enabling students to design algorithms, implement programs using core programming constructs, apply data structures and file handling techniques, and develop secure and intelligent solutions 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. — Understand CO2: Implement Python programs using data types, operators, and expressions to perform computational tasks. — Apply CO3: Develop programs using control structures, functions, and recursion to solve structured problems. — Apply CO4: Utilize data structures such as lists, tuples, and dictionaries for efficient data representation and manipulation. — Apply CO5: Design and implement Python programs for secure file handling, exception management, and intelligent data validation for real-world applications. — 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**

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), Secure File Handling, Intelligent Error Detection using AI Concepts, Smart Input Validation Techniques, Automated Data Validation Applications.

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

WEEK 15.1: Secure and Intelligent Python Applications
Lab Sheet 31: Secure File Handling and Validation
Level 1: Write a Python program for secure file reading and writing with exception handling.
Level 2: Implement intelligent input validation for user data using exception handling techniques.
Lab Sheet 32: AI-based Python Applications
Level 1: Develop a Python program for automated data validation or log analysis.
Level 2: Implement a simple intelligent application using Python modules and file processing concepts.

Project work/Assignment:

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

Text Book

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021
2. Eric Matthes, Python Crash Course,: A Hands-On, Project-Based Introduction to Programming, 3rd Edition, 2023

References

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc20_cs70/preview

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.

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 Title: Design Thinking in Practice**	**L- T-P- C**	**2-0-2-3**
Version No.	1.0		
Course Pre-requisites	NIL		
Anti-requisites	NIL		
Course Description	This course introduces students to 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** 1. **Explain** the principles, framework, and process of design thinking 2. **Formulate** Engineering Problem from user challenges, customer expectations, and market opportunities using design thinking process. 3. **Analyze** the Engineering Problem using the basic concepts of microcontroller and sensory devices. 4. **Find** alternate methods to solve the engineering problem by working with embedded computing platforms. 5. **Develop** functional prototypes using embedded boards, sensors, and an intelligent system for the chosen method 6. **Validate** prototype performance through testing, user feedback, and iterative improvements.

Course Content		
Module 1	**Introduction to Design thinking**	**6 Sessions**
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**	**8 Sessions**
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**	**8 Sessions**
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**	**8 Sessions**

Importance of Prototyping in Design Thinking Concept Refinement Using Prototypes From Idea to Functional Prototype User 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.
11. 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 Application & Tools that can be used:

Application Area:
Home Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino, 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.

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. Presidency University Library Link **Presentation:** There will be a review presentation (Phase 1, Phase 2, and Phase 3) from among the groups, where the students will be given a project, and they have to demonstrate the working and discuss the applications for the same

References:

1. Design Thinking by Clarke, Rachel Ivy. Series: Library Futures, Vol. 4. Chicago: ALA Neal-Schuman. 2020. eBook., Database: eBook Collection (EBSCOhost)
2. Neerparaj Rai, "Arduino Projects for Engineers," BPB Publishers, first edition, 2016.
3. Stewart Watkiss "Learn Electronics with Raspberry Pi" Apress Berkeley, CA. Second edition, 2020. ISBN978-1-4842-6348-8
4. Jo Prusa, "Basics of 3D printing", Prusa Research, 3rd edition.
5. Volker Ziemann, "A Hands-On Course in Sensors Using the Arduino and Raspberry Pi (Series in Sensors)", CRC Press, 1st Edition. 2018.
6. Professional CUDA C Programming. Professional CUDA C Programming. Wrox Press, 2014.

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

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

1. Tim Brown, "Design Thinking," Harvard Business Review, vol. 86, no. 6, pp. 84-92, Jun. 2008.
2. Rolf Faste, "Ambidextrous Thinking," in Innovations in Mechanical Engineering Curricula for the 1990s, American Society of Mechanical Engineers, 1994, pp. 1-6.
3. 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, Aug. 2021.
4. 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.
5. Espressif Systems, "ESP32 Series Datasheet," 2024.
6. 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.

Catalogue prepared by	Dr. Divyarani M S, Dr. M Manikandan
Recommended by the Board of Studies on	BoS Number:
Date of Approval by the Academic Council	Academic Council Meeting No. dated on

Course Code: PHY2504	Course Title: Optoelectronics and Quantum Physics Lab Type of Course: 1] School Core	L-T-P-C	0-0-2-1
Version No.	1.0		
Course Pre-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 Out Comes	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 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

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 Application & Tools that can be used: 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.

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

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**	**L-T- 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			
Anti-requisites	CSSXXXX		
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: 1. William Oakes & Les Leone, "Engineering Your Future: An Introduction to Engineering", Oxford University Press, 9th Edition, 2021 2. Barry F. Kavanagh, “Introduction to Geomatics”, Pearson, 5th Edition, 2021 3. Ian Gibson, David Rosen, & Brent Stucker, “Additive Manufacturing Technologies”, Springer, 3rd Edition, 2021 4. Sudip Misra, "The Internet of Things: Enabling Technologies, Protocols, and Use Cases", Wiley, 2nd Edition, 2022 5. James Kurose & Keith Ross, “Computer Networking: A Top-Down Approach”, Pearson, 8th Edition, 2020				
References 1. Supratim Choudhuri, “Bioinformatics for Beginners: Genes, Genomes, and Molecular Evolution", Academic Press, 1st Edition, 2023, 2. Robert McGinn, "The Ethical Engineer: Contemporary Concepts and Cases", Princeton University Press, 1st Edition, 2020 3. Charles J. Kibert, “Sustainable Construction: Green Building Design and Delivery”, Wiley, 5th Edition, 2022 4. Anthony M. Townsend, "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", W.W. Norton & Company, 1st Edition, 2020 5. David Buchla, "Renewable Energy Systems: A Smart Energy Systems Approach", Pearson, 2nd Edition, 2023 6. Charles Platt, "Make: Electronics: Learning Through Discovery", Make Community, 3rd Edition, 2021 7. Charles J. Brooks, Christopher Grow, & Philip Craig, “Cybersecurity Essentials", Wiley, 2nd Edition, 2021 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	CSSXXXX		
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. **Photovoltaics:** 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

1. Wiley, “Engineering Chemistry”, Wiley.
2. G.A. Ozin and A.C. Arsenault, Nanochemistry: A chemical approach to nanomaterials, Royal Society of Chemistry, 2009

Reference Books

1. Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press,
2. ISBN: 978-036-727-510-5.
3. E-waste recycling and management: present scenarios and environmental issues, Khan, Anish, and
4. Abdullah M. Asiri. 2019, Springer, Vol. 33. ISBN: 978-3-030-14186-8.
5. Essentials of computational chemistry: theories and models, Christopher J Cramer, 2013, John Wiley &
6. Sons. ISBN: 978-0-470-09182-1.
7. Energy storage and conversion devices: Supercapacitors, batteries and hydroelectric cells, Anurag Gaur,
8. L. Sharma, Anil Arya. 2021, CRC press, 1st edition, ISBN: 978-1-003-14176-1.
9. Fundamentals of analytical chemistry: An introduction, Douglas A. Skooget etal., 2004 Thomson Asia pte
10. Ltd., 8th, ISBN: 978-0-495-55828-6

11. Functional and smart materials, Chander Prakash, Sunpreet Singh, J. Paulo Davim, 2020, CRC Press,

12. ISBN: 978-036-727-510-5.

13. Electrical and electronic devices, circuits and materials: Technological challenges and solutions. Tripathi,

14. L., Alvi, P. A., & Subramaniam, U, 2021, John Wiley & Sons, ISBN: 978-0367564261.

15. F. Jensen, Introduction to Computational Chemistry, 3rd edition, Wiley, 2017.

E 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. 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 Title: 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**		
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 Solvi ng 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 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**	**Assignment (Algorithms,**	**6 Sessions**

		Flowcharts, and Basic C Programs)	
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**	**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**	**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**	**Assignment (Structures, Unions, and File Operations in C)**	**6 Sessions**
Topics: **Structures:** Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Mem bers – **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**	**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.			
Text Book(s): 1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.			
Reference Book(s): 1. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. 2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016. 3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2015 4. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014. 5. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.			
Web Links and Video Lectures: 1. NPTEL – Programming in C 2. NPTEL – Problem Solving Through Programming in C 3. GeeksforGeeks – C Programming Language			

Course Code: ENG2030	**Course Title: 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)					
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 this course the students shall be able to:** 1. **Explain** the principles governing professional communication identity, communicator ethics, and context-sensitive self-presentation across workplace, hierarchical, and digital contexts. 2. **Demonstrate** advanced vocal, rhetorical, and adaptive strategies across high-stakes spoken communication genres, including interviews, pitches, negotiations, and leadership scenarios. 3. **Demonstrate** advanced vocal, rhetorical, and adaptive strategies across high-stakes spoken communication genres, including interviews, pitches, negotiations, and leadership scenarios. 4. **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. 5. **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.

Course Content: Communication in Practice

Module 1	**Words that Work: Vocabulary, Register, and Precision**	**CA1**	**Register Switching Activity**	**09 Sessions**

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**	**CA2**	**Rapid Listening and Response**	**12 Sessions**

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**	**CA**	**Mock Professional Interview, Pitching an Idea Pitch**	**12 Sessions**

1. Speaking as a professional: identity, presence, and the first impression
2. Vocal authority, physical presence, and communication across hierarchies
3. Interview communication: structure, composure, and the STAR framework
4. Pitching ideas: the 3-minute and 10-minute pitch architecture
5. Negotiation and principled disagreement

6. Communicating in leadership positions: chairing, facilitating, and giving direction
7. Managing communication under pressure: hostile questions, silence, and contradiction

Module 4	Adaptive Communication	CA	Communication Strategy Plan	12 Sessions

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 Application & Tools that can be used: 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

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(s):
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.
Reference Book(s):
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.
Web Sources:
• 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.

Catalogue prepared by	Dr Ajith K and Dr Shahanas Punnilath Shanavas
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

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.			
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 Title: 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**		
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):

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

Reference Book(s):

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

Web Links and Video Lectures:

1. NPTEL – Programming in C
2. NPTEL – Problem Solving Through Programming in C
1. 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			
Anti-requisites			
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. CO2: estimate the presence of acids and metal ions in domestic and industrial waste using laboratory techniques. CO3: review the experimental results and demonstrate improved experimental skills through hands-on laboratory experience. CO4: classify laboratory techniques such as experimental setups for synthesis, purification, recovery and analysis.		

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 Title: 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**					
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: 1. **Demonstrate** the behavior of passive elements and fundamental electrical circuit laws 2. **Determine** the power factor, impedance, and phase relationship of R and RL loads under AC supply conditions. 3. **Develop** electrical circuits and three-phase supply systems using MATLAB/Simulink to study resistance, voltage, and current characteristics. 4. **Analyze** the performance characteristics of electrical machines, including single-phase transformers and three-phase induction motors, under different operating conditions. 5. **Examine** the output characteristics and performance parameters of half-wave and full-wave rectifiers. 6. **Illustrate** the performance characteristics of Zener diode and MOSFET under different operating conditions.					
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 Application & Tools that can be used:

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

Professionally Used Software: MATLAB 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.

Course Material

1. Basics of Electrical and Electronics Engineering Laboratory Manual, Presidency University, Bengaluru.

Text Book:

1. D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 4th Edition, McGraw Hill Education, New Delhi, 2019.
2. 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

1. John Hiley, Keith Brown and Ian McKenzie-Smith, Hughes Electrical and Electronic Technology, 12th Edition, Pearson Education, 2016.
2. S. K. Bhattacharya and D. Devaraj, Basic Electrical and Electronics Engineering, 2nd Edition, Pearson Education India, 2017.
3. T. K. Nagsarkar and M. S. Sukhija, Principles of Basic Electrical Engineering, 1st Edition, Oxford University Press, 2018.
4. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 12th Edition, Pearson Education, 2019.
5. A. K. Maini and Varsha Agrawal, Electronic Devices and Circuits, 2nd Edition, Wiley India, 2019.
6. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 8th Edition, Oxford University Press, 2019.

Online 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.

Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: MAT2311	**Course Title: 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.

<table>
<tr><td colspan="2">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</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td>Catalogue prepared by</td><td>Dr. V Ramalatha</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td></td></tr>
<tr><td>Date of Approval by the Academic Council</td><td></td></tr>
</table>

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			
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.		

<table>
<tr><td>Course Outcomes</td><td colspan="3">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]</td></tr>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>Module 1</td><td>Introduction and Physical layer</td><td>Assessment: Assignment (Problem Solving)</td><td>9 Sessions</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>Module 2</td><td>Data Link Layer</td><td>Assessment: Assignment (Problem Solving)</td><td>12 Sessions</td></tr>
<tr><td colspan="4">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</td></tr>
<tr><td>Module 3</td><td>Network Layer</td><td>Assessment: Assignment (Problem Solving)</td><td>13 Sessions</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>Module 4</td><td>Transport and Application Layer</td><td>Assessment: Assignment (Problem Solving)</td><td>11 Sessions</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Targeted Applications & Tools: Cisco Packet Tracer, Wireshark, and NS2 Simulator.</td></tr>
<tr><td colspan="4">Skill-Building Activities through Experiential Learning:</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Text Book
T1: T1. Behrouz A. Forouzan, “Data Communications and Networking with TCP/IP Protocol Suite”, 6th Edition, Tata McGraw-Hill, 2022.
T2: Andrew S Tanenbaum, Nick Feamster & David J Wetherall, “Computer Networks” Sixth Edition, Pearson Publication, 2022.</td></tr>
<tr><td colspan="4">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</td></tr>
<tr><td colspan="4">E-Resources/Web Resources</td></tr>
</table>

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 Title: Data Structures Type of Course: Theory Course (PCC)	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 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 this course, students will 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	9 Sessions

Introduction – Introduction to Data Structures, Types and concept of Arrays.

Stack - Concepts and representation, Stack operations, stack implementation using array and Applications of Stack.

Queues - Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.

Module 2	Linear Data Structure- Linked List	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	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	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	6 Sessions

Topic: 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 Application & Tools that can be used

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

Project work/Assignment:

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

Text Book

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

T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
References R1 Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017. R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019. Web resources: 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 Title: 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		
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 this course, students will be able to: CO1: Explain the concepts of fundamental data structures such as arrays, stacks, and queues and their operations. Understand CO2: Implement linear data structures such as linked lists to solve real-world problems. Apply		

	CO3: Utilize appropriate non-linear data structures such as trees and graphs for given problem scenarios.	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.	Apply
	CO5: Apply data structure concepts in cybersecurity, AI/ML, blockchain, and intelligent computing applications.	Apply

Course Content:	30 Sessions

List of Laboratory Tasks: 30 Sessions

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 Application & Tools that can be used

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

Project work/Assignment:

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

Text Book

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

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

References

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

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

Web resources:

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 Title: Object Oriented Programming Using Java** **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 core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques					
Course Outcomes	On successful completion of the course, students shall be able to: **CO1:** Describe fundamental programming concepts. [Understand] **CO2:** Apply the concepts of classes, objects, and methods to solve problems. [Apply] **CO3:** Apply the concepts of arrays and strings. [Apply] **CO4:** Implement inheritance and polymorphism to develop secure applications. [Apply] **CO5:** Apply the concepts of interfaces and error-handling mechanisms. [Apply]					
Course Content:						
Module 1	**Basic Concepts of Programming and Java**					**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**					**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	**Arrays, String and String buffer**					**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**	**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	**Input & Output Operation in Java**	**8 Sessions**
Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.		

Text Book

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

References

1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.
2. James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.
3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

E book link 1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf **E book link 2:** Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub)

Web resources

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

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

Topics relevant to development of "Skill Development":

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: **CSS2256**	**Course Title: Object Oriented Programming Using Java Lab** **Type of Course: Laboratory Course (PCC)**	**L-T- P- C**	**0**	**0**	**2**	**1**
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques					
Course Outcomes	On successful completion of the course, students shall be able to: **CO1:** Demonstrate fundamental programming concepts. [Apply][Text Wrapping Break]**CO2:** Apply the concepts of classes, objects, and methods to solve problems. [Apply][Text Wrapping Break]**CO3:** Apply the concepts of arrays and strings. [Apply][Text Wrapping Break]**CO4:** Implement inheritance and polymorphism to develop secure applications. [Apply][Text Wrapping Break]**CO5:** Apply the concepts of interfaces and error-handling mechanisms. [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.

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

Text Book

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

References

1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

2. James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

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

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

Web resources

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

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

Topics relevant to development of "Skill Development":

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 Title: 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		
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 this course, students will be able to: **CO1:** Describe the fundamental components of a computer system and their interconnections. — Remember **CO2:** Explain the concepts of Instruction Set Architecture (ISA) and memory organization. — Understand **CO3:** Apply techniques to perform arithmetic and logical operations in computer systems. — Apply **CO4:** Explain the organization and functioning of processor and memory subsystems. — Understand

Course Content:

Module 1	Basic Structure of Computer	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	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	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	05 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	06 Sessions
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 Application & Tools that can be used: Targeted employment sector is processor manufacturing and memory chip fabrication vendors like Intel, AMD, Motorola, NVidia, Samsung, Micron Technology, western Digital etc. Targeted job profiles include Memory circuit design and verification engineers, Physical system design engineer, System programmer, Fabrication engineer etc. Tools: Virtual Lab, IIT KGP Tejas – Java Based Architectural Simulator, IIT Delhi		
Project work/Assignment:		
Each batch of students (self-selected batch mates – up to 4 in a batch) will be allocated case studies/assignments		
Textbook(s): 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Sixth Edition, McGraw-Hill Higher Education, 2023 reprint. 2. William Stallings, “Computer Organization & Architecture – Designing for Performance”, 11th Edition, Pearson Education Inc., 2019.		
References 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. 2. https://nptel.ac.in/courses/106105163		

3. https://nptel.ac.in/courses/106106092
4. https://puniversity.informaticsglobal.com:2229/login.aspx

Course Code: CSS2258	Course Title: Web Technologies 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 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.

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

CSS, PHP. Designing for healthcare.

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

E-References:

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

Course Code: CSS2259	Course Title: 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		
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 15.1: 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-References:

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.

ourse Code: CIV7601	Course Title: Universal Human Values and Ethics Type of Course: MAC course	L-T-P-C	-	-	-	0
Course Pre-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.

Online Link*:

1. UHV II - https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So&pp=0gcJCWMEOCosWNin
2. Lecture by Dr. Kumar Sambhav, NPTEL course: Universal Human Values, https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
3. 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. 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
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2019.
3. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

Reference Books

1. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
2. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
3. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
4. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
5. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
6. A N Tripathy, 2003, Human Values, New Age International Publishers.
7. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press

8. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
9. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
10. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.

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

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			
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 -]
	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 –]
	CO5: Rearrange the information to simplify the question	[Level –]

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 Reasoning by R S Aggarwal

References

E-Resources/Web Resources

1. www.indiabix.com

2. www.youtube.com/c/TheAptitudeGuy/videos

<table>
<tr><td>Course Code:
CHE7601</td><td>Course Name: Environmental Studies

Type of Course:MOOC course</td><td>L- T-P- C</td><td>1-0-0-0</td></tr>
<tr><td>Version No.</td><td colspan="3">1.0</td></tr>
<tr><td>NCrF Level-</td><td colspan="3">5.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Co-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="3">CSSXXXX</td></tr>
<tr><td>Course Description</td><td colspan="3">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</td></tr>
<tr><td>Course Objective</td><td colspan="3">The objective of the course is ‘SKILL DEVELOPMENT’ of the student by using ‘PARTICIPATIVE LEARNING’ techniques</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">On successful completion of the course the students shall be able to:

<table><tr><td>CO1: Describe the issues related to natural resources, ecosystems and biodiversity</td><td>L1– Remember</td></tr><tr><td>CO2: Identify environmental hazards affecting air, water and soil quality</td><td>L2– Understand</td></tr><tr><td>CO3:Recognize the importance of healthy environment and finding the sustainable methods to protect the environment</td><td>L3 – Apply</td></tr><tr><td>CO4: Convert skills to address immediate environmental concerns through changes in environmental processes, policies, and decisions</td><td>L4 – Analyze</td></tr></table></td></tr>
<tr><td colspan="4">Course Content:</td></tr>
<tr><td>Module 1</td><td>Understanding Environment, Natural Resources, and Sustainability</td><td></td><td></td></tr>
<tr><td colspan="4">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.</td></tr>
</table>

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: CIT2500	Course Name: **Fog Computing for IoT** Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level-	NIL		
Course Pre-requisites	NIL		
Co-requisites			
Anti-requisites			
Course Description	The course will provide a solid base for understanding the challenges and problems underlying the design and development of fog computing systems and applications. Thus, this course will teach how to specify, design, program, analyze and implement such systems and applications. Fog computing is a decentralized computing infrastructure in which data, compute, storage and applications are located somewhere between the data source and the cloud. Like edge computing, fog computing brings the advantages and power of the cloud closer to where data is created and acted upon. Many people use the terms fog computing and edge computing interchangeably because both involve bringing intelligence and processing closer to where the data is created. This is often done to improve efficiency, though it might also be done for security and compliance reasons.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Network Slicing, Big Data Analytics and attain **SKILL DEVELOPMENT** through PARTICIPATIVE LEARNING techniques**.**		

<table>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of the course the students shall be able to:
CO1 Summarize the fundamental characteristics of fog computing in relation to cloud and edge architectures. [Level 1: Understanding]
CO2 Apply communication standards within a multi-layered fog computing network architecture. [Level 3: Apply]
CO3 Deconstruct the management challenges of network slicing in software-defined fog environments [Level 4: Analyse]
CO4 Explain security management and privacy protection methods for big data in distributed IoT stacks [Level 4: Understanding]
CO5 Analyze integrated fog-IoT solutions for smart city and healthcare application scenarios [Level 4: Analyse]</td></tr>
<tr><td colspan="5">Course Content:</td></tr>
<tr><td>Module 1</td><td>INTRODUCTION TO FOG COMPUTING</td><td>Assignment, Programming activity</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing, Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT , FOG, Cloud Benefits.</td></tr>
<tr><td>Module 2</td><td>FOG ARCHITECTURE</td><td>Assignment
Programming activity</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction, IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.</td></tr>
<tr><td>Module 3</td><td>MANAGEMENT AND ORCHESTRATION</td><td>Assignment
Programming activity</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog, Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds.</td></tr>
<tr><td>Module 4</td><td>FOG INTEGRATION TECHNOLOGIES WITH IOT</td><td>Assignment</td><td colspan="2">10 Sessions</td></tr>
</table>

		Programming activity	

Topics:

IoT Integration, Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics: Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation. Case Study: Intelligent Traffic Lights Management (ITLM) System, Fog Computing for Smart Transportation Applications, Fog-IoT: architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, security and privacy issues.

Targeted Applications & Tools: **Case Study:** Wind Farm - Smart Traffic Light System, Wearable Sensing Devices, Wearable Event Device ,Wearable System, Demonstrations , Post Application Example . . Event Applications Example.

Tools/Software/Platform	Application
Cisco IOx & Fog Director	Deploy containerised analytics at roadside gateways for Smart Traffic-Light Systems—low-latency phase scheduling and vehicle-count aggregation.
AWS IoT Greengrass	Runs Lambda functions on turbine-edge controllers in a Wind-Farm case study to pre-filter vibration data and push only anomalies to the cloud.
FogFlow (FIWARE)	Event-driven data-flow orchestration across fog nodes for Wearable Sensing and Wearable Event Device streams (e.g., heart-rate alerts).
K3s (Lightweight Kubernetes)	Manages micro-service clusters on ARM-based edge boxes in Smart Transportation and urban-infrastructure pilots.
Eclipse ioFog / Edgeworx	Provides secure container runtime and remote OTA updates for Demonstration kiosks and post-event analytics in stadium IoT deployments.
Azure IoT Edge	Executes TensorFlow-Lite models on hospital gateways for Healthcare Monitoring—real-time patient-vitals classification near the bedside.

Skill-Building Activities through Experiential Learning: to “SKILL DEVELOPMENT”: Network Slices in 5G, Big Data Analytics, Fog, Prototypes and Evaluation for developing
Skills through PARTICIPATIVE LEARNING techniques. This is attained through assessment component mentioned in the course handout.

- 5G Network Slicing Prototype for Smart City Fog Deployments

Design and simulate a fog-based network architecture supporting intelligent traffic light management and urban mobility monitoring. Implement virtual network slices for video surveillance, vehicular telemetry, and emergency alerts using lightweight SDN-based orchestration. Evaluate latency, bandwidth utilization, and service isolation across slices to simulate real-time urban service differentiation.

- Fog-Node Big Data Pipeline for Industrial IoT

Develop a fog-based mini-pipeline that ingests sensor data from an industrial IoT setup (e.g., temperature, vibration). Implement preprocessing and analytics locally at the fog layer to detect anomalies. Benchmark against a pure cloud model to compare response times, processing overhead, and bandwidth savings. Visualize insights using a dashboard hosted at the edge.

- Participative Security Simulation in Fog-IoT Environments

Collaboratively simulate an IoT network integrated with fog nodes handling access control and encrypted data streams. Emulate common attack scenarios (e.g., packet sniffing, spoofing) and implement layered mitigation using middleware and authentication protocols. Conduct peer-reviewed security audits and document real-time threat detection, recovery latency, and data integrity validation.

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

1.Problem Solving: Choose an appropriate set of visualization elements and design for a dashboard.

2.Programming: Implementation of the chosen dashboard

Text Book

1. Abbas, Assad, Samee U. Khan, and Albert Y. Zomaya, eds. *Fog Computing: Theory and Practice*. John Wiley & Sons, 2020.

https://www.wiley.com/en-us/Fog+Computing%3A+Theory+and+Practice

2. Buyya, Rajkumar, and Satish Narayana Srirama, eds. *Fog and edge computing: principles and paradigms*. John Wiley & Sons, 2019.

https://www.wiley.com/en-us/Fog+and+Edge+Computing%3A+Principles+and+Paradigm

3. Misra, Sudip, Subhadeep Sarkar, and Subarna Chatterjee. Sensors, cloud, and fog: the enabling technologies for the Internet of Things. CRC Press, 2019.

https://www.routledge.com/Sensors-Cloud-and-Fog-The-Enabling-Technologies-for--the-Internet-of-Things/Misra-Sarkar-Chatterjee

1. References Mahmood, Zaigham, ed. Fog computing: concepts, frameworks and technologies. Springer, 2018.

https://link.springer.com/book/10.1007/978-3-319-94890-4

2. Tanwar, Sudeep, and Tanwar. Fog computing for Healthcare 4.0 environments. Springer International Publishing, 2021. https://www.sciencedirect.com/science/article/pii/S0045790618303860

Tomar, R., Katal, A., Dahiya, S., Singh, N., & Choudhury, T. (Eds.). (2022). Fog Computing: Concepts, Frameworks, and Applications (1st ed.). Chapman and Hall/CRC. https://www.taylorfrancis.com/books/edit/10.1201/9781003188230/fog-computing-ravi-tomar-avita-katal-susheela-dahiya-niharika-singh-tanupriya-choudhury

E-Resources/Web Resources

Web Based Resources and E-books:

1. https://www.codecademy.com/learn/learn-c-sharp
2. https://dotnet.microsoft.com/en-us/learn/csharp
3. https://www.learncs.org/
4. https://www.codechef.com/learn/course/c-sharp

https://csharp-station.com/

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			
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

<table>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">E-Resources/Web Resources</td></tr>
<tr><td>Course Code:

CSS2261</td><td>Course Name: Database Management Systems Lab

Type of Course: Laboratory Course</td><td>L- T-P-C</td><td>0-0-2-1</td></tr>
<tr><td>Version No.</td><td colspan="3">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Co-requisites</td><td colspan="3"></td></tr>
<tr><td>Anti-requisites</td><td colspan="3">NIL</td></tr>
<tr><td>Course Description</td><td colspan="3">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.</td></tr>
<tr><td>Course Objective</td><td colspan="3">The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain Employability through Problem Solving Methodologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">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]</td></tr>
</table>

	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: 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 -] **CO2**: Apply and interpret financial information for business decision making. [Level –] **CO3:** Identify various heads of income and deduction under Income Tax Act, 1961. [Level –]		

Course Content:			
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/

Course Code: **CSS2262**	**Course Title: 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		
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: Explain the efficiency of algorithms in terms of time and space complexity.	Understand
CO2: Apply divide-and-conquer and decrease-and-conquer techniques to solve searching and sorting problems.	Apply
CO3: Apply dynamic programming and greedy techniques to solve computational problems.	Apply
CO4: Apply time–space trade-off techniques and analyze the limitations of algorithms for problem solving.	Apply
CO5: Analyze problems using backtracking, branch-and-bound, and AI-based optimization techniques to develop optimal solutions.	Analyze

Course Content:		
Module 1	**Introduction**	**14 Sessions**
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**	**11 Sessions**
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**	**13 Sessions**
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:**	**11 Sessions**
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**	**11 Sessions**
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.		

Text Book:

1. Anany Levitin, *"Introduction to the Design and Analysis of Algorithms*", 3rd edition, Pearson Education, 2018.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to Algorithms*", 4th edition, MIT Press, 2022.

Reference Books:

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

Online 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 Title: 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		
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 Press, 2022.

References :

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

R2. Tim Roughgarden, *"Algorithms Illuminated"* (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyourself Publishing, 2017-2019.

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

R4. Donald E. Knuth, "*The Art of Computer Programming",* Volumes 1and 3 Pearson.

Web Based Resources and E-books:

W1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview

W2. Coursera: Analysis of Algorithms by Princeton University

W3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses).

W4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University

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

Course Code: CSS2264	**Course Title: Essentials of AI**	**L-T-P-C**	**3-0-0-3**

	Type of Course: -Theory Course (ESC)		
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:

1. Implementation of AI-based content generation and chatbot interaction using prompt engineering techniques.
   Tools: ChatGPT, Google Gemini, Hugging Face
2. Implementation of image generation and creative AI applications using generative AI tools.
   Tools: Canva AI, DALL·E, Adobe Firefly

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

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):

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

References:

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

Weblinks

- OpenAI
- Google AI
- IBM Artificial Intelligence
- Microsoft AI Learning
- Coursera – AI Courses
- NPTEL – Introduction to Artificial Intelligence
- NPTEL – Artificial Intelligence: Search Methods for Problem Solving

Course Code: CSS2265	**Course Title: 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, visualization, and evaluation techniques. [Level 4 – Analyze] **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 Application & Tools that can be used:

1. ChatGPT, Gemini, Hugging Face, Canva AI, Python

2. 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):

1. Stuart Russel and Peter Norvig. Artificial Intelligence: A Modern Approach. 4th Edition. Pearson Education. 2022.
2. Prateek Joshi and Alberto Artasanchez. Artificial Intelligence with Python. 2nd Edition. Packt. 2020.
3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 2022

References:

1. Deepak Khemani. *A First Course in Artificial Intelligence*. 1st Edition. 6th Reprint, 2018.
2. Munesh Chandra Trivedi. *A Classical Approach to Artificial Intelligence*. 2nd Edition. Khanna Publishers. 2018.

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			
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.
Text Book(s): 1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6th Ed, 2018. 2. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, 3rd Ed,2012
Reference(s): 1. Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008. 2. Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014.
E Resources 1. NPTEL 2. Opencourseware 3. TOC Notes

Course Code: CSS2502	**Course Title: Cryptography and Network Security** **Type of Course: Program Core & Theory only**	**L- T-P- C**	3	0	3
Version No.	1				
Course Pre-requisites	CSE1507 Data Communication and Computer Networks				
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.				

<table>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of this course the students shall be able to:

CO1: Extrapolate cryptography fundamentals and security architecture [Level 2 - Understa
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]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Cryptography and types of Ciphers</td><td>Problem Solving</td><td>Identify the basic concept of Cryptography</td><td>10 Sessions</td></tr>
<tr><td colspan="5">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.</td></tr>
<tr><td>Module 2</td><td>Symmetric Key Cryptography and Number Theory</td><td>Problem Solving & Participative Learning</td><td>Apply the concepts of cryptographic algorithms</td><td>13 Sessions</td></tr>
<tr><td colspan="5">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</td></tr>
</table>

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.				
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: 1. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall, 7th Edition, 2017. **Reference Books:** 1. Behrouz A Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", McGraw Hill, third edition, 2010. 2. R.Rajaram, "Network Security and Cryptography" SciTech Publication.3rd Edition, 2014. 3. AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2nd Edition, 2019. 4. BruceSchneier, "Applied Cryptography", John Wiley and Sons Inc. Scond Edition, 2015.				

Web references: 1.https://onlinecourses.nptel.ac.in/noc22_cs90/preview 2.e-pgpathshala UGC lecture series : E-Series and Self learning Materials. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ== 3. http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=10133&query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security 4.http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5875&query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security.
Topics relevant to "Skill Development": Symmetric and Asymmetric Encryption Algorithms and its problems.

Course Code: CIT2501	Course Name: **Wireless Communication in IOT** Type of Course: Theory Course	L- T-P-C	3-0-0-3
Version No.	1.2		
NCrF Level-	CSE2251		
Course Pre-requisites	**NIL**		
Co-requisites			
Anti-requisites			
Course Description	This course provides an introduction into aspects of the emerging IoT (Internet of Things) technology, WIFI IoT modules, Bluetooth, ZigBee, LoRaWAN, fundamentals of wireless communication based on IEEE 802.11 b/g/n, integration of sensors and data processing by IoT protocols, wireless network architecture and hardware components, Routing, Switching and Traffic management.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Wireless Communication in IOT** and attain **SKILL DEVELOPMENT** through **PARTICIPATIVE LEARNING** techniques		

Course Outcomes	On successful completion of the course the students shall be able to: CO1 Describe wireless sensor networks, IoT concepts, and enabling technologies. [Level 2: Understand] CO2 Explain WSN architectures, node design, and communication frameworks. [Level2: Understand] CO3 Implement wireless communication protocols for IoT applications. [Level 3: Apply] CO4 Examine WSN protocols and performance parameters for network optimization. [Level 4: Analyse] CO5 Evaluate wireless communication technologies for IoT-based solutions. [Level 4: Analyse]		
Course Content:			
Module 1	**Overview of Wireless Sensor Networks**	Assignment Analysis- various sensors and pin configuration	**11 Sessions**
Topics: Challenges for Wireless Sensor Networks in IOT, Enabling Technologies for Wireless Sensor Networks in IOT, RFID. **Overview of Internet** of Things: IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT,M2M communication, (Examples of IoT)			
Module 2	**IOT based Wireless communication Architecture**	Assignment Analysis –suitable wireless architecture	**11 Sessions**
Topics: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs Gateway Concepts.			
Module 3	**Wireless Communication Protocols in IOT**	Case Study Analysis – IOT protocols for adhoc applications	12 Sessions
Topics: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, integration of sensors and data processing by IoT protocols.			
Module 4	**Wireless communication technologies**	Assignment	9 Sessions

		Case study	

Topics:

Wi-Fi, Bluetooth, ZigBee, Lorawan, RFID.

Case Studies: Built a Wireless network using Packet Tracer and analysing parameters, Smart Phone and mobile network Project, Bluetooth Scan Project, Wi-Fi Analysis Project

Targeted Applications & Tools: **Case Study:** Targeted employment sector includes innovative thinking and creative abilities and are looking for an exciting work environment, professional development, and higher compensations that IT professionals. Targeted job profiles include IT / Networking, IoT Solutions Engineer, IOT develop/creator etc.

Tools:

- **Thingsboard open source IOT platforms**
- **Arduino open-source platform**

Adafruit INA219 Current Sensor Breakout

Project work/Assignment:

Mini Project:

Model demonstrating the wireless communication network using tinkercad and supporting sensors.

Term Assignments:

- **Comparative analysis of** WIFI **IoT modules, Bluetooth, ZigBee, LoRaWAN**

Carry out a thorough analysis of the wireless technologies

- **A short survey of the recent trends in the sensors and data analysis**

Study and analyze few important present day sensors and its related issues.

Skill-Building Activities through Experiential Learning: to "SKILL DEVELOPMENT": Network Slices in 5G, Big Data Analytics, Fog, Prototypes and Evaluation for developing
Skills through PARTICIPATIVE LEARNING techniques. This is attained through
assessment component mentioned in the course handout.

- 5G Network Slicing Prototype for Smart City Fog Deployments

Design and simulate a fog-based network architecture supporting intelligent traffic light management and urban mobility monitoring. Implement virtual network slices for video surveillance, vehicular telemetry, and emergency alerts using lightweight SDN-based orchestration. Evaluate latency, bandwidth utilization, and service isolation across slices to simulate real-time urban service differentiation.

- Fog-Node Big Data Pipeline for Industrial IoT

Develop a fog-based mini-pipeline that ingests sensor data from an industrial IoT setup (e.g., temperature, vibration). Implement preprocessing and analytics locally at the fog layer to detect anomalies. Benchmark against a pure cloud model to compare response times, processing overhead, and bandwidth savings. Visualize insights using a dashboard hosted at the edge.

- Participative Security Simulation in Fog-IoT Environments

Collaboratively simulate an IoT network integrated with fog nodes handling access control and encrypted data streams. Emulate common attack scenarios (e.g., packet sniffing, spoofing) and implement layered mitigation using middleware and authentication protocols. Conduct peer-reviewed security audits and document real-time threat detection, recovery latency, and data integrity validation.

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

1.Problem Solving: Choose an appropriate set of visualization elements and design for a dashboard.

2.Programming: Implementation of the chosen dashboard

Text Book

1. Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts" River Publishers, Denmark, 2015 (Indian reprint).

Bhagirathi Nayak, Subhendu Kumar Pani, Tanupriya Choudhury, Suneeta Satpathy, Sachi Nandan Mohanty, "Wireless Sensor Networks and the Internet of Things", Taylor and Francis group, 2021.

References

1. Iti Saha Misra, "Wireless Communication and Networks: 3G and Beyond", 2/e, McGraw Hill

Education (india) Private Ltd, New Delhi, 2013.

2. Geetharani P, " IOT & Wireless Sensor Networks", Medtech publisher, 2019.

References

2. Iti Saha Misra, "Wireless Communication and Networks: 3G and Beyond", 2/e, McGraw Hill

Education (india) Private Ltd, New Delhi, 2013.

3. Geetharani P, " IOT & Wireless Sensor Networks", Medtech publisher, 2019.

Web Based Resources and E-books:

Digital Learning Resources (Library Resources)

W1.**https://www.researchgate.net/publication/307567464_Sustainable_Development_in_Practice_Case_Studies_for_Engineers_and_Scientists_Second_Edition**

W2. E book link R1: https://web.s.ebscohost.com/ehost/detail/detail?vid=8&sid=cbc51846-7bf7-482b-8aac-fbd99ab97ee4%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#

E book link R2: https://web.s.ebscohost.com/ehost/detail/detail?vid=9&sid=cbc51846-7bf7-482b-8aac-fbd99ab97ee4%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#

W1. https://puniversity.informaticsglobal.com/login

W2. https://developer.android.com/reference/classes.html

W3. https://www.iotforall.com/mobile-iot

Topics relevant to development of " **SKILL DEVELOPMENT** ": Bluetooth, Zigbee, Wi-Fi Topics related to development of " **PARTICIPATIVE LEARNING** ": Project implementations in software Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS": Collaboration and Data collection for Term assignments and Case Studies.

Course Code: **CIT2503**	Course Name: **Mobile Application for IoT** Type of Course: **Theory**	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level -			
Course Pre - requisites	**CSS2255**		
Anti-requisites	NILL		
Course Description	Mobile Application is the essential part for IoT infrastructure, which helps in understanding the architectural overview of IOT. The purpose of this course is to expose the students to understand the IoT Reference Architecture and Real World Design Constraints along with various IOT protocols. This course is both conceptual and analytical in nature that would help the student to predict the effects of forces and its motion while carrying out creative design functions.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Mobile and Application for IoT** and attain **Skill Development** through **Participative Learning** techniques.		
Course Outcomes	On successful completion of the course the students shall be able to: CO1 Understand the architectural overview and design principles of IoT and M2M technology fundamentals. [Level 2: Understanding] CO2 Analyze hardware and software design constraints for embedded systems and mobile applications. [Level 4: Analys] CO3 Examine the challenges and solutions in UX/UI design specifically for IoT mobile applications. [Level 4: Analys] CO4 Apply Android architecture components to build mobile interfaces for data persistence and deployment [Level 3: Apply]		

	CO5 Implement mobile integration with external services including GPS, Maps, and server-side applications. [Level 3: Apply]		
Course Content:			
Module 1	Overview	Assignment, Programming Task	**9 Sessions**
Topics: IoT-An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management			
Module 2	Basic Design	Assignment, Data Collection/Excel	**10 Sessions**
Topics: Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability. **Assignment:** Recent trends In mobile application development			
Module 3	IOT mobile apps	Assignment, Programming/Data analysis task	**9 Sessions**
Topics: IoT Mobile App Development Trends In 2020 - Role of Mobile Apps in revolutionizing the world of IoT - UX / UI design for IoT Mobile apps - challenges of UX/UI design for IoT applications - practice tips on design for IoT mobile apps IoT App Design Solutions **Assignment:** Challenges faced during mobile application development			
Module 4	TECHNOLOGY I-ANDROID	Assignment, Programming/Data analysis task	**10 Sessions**
Topics: Introduction Establishing the development environment Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment Interaction with server side applications Using Google Maps, GPS and Wifi Integration with social media applications.			

Targeted Applications & Tools: **Targeted Protocols & Tools that can be used:** Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread
Skill-Building Activities through Experiential Learning:
Topics relevant to "SKILL DEVELOPMENT": AI and Deep Learning for IOT for **Skilldevelopment** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.
Text Book T1: "From machine to machine to the internet of things: Introduction to the new age of intelligence", 1st edition, Academic press, 2014. T2: Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
References R1: Bernd Scholz- -3-642-19156-5 e-ISBN 978-3- 642-19157-2, Springer R2: Andrea Goldsmith, "Android in practice," Cambridge University Press, 2005
E-Resources/Web Resources W1: https://relevant.software/blog/mobile-iot-apps/ W2: https://medium.com/@its.mattfitzgerald/top-14-iot-mobile-app-development-trends-to- expect-in-2020-7fd7718155dc W3:https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.as px%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost- %2520live%26ebv%3dEB%26ppid%3dpp_xiii
Topics relevant to "SKILL DEVELOPMENT": Wifi integration and social media analysis for developing **Skill Development** through **Participative Learning Techniques.** This is attained through the assessment component mentioned in the course handout.

Course Code: **CIT2505**	Course Name: Mobile Application for IOT Type of Course: Laboratory Course	L- T-P- C	0-0-2-1
Version No.	1		
NCrF Level-	NILL		
Course Pre-requisites	CSS2255		
Co-requisites	NILL		
Anti-requisites	NILL		
Course Description	This course provides hands-on experience in designing and developing mobile applications that interface with Internet of Things (IoT) devices. Students will		

	learn to build mobile applications capable of monitoring, controlling, and interacting with various sensors and actuators through communication protocols such as Wi-Fi and Bluetooth. The course explores mobile concepts that enable individual devices to derive greater value from networked connections among processes, data, and things. The Mobile Internet of Things (IoT) refers to objects interacting with mobile application systems and other smart devices. The course will emphasize creative thinking and mobile application concepts within IoT technologies.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mobile Application for IoT Lab and attain **Employability** through Experiential **Learning** techniques
Course Outcomes	**On successful completion of the course the students shall be able to:** CO1 Design and Develop the real time applications using Arduino/Raspberry Pi /ESP Controller and Sensors. [Level 6: Creating] C02 Demonstrate use of Mobile interface IoT devices for simple application [Level 2: Understand] C03 Compare and contrast the deployment of smart objects and the technologies to connect them to network. [Level 2: Understand] C04 &C05 Illustrate different sensor technologies for sensing real world entities and identify the applications of mobile interface IoT in Industry [Level 2: Understand]

Course Content:

Mobile Application for IoT Lab

Arduino Cycle-1

1. Ilustrate Arduino program to implement blinking led using IDE.
2. Demonstrate Arduino program to implement blinking led for 10 times using IDE
3. Arduino program to implement blinking of alternate leds and
4. Arduino program to implement to fade led
5. Illustrate Arduino program to implement blinking of odd and even LEDs
6. Demonstrate scrolling of LEDs
7. Illustrate Arduino program to control an LED using push button.
8. Demonstrate Multiple switches to control multiple LEDs
9. Illustrate Arduino program to implement Interactive Traffic System using Push Button
10. Demonstrate traffic system without Push button
11. Demonstrate Arduino program To control Servo motor using potentiometer.
12. Illustrate Arduino program To control Servo motor without using potentiometer
13. Illustrate Arduino program to implement IR sensor to detect obstacle.
14. Demonstrate Arduino program to implement PIR sensor for motion detection
15. Illustrate Arduino program to implement Ultrasonic sensor to detect distance.
16. Illustrate Arduino program to implement DHT11 sensor.

Raspberry Cycle-2

1. Demonstrate Installation of Raspberry pi operating system.
2. Illustration of working with basic commands using Raspberry Pi
3. Illustrate python program to blink odd and even Leds for one time.
4. Demonstrate python program to blink odd and even Leds for 5 times with a delay of 5 seconds.

5. Illustrate Raspberry pi program to Blink an LED using python.
6. Demonstrate Raspberry pi program to Blink an LED for 10 times using python
7. Demonstrate remote logging in raspberry pi using SSH
8. Demonstrate remote logging in raspberry pi using Remote desktop
9. Illustrate Raspberry pi program to find Temp/Humidity using DHT11/22

ESP 32 Cycle 3

1. Blinking of an LED using ESP32
2. Implementation of DHT Sensor using ESP32
3. Implementation of IR Sensor using ESP32

[Light Control Using Mobile Blynk App (WiFi)
Fan Control Using Mobile Serial Bluetooth App(BT)
Buzzer Control Using Mobile Serial Bluetooth App(BT)
Light Control Using Mobile Google Voice App (WiFi)
Fan Control Using Mobile Arduino Voice Bluetooth App(BT)

- Buzzer Voice Control Using Mobile Serial Bluetooth App(BT)]

Targeted Applications & Tools:

Skill-Building Activities through Experiential Learning:

Text Book

T1. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – Wiley India Private Limited, 1st edition, 2011.

T2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Editi on, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743),2017

Topics relevant to " Skill Development" Understanding Bluetooth, Zigbee, Wi-Fi
Topics related to " PARTICIPATIVE LEARNING ": Project implementations in software

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	CAI2501		
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: CIT2400	Course Name: Cyber Physical Systems Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	2.0		
NCrF Level-	5.5		
Course Pre-requisites	*Data Communications and Computer Networks*		
Co-requisites			
Anti-requisites			
Course Description	This course introduces students to an industrial viewpoint of Cyber-Physical Systems which includes sensors and actuators, computing and communication systems. It will also include networking protocols, security and various CPS/IoT applications. This course helps to make students industry-ready and equip them with the domain knowledge needed to take up projects in Cyber-Physical Systems Topics include Computational foundation of Cyber Physical Systems, Cyber Physical System Design and system requirements Physical System Platforms Embedded Systems vs Internet of Things vs Cyber Physical System and Concurrent Models of computation.		
Course Objective	This course aims to provide foundational knowledge of Cyber-Physical Systems (CPS), covering the integration of computational algorithms and physical components through embedded systems and real-time computing. It enables students to understand CPS architectures, sensors and actuators, networked control systems, and system modelling techniques. The course emphasizes reliability, security, and resilience in CPS design, while exploring real-world applications in domains such as smart transportation, industrial automation, healthcare, robotics, and energy systems.		
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: Remembering] CO2 **Identify** the principal concept needed in a question. [Level 3: Apply] CO3 **Solve** the quantitative and logical ability questions with the appropriate concept. [Level 3: Apply] CO4 **Analyse** the data given in complex problems [Level 4: Analys]		

	CO5 **Rearrange** the information to simplify the question [Level 4: Analys]		
Course Content:			
Module 1	Computational foundation of Cyber Physical Systems	Conceptual Case Study etc.	11 Sessions
Topics: Cyber Physical Systems in Real world, Basic Principle of Cyber Physical Systems, Industry 4.0, IIoT. Cyber Physical Systems Design Recommendations, CPS system requirements, Cyber Physical System Application, Case study of Cyber Physical Systems			
Module 2	Cyber Physical System Platforms:	Conceptual Case Study etc.	12 Sessions
Topics: Hardware platforms for Cyber Physical Systems (Sensors/Actuators, Microprocessor/Microcontrollers), Wireless Technologies for Cyber Physical Systems. Cyber Physical System – Models and Dynamics Behaviors - Continuous Dynamics, Discrete dynamics, Hybrid Systems.			
Module 3	Concurrent Models of computation:	Conceptual Case Study etc.	12 Sessions
Topics: Structure of Models, Synchronous Reactive models, Dataflow models of computation, Timed models of computation, Study of Embedded Systems vs Internet of Things vs Cyber Physical System: Design of Embedded Systems (I/O Units, Multitasking and Scheduling), Internet of Things Architecture, CPS Architecture			
Module 4	Security and Privacy in Cyber Physical Systems:	Conceptual Case Study etc.	10 Sessions
Topics: Security and Privacy Issues in CPSs, Local Network Security for CPSs, Internet-Wide Secure Communication, Security and Privacy for Cloud-Interconnected CPSs, Case Study: Cybersecurity in Digital Manufacturing/Industry 4.0, Contemporary issues.			
Targeted Applications & Tools:			
Tools/Software/Platform	Application		
MATLAB/Simulink, Stateflow	Model, simulate, and analyze CPS components such as control systems, robotics, and communication networks.		
NS-3, OMNeT++	Simulate CPS communication protocols, networking scenarios, and test real-time constraints.		
LabVIEW, NI CompactRIO	Real-time data acquisition, hardware-in-loop (HIL) testing, and embedded system control for CPS.		
ROS (Robot Operating System), Gazebo	Design, simulate, and deploy robotic CPS applications with sensor integration.		

Skill-Building Activities through Experiential Learning:

- Smart Traffic Flow Simulation with SUMO and Veins
  This activity models an intelligent transportation system where vehicles communicate with infrastructure to optimize traffic flow. Students use SUMO to simulate vehicular movement, integrate Veins for V2X communication, and analyze how adaptive traffic lights reduce congestion and travel time.
- IoT Sensor Data Collection and Stream Processing with Kafka and Spark
  Participants deploy IoT devices (Arduino/Raspberry Pi) to generate real-time environmental data such as temperature or air quality. Data streams are ingested through Apache Kafka, processed with Apache Spark Streaming, and stored in HDFS for anomaly detection and visualization.
- Cybersecurity Threat Detection in CPS Networks using NS-3 and Wireshark
  This activity simulates CPS communication networks in NS-3 and captures traffic using Wireshark. Students analyze packet flows to identify malicious activities (e.g., DoS attacks, spoofing) and implement security rules to mitigate these threats, strengthening CPS resilience.
- Predictive Maintenance for Industrial CPS using ML Models in TensorFlow
  Participants work with time-series data from simulated industrial machines (e.g., vibration, temperature sensors). Using TensorFlow, they build predictive maintenance models to detect early signs of component failure, ensuring system reliability and cost reduction.
- Digital Twin Development using MATLAB/Simulink and IoT Devices
  This activity introduces the concept of digital twins by connecting IoT sensor data (collected via Raspberry Pi/Arduino) to a real-time Simulink model. Students simulate physical processes (e.g., a smart grid subsystem or robotic arm) and synchronize them with the digital model for monitoring and control.
- Social Media Sentiment Analysis for CPS-driven Decision Support using Hadoop Ecosystem
  Students collect unstructured social media data (Twitter/Reddit) about traffic, healthcare, or smart city services. Data is stored in HDFS, processed with Hive and Pig, and analysed for sentiment patterns that can support CPS decision-making (e.g., detecting public response to emergency events).

Text Book

T1: Rajeev Alur," Principles of Cyber Physical Systems", MIT Press, 2023, ISBN: 9780262548922

T2: E. A. Lee, Sanjit Seshia , "Introduction to Embedded Systems – A Cyber–Physical Systems Approach", Second Edition, MIT Press, 2017, ISBN: 978-0-262-53381-2

T3: Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.

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 Industrial Cyber-Physical Systems

https://www.ieee-ies.org/pubs/transactions-on-industrial-cyberphysical-systems

2. ACM Transactions on Cyber-Physical Systems

https://dl.acm.org/journal/tcps

3. IET Cyber-Physical Systems: Theory & Applications

https://ietresearch.onlinelibrary.wiley.com/journal/23983396

SWAYAM/NPTEL/MOOCs:

1. NPTEL - Foundations of Cyber Physical Systems
2. Coursera – Cyber-Physical Systems: Modelling and Simulation
3. TCS - Cyber-Physical Systems

Course Code: CSS7000	**Course Title: 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: APT4006	**Course Title: Logical and Critical Thinking** **Type of Course:** Audited	**L- T-P-C**	0-0-2-0	
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. Level 3 – Apply CO3: Analyze and structure reasoning techniques and spatial visualization skills. Level 4 – Analyze			
Course Content:				
Module 1	Logical Thinking	Assignment		**16 Hours**
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**

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**	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 equip citizens with the zeal for capacity building.	Level 2 – Understand	

	CO2: Recognize and identify the values of the Constitution of India.	Level 1 – Remember
	CO3: Explain citizen-centric awareness of the rights and responsibilities of the State.	Level 2 – Understand
	CO4: Explain the role of State actors in building India.	Level 2 – Understand

Course Content:

Module 1	**Understanding the Making of the Constitution: The Constituent Assembly & The Constitution of India**

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)**

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**

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**

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)

Targeted Application & Tools that can be used:
Application areas to familiarize students with fundamentals of Indian Constitutional concepts.
Tools: Online Tools – NPTEL and Swayam.

Project work/Assignment:

Assessment Type
Online end term exam will be conducted as notified by the Presidency University.

Online Link*:

1. Prof. Amitabha Ray, SWAYAM Course: "Constitutional Government & Democracy in India"
   https://onlinecourses.swayam2.ac.in/cec19_hs13/preview

* Other source links are available in below Resources link.

Text Book

1. Durga Das Basu --- Introduction to the Constitution of India, 23rd Edition (Gurgaon; LexisNexis, 2018).
2. MP Jain's Constitutional Law of India, Lexis Nexis
3. V.N Shukla's Indian Constitutional Law, M.P Singh 13th Edition
4. MV Pylee's Constitution of India
5. J.C.Johari -- The Constitution of India: A Politico-Legal Study (Greater Noida: Sterling Publishers Pvt. Ltd. 2013).
6. Himangshu Roy and M.P.Singh – Indian Political System, 4th Edition (Bengaluru; Pearson Education, 2018)
7. Vidya Bhushan & Vishnoo Bhagwan--- Indian Administration (S. Chand, 2011)
8. S.R.Maheswari --- Indian Administration (Orient Blackswan, 2001)

9. Dr. A.Avasthi & A.P. Avasthi --- Indian Administration (L.N. Agarwal Educational Publishing, 2017). 10. B. L. Fadia --- Indian Government and Politics (Sahitya a. Bhawan, 13th Revised Edition, 2017). 11. P.M.Bakshi – The Constitution of India (Prayagraj, UP; a. Universal Law Publishing, January, 2018)
eference Books 1. HM Seervai, Constitutional Law of India, 4th Ed. Vol I, II, & III 2. Uday Raj Rai, Constitutional Law-I 3. Democracy and Constitutionalism in India, Oxford University Press 2009 **esources:** 1. https://onlinecourses.nptel.ac.in/noc20_lw03/course?&force_user=true 2. https://onlinecourses.swayam2.ac.in/cec19_hs13/course?&force_user=true 3. https://nptel.ac.in/courses/129106003 4. https://nptel.ac.in/courses/129106411 5. https://nptel.ac.in/courses/129105608 6. https://nptel.ac.in/courses/129106002
opics relevant to Skill Development: 1. An attitude of inquiry. 2. Write reports **he topics related to Constitutional Studies and its application :** ll topics in theory component are relevant to Indian Constitution.

Course Code: **CSS2271**	**Course Title: 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					
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 foster understanding of contemporary software practices and industry tools such as CASE tools, GitHub, and Selenium. AI-enhanced tools are introduced for documentation, automation, and intelligent testing workflows					
Course Objectives	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, and manage software projects effectively.					

Course Outcomes	On successful completion of this course, students will be able to: **CO1:**[Text Wrapping Break]Explain software engineering principles, ethics, and various software development life cycle models. [Understand] **CO2:**[Text Wrapping Break]Identify software requirements and develop design models, including Software Requirement Specification (SRS) documents. [Apply] **CO3:**[Text Wrapping Break]Apply Agile development practices and DevOps principles in software development. [Apply] **CO4:**[Text Wrapping Break]Apply software testing strategies, configuration management, and maintenance techniques. [Apply] **CO5:**[Text Wrapping Break]Evaluate software design and development practices to ensure quality, reliability, and scalability. [Evaluate]	
Course Content:		
Module 1	**Introduction to Software Engineering and Process Models**	**10 Sessions**
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**	**12 Sessions**
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**	**10 Sessions**
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**	**13 Sessions**
Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing. **Software Quality Assurance**-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).		

Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.

Targeted Application & Tools that can be used:

Git hub/Lambda/Taskade/Bit.ai/Testsigma/TestRogor

Text Books:

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

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)

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: CIT2504	Course Name: AI and Deep Learning for **IoT** Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	NILL		
NCrF Level-	NILL		
Course Pre-requisites	CSS2264		

Co-requisites	NILL
Anti-requisites	NILL
Course Description	This course explores the integration of Artificial Intelligence (AI) and Deep Learning (DL) with the Internet of Things (IoT), focusing on AI-driven data processing, decision-making, and automation in smart applications. Students will learn key concepts of machine learning, neural networks, edge AI, federated learning, and TinyML, along with deployment on IoT edge devices like Raspberry Pi and NVIDIA Jetson. The course covers cloud-based AI, real-time inference, energy efficiency, security challenges, and practical applications in smart agriculture, healthcare, and industrial IoT
Course Objective	The objective of the course is to familiarize the learners with the concepts of Wireless Communication for IoT and attain Skill Development through Participative Learning techniques
Course Outcomes	On successful completion of the course the students shall be able to: CO1 Explain the concepts of Artificial Intelligence, Deep Learning, and their integration with IoT (AIoT) for smart applications. [Level 2: Understanding] CO2 Apply techniques to establish communication between mobile devices and IoT gateways using standard protocols. [Level 3: Apply] CO3 Apply knowledge of sensor technologies to select and utilize appropriate sensors for IoT-based applications. [Level 3: Apply] CO4 Analyse AIoT frameworks and architectures in real-world applications such as smart traffic systems, healthcare, and industrial IoT. [Level 4: Analys] CO5 Analyse the role of AI techniques, including neural networks, edge AI, and TinyML, in developing efficient IoT solutions. (Analyse) [Level 4: Analys]

Course Content:

Module 1	Introduction to Artificial Intelligence and Internet of Things (AIoT)	Assignment, Problem Solving	**12 sessions**

Topics: Introduction to Artificial Intelligence and Internet of Things (AIoT) Overview of Artificial Intelligence (AI) and its applications across various industries. Introduction to the Internet of Things (IoT) and its significance in the modern interconnected world. Understanding the concept of Artificial Intelligence of Things (AIoT) and its potential to revolutionize technology integration.

Module 2	Connecting Mobile Devices to IoT Gateways	Assignment,	**10 sessions**

		Problem Solving	
Topics: Connecting Mobile Devices to IoT Gateways Exploring the role of IoT gateways in bridging the gap between mobile devices and IoT networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobile to-IoT connections.			
Module 3	Sensor Technologies and Academic Concepts	Assignment. Problem Solving	**12 sessions**
Topics: Sensor Technologies and Academic Concepts Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.			
Module 4	AIoT Application Development	Assignment, Problem Solving	**11 sessions**
AIoT Application Development, Introduction to tools and platforms essential for building AIoT applications. Practical Aspects of AIoT applications, including Smart Traffic Signal System for Color Blind Individuals Plant Health Analysis Smart Door Access Control System.			
Targeted Applications & Tools: Nill			
Skill-Building Activities through Experiential Learning:			
Nill			
Text Book 1. Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Pearson Education, 2021 2. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann, 2016 3. Michael J. McGrath, "Sensor Technologies: Healthcare, Wellness and Environmental Applications", Apress, 2013			
References R1. Chandra Singh, K V S S S S Sairam, Niranjan N Chiplunkar, Rathishchandra R Gatti Create citation, “Self-Powered Aiot Systems”:Apple Academic Press 2024 R2. Kashif Naseer Qureshi, Thomas Newe Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems, CRC Press 2024 **Web Based Resources and E-books:** W1.https://www.linkedin.com/learning/ai-in-connected-products-aiot W2. https://www.coursera.org/learn/iot W3. https://www.tinkercad.com/things?type=circuits&sort=staff&view_mode=small			
E-Resources/Web Resources			

Web Based Resources and E-books: W1.https://www.linkedin.com/learning/ai-in-connected-products-aiot W2. https://www.coursera.org/learn/iot W3. https://www.tinkercad.com/things?type=circuits&sort=staff&view_mode=small
Topics relevant to "SKILL DEVELOPMENT": AI and Deep Learning for IOT for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT2502	Course Name: **Privacy and Security in IoT** Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1.0		
NCrF Level-	CSE2502-Cryptography and Network Security		
Course Pre-requisites	NIL		
Co-requisites	The purpose of this course is to enable the students to appreciate the need for cryptography and to identify the applications of cryptography in the Internet of Things (IoT). The course is both conceptual and analytical in nature and needs fair knowledge of mathematics and computing. The course develops critical thinking and analytical skills.		
Anti-requisites	The objective of the course is to familiarize the learners with the concepts of **Privacy and Security in IoT** and attain **Skill Development** through **Problem-Solving** Methodologies.		
Course Description	The purpose of this course is to enable the students to appreciate the need for cryptography and to identify the applications of cryptography in the Internet of Things (IoT). The course is both conceptual and analytical in nature and needs fair knowledge of mathematics and computing. The course develops critical thinking and analytical skills.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Privacy and Security in IoT** and attain **Skill Development** through **Problem-Solving** Methodologies.		
Course Outcomes	On successful completion of the course the students shall be able to: CO1 Explain the fundamental concepts of elliptic curves and their use in cryptography. [Level 2: Understanding] CO2 Illustrate elliptic curve operations such as point addition and point doubling. [Level 2: Understanding] CO3 Apply elliptic curve cryptographic techniques including ECC-based key exchange and digital signatures. [Level 3: Apply] CO4 Use elliptic curve methods to implement secure public-key cryptosystems. [Level 3: Apply] CO5 Apply security and privacy techniques to design secure IoT systems and architectures [Level 3: Apply]		
Course Content:			

Module 1	**Introduction to Elliptic Curves**	Quiz , Comprehension based Quizzes and assignments	**15 Sessions**
Elliptic Curve Cryptosystems (ECC): Introduction to ECC, Method of Diophantus, Elliptic curves in Cryptography, Discrete Logarithms in Finite Fields, Elliptic Curve on a finite set of Integers, Definition of Elliptic curves, General form of an EC, Weierstrass Equation, Points on the Elliptic Curve (EC), The Abelian Group, Operations on ECC- Point addition, Point doubling.			
Module 2	**Elliptic Curve Cryptosystems**	Quizzes and assignments , Comprehension based Quizzes and assignments	**15 Sessions**
Topics: E**lliptic Curve Cryptosystems (ECC):** Public-Key Cryptosystems, Public-Key Cryptography, What Is Elliptic Curve Cryptography (ECC)?, Using Elliptic Curves In Cryptography, Generic Procedures of ECC, Example – Elliptic Curve Cryptosystem Analog to El Gamal, Diffie-Hellman (DH) Key Exchange, ECC Diffie-Hellman, Example – Elliptic Curve Diffie-Hellman Exchange, Elliptic Curve Digital Signature Algorithm (ECDSA) Why use ECC?, Security of ECC, Applications of ECC, Benefits of ECC.			
Module 3	IoT Protocols	Assignment, Comprehension based Quizzes and assignments	**15 Sessions**
Topics: **Privacy and Data Protection in IoT Systems** Privacy challenges in IoT devices and environments, Identity management and anonymization techniques, Secure data storage and transmission for IoT, Privacy-preserving techniques: homomorphic encryption, secure multi-party computation, Designing secure IoT architectures: edge, fog, and cloud layers, Threat modeling for IoT devices and networks, End-to-end security considerations in IoT, Secure boot, firmware updates, and trusted execution environments (TEE), Intrusion detection and anomaly detection for IoT.			
Targeted Applications & Tools: Application areas are to secure cryptocurrency- Bitcoin, Ethereum and Ripple using ECC in key agreements, and digital signatures. **Professionally Used Software:** elliptic2 : https://www.graui.de/code/elliptic2/			
Project work/Assignment:			
Assignment:			

Assignment 1: Collect the running time of ECC on different standard NIST curves. **Assignment 2:** Prepare a compressive report on the efficiency of NIST Vs SECP curves**.**
Skill-Building Activities through Experiential Learning:
NILL
Textbook(s): T1. Elliptic curve cryptography, Elliptic Curve Cryptography, Debdeep Mukhopadhyay Dept of Computer Sc and Engg, IIT Madras (Lecture Notes) T2. I. Blake, G. Seroussi, N. Smart, Elliptic Curves in Cryptography , Cambridge University 2020 T3. Arshdeep Bagha, Vijay Madisetti, "Internet of Things - A hands-on approach", Universities Press, 2021., Second Edition
References R1. Joseph H Silver man The Arithmetic of Elliptic Curves: Springer; 2nd Edition April 2016 R2. Darrel Hankerson, Scott Vanstone, Alfred J. Menezes Guide to Elliptic Curve Cryptography Springer 2018 R3. Security and Privacy in the Internet of Things. (2020). United States: CRC Press. R4. Security and Privacy Preserving for IoT and 5G Networks: Techniques, Challenges, and New Directions. (2021). Switzerland: Springer International Publishing.
Topics related to the development of **"SKILL DEVELOPMENT":** IOT Protocols, Elliptic Curve Cryptosystem, for **Skill Development through Participative Learning Techniques.** This is attained through assessment components as mentioned in the course handout.

Course Code: CSS2274	**Course Title: Competitive Programming and Problem Solving** **Type Of Course: Laboratory Course (ESC)**	**L-T-P-C**	**0**	**0**	**4**	**2**
Version No.	1.0					
Course Pre- requisites	NIL					
Anti-requisites	NIL					
Course Description	The Competitive Programming and Problem Solving course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the					

	confidence to excel in competitions, technical interviews, and practical applications.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Competitive Programming and Problem Solving and attain Skill Development through Experiential Learning techniques.
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. [Understand] **CO2:** Analyze the time and space complexity of number-theoretic solutions to determine the need for optimization under competitive programming constraints. [Analyze] **CO3:** Apply appropriate algorithmic paradigms and data structures to solve problems within defined time and memory constraints. [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. [Analyze] **CO5:** Analyze advanced problem-solving techniques using dynamic programming to evaluate their effectiveness in large-scale competitive programming problems. [Analyze]

Course Content:

Module 1	**Introduction to Competitive Programming**	**NA**

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:	**Number Theory for Problem-Solving**	**NA**

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**	**NA**

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**	**NA**

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**	**NA**

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 Practical Tasks **60 Sessions**

WEEK 1

Lab Sheet 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.

Lab Sheet 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

Lab Sheet 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.

Lab Sheet 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

Lab Sheet 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.

Lab Sheet 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

Lab Sheet 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.

Lab Sheet 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

Lab Sheet 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.

Lab Sheet 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

Lab Sheet 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.

Lab Sheet 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

Lab Sheet 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.

Lab Sheet 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

Lab Sheet 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.

Lab Sheet 16: Game Algorithms

Level 1: Represent a game state using a tree structure.

Level 2: Implement minimax algorithm with alpha-beta pruning.

WEEK 9

Lab Sheet 17: Sorting Algorithms

Level 1: Write a program to implement insertion sort.

Level 2: Write a program to implement merge sort or quick sort.

Lab Sheet 18: Searching Algorithms

Level 1: Write a program to perform linear search.

Level 2: Write a program to perform binary search efficiently.

WEEK 10

Lab Sheet 19: Algorithm Analysis

Level 1: Write a program to compare execution time of two algorithms.

Level 2: Optimize a given algorithm to improve performance.

Lab Sheet 20: Recursion

Level 1: Write a program to solve Tower of Hanoi.

Level 2: Compare recursive and iterative solutions for a problem.

WEEK 11

Lab Sheet 21: Graph Representation

Level 1: Represent a graph using adjacency list.

Level 2: Represent a graph using adjacency matrix.

Lab Sheet 22: Graph Traversal

Level 1: Implement Depth First Search (DFS).

Level 2: Implement Breadth First Search (BFS).

WEEK 12

Lab Sheet 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.

Lab Sheet 24: Real-world Application

Level 1: Design a simple recommendation system.

Level 2: Optimize it for large-scale data.

WEEK 13

Lab Sheet 25: String Algorithms

Level 1: Write a program for basic string matching.

Level 2: Implement efficient pattern matching algorithm.

Lab Sheet 26: Network Algorithms

Level 1: Check connectivity in a network.

Level 2: Detect anomalies using data comparison techniques.

WEEK 14

Lab Sheet 27: Algorithm Design

Level 1: Solve a problem using brute-force approach.

Level 2: Improve the solution using greedy or dynamic approach.

Lab Sheet 28: Performance Evaluation

Level 1: Analyze runtime of a program.

Level 2: Compare different algorithmic approaches.

WEEK 15

Lab Sheet 29: Case Study

Level 1: Implement a real-world problem solution.

Level 2: Optimize and document the solution.

Lab Sheet 30: Mini Project

Level 1: Combine multiple algorithms to build a system.

Level 2: Present optimized solution with performance analysis.

Targeted Application & Tools that can be used:

1. C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation fla gs (e.g., -O2 for optimization).
2. IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.
3. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submit ting solutions.
4. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
5. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).
6. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.
7. String Libraries: Familiarize students with the string manipulation functions available in C++.
8. Graph Visualization Tools: Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.
9. DP Debugging Techniques: Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful

Text Books:

1. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition), *Antti Laaksonen, springer, 2024*
2. "Data Structures and Algorithms in Java: A Project-Based Approach" – *Dan S. Myers, Cambridge University Press*

Reference Books:

1. Data Structures and Algorithmic Thinking with Python/C++/Java", Narasimha Karumanchi, 5th Ed ition, Career Monk, 2017.
2. Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022 **.**

Web Resources

1. https://nptel.ac.in/courses/106106231
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Assessment Type 1. Midterm exam 2. Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.) 3. Quiz 4. End Term Exam 5. Self-Learning

Course Code: APT4005	Course Title: 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.				
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 1 – Remember CO2: Identify the principal concept needed in a question. Level 2 – Understand CO3: Solve quantitative and logical ability questions using the appropriate concept. Level 3 – Apply				
Course Content:					
Module 1	Quantitative Ability	Lab-10hrs		Platform Assessment-10hrs	20 Hours
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	Lab-5hrs		Platform Assessment-5hrs	10 Hours
Topics: - Parts of Speech, Subject Verb Agreement, Spotting Error, Cloze Test, Verbal Analogies, Reading Comprehension, Idioms & Phrases, Para Jumbles					
Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS					

Evaluation	Continuous Evaluation Topic wise evaluation
Text Book Fast track objective by Rajesh Verma R S Aggarwal S.P Bakshi	
References www.indiabix.com www.testbook.com www.youtube.com/c/TheAptitudeGuy/videos	
Topics relevant to Skill development:Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques.This is attained through assessment component mentioned in course handout	

Course code: PPS3018	**Course Title: Preparedness for Interview Type of Course: Practical Only Course**	**L- T- P- C**	**1-0-0-0**
Version No.	1.0		
Course Pre-requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate, and learn.		
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 that effectively showcase qualifications, skills, achievements, and career objectives. — L3 – Apply CO2: Illustrate and organize resume content effectively using appropriate formats, design principles, and professional standards. — L2 – Understand CO3: Apply communication skills, subject knowledge, and professional etiquette to participate actively and effectively in group discussions and interviews. — L3 – Apply		
Course Content:			
Module 1	**Resume Building**	**Classroom activity**	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**	**Mock G D**	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**	**Grooming checks + Evaluation + Mock Interview+ Role Play**	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**	**Practice sessions**	2 Sessions
Targeted Application & Tools that can be used: 1. TED Talks 2. You Tube Links 3. Role Play activities			
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
Continuous Individual Assessment			
The Topics related to Skill Development: Art Of Presentation and Group Discussion for **Skill Development** through **Participative Learning** Tech- niques. This is attained through assessment Component mentioned in course handout.			

Course Code: CSS7100	**Course Title: Mini Project** **Type of Course: PRW**	**L- T-P- C**	**0-0-0-4**
Version No.	1.0		
Course Pre-requisites	Knowledge and Skills related to all the courses studied in previous semesters.		
Anti-requisites	NIL		
Course Description	Students observe science and technology in action, develop an awareness of the 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 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: CCS7300	**Course Title: Capstone Project** **Type of Course: PRW**	**L- T-P- C**	**0-0-0-10**
Version No.	1.0		
Course Pre-requisites	Knowledge and Skills related to all the courses studied in previous semesters.		
Anti-requisites	NIL		
Course Description	Students 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 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 at various societal levels [Level 2 - Understand] **CO2:** Apply tools and techniques for problem solving. [Level 3 - Apply] **CO3:** Design and plan experiments 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]		

Course Code: CIT3400	Course Title: **Architecting Smart IoT Devices** Type of Course: Program Core -Theory	L-T-P-C	3	0	0	3
Version No.						
Course Pre-requisites	CSE2251					
Anti-requisites	NIL					
Course Description	The Architecting Smart IoT Devices course, offered by EIT Digital through Coursera, guides learners through the development of embedded systems devices, emphasizing the use of pre-made hardware and software components to expedite time-to-market. Participants will explore processor families, operating systems, boards, and networks, gaining insights into their selection and integration. The curriculum encompasses debugging techniques, device fine-tuning, and strategies for achieving low power consumption. By course completion, students will be equipped to architect and implement their own embedded devices					
Course Objective	The objective of the course is to familiarize the learners with the concepts **of Architecting Smart IoT Devices** and attain Skill Development through **Participative Learning techniques**					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1**: Explain how the IoT is different from traditional systems. [Level-1 Understand] **CO2:** Apply embedded programming techniques using C and Python for developing IoT applications and case studies. [Level-3 Apply] **CO3:** Examine the architecture and operation of IoT. [Level-3 Apply] **CO4:** Analyze the structure and functionalities of Embedded RTOS including multitasking, scheduling, interrupts, and synchronization mechanisms. [Level-4 Analysis] **CO5:** Explore various tools and programming paradigms for IoT applications. **[**Level-4 Apply]					
Course Content						
Module 1	Design Principles of IoT and Prototyping the Embedded Devices for IoT	Assignment	Problem Solving	12 Sessions		
Design Principles of IoT: Design principles of connected devices, data acquiring organizing and analytics in IoT, system architecture of loT. Prototyping the Embedded Devices for IoT: System hardware and prototyping, sensors and actuators for IoT, Radio module and wireless sensor network, gateways internet and web, software components.						
Module 2	Embedded Programming for IoT	Assignment	Problem Solving	10 Sessions		
Embedded Programming for IoT: Programming connected devices, C and python for IoT, Case study: Temperature controller, Smart irrigation system.						
Module 3	Embedded RTOS	Assignment	Problem Solving	12 Sessions		

Embedded RTOS: Program structure and real time, multitasking and scheduling, RTOS services, signals, semaphores, Nucleus SE, application timers, interrupts in nucleus ES, Nucleus SE initialization and starn1p.				
Module 4	Tools for IoT and loT physical Devices	Assignment	Problem Solving	11 Sessions
Tools for IoT: Introduction, chef puppet, NETCONF - YANG case studies. loT physical Devices: Basic building blocks of an IoT device and endpoints, family of ploT devices, pcDuino, Beagle bone black, cubie board, domain specific IoTs.				
Targeted Application & Tools that can be used:				
Text Book 1. Raj Kamal, Internet of Things, Architecture and Design Principles, lst edition, McGraw Hill Education, May 2017. 2. Arsheep Baga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st Edition, Universities press, 2015.				
References R1. David Etter, IoT (Internet of Things Programming: A simple and fast way of Learning IoT, Kindle edition 2016. R2. Fei HU, Security and Privacy in Internet of Things (loTs): Models, Algorithms, and Implementations, 1st Edition, CRC Press, 2016. R3. Colin Walls, Embedded RTOS Design Insights and Implementation. 1st edition. Elsevier. December 2020. **Web Resources:** W1. https://www.coursera.org/learn/iot-architecture W2. https://www.mooc-list.com/course/architecting-smart-iot-devices-coursera W3. https://www.classcentral.com/course/iot-architecture-6839				
Topics relevant to "**SKILL DEVELOPMENT**": Architecting Smart IoT Devices for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.				

Course Code: CIT3401	Course Title: **Intelligent Sensor and System**	L-T-P-C	2	0	2	3
Version No.						
Course Pre-requisites	CSE2251					
Anti-requisites	NIL					
Course Description	The Intelligent Sensor and System course explores the design, development, and application of smart sensors and intelligent systems in IoT and automation. It covers sensor principles, signal processing, data acquisition, and wireless communication technologies such as BLE, Zigbee, and LoRa. The course also delves into AI-powered sensor analytics, sensor fusion techniques, edge computing, and real-time decision-making for smart applications in healthcare, industrial automation, and smart cities. By the end, learners will gain expertise in building intelligent sensing systems with enhanced accuracy, efficiency, and autonomy.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Intelligent Sensor and System** and attain Skill Development through **Participative Learning** techniques					

<table>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:

CO1: Summarize the fundamental principles and output characteristics of distinct IoT sensors and transducers. [Level-1 Understand]

CO 2: Analyze signal acquisition techniques and sensor interfacing with Microcontroller Units (MCUs). [Level-4 Analyze]

CO 3: Deconstruct wireless sensing frameworks including RF sensing and RF MEMS for industrial networks. [Level-4 Analyze]

CO 4: Examine smart application requirements for automotive, industrial, and consumer sectors. [Level-4 Analyze]

CO 5: Develop an intelligent sensing system prototype for a real-world smart city or healthcare scenario. [Level-3 Apply]</td></tr>
<tr><td>Course Content</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basics of Sensors and Application Specific Sensors</td><td>Assignment</td><td>Problem Solving</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Basics of Sensors: Introduction- Sensor Vs Transducer, Nature of Sensors, Sensor Output Characteristics, Sensing Technologies, Digital Output Sensors.

Application Specific Sensors: Occupancy and motion detectors: ultrasonic – microwave – capacitive detectors- optical presence sensor, Light Detectors: Photo diodes – phototransistor – photoresistor CCD and CMOS image sensors, Temperature Sensors: thermos-resistive sensors – thermoelectric contact sensor.</td></tr>
<tr><td>Module 2</td><td>Sensor with Microcontroller</td><td>Assignment</td><td>Problem Solving</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Sensor with Microcontroller: Introduction, Amplification and Signal Conditioning, Integrated Signal Conditioning, Digital Conversion, MCU Control, MCUs for Sensor Interface, Techniques and Systems Considerations, Sensor Integration.</td></tr>
<tr><td>Module 3</td><td>Wireless Sensing</td><td>Assignment</td><td>Problem Solving</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Wireless Sensing: Wireless Data and Communications, Wireless Sensing Networks, Industrial Wireless Sensing Networks, RF Sensing, Telemetry, RF MEMS, Complete System Consideration.</td></tr>
<tr><td>Module 4</td><td>Smart Applications and System Requirements</td><td>Assignment</td><td>Problem Solving</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Smart Applications and System Requirements: Automotive Applications, Industrial (Robotic) Applications, Consumer Applications, Future Sensor Plus Semiconductor Capabilities, Future System Requirements.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:

1.Characterization of Temperature and Light Sensors: Measuring and plotting the output characteristics of Thermistors and Photoresistors (LDRs).</td></tr>
</table>

2.Motion Detection using Ultrasonic/PIR Sensors: Implementing a system to trigger alerts based on occupancy and microwave/ultrasonic detection.

3.Signal Conditioning and Amplification: Using Op-Amps to condition analog sensor signals for digital conversion.

4.Sensor Interfacing with MCU: Reading data from digital output sensors and performing basic MCU control using C/C++.

5.Wireless Data Logging via Bluetooth/Zigbee: Establishing a wireless sensing link to transmit sensor data from a remote node to a gateway.

6. Telemetry and RF Sensing Implementation: Designing a simple telemetry system to monitor environmental data remotely.

7. Smart Automotive Proximity System: Building a prototype for vehicle obstacle detection and real-time distance measurement.

8. Industrial Robot (Basic) Integration: Interfacing sensors with a robotic arm or movement platform for obstacle avoidance

Text Book

1. Frank, Randy, "Understanding smart sensors", Artech House integrated microsystems series, 3rd Edition, 2013.

2. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", 5th Edition, Springer, 2016.

References

R1. Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, "Internet of Things: Technologies and Applications for a New Age of Intelligence", Academic Press, 16- Nov- 2018.

R2. Henry Leung, Subhas Chandra Mukhopadhyay, "Intelligent Environmental Sensing", Springer, 22-Jan-2015.

Web Resources:

W1. https://www.sciencedirect.com/topics/engineering/smart-sensors

W2. https://www.azosensors.com/article.aspx?ArticleID=1289

Topics relevant to "**SKILL DEVELOPMENT**": Intelligent Sensor and System for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3402	Course Title: IoT Architecture and Protocol Type of Course: Theory & Integrated Laboratory		L-T-P-C	2	0	2	3
Version No.						
Course Pre-requisites	CSE2251					
Anti-requisites	NIL					
Course Description	The IoT Architecture and Protocols course provides a comprehensive understanding of the layered architecture of IoT systems, including perception, network, edge, and application layers. It covers key IoT communication protocols such as UPnP, CoAP, MQTT, XMPP. SCADA, Web Socket, IP-based Protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4. The course also explores IoT data flow, interoperability challenges, security considerations, and real-world use cases in smart cities, healthcare, and industrial automation, equipping learners with the knowledge to design and implement efficient and secure IoT solutions.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of IoT Architecture and Protocol and attain Employability through Problem Solving Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Describe IoT fundamentals, applications, and reference models. [Level-1 Understand] **CO2:** Explain IoT reference architecture and its functional components. [Level-1 Understand] **CO3:** Apply IoT communication and application protocols. [Level-3 Apply] **CO4:** Analyze IoT architectures and cloud integration mechanisms. [Level-4 Analyze] **CO5:** Evaluate IoT-based solutions using real-world case studies. [Level-4 Analyze]					
Course Content						
Module 1	Introduction and IoT Reference Model	Assignment	Problem Solving	8 sessions		
Introduction to IOT, Applications of IOT, Use cases of IOT IoT Reference Model: Domain, information, functional and communication models. Amazon Web Services for IoT: Amazon EC2, Amazon Auto Scaling, Amazon S3, Amazon RDS, Amazon DynamoDB, Amazon Kinesis, Amazon SQS, Amazon EMR, SkyNet IoT Messaging Platform.						
Module 2	IoT Reference Architecture	Assignment	Problem Solving	8 sessions		
IoT Reference Architecture: Architecture, Functional, information, deployment and operation views, SOA based Architecture, API-based Architecture, OPENIoT Architecture for IoT/Cloud Convergence.						
Module 3	Application Protocols for IoT	Assignment	Problem Solving	8 sessions		
Application Protocols for IoT: UPnP, CoAP, MQTT, XMPP. SCADA, Web Socket, IP-based Protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4.						
Module 4	Case study	Assignment	Problem Solving	06 Sessions		
Case study: Cloud-Based Smart-Facilities Management, Healthcare, Environment Monitoring System						
Targeted Application & Tools that can be used:						
Experiments	1. Execute Hello world in cooja Simulator [15 sessions]					

	2. Study of 6LoWPAN protocol 3. Analysis of CoAP Mesh Network 4. Study of HTTP Protocol 5. Testing MQTT based IoT based Protocol or Experimental study of IoT based topologies on MQTT topologies 6. Simulation of Bluetooth Low Energy and Zigbee Smart Energy

Text Books:

1. Bassi, Alessandro, et al, "Enabling things to talk", Springer-Verlag Berlin An, 2016.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
3. Vijay Madisetti and Arshdeep Bagha, "Internet of Things (A Hands-on- Approach)", 1st Edition, VPT, 2014.

References

R1. Hersent, Olivier, David Boswarthick, and Omar Elloumi. "The internet of things: Key applications and protocols", John Wiley & Sons, 2011.
R2. Bunya, Rajkumar, and Amir Vahid Dastjerdi, eds "Internet of Things:Principles and paradigms", Elsevier, 2016.

Web Resources:

W1. https://www.slideshare.net/slideshow/unit-vpdf-258200283/258200283

Topics relevant to "**SKILL DEVELOPMENT**": IoT Architecture and Protocols for Employability through **Problem Solving Methodologies**. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3403	Course Title: Embedded Systems For IoT Type of Course: Theory	L-T-P-C	3	0	0	3
Version No.						
Course Pre-requisites	CIT3400					
Anti-requisites	NIL					
Course Description	This course provides an in-depth understanding of embedded systems and the Internet of Things (IoT), focusing on hardware architecture, programming, and real-world applications. Students will learn about microcontrollers, interfacing techniques, and embedded C programming. The course covers IoT concepts, including communication protocols, data acquisition, and cloud integration. Practical lab sessions will enable students to develop and implement IoT-based applications using platforms like Arduino and Raspberry Pi. By the end of the course, students will be able to design, build, and deploy smart embedded systems for applications in home automation, healthcare, agriculture, and industrial IoT.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Embedded System for IoT and attain Employability through Problem Solving Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Describe microcontroller architecture and embedded C programming concepts. [Level-1 Understand]					

	CO2: Explain IoT devices and Arduino programming fundamentals.	[Level-1 Understand]
	CO3: Implement IoT communication protocols and interfacing techniques.	[Level-3 Apply]
	CO4: Classify IoT platforms and hardware–software integration mechanisms.	[Level-4 Analyze]
	CO5: Design IoT-based embedded applications for real-world scenarios.	[Level-3 Apply]

Course Content				
Module 1	8-BIT EMBEDDED PROCESSOR and EMBEDDED C PROGRAMMING	Assignment	Problem Solving	12 sessions
Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling. EMBEDDED C PROGRAMMING: Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies				
Module 2	IOT AND ARDUINO PROGRAMMIN	Assignment	Problem Solving	12 sessions
Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino– Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.				
Module 3	IoT Communication And Open Platforms	Assignment	Problem Solving	11 sessions
IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee– GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming –Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins –Connecting to the Cloud.				
Module 4	APPLICATIONS DEVELOPMENT	Assignment	Problem Solving	09 sessions
Complete Design of Embedded Systems – Development of IoT Applications – Home Automation –Smart Agriculture – Smart Cities – Smart Healthcare				
Targeted Application & Tools that can be used:				
Text Book				

T1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin D. McKinlay – The 8051 Microcontroller and Embedded Systems Using Assembly and C (2nd Edition, Pearson)

T2. Raj Kamal – Internet of Things: Architecture and Design Principles (McGraw Hill)

T3. Jonathan Valvano – Embedded Systems: Introduction to ARM Cortex-M Microcontrollers

References

R1. David E. Simon – An Embedded Software Primer (Pearson)

R2. Frank Vahid and Tony Givargis – Embedded System Design: A Unified Hardware/Software Introduction (Wiley)

R3. Adrian McEwen & Hakim Cassimally – Designing the Internet of Things (Wiley)

R4. Pethuru Raj & Anupama Raman – The Internet of Things: Enabling Technologies, Platforms, and Use Cases (CRC Press)

R5. Daniel Minoli – Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications (Wiley)

Web Based Resources and E-books:

W1. https://archive.nptel.ac.in/courses/108/102/108102169/

W2. https://archive.nptel.ac.in/courses/106/105/106105193/

W3. https://www.coursera.org/learn/iot

W4. https://www.edx.org/course/collaborative-data-science-for-healthcare

W4. https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/

Topics relevant to "SKILL DEVELOPMENT":

Embedded System for Employability through Problem Solving Methodologies. This is attained through the assessment component mentioned in the course handout.

Course Code: **CIT3404**	Course Title**: IoT System Design and Development** Type of Course: Theory	L-T-P-C	3	0	0	3
Version No.						
Course pre-requisites	CIT3401					
Anti-requisites	NIL					
Course Description	The IoT System Design and Development course provides a comprehensive understanding of IoT architecture, hardware components, communication protocols, data management, and real-world applications. Students will gain hands-on experience with embedded platforms like Arduino, Raspberry Pi, and Jetson Nano, integrating sensors, actuators, and microcontrollers for IoT solutions. The course covers Wi-Fi, Bluetooth, LPWAN, and CoAP protocols, along with IoT data storage, analytics, and visualization. Learners will explore IoT applications in smart homes, healthcare, agriculture, industrial automation, and smart cities, while addressing design challenges, security concerns, and emerging technologies such as AIoT, Blockchain, and 5G integration. Through participative learning and problem-solving activities, students will develop practical skills to design and implement IoT-driven smart applications.					

<table>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of IoT system Design and Development and attain Employability through Problem Solving Methodologies.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:

CO1: Understand the basic concepts, principles and challenges in IoT. [Level-1 Understand]

CO2: Describe the functioning of hardware devices and sensors used for IoT. [Level-1 Understand]

CO3. Analyze network communication aspects and protocols used in IoT. [Level-4 Analyse]

CO4. Apply IoT for developing real life applications using Arduino programming. [Level-3 Apply]

CO5: Analyze IoT system design challenges, including data management, security, and emerging technologies such as AIoT, blockchain, and 5G. [Level-4 Analyze]</td></tr>
<tr><td>Course Content</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Internet of Things (IoT) and Hardware for IoT</td><td>Assignment</td><td>Problem Solving</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Introduction to Internet of Things (IoT): Vision, Definition, IoT architecture: Layers and protocols, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Sensing, Actuation. IoT communication models: Device-to-device, device-tocloud, device-to-gateway, Challenges and opportunities in IoT
Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boards</td></tr>
<tr><td>Module 2</td><td>IoT Protocols and Arduino Programming</td><td>Assignment</td><td>Problem Solving</td><td>11 Sessions</td></tr>
<tr><td colspan="5">IoT Protocols and Arduino Programming: Wi-Fi, Bluetooth, CoAP, LPWAN protocol. Sensor Networks: Sensor deployment & Node discovery, Introduction to Arduino Programming: Arduino Platform Boards Anatomy, Arduino IDE, coding, using emulator, using libraries, additions in Arduino, programming the Arduino for IoT, Integration of Sensors and Actuators with Arduino</td></tr>
<tr><td>Module 3</td><td>IoT Data Management and Analytics</td><td>Assignment</td><td>Problem Solving</td><td>12 Sessions</td></tr>
<tr><td colspan="5">IoT Data Management and Analytics: Data generation and collection in IoT systems, IoT data storage, Cloud-based and local storage, Data preprocessing and analysis, Basics of analytics for IoT data, IoT dashboards, Visualization and interpretation of data, Role of machine learning and AI in IoT</td></tr>
<tr><td>Module 4</td><td>Challenges in IoT Design challenges</td><td>Assignment</td><td>Problem Solving</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Challenges in IoT Design challenges: IoT applications: Smart homes, smart cities, healthcare, agriculture, Smart Metering, City Automation, Automotive Applications, home automation, smart cards, and industry, IoT and automation: Role in industrial IoT (IIoT), Emerging technologies: AIoT, Blockchain for IoT, and 5G integration IoT, Development Challenges, Security Challenges.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:</td></tr>
<tr><td colspan="5">Text Book:
Olivier Hersent, David Boswarthick, Omar Elloumi “The Internet of Things key applications and protocols”, willey.</td></tr>
<tr><td colspan="5">References</td></tr>
</table>

R1. Jeeva Jose, Internet of Things, Khanna Publishing House.
R2. Michael Miller "The Internet of Things" by Pearson.
R3. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016.
R4. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014.
R5. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India.

Web Based Resources and E-books:

W1. https://avigna.ai/what-are-protocols-in-iot-a-guide-to-communication-standards-for-smart-devices/
W2. https://www.arduino.cc/en/Guide
W3. https://www.startertutorials.com/blog/wireless-protocols-for-iot.html
W4. https://www.edx.org/course/collaborative-data-science-for-healthcare

Topics relevant to "**SKILL DEVELOPMENT**": IoT System Design and Development for Employability through Problem Solving Methodologies. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3405	Course Title: **Edge and Fog Computing for IoT**	L-T-P-C	3	0	0	3
Version No.	1					
Course Pre-requisites	CIT2500					
Anti-requisites	NIL					
Course Description	This course explores the concepts, architecture, and technologies behind Edge and Fog Computing as essential components of modern Internet of Things (IoT) ecosystems. Students will learn how these paradigms address the limitations of cloud computing by bringing computation closer to data sources, thus enabling low latency, bandwidth efficiency, and real-time decision-making. Topics include distributed processing, resource management, latency optimization, security, and real-world applications across domains such as smart cities, healthcare, industrial IoT (IIoT), and autonomous systems.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Edge and Fog Computing for IoT and attain Skill Development through Participative Learning techniques					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Explain the hierarchical relationship among Cloud, Fog, and Edge computing models and their significance in overcoming the limitations of centralized computing systems. [Level-1 Understand] **CO2:** Apply resource management and latency optimization techniques to enable efficient data processing across distributed IoT environments. [Level-3 Apply] **CO3:** Analyse optimization opportunities throughout the service life cycle and Fog [Level-4 Analyse]					

	architecture to enhance system performance, efficiency, and feasibility.	
	CO4: Implement IoT applications by addressing legal, security, and performance considerations in domains such as smart cities and healthcare.	[Level-3 Apply]
	CO5: Examine an integrated middleware or API framework that combines Edge and Fog resources to support real-time decision-making in IoT systems.	[Level-3 Apply]

Course Content				
Module 1	Internet of Things (IoT) and New Computing Paradigms and Challenges in Federating Edge Resources	Assignment	Problem Solving	12 Sessions

Internet of Things (IoT) and New Computing Paradigms: Introduction - Relevant Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models – Edge Computing Platforms - Opportunities and Challenges

Challenges in Federating Edge Resources: Introduction - Methodology - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics – Threads - Standards

Module 2	Orchestration of Network Slices in Fog, Edge, and Clouds and Optimization Problems in Fog and Edge Computing	Assignment	Problem Solving	12 Sessions

Orchestration of Network Slices in Fog, Edge, and Clouds: Introduction – Background - Network Slicing - Network Slicing in Software-Defined CloudsNetwork Slicing Management in Edge and Fog - Internet of Vehicles (IoV): Architecture, Protocols and Seven-layer security model architecture for Internet of Vehicles - IoV: Network Models, Challenges and future aspects

Optimization Problems in Fog and Edge Computing: Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Further Quality Attributes - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing

Module 3	Middleware for Fog and Edge Computing and Technologies in Fog Computing	Assignment	Problem Solving	8 Sessions

Middleware for Fog and Edge Computing: Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures - System Model - Case Study.

Technologies in Fog Computing: Fog Data Management - Smart Building - Predictive Analysis with FogTorch - Machine Learning in Fog Computing - Data Analytics in the Fog - Data Analytics in the Fog Architecture.				
Module 4	Applications of Fog and Edge Computing	Assignment	Problem Solving	8 Sessions
Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog				
Targeted Application & Tools that can be used:				
Text Book 1. Buyya, Rajkumar, and Satish Narayana Srirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.				
References R1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014, 2 ndedition, CreateSpace Independent Publishing Platform, USA. R2. OvidiuVermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India. **Web Based Resources and E-books:** W1. https://www.cisco.com/c/en/us/solutions/internet-of-things/fog-computing.html W2. https://www.fogcomputingconsortium.org/architecture/ W3. https://www.technologyreview.com/2015/03/17/247693/fog-computing/ W4. https://www.etsi.org/technologies/multi-access-edge-computing				
Topics relevant to "**SKILL DEVELOPMENT**": Edge and Fog computing for IOT for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.				

Course Code: **CIT3406**	Course Title: **Cloud Computing for IOT** Type of Course: Theory	L-T-P-C	3	0	0	3
Version No.						
Course Pre-requisites	CSE2264					
Anti-requisites	NIL					

Course Description	This course offers a comprehensive introduction to the Internet of Things (IoT) and Cloud Computing, focusing on key concepts, technologies, and hands-on experience. The course starts with understanding the fundamentals of IoT, including its components like Arduino architecture, sensors, and actuators. Students will explore IoT communication protocols, networking using the ESP8266 Wi-Fi module, and cloud integration for data storage and processing. The course will provide an overview of cloud platforms such as AWS, Microsoft Azure, and Google Cloud Platform. Additionally, students will delve deeper into cloud services, with a focus on AWS architecture, compute, and storage services. By the end of the course, students will have a solid understanding of designing IoT systems and integrating them with cloud platforms for data management and analytics.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cloud Computing for IoT and attain Employability through Problem Solving Methodologies			
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Outline IoT fundamentals, Arduino architecture, and sensor integration. [Level-1 Understand] **CO2:** Discuss IoT networking, protocols, and cloud-based connectivity. [Level-1 Understand] **CO3:** Develop IoT systems using ESP8266 and cloud platforms. [Level-3 Apply] **CO4:** Examine cloud computing models, services, and architectures. [Level-4 Analyze] **CO5:** Assess advanced cloud services for scalable IoT applications. [Level-4 Analyze]			
Course Content				
Module 1	Introduction of IoT	Assignment	Problem Solving	12 Sessions
Introduction of IoT Introduction to IoT. Understanding IoT fundamentals, Arduino Simulation Environment. Arduino Uno Architecture, and Sensor & Actuators with Arduino and Overview of Sensors working.				
Module 2	Updation in IoT Systems	Assignment	Problem Solving	11 Sessions
Updation in IoT Systems Basic Networking with ESP8266 Wi-Fi module. Basics of Wireless Networking, IoT Protocols, and Cloud Platforms for IOT with some real live minor projects.				
Module 3	Cloud Computing	Assignment	Problem Solving	12 Sessions
Cloud Computing: Introduction, Management, storage and processing of data on networks of the internet server, and On-demand IT resources over the internet etc. Introduction to platforms such as Amazon Web Services, Microsoft Azure and Google Cloud Platform.				

Module 4	Advancement in Cloud Computing	Assignment	Problem Solving	10 Sessions

Advancement in Cloud Computing: Brief on AWS Architecture and different models of Cloud Computing. Compute Services: AWS Lambda, Elastic Beanstalk, AWS EC2, Auto Scaling, and Load Balancing. Storage Services: Amazon EBS, Amazon S3, Amazon EFS, Amazon Glacier, Amazon Global Accelerator, Amazon FSx, and Storage Gateway

Targeted Application & Tools that can be used:

Text Book

T1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

T2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

T3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

References

R1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan

R2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

R3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014

Web Based Resources and E-books:

W1.https://www.coursera.org/learn/iot-wireless-cloud-computing

W2. https://www.edx.org/learn/amazon-web-services-aws/amazon-web-services-aws-iot-developing-and-deploying-an-internet-of-things

Topics relevant to "**SKILL DEVELOPMENT**": Cloud Computing for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3407	Course Title: **IOT Data Analytics and Machine Learning** Type of Course: Theory	L-T-P-C	3	0	0	3
Version No.						
Course Pre-requisites	CSE2264					
Anti-requisites	NIL					
Course Description	This course provides an in-depth understanding of data analytics and machine learning techniques for IoT applications. Students will explore how IoT devices generate data, methods for data collection, processing, and real-time analytics. The course covers statistical analysis, feature engineering, and predictive modeling using					

	machine learning techniques tailored for IoT environments. Additionally, students will learn about edge and cloud-based analytics, AI-driven decision-making, and anomaly detection for IoT security and efficiency.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of IOT Data Analytics and Machine Learning and attain Skill Development through Participative Learning techniques			
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Outline IoT analytics concepts, architectures, and networking protocols. **[Level-1 Understand]** **CO2:** Interpret IoT data using visualization and statistical techniques. **[Level-1 Understand]** **CO3:** Develop machine learning models for IoT data analysis. **[Level-3 Apply]** **CO4:** Examine data science techniques and feature engineering for IoT analytics. **[Level-4 Analyze]** **CO5:** Assess machine learning applications in Industrial IoT environments. **[Level-4 Analyze]**			
Course Content				
Module 1	Defining IoT Analytics and Challenges and IoT Devices and Networking Protocols	Assignment	Problem Solving	12 Sessions
Defining IoT Analytics and Challenges: Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges IoT Devices and Networking Protocols: IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.				
Module 2	Exploring IoT Data	Assignment	Problem Solving	12 Sessions
Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.				
Module 3	Data Science for IoT Analytics	Assignment	Problem Solving	8 Sessions
Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.				
Module 4	ML in Industrial IoT	Assignment	Problem Solving	8 Sessions
ML in Industrial IoT Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.				

Targeted Application & Tools that can be used:

Text Book:

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730.

References

1. Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley.

2. Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.

3. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Gerardus Blokdyk.

4. IoT Analytics A Complete Guide, 5starcooks

Web Based Resources and E-books:

W1: Coursera – IoT Data Analytics & Machine Learning

W2: Udacity – AI for IoT

W3: edX – Data Analytics for IoT

Topics relevant to "SKILL DEVELOPMENT":

Industrial and Medical IOT for **Skill development** through **Participative Learning techniques**. This is attained through the assessment component mentioned in the course handout.

Course Code: **CIT3408**	Course Title: **Digital Twin and Simulation in IoT** Type of Course: Theory	L-T-P-C	3	0	0	3
Version No.	01					
Course Pre-requisites	CSE2502					
Anti-requisites	NIL					
Course Description	This course covers the foundations and advanced concepts of Internet of Things (IoT), communication protocols, and the design of Digital Twins. It emphasizes the integration of IoT with emerging technologies such as edge computing, cloud computing, and machine learning for data-driven insights in manufacturing, healthcare, smart cities, and more. The course will also explore the role of IoT in industrial automation, control systems, and process industry, providing real-world case studies and applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Wearable Technology and IOT and attain Skill Development through Participative Learning techniques					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Explain different communication technologies used in Industry 4.0 applications. [Level-1 Understand]					

	CO2: Apply edge and cloud computing techniques for data acquisition, processing, and visualization in IoT systems.	[Level-3 Apply]
	CO3: Explain the concept and architecture of Digital Twins in manufacturing industries**.**	[Level-1 Understand]
	CO4: Apply Digital Twin models for discrete and process industries using simulation tools.	[Level-3 Apply**]**
	CO5: Apply Digital Twin systems for real-time monitoring and industrial applications.	[Level-3 Apply]

Course Content				
Module 1	Introduction	Assignment	Problem Solving	12 Sessions
Introduction: The various industrial revolutions, digitalization, and the networked economy, drivers, enablers, comparison of industry 4.0 factory and today's factory, challenges. Communication Technologies of IIoT Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID, Industry standards communication technology (LoRA, WAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network.				
Module 2	Visualization and Data Types of IIoT Communication	Assignment	Problem Solving	12 Sessions
Visualization and Data Types of IIoT Communication. Front-end EDGE devices, Emerging descriptive data standards for IIoT, Cloud database, Could computing, Fog/Edge computing. Pushing data to the cloud. Grabbing the content from a web page, Sending data on the web, Troubleshooting. Application of IIOT Case study: Health monitoring, smart city, Smart irrigation, Robot surveillance.				
Module 3	Design of Digital Twins	Assignment	Problem Solving	12 Sessions
Design of Digital Twins: Technological needs. Physics-based approach: Model identification, Model creation. Data- driven approach: Model development using ML/DL models. Digital twins for Prototype, Product, and Performance.				
Module 4	Digital Twins validation	Assignment	Problem Solving	10 Sessions
Digital Twins validation. Control system requirements in a Discrete Industry, Digital Twins of a Product, Digital Thread in a Discrete Industry, Data Collection & Analysis for Product & production improvements, Automation Simulation, and Digital Enterprise. Process Industry: Basics of Process Industry, Trends in the process industry, control system requirements in a process industry, Digital Twins of a plant, Digital Thread in Process Industry.				
Targeted Application & Tools that can be used:				

Text Books:

1. Bruno Sergi, Elena G.Popkova, Aleksei V. Bogoviz and Tatiana N. Litvinova, "Understanding Industry 4.0: AI, The internet of things, and the future of work", Emerald publishing limited, 2019.
2. Alp Ustundag and Emre Cevikcan, "Industry 0: Managing the Digital Transformation", Springer Series in Advanced Manufacturing., Switzerland, 2017.

References

R1. Andrew Yeh Chris Nee, Fei Tao, and Meng Zhang, "Digital Twin Driven Smart Manufacturing", Elsevier Science., United States, 2019.

R2. Shyam Varan Nath, Pieter van Schalkwyk, Dan Isaacs, "Building Industrial Digital Twins Design, Develop, and Deploy Digital Twin Solutions for Real-world Industries Using Azure Digital Twins", Packt Publishing, 2021.

Web Based Resources and E-books:

W1.https://docs.oracle.com/en/cloud/paas/iot-cloud/iotgs/iot-digital-twin-framework.html

W2. https://www.cumulocity.com/resource-library/what-are-iot-digital-twins/

W3. https://www.ptc.com/en/blogs/corporate/iot-digital-twin

Topics relevant to "SKILL DEVELOPMENT": IIoT, Digital Twin and IEEE802.15.4 for **Skill development** through **Participative Learning** techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: **CIT3409**	Course Title: **Autonomous System & Robotics with IOT** Type of Course: Theory	L-T-P-C	**3**	**0**	**0**	**3**
Version No.	01					
Course Pre-requisites	CSE2251					
Anti-requisites	NIL					
Course Description	Robotics and IoT are converging to create intelligent, autonomous systems that enhance efficiency across industries such as agriculture, healthcare, manufacturing, and transportation. By integrating IoT sensors, cloud computing, AI, and machine learning, robots can perceive, analyze, and act in real time, enabling applications like smart warehouses, autonomous vehicles, precision farming, and remote healthcare. IoT-driven robotics allows for real-time monitoring, predictive maintenance, and adaptive decision-making, making systems more efficient and responsive.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Autonomous System and Robotics with IoT and attain Skill Development through Participative Learning techniques					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Explain the IoT ecosystem in the robotic paradigm. [Level-1 Understand] **CO2:** Apply IoT infrastructure and communication architectures to develop Internet of Robotic Things (IoRT) applications. [Level-3 Apply] **CO3:** Examine IoT techniques in robotics across different platforms. [Level-3 Apply]					

	CO4: Apply cloud robotics concepts for automation applications. [Level-3 Apply] **CO5:** Apply autonomous system concepts integrated with IoT for real-world robotic applications. [Level-3 Apply]			
Course Content				
Module 1	Introduction to IoT and Vision systems and Robotic Sensors	Assignment	Problem Solving	12 Sessions
Introduction to IoT and Vision systems: History and evolution of IoT, AI, ML, Machine Vision, optoelectronic sensors, 3D & 2D machine vision technologies, robot navigation, control schemes, motion controllers, intelligent algorithms and vision systems. Robotic Sensors: Optical sensors and actuators; Mechanical sensors and actuators; Acoustic sensors and actuators; Performance characteristics of sensors and actuators				
Module 2	Internet of Robotic Things	Assignment	Problem Solving	10 Sessions
Internet of Robotic Things: Communication architecture for IoRT; Decentralized and automated IoT infrastructure using Blockchain; IoRT Platforms Architecture, IoRT applications				
Module 3	Autonomous Vehicle Systems and Industrial Internet of Things	Assignment	Problem Solving	12 Sessions
Introduction to Autonomous Driving; Perception in Autonomous Driving; Robot Operating System (ROS) Overview - Client Systems for Autonomous Driving - Decision planning and control in autonomous vehicle systems - Cloud Platform for Autonomous Driving. Industrial Internet of Things: IIoT Architecture; IIoT Applications and Challenges; IIoT Standards and Frameworks; IIoT security concerns.				
Module 4	IoMT and Robotics in Healthcare and Cloud Robotics and Industrial Automation	Assignment	Problem Solving	11 Sessions
IoMT and Robotics in Healthcare: IoMT Driven connected healthcare, Efficient design for IoMT based healthcare design, Robotics in healthcare. Cloud Robotics and Industrial Automation: Components of Cloud Robotics; Limitations and challenges of Cloud Robotics; Applications: Autonomous mobile robots, Cloud medical robots, Industrial robots				
Targeted Application & Tools that can be used:				
Text Books: 1. Vermesan, Ovidiu, and Joël Bacquet, eds.,Cognitive Hyperconnected Digital Transformation: Internet of Things Intelligence Evolution, 1st edition, River Publishers, 2017.				

2. A.K.Gupta, S.K.Arora, and J.Riescher, Industrial Automation and Robotics, 1st edition, Mercury Learning and Information LLC,2017

References

R1. A.K Dubey, A.Kumar, and S.R Kumar., AI and IoT-based Intelligent Automation in Robotics, 1st edition. Wiley, 2020

R2. A.E.Hassanien, N.Dey, and S.Borra, Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications, 1st edition ,Taylor & Francis Group,2019

R3. S.Liu, L.Li and J.Tang, Creating Autonomous Vehicle Systems, Synthesis Lectures on Computer Science, 1st edition ,Morgan & Claypool,2018

R4. Nathan Ida, Sensors, Actuators, and Their Interfaces: A multidisciplinary introduction, 2nd edition The Institution of Engineering and Technology, 2017

Web Resources:

W1. https://www.iotforall.com/

W2. https://www.iotforall.com/future-iot-robotics

W3.https://www.iotforall.com/is-the-internet-of-robotic-things-the-future-of-manufacturing

Topics relevant to "**SKILL DEVELOPMENT**": Autonomous System and robotics for Skill development through **Participative Learning** techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3410	**Course Title: Secure IoT** **Type of Course: Theory**	**L-T-P-C**	3	0	0	3
Version No.						
Course Pre-requisites	Cryptography and Network Security					
Anti-requisites	NIL					
Course Description	This course is ideal for those pursuing careers in IoT development, network security, and privacy management, providing them with the skills necessary to tackle the unique security challenges presented by the rapidly growing IoT ecosystem.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of IoT security and Privacy and attain Skill Development through Participative Learning techniques					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Summarize the IoT security lifecycle, including common vulnerabilities, attack vectors, and countermeasures. [Level-1 Understand] **CO2:** Analyze malware propagation dynamics and Defense schemes to ensure network robustness in IoT systems. [Level-4 Analyze]					

	CO3: Implement privacy-preserving data dissemination and protection schemes for smart buildings and wireless body sensor networks.	[Level-3 Apply]
	CO4: Deconstruct Trust Models and Public Key Infrastructure (PKI) components specialized for IoT authentication.	[Level-4 Analyze]
	CO5: Design a secure IoT framework incorporating cognitive security and time-based secure key generation.	[Level-4 Analyze]

Course Content				
Module 1	Security in IoT and Network Robustness and Malware Propagation Control in IoT	Assignment	Problem Solving	**8 Sessions**

IoT security: Vulnerabilities, Attacks and Countermeasures - Security Engineering for IoT development - IoT security lifecycle

Network Robustness and Malware Propagation Control in IoT: Network Robustness - Fusion Based Defense Scheme - Sequential Defense Scheme - Location Certificate Based Scheme - Sybil node detection scheme - Formal Modeling and Verification -Sybil Attack Detection in Vehicular Networks - Performance evaluation of various Malware Dynamics Models - Analysis of Attack Vectors on Smart Home Systems.

Module 2	Privacy Preservation in IoT and Privacy Protection in IoT	Assignment	Problem Solving	**9 Sessions**

Privacy Preservation in IoT: Privacy Preservation Data Dissemination: Network Model, Threat Model – Problem formulation and definition - Baseline data dissemination - Spatial Privacy Graph based data dissemination -Experiment Validation - Smart building concept-Privacy Threats in Smart Building - Privacy Preserving Approaches in Smart Building - Smart Meter Privacy Preserving Approaches.

Privacy Protection in IoT: Lightweight and Robust Schemes for Privacy Protection in IoT Applications: One Time Mask Scheme, One Time Permutation Scheme - Mobile Wireless Body Sensor Network - Participatory Sensing.

Module 3	Trust Models for IoT	Assignment	Problem Solving	**12 Sessions**

Trust Model Concepts - Public Key Infrastructures Architecture Components - Public Key Certificate Formats - Design Considerations for Digital Certificates - Public Key Reference Infrastructure for the IoT - Authentication in IoT - Computational Security for IoT

Module 4	Security Protocols for IoT Access Networks	Assignment	Problem Solving	**08 Sessions**

Time Based Secure Key Generation -Security Access Algorithm: Unidirectional, Bidirectional Transmission - Cognitive Security - IoT Security Framework - Secure IoT Layers – Secure Communication Links in IoT - Secure Resource Management, Secure IoT Databases.

Targeted Application & Tools that can be used:

Textbook

1. Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.

References

R1. Russell, Brian and Drew Van Duren. Practical Internet of Things Security, 2016,1st edition, PACKT Publishing Ltd, UK

R2. Kim, S., Deka, G. C., & Zhang, P. (2019). Role of blockchain technology in IoT applications. Academic Press.

R3. Whitehouse O Security of things: An Implementers' guide to cyber security for internet of things devices and beyond, 2014, 1st edition, NCC Group, UK.

Web Based Resources and E-books:

W1. https://www.iotsecurityfoundation.org/

W2. https://owasp.org/www-project-internet-of-things/

W3. https://www.csail.mit.edu/research/internet-things

W4. https://www.nist.gov/programs-projects/cybersecurity-internet-things

Topics relevant to "SKILL DEVELOPMENT":

IOT Security and Privacy for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: **CIT3411**	Course Title: **Big Data Analytics for IoT** Type of Course: Theory with embedded lab	L- T-P- C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	Basics of Big Data Technologies, Database Management System (DDL, DML of SQL Queries and Creation of Class & object, interface, reading & writing a file, control statements in java programming) & NoSQL.					
Anti-requisites	NIL					
Course Description	The course covers basic concepts for IOT Analytics, collection of data for IOT, Integration of IOT with Cloud, Big Data Environments. Students can learn about applying geospatial analytics and applying machine learning to the IOT data. The course also covers the organization of the IOT data, cost benefits of using IOT and review of IOT in various sectors.					
Course Objective	This course is designed to improve the learners' SKILL DEVELOPMENT by using EXPERIENTIAL LEARNING techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: **CO1:** Demonstrate **cloud-based IoT concepts and environments** to design data-driven IoT solutions **[Level 3 - Apply]** **CO2:** Execute **data collection, storage, and organization techniques** for efficient handling of IoT data **[Level 3 - Apply]** **CO3:** Apply **data analytics and machine learning techniques** to solve problems in Internet of Things applications **[Level 3 - Apply]** **CO4:** Implement **Hadoop ecosystem tools and big data technologies** to perform analytics on IoT-generated data **[Level 3 - Apply]** **CO5:** Utilize **data processing frameworks such as Apache Spark** to analyze and process large-scale IoT data efficiently **[Level 3 - Apply]**					
Course Content:						
Module 1	IOT Analytics	Assignment		10 SESSIONS		
Introduction – Introduction , Types of Data, Types of Data Processing, Issues with Traditional Data Processing, Big Data, Hadoop- Challenges with Hadoop, Cloud-Evolution of Cloud, IoT Enabling Technologies, Introduction to Data Analytics for IoT, Structured Versus Unstructured Data, Types of Data Analysis Results, IoT Data Analytics Challenges, Machine Learning Overview, IOT analytics Lifecycle and Techniques						
Module 2	Hadoop Ecosystem Tools			8 SESSIONS		
Introduction – Big Data and Big Data Analytics – Hadoop Ecosystem, Hadoop Distributed File System (HDFS), MapReduce, YARN Architecture, PIG Architecture, Apache HIVE, Mahout, Apache Spark, Apache HBase, Apache Zookeeper.						
Module 3	Cloud based IOT platform	Case Study		8 SESSIONS		
AWS overview, AWS key services for IOT analytics, Creating an AWS Cloud Analytics environment. Microsoft Azure overview, Azure Data lake store, HDInsight, Thingworx overview.						

Module 4	Strategies and Techniques in Data collection	Assignment		6 SESSIONS

Designing data processing for analytics, Applying big data technology to storage, Apache Spark for Data processing

List of Practical Tasks: [30 sessions]

Experiment 1:[Module 1]

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

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

Experiment 2: [Module 1]

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

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

Experiment 3: [Module 1]

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

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

Experiment 4: [Module 2]

Level 1: Hadoop Single node cluster installation on ubuntu

Level 2: Hadoop Multiple node cluster installation, windows installation

Experiment 5: [Module 2]

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

Level 2: Analysis on particular matching word on huge dataset

Experiment 6: [Module 2]

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

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

Experiment 7: [Module 2]

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

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

Experiment 8: [Module 2]

Level 1: Working on hive commands

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

Experiment 9: [Module 2]

Level 1: Working on Hbase commands.

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

Experiment 10: [Module 2]

Level 1: Installation of spark and word count analysis

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

Experiment 11: [Module 3]

Level 1: Temperature Data stored in cloud through IoT devices

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

Experiment 12: [Module 3]

Level 1: Healthcare Data stored through IoT sensors in Cloud

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

Experiment 13: [Module 4]

Level 1: Data Processing using Spark

Level 2: Using RDD collect Data and apply Aggregation Functions

Targeted Application & Tools that can be used:

Hadoop ecosystem tools, Thingworx , AWS Cloud

Project work/Assignment:
Student will be asked to carry out a mini project integrating IoT & data Analytics.
Text Book T1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley., 2nd Edition, 2019. T2. Analytics for the Internet of things,Andrew Minteer. Packt publishing, 1st Edition,2017. T3. Big Data and the Internet of Things, Robert Stackowiak, Art Licht, Venu Mantha and Louis Nagode, Apress, 2nd Edition, 2020
References R1. Building blocks for IOT Analytics. Internet-of-Things Analytics. John Soldatos (Editor). River Publisher Series in Signal Image and Speech Processing. 2020 R2. IOT and Analytics in Agriculture.,Prasant Kumar Pattnaik, Raghvendra Kumar, Souvik Pal, S. N. Panda. Springer, First Edition, 2020. web resources W1. NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs92/preview W2. Coursera: https://www.coursera.org/learn/big-data-introduction W3. EDX: https://www.edx.org/course/big-data-fundamentals W4. E-book Link : https://www.wiley.com /en-us/Internet+of+Things+and+ Data+ Analytics + Handbook -p-9781119173625 https://presiuniv.knimbus.com/user#/home
Topics relevant to “Skill Development”: Organize IOT data – Linked analytics datasets – Managing data in cloud.

<table>
<tr><td>Course Code:

CIT3412</td><td colspan="5">Course Title: IoT for healthcare and Wearable Technology

Type of Course: Theory</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="10"></td></tr>
<tr><td>Course Pre-requisites</td><td colspan="10">Data Communication and Network</td></tr>
<tr><td>Anti-requisites</td><td colspan="10">NIL</td></tr>
<tr><td>Course Description</td><td colspan="10">A course on Iot for healthcare and wearable technology within the context of the Internet of Things (IoT) would explore the fundamentals of both, focusing on how wearable devices collect and transmit data, and the applications of this technology across various sectors</td></tr>
<tr><td>Course Objective</td><td colspan="10">The objective of the course is to familiarize the learners with the concepts of IoT for healthcare and Wearable Technology and attain Skill Development through Participative Learning techniques</td></tr>
<tr><td>Course Out Comes</td><td colspan="10">On successful completion of the course the students shall be able to:

CO 1: Summarize the evolution of wearable technology and the role of functional modules in the IoT ecosystem. [Level 2 - Understand]

CO2: Analyze wireless communication standards and hardware platforms suitable for wearable applications. [Level 4 - Analyze]

CO3: Deconstruct the IoT architecture layers, including cloud and fog-based models for healthcare data management. [Level 4 - Analyze]

CO4: Implement IoT application development using standard protocols and backend database technologies. [Level 3 - Apply]

CO5: Examine security and privacy constraints in wearable IoT through cross-sector case studies. [Level 4 - Analyze]</td></tr>
<tr><td>Course Content</td><td colspan="10"></td></tr>
<tr><td>Module 1</td><td colspan="3">Role of IoT in wearable devices and IoT supported technologies:</td><td colspan="3">Assignment</td><td colspan="2">Problem Solving</td><td colspan="2">12 Sessions</td></tr>
</table>

	Internet/Web and networking basics			

Role of IoT in wearable devices: Smart connectivity and Big picture of IoT-smart devices, networks, Wireless technologies and need for data analysis. Evolution of wearable technology, Wearable IoT use cases- Smart watches , Android wear, Smart glasses, fitness trackers, health care devices, cameras, smart clothing etc

IoT supported technologies: Internet/Web and networking basics: OSI model, data transfer referred with OSI model, IP Addressing, point to point data transfer, point to multi point data transfer & network topologies, sub-nets, network topologies referred with web, introduction to web servers and cloud computing

Module 2	IoT supported technologies: Hardware platforms and Wireless communication standards	Assignment	Problem Solving	**12 Sessions**

IoT supported technologies: Hardware platforms: Overview of single board computers (Raspberry pi/Beagle bone black), ARM Cortex Processors, Arduino. Network Fundamentals: Overview and working principle of wired and wireless networking equipment's – router, switches, access points, and hubs. Networking configurations in Linux accessing hardware & device files interactions.

Wireless communication standards: Bluetooth - IEEE 802.15.1, Wireless LAN- IEEE 802.11(WiFi) , Near Field communication, WiMaxIEEE 802.16, LR-WPAN- IEEE 802.15.4 (Zigbee), 6LoWPAN, mobile network, GPS

Module 3	IOT architecture:	Assignment	Problem Solving	**10 Sessions**

IoT functional requirements, building blocks, IoT architecture layers, cloud and fog based architecture, M2M – Machine to Machine architecture, Web of Things, physical layer, MAC layer, 6LoWPAN security aspects in IoT

Module 4	IOT Application Development and Wearable IoT	Assignment	Problem Solving	**11 Sessions**

Application Protocols: MQTT, REST/HTTP, CoAP, MySQL Back-end Application Designing: Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools

Wearable IoT: Case studies – Health care, fitness and sports, industrial, defence and security, home automation, gaming, fashion and apparel

Targeted Application & Tools that can be used:

Textbook

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2013

References

1. The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World 1st Edition

2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, StamatisKarnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.

3. IEEE Standards Association Working Group for an Architectural Framework for the Internet of Things (IoT) (P2413) - http://grouper.ieee.org/groups/2413/

4. Internet of Things – Architecture – Final Architectural Reference Model for the IoT v3.0, http://www.iot-a.eu/publi

Web Based Resources and E-books:

W1.https://www.techtarget.com/searchmobilecomputing/definition/wearable-technology

W2. https://www.investopedia.com/terms/w/wearable-technology.asp

Topics relevant to "SKILL DEVELOPMENT": Wireless Communication Standards, Application protocols and wearable devices for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3413	**Course Title:** Industrial IOT **Type of Course:** Theory	**L-T-P-C**	3	0	0	3
Version No.	01					
Course Pre-requisites	DCCN					
Anti-requisites	NIL					
Course Description	The Industrial Internet of Things (IIoT) course explores the integration of smart sensors, edge computing, and connectivity in industrial settings to enhance automation, efficiency, and data-driven decision-making. It covers IIoT architecture, communication protocols, security challenges, real-world applications in manufacturing, energy, and healthcare, and the role of AI and machine learning in predictive maintenance. The course also delves into industrial cloud platforms, digital twins, and cybersecurity best practices, providing a comprehensive understanding of IIoT's impact on Industry 4.0 and smart factories.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Industrial IoT and attain Skill Development through Participative Learning techniques					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1:** Identify key opportunities and benefits of the Industrial Internet of Things (IIoT) across various sectors. **[Level 2 - Understand]** **CO2:** Demonstrate the use of cloud and virtualization technologies in IIoT environments. **[Level 3 - Apply]** **CO3:** Analyze the Industrial Internet Architecture Framework (IIAF) and its three-tier topology. **[Level 4 - Analyze]** **CO4:** Categorize legacy and modern communication protocols used in Industrial Internet systems. **[Level 4 - Analyze]** **CO5:** Examine middleware software patterns and IIoT platforms for real-world smart factory applications. **[Level 4 - Analyze]**					
Course Content						
Module 1	Introduction	Assignment	Problem Solving	**12 Sessions**		
Introduction To Industrial Internet and Use-Cases: Industrial Internet- Key IIoT Technologies-Innovation and the IIoT -Key Opportunities and Benefits - The Digital and Human Workforce - Logistics and the Industrial Internet-IOT Innovations in Retail. The Technical and Business Innovators of The Industrial Internet: Cyber Physical Systems (CPS), – IP Mobility – Network Virtualization - SDN (Software						

Defined Networks)- The Cloud and Fog – Role of Big Data in IIOT - Role of Machine learning and AI in IIOT				
Module 2	IIOT Reference Architecture	Assignment	Problem Solving	**10 Sessions**
IIOT Reference Architecture: Industrial Internet Architecture Framework (IIAF) -Industrial Internet Viewpoints -. Architectural Topology: The Three Tier Topology- Key System Characteristics- Data Management- Advanced data analytics				
Module 3	Protocols for Industrial Internet Systems	Assignment	Problem Solving	**12 Sessions**
Protocols for Industrial Internet Systems: Legacy Industrial Protocols - Modern Communication Protocols-Proximity Network Communication Protocols- Wireless Communication Technologies- Gateways: industrial gateways - CoAP (Constrained Application Protocol)- NFC.				
Module 4	Middleware Software Patterns and IIOT Platforms	Assignment	Problem Solving	**11 Sessions**
Middleware Software Patterns and IIOT Platforms: Publish/Subscribe Pattern: MQTT, XMPP, AMQP, DDS- Middleware Architecture- SigFoxLoRaWAN Augmented reality- Real-World Smart Factories, Application of IIOT: Case study: Health monitoring, IoT smart city, Smart irrigation, Robot surveillance				
Targeted Application & Tools that can be used:				

Text Book

1. Gilchrist, Alasdair, "Industry 4.0 The Industrial Internet of Things", Apress, 2017.

References

R1. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat "Industrial Internet of Things: Cyber manufacturing Systems" (Springer), 2017.

R2. Zaigham Mahmood, "The Internet of Things in the Industrial Sector: Security and Device connectivity, smart environments and Industry 4.0 (Springer), 2019.

R3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

R4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.

R5. Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642- 19156-5 e-ISBN 978-3-642-19157-2, Springer

R6. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 20132 Cuno Pfister, Getting Started with the Internet of Things, O "Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Web Resources:

W1. https://www.coursera.org/learn/applied-industrial-internet-of-things

W2. https://www.isa.org/training/course-description/dt101

W3. https://www.coursera.org/certificates/iiot-boulder

Topics relevant to **"SKILL DEVELOPMENT":** Industrial IOT for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3414	**Course Title: IOT Data Analytics and Machine Learning** **Type of Course: Theory**	**L-T-P-C**	3	0	0	3
Version No.						
Course Pre-requisites	DCCN					
Anti-requisites	NIL					
Course Description	This course provides a comprehensive understanding of energy management principles and techniques in IoT systems. It covers various energy sources, storage solutions, and power management strategies, focusing on optimizing energy consumption in IoT devices. Students will explore energy-efficient sensors, low-power communication technologies, and AI-driven energy optimization techniques. The course also delves into designing and implementing energy-efficient IoT solutions, including renewable energy integration and performance optimization. Additionally, it addresses advanced topics such as energy management in smart cities, industrial IoT applications, and sustainability challenges.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Energy Efficient IOT system and attain Skill Development through Participative Learning techniques					
Course Out Comes	On successful completion of the course the students shall be able to: **CO1.** Understand various energy sources, consumption patterns, and management techniques in IoT systems. **[Level 2 - Understand]** **CO2.** Analyze energy-efficient hardware and software solutions for IoT energy optimization. **[Level 4 - Analyze]** **CO3.** Apply AI-driven optimization and software-based analytics to enhance IoT energy management. **[Level 3 - Apply]** **CO4.** Deconstruct the design principles and integration methodologies for renewable energy-based IoT solutions. **[Level 4 - Analyze]** **CO5.** Examine advanced energy management applications in smart grids, industrial IoT, and sustainable development. **[Level 4 - Analyze]**					
Course Content						

Module 1	**Energy Management Basics in IoT**	Assignment	Problem Solving	**12 Sessions**
Energy Management Basics in IoT: Energy sources and storage options, Battery technologies and renewable energy solutions, Energy consumption patterns in IoT devices, Power management strategies, Energy-efficient design principles.				
Module 2	**Technologies for IoT Energy Management**	Assignment	Problem Solving	**12 Sessions**
Technologies for IoT Energy Management: Energy-efficient sensors and actuators, Low-power communication technologies (LoRaWAN, Zigbee, BLE), AI-driven energy optimization, Software-based energy analytics, Networking and connectivity considerations for energy efficiency.				
Module 3	**Designing and Implementing IoT Energy Solutions**	Assignment	Problem Solving	**8 Sessions**
Designing and Implementing IoT Energy Solutions: Efficient design principles, Component selection and integration, Renewable energy integration in IoT, Prototyping and testing methodologies, Deployment and performance optimization strategies.				
Module 4	**Advanced Topics in IoT Energy Management**	Assignment	Problem Solving	**8 Sessions**
Advanced Topics in IoT Energy Management: Smart cities and smart grids, Energy management in industrial IoT, Sustainable development and environmental considerations, Emerging trends and challenges, Ethical and regulatory aspects of IoT energy solutions.				
Targeted Application & Tools that can be used:				
Text Book 1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, and David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 2014, First Edition, Academic Press. 2. Shuang-Hua Yang, Wireless Sensor Networks: Principles, Design, and Applications, 2013, First Edition, Springer.				
References R1. Mischa Dohler, Burkhard Rätting, Energy Harvesting for Autonomous Systems, 2010, First Edition, Artech House. R2. Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, 2021, First Edition, Cambridge University Press. R3. Mohammad S. Obaidat, Mieso K. Denko, Isaac Woungang, Handbook of Green Information and				

Communication Systems, 2013, First Edition, Elsevier. **Web Based Resources and E-books:** W1: https://iot-analytics.com/ W2: https://www.coursera.org/certificates/iiot-boulder W3: https://www.coursera.org/learn/energy-management-for-iot-devices
Topics relevant to "SKILL DEVELOPMENT": Energy Efficiency for IOT System for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: **CIT3416**	**Course Title: Foundations of IoT & Embedded Circuit Systems** **Type of Course: Program Core – Lab integrated with theory**	**L-T-P-C**	2	0	2	3
Version No.						
Course Pre-requisites	Innovative Projects Using Arduino					
Anti-requisites	NIL					
Course Description	This course introduces fundamentals of Internet of Things, embedded circuit concepts, sensor operation, and Raspberry Pi configuration. Students will work hands-on with GPIO-based circuits and build a mini-project demonstrating sensor-actuator interactions.					
Course Objective	Understand IoT system structure, applications and technologies. Learn basic circuit elements, components, sensors & actuators. Configure Raspberry Pi environment for hardware programming. Build a functional prototype using GPIO Zero.					
Course Out Comes	CO1. Explain IoT architecture, components, platforms, and applications with real-world relevance. CO2. Interpret circuit elements such as resistors, sensors, actuators and describe their working principles. CO3. Carrying out Raspberry Pi OS Configuration and operate system utilities through command-line interface. CO4. Develop a functional mini-IoT prototype integrated with sensors and real-time controls.					
Course Content						
Module 1	**Introduction to IoT**	Assignment	Problem Solving	**10** Sessions		

Definition, scope and evolution of IoT, IoT Vs Embedded Systems Vs IIoT , Basic IoT architecture: Sensing - Network - Processing – Application, IoT Application Domains: Smart Home, Healthcare, Industry 4.0, AgriTech, IoT Platforms overview: Open-source vs Proprietary, Networking fundamentals in IoT: IP addressing, Wireless IoT networks.

Outcome: Understanding of IoT system architecture and applicability.

Module 2	**Electronic Circuit & Component Fundamentals**	Assignment	Problem Solving	**10** Sessions

Ohm's law, voltage-current-power relationships, Passive components: Resistor, Capacitor, Inductor – symbols & identification, Active components: Diodes, Transistors, ICs, Regulators, Analog vs Digital signals, Types of sensors: Temperature, Humidity, IR, Ultrasonic, Gas, LDR, Accelerometer. Actuators: Relays, Motors, Buzzers, LEDs.

Outcome: Ability to build & test basic circuits with sensors.

Module 3	**Raspberry Pi Setup & OS Configuration**	Assignment	Problem Solving	**5** Sessions

Raspberry Pi architecture & SOC, SD card imaging (Raspberry Pi OS), Boot sequence, login modes, SSH/VNC access, Network configuration & remote access, Package installation, update/upgrade.

Outcome: Students configure and operate Raspberry Pi confidently

Module 4	**IoT Device Interfacing with GPIO**	Assignment	Problem Solving	**5** Sessions

GPIO layout & addressing, Pull-up/pull-down concepts, GPIO Zero vs RPi. GPIO library

Data logging concepts

Outcome: Hands-on GPIO programming and sensor integration.

List of Laboratory Tasks: **30 Sessions**

1. Breadboard testing & component identification
   Level 1: LED blink + resistor calculation.
   Level 2: Sensor reading using simple Python programming.
2. Relay/Motor driver control
   Level 1: LED blink + resistor calculation.

Level 2: Sensor reading using simple Python programming.

3. Raspberry Pi Setup & OS Configuration
   Level 1: Flash OS, boot Raspberry Pi.
   Level 2: Connect via SSH & VNC headless mode.
4. Raspberry Pi Setup & OS Configuration
   Level 1: Python + GPIO libraries installation
   Level 2: Write a program that turns on 3 LEDs of different colors one by one each time a button is pressed by using GPIO Zero. Suppose that there are Green, Amber, and Red LEDs, and the initial state is Green. Whenever the button is pressed, the next LED is turned on, and the existing LED is turned off.
5. Raspberry Pi Setup & OS Configuration
   Level 1: Python + GPIO libraries installation
   Level 2: Write a program that measures the distance through an ultrasonic sensor and turns on one of three LEDs when within a certain distance range. If the calculated decimeter distance is less than 20, the red LED is turned on. When it is more than 80, the green LED is turned on. Otherwise, the amber LED is turned on.
6. Raspberry Pi Setup & programming
   Level 1: Temperature sensing with DTH11 & Analog – Digital interface
   Level 2: PIR motion based light trigger & Interrupt based environment
7. Raspberry Pi Setup & programming
   Level 1: Ultrasonic distance measurement & Timing measurement
   Level 2: PIR motion based light trigger & Interrupt based environment
8. Level 2: Min project (2 Lab slots) & Any two sensor applications.

Assessment:

CA-1-(Weekly Lab Evaluations) - 10% - 20 Marks

CA-2-(Lab Test 1)- 5% - 10 Marks

CA-3(Lab Test 2)- 10% - 20 Marks

Mid-Term Exam [Theory] – 25% - 50 Marks

End-Term Exam [Theory] – 50% - 100 Marks

Targeted Application & Tools that can be used: SIC Lab - Raspberry Pi, IoT sensors- Temperature, Humidity, IR, Ultrasonic, Gas, LDR, Accelerometer. Actuators: Relays, Motors, Buzzers, LEDs.

Text Book

1. Raj Kamal, Internet of Things, Architecture and Design Principles, lst edition, McGraw Hill Education, May 2017.

2. Arsheep Baga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st Edition, Universities press, 2015.

References

R1: SIC High-Level Design Document IoT course

R2. David Etter, IoT (Internet of Things Programming: A simple and fast way of Learning IoT, Kindle edition 2016.

Topics relevant to "SKILL DEVELOPMENT": Ability to build & test basic circuits with sensors, Hands-on GPIO programming and sensor integration using IoT tools through Experiential Learning as mentioned in the course handout.

Course Code: **CIT3417**	**Course Title:** Version Control & Collaborative IoT Software Development **Type of Course: Program Core – Lab integrated with theory**	**L-T-P-C**	2	0	2	3
Version No.						
Course Pre-requisites	Innovative Projects Using Arduino					
Anti-requisites	NIL					
Course Description	This course trains learners in Git-based version control, repository management, GitHub collaboration workflows, and automation for IoT software projects. Students maintain code repositories and execute pull request workflows					
Course Objective	Master Git fundamentals – commit, branch, merge, restore Work with GitHub repositories, issues, wiki & documentation Collaborate through forks, PR reviews and repo governance Execute software release workflows through assignments					
Course Out Comes	CO1: Explain the need for version control systems and distinguish between centralized and distributed version control models. CO2: Apply Git commands to manage source code versions, branches, merges, and resolve conflicts in a local and remote repository. CO3: Use GitHub features such as forks, pull requests, issues, and documentation to support collaborative software development. CO4:Evaluate team-based version control workflows by implementing structured branching strategies, pull-request reviews, and release tagging on an IoT-related codebase.					
Course Content						

Module 1	**Fundamentals of Version Control**	Assignment	Problem Solving	**6 Classes**

Why Version Control is needed, Centralized vs Distributed VCS,Git concepts: Repository, Working Tree, Staging Area
Commit, Branch, Checkout
Git configuration files: .gitignore, HEAD, config

Module 2	Git Installation & Working	Assignment	Problem Solving	**12 Class**

Git installation on Windows/Linux, Staging area, commit history, diff,Branching models (feature branch concept),Merge strategies, Rebase vs merge (conceptual),Tagging and release versioning, Revert, reset, cherry-pick, Merge conflict identification & resolution

Module 3	GitHub for Collaboration	Assignment	Problem Solving	**8 Classes**

GitHub overview and terminology, Fork, Clone, Pull Request, Issues, Labels, Milestones, README & Markdown documentation, Repository visibility and access control, Introduction to GitHub Actions (conceptual level)

Module 4	**Group project implementation**	Assignment	Problem Solving	**4 classes**

Collaborative Software Development Models: Individual vs team-based development, Role of version control in teamwork
Branching Strategies (Conceptual): Centralized workflow, Feature-branch workflow, Pull request–based workflow
Code Review & Pull Request Lifecycle: Review comments, Approval and merge policies, Common mistakes in PRs
Release Management & Repository Quality: Versioning semantics (v1.0, v1.1, etc.), Changelog maintenance, Repository audit checklist

Laboratory Tasks 30 sessions

Unit–1: Fundamentals of Version Control

1. Installation and Configuration of Git

   (Install Git, set user name and email)

2. Creating and Initializing a Local Git Repository

(git init, repository structure, git status)

3. Basic Commit Workflow

(git add, git commit, git log)

4. File Tracking and Ignore Rules

Usage of .gitignore

5. Undoing Changes in Git

(git restore, git checkout, git reset --soft)

6. Branch Creation and Merging

Create, switch, and merge branches

Unit–2: Git Installation & Working

7. Commit History Analysis and Difference Tracking

(git log, git diff)

8. Feature Branch Workflow Implementation

Working with parallel branches

9. Merge Conflict Simulation and Resolution

Manual conflict handling

10. Reset and Revert Operations

Case studies using git reset and git revert

11. Tagging and Version Management

Lightweight and annotated tags

12. Release Snapshot Creation Using Tags

Versioned software release

13. Branch Cleanup and Maintenance

Deleting merged and stale branches

14. Cherry-pick Operation

Applying selective commits

15. Rebase Demonstration

Linearizing commit history

16. Mini Lab Assignment: Repository Maintenance

Apply best practices for clean repository history

Unit–3: GitHub for Collaboration

17. GitHub Account Setup and Repository Creation

Creating public/private repositories

18. Pushing Local Repository to GitHub

Remote repository configuration

19. Forking and Cloning a Repository

Working with forked repositories

20. Pull Request Creation and Review Workflow

Submitting and merging PRs

21. Issue Creation and Assignment

Issue tracking using GitHub Issues

22. Markdown Documentation Using README

Creating structured project documentation

23. Basic GitHub Actions Workflow

Simple CI automation (build/test)

24. Repository Access Control and Collaboration Settings

Adding collaborators and managing permissions

Unit–4: Group Project Implementation

25. Forking an IoT-Related Open-Source Repository

Team repository setup

26. Structured Branching Strategy Implementation

Feature branch creation and usage

27. Pull Request–Based Feature Integration

Peer review and merge process

28. Issue Tracking and Milestone Management

Task planning and progress tracking

29. Version Release and Tagging

Final release creation

30. Repository Audit, Documentation Review, and Viva

Evaluation of Git workflow, commits, and collaboration

Assessment:

CA-1-(Weekly Lab Evaluations) - 10% - 20 Marks

CA-2-(Lab Test 1)- 5% - 10 Marks

CA-3(Lab Test 2)- 10% - 20 Marks

Mid-Term Exam [Theory] – 25% - 50 Marks

End-Term Exam [Theory] – 50% - 100 Marks

Targeted Applications and Tools: Open-source project contribution and maintenance workflows,Version-controlled development,Software release and configuration management.**Git** (Open-source distributed version control system),**GitHub (Free Tier)** for collaboration,**Linux / Windows OS,Python / Node.js** (for IoT-related sample codebases),**Markdown** for documentation,**Visual Studio Code** or any open-source editorcation & Tools that can be used: SIC Lab

Text Book

1. Jon Loeliger and Matthew McCullough,
Version Control with Git: Powerful Tools and Techniques for Collaborative Software Development,2nd Edition, O'Reilly Media, 2012.
2. Scott Chacon and Ben Straub,
Pro Git, 2nd Edition, Apress, 2014.
(Official Git book)

References

R1: SIC High-Level Design Document IoT course

R2:**PremKumar Ponuthorai and Jon Loeliger**,
Mastering Git, Packt Publishing, 2016.

Online References

1. *Git Official Documentation* – https://git-scm.com/docs
2. *Pro Git Book (Online Edition)* – https://git-scm.com/book
3. *GitHub Documentation* – https://docs.github.com
4. *GitHub Guides* – https://guides.github.com

Topics relevant to "SKILL DEVELOPMENT":

Hands-on practice of Git-based version control, structured branching, Collaborative development using GitHub.Versioned software release management and documentation practices aligned with industry workflows.

Course Code: **CIT3418**	**Course Title:** **Advanced IoT Platforms & AI Orchestration** **Type of Course:** **Program Elective – Lab integrated with theory**	**L-T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	This course provides an advanced exploration of the **AIoT (Artificial Intelligence of Things)** landscape, focusing on the convergence of industrial IoT platforms and edge-based intelligence. Students will transition from foundational hardware control to architecting complex ecosystems using the **oneM2M** standard and **Mobius** platforms. The curriculum emphasizes sustainable engineering through the **Galaxy Upcycling** framework and explores the deployment of **Generative AI** at the edge using **PEFT**, **RAG**, and autonomous agent frameworks to build responsive, intelligent systems.					
Course Objective	*The objective of the course is to familiarize the learners with the concepts of* ***Industrial IoT Platforms****,* ***Sustainable Hardware Engineering****, and* ***Advanced LLM Optimization*** *using tools like* ***Node-RED****,* ***Mobius****,* ***LangChain****, and* ***Hugging Face*** *to attain* ***SKILL DEVELOPMENT*** *through* ***EXPERIENTIAL LEARNING*** *techniques.*					
Course Out Comes	**CO1**: Execute text collection and string manipulation for building raw datasets. **CO2**: Implement advanced text preprocessing, including lemmatization and POS tagging. **CO3**: Analyze language and representation models to extract business insights. **CO4**: Apply word embedding techniques using Keras for vector space modeling. **CO5**: Build and train Perceptrons and Multilayer Perceptrons for classification tasks. **CO6**: Optimize neural network performance using gradient descent and backpropagation.r					
Pre-requisite Modules	**Prerequisite 1: Generative AI Foundations** Students must master the foundations of GenAI, tracing its evolution and core mechanisms. **Introduction to Generative AI** Evolution and Fundamentals: AI & GenAI Trends, Core Tech (Transformer & Diffusion). Text Generation Models (LLMs): Overview and Representative LLMs. Image, Video, and Code Models: Capabilities, style/content patterns, and Vibe Coding. **Prompt Engineering Basics** Fundamentals: 6-element structuring strategy (Role, Goal, Context, Constraints, Style, Output Format). Techniques: Zero-shot vs. Few-shot, Instruction vs. System prompts, Schema-first prompting. Advanced Reasoning: Step-by-step instructions, ToT (Tree of Thoughts), and ReAct. **Foundation Models and Platforms**					

	Internal Components: Digitalizing Language (Tokenizer), Transformer Architecture deep dive. Strategies: Practical application methods, RAG (Retrieval-Augmented Generation) concepts. **AI Ethics and Responsibility** Ethical Challenges: Data Bias, Content Integrity (Hallucinations / Deepfakes), Black-box transparency. Risk Management: Policy-based guardrails and technical defence mechanisms. **Prerequisite 2: IoT Foundations** **Introduction to IoT** IoT Overview: Definition, background, and emergence of IoT. IoT Applications, Components, and Networks: Industry applications and network environments. **Basic Circuit and Raspberry Pi Configuration** How to Run Raspberry Pi: Practice environment configuration and setup. Understanding Circuits & Sensors: Digital input, electric circuits, and sensor classification (Ultrasonic, DHT11). Mini Project Using GPIO Zero: Controlling LEDs and buttons. **Version Control with Git and GitHub** What is Version Control?: Types and benefits. Git & GitHub Mastery: Installation, terminologies, and collaboration through GUI environments. **Raspberry Pi with Python** Device Development: CPU monitoring, temperature data visualization, and sensor span control. Voice Recognition: Integrating Generative AI (Whisper STT) for text-based device control. **Linux 101** Raspberry Pi OS: Commands, compiling (gcc), automated build (make), and debugging (gdb). Editors and IDEs: Nano and Visual Studio Code (VSC). **Network Communication and Network Programming** Protocols & Sockets: OSI Model, TCP/IP, HTTP, and MQTT binding. Database Integration: Using Raspberry Pi as a DB Server with MariaDB and HeidiSQL.
Course Content	

Module 1	**Event-Driven IoT with Node.js**	Assignment	Problem Solving	**07** Sessions
Node.js Architecture & Setup: Understanding the Node.js concept, installation of development tools, and project initialization. **Core Programming**: Implementing console logging, utilizing built-in Node modules, and managing project dependencies. **Asynchronous Logic**: Mastering events and file system management for persistent IoT logging.				

Module 2	**Visual Orchestration & Troubleshooting**	Assignment	Problem Solving	**08** Sessions
Node-RED Framework: Introduction to visual flow-based programming for rapid IoT deployment. Hardware Control: Implementing LED control and access detection logic through Node-RED nodes. System Reliability: Identifying common runtime errors and implementing industrial troubleshooting protocols.				
Module 3	**Industrial Standard Platforms**	Assignment	Problem Solving	**07** Sessions
oneM2M Ecosystem: Deep dive into oneM2M Platform Architecture and the OCEAN open-source repository. **Mobius Platform Operations**: Installing the Mobius open IoT platform and establishing a standardized service environment. **Standardized Messaging**: Implementing resource trees and container management within a oneM2M environment.				
Module 4	**Automation Bus & Data Insights**	Assignment	Problem Solving	**08** Sessions
OpenHAB Integration: Overview of the Open Home Automation Bus and full-scale installation. **Advanced Connectivity**: Configuring OpenHAB for MQTT Binding to bridge disparate device protocols. **Data Visualization**: Exploring visualization concepts and deploying **Grafana** for industrial-grade data dashboards.				

List of Laboratory Tasks:

Node.js Environment
Level 1: Install Node.js and create a "Hello IoT" script that logs data to the console.
Level 2: Create a custom module that calculates sensor offsets and import it into a main script.

File-Based Logging
Level 1: Write a script to create and append "system_ready" messages to a local text file.
Level 2: Develop a persistent logger that captures sensor events and saves them as timestamped JSON entries.

Visual Flow Control
Level 1: Deploy Node-RED and create a simple "Inject" to "Debug" flow.
Level 2: Connect a Raspberry Pi GPIO node in Node-RED to toggle a physical LED via a dashboard button.

Smart Access Detection
Level 1: Use a Digital Infrared sensor to trigger a basic "Access Detected" console log in Node-RED.
Level 2: Build a security flow that triggers a buzzer and sends a notification when the Infrared sensor is tripped.

Mobius Platform Setup
Level 1: Install and initialize the Mobius platform on a Raspberry Pi server.
Level 2: Successfully register a virtual "Application Entity (AE)" within the Mobius resource tree.

oneM2M Resource Management
Level 1: Create a "Container" resource in Mobius to hold temperature data.
Level 2: Use POST requests to push live sensor strings from a Python script into the Mobius container.

OpenHAB Automation
Level 1: Install OpenHAB and access the Paper UI dashboard.

Level 2: Bind a virtual "Switch Item" to a physical GPIO pin to control a device from the OpenHAB UI.

MQTT Orchestration
Level 1: Configure a Mosquitto broker and test a basic Publish/Subscribe message loop.
Level 2: Configure OpenHAB to subscribe to an MQTT topic that receives DHT11 data from a remote Pi.

Industrial Visualization
Level 1: Install Grafana and connect it to a local MariaDB data source.
Level 2: Create a real-time line chart in Grafana to visualize historical temperature fluctuations.

Multi-Protocol Bridge
Level 1: Create a Node-RED flow that converts an incoming HTTP request into an MQTT message.
Level 2: Build a bridge that takes Raspberry Pi sensor data (HTTP) and displays it on an OpenHAB dashboard (MQTT).

Error Handling
Level 1: Implement a "Try-Catch" block in Node.js to handle a missing sensor file error.
Level 2: Design a "Heartbeat" monitor in Node-RED that notifies the user if a sensor stops sending data.

Advanced Dashboarding
Level 1: Design a Grafana "Stat" panel showing the current status (ON/OFF) of a connected device.
Level 2: Create a complex dashboard combining Gauges for live values and Bar Charts for daily energy usage.

Platform Integration
Level 1: Use the OCEAN platform tools to inspect resources on a remote Mobius server.
Level 2: Implement a "Subscription" resource in Mobius that automatically triggers an LED when data exceeds a threshold.

System Diagnostics
Level 1: Use Linux commands to monitor memory usage of the running Mobius and Node-RED services.
Level 2: Write a Shell script to automatically restart the Node.js IoT service if it crashes.

Edge-to-Platform Pipeline
Level 1: Push a single sensor reading from a local breadboard to a Grafana dashboard through Node-RED.
Level 2: Build a full industrial pipeline: Sensor → Raspberry Pi → Node-RED → Mobius → Grafana.

Assessment:

CA-1-(Lab Test 1)- 5% - 10 Marks

CA-2(Lab Test 2)- 10% - 20 Marks

CA-3-(Weekly Lab Evaluations) - 10% - 20 Marks

Mid-Term Exam [Theory] – 25% - 50 Marks

End-Term Exam [Theory] – 50% - 100 Marks

Targeted Application & Tools that can be used:

Industrial Automation: Utilizing **oneM2M** and **Mobius** for standardized device management.

Smart Sustainable Systems: Implementing **Galaxy Upcycling** to repurpose legacy hardware via the **SmartThings SDK**.

Edge AI Orchestration: Deploying optimized LLMs using **PyTorch**, **Hugging Face**, and **LangChain**.

Data Intelligence: Real-time monitoring and visualization using **Grafana** and **OpenHAB**.

Text Book

1. **Ian Goodfellow, Yoshua Bengio, and Aaron Courville**, Deep Learning, 1st Edition, MIT Press, 2016.
2. **Dan Jurafsky and James H. Martin**, Speech and Language Processing, 3rd Edition (Draft), Pearson, 2023.
3. **Lewis Tunstall, Leandro von Werra, and Thomas Wolf**, Natural Language Processing with Transformers: Building Language Applications with Hugging Face, 2nd Edition, O'Reilly Media, 2024.
4. **Denis Rothman**, Transformers for Natural Language Processing: Build, train, and fine-tune advanced neural networks, 3rd Edition, Packt Publishing, 2024
5. **Sebastian Raschka**, Build a Large Language Model (From Scratch), 1st Edition, Manning Publications, 2024.
6. **Lewis Tunstall et al.**, Natural Language Processing with Transformers, 2nd Edition, O'Reilly Media, 2024.
7. **Raj Kamal**, Internet of Things: Architecture and Design Principles, 1st Edition, McGraw Hill Education, 2017.

References

R1. *SIC GenAI High Level Design Document*.
R2. *SIC IoT High-Level Design Document_rev3.0*.
R3. **B. Santhosh Kumar et al.**, *Generative AI with LangChain*, 1st Edition, Packt Publishing, 2024.
R4. **Ashish Vaswani et al.**, *Attention is All You Need*, 2017.

Topics relevant to "SKILL DEVELOPMENT":

Ability to implement **Attention Mechanisms**, perform hands-on **Retrieval-Augmented Generation (RAG)** and **PEFT (LoRA)**, and execute industrial platform orchestration using **oneM2M** and **Node.js** frameworks through **Experiential Learning** techniques.