PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum 2025-2029

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)

Regulation Number: PU/AC-26.9/SoCSE6/CIT/2025-2029

Resolution No. 9 of the 26th Meeting of the Academic Council held on 25th July 2025, and ratified by the Board of Management in its 27th Meeting held on 28th July 2025.

July 2025

Table of Contents

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 of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

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

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.0 of Academic Regulations) in the prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Programme Educational Objectives (PEO)

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

PEO1. Demonstrate as a Computer Engineering Professional

PEO2. Engage in lifelong learning through research and professional development

PEO3. Serve as a leader in the profession through consultancy, extension activities and/ or entrepreneurship

8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

8.1 Programme Outcomes (PO)

On successful completion of the Program, the students shall be able to:

PO1: Engineering Knowledge: Apply 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:

PSO1: 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.

PSO2: 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

PSO3: 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 Regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

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

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

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

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

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause 8.10 of Academic Regulations) 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**

2   Table 1: Assessment Components and Weightage for different category of

Courses		
Nature of Course and Structure	aluation Component	Weightage
Lecture-based Course L component in the L-T-P Structure is predominant (more than 1) amples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.)	ntinuous Assessments	50%
	nd Term Examination	50%
Lab/Practice-based Course P component in the L-T-P Structure is predominant amples: 0-0-4; 1-0-4; 1-0-2; etc.)	ntinuous Assessments	75%
	nd Term Examination	25%
Skill based Courses like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does not lend itself to a typical L-T-P structure	delines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable.	

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 8.9.1 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 17.3 (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 17.3 (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.

Sl. No.	Course Duration	Credit Equivalence
Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses		
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.

Sl. No.	Baskets	Credit Contribution
**Table 3: B.Tech. (Computer Science & Engineering-Internet of Things) 2025-2029: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets**		
1	Humanities and Social Sciences including Management Courses (HSMC)	10
2	Basic Science Courses (BSC)	24
3	Engineering Science Courses (ESC)	22
4	Professional Core Courses (PCC)	64
5	Project Work (PRW)	16
6	Professional Elective Courses (PEC)	18
7	Open Elective Courses (OEC)	06
8	Mandatory Courses (MAC)*	0
	Total Credits	**160 (Minimum)**

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

In the entire Program, the practical and skill based course component contribute to an extent of approximately 61% out of the total credits of 160 for B.Tech. (Computer Science and Engineering-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 19.2.1 of Academic Regulations;

c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and

d. No disciplinary action is pending against her/him.

PART C: CURRICULUM STRUCTURE

17.Curriculum Structure – Basket Wise Course List (not Semester Wise)
List of Courses Tabled – aligned to the Program Structure
(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

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

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

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

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

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

Table 3.2: List of Basic Science Courses (BSC)

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite
1	MAT2301	Calculus and Differential Equations	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	MAT2402	Probability and Statistics	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	MAT2303	Linear Algebra and Vector Calculus	3	1	0	4	4	EM	Nil
8	MAT2404	Discrete Mathematics	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	CSE1500	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	EEE1250	Basics of Electrical and Electronics Engineering Lab	0	0	2	1	2	F/S	Nil
8	ECE1511	Design Workshop	1	0	2	2	3	S/EM	Nil
9	CSE2264	Essentials of AI	3	0	0	3	3	S/EM	Nil
10	CSE2265	Essentials of AI Lab	0	0	2	1	2	S/EM	Nil
11	CSE2274	Competitive Programming and Problem Solving	0	0	4	2	4	S/EM	Nil
		Total	**15**	**0**	**14**	**22**	**29**		

S. No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills/Focus	Pre-requisites/ Co-requisites
		Table 3.4: List of Professional Core Courses (PCC)							
1	CSE2200	Problem Solving using C	2	0	0	2	2	S	Nil
2	CSE2201	Problem Solving using C Lab	0	0	4	2	4	S/EM	Nil
3	CSE2251	Data Communication and Computer Networks	3	0	0	3	3	S	Nil
4	CSE2252	Data Communication and Computer Networks Lab	0	0	2	1	2	S	Nil
5	CSE2253	Data Structures	3	0	0	3	3	S	Nil
6	CSE2254	Data Structures Lab	0	0	2	1	2	S/EM	Nil
7	CSE2255	Object Oriented Programming Using Java	3	0	0	3	3	S	Nil
8	CSE2256	Object Oriented Programming Using Java Lab	0	0	2	1	2	S/EM	Nil
9	CSE2257	Computer Organization and Architecture	3	0	0	3	3	S	NIL
10	CSE2258	Web Technologies	3	0	0	3	3	S	CSE2251
11	CSE2259	Web Technologies Lab	0	0	2	1	2	S	NIL
12	CSE2502	Cryptography and Network Security	3	0	0	3	3	S	CSE2251
13	CSE2269	Operating Systems	3	0	0	3	3	S/EM	NIL
14	CSE2270	Operating Systems Lab	0	0	2	1	2	S/EM	NIL
15	CSE2260	Database Management Systems	3	0	0	3	3	S	NIL
16	CSE2261	Database Management Systems Lab	0	0	2	1	2	**S**	CSE2251
17	CIT2500	FoG Computing for IoT	3	0	0	3	3	**S**	Nil
18	CIT2501	Wireless Communication in IoT	3	0	0	3	3	S	CSE2251
19	CSE2262	Analysis of Algorithms	3	1	0	4	4	**S**	NIL
20	CSE2263	Analysis of Algorithms Lab	0	0	2	1	2	**S**	NIL
21	CSE2266	Theory of Computation	3	0	0	3	3	S	NIL

22	CIT2503	Mobile Application for IoT	3	0	0	3		3	S	CSE2255
23	CIT2505	Mobile Application for IoT Lab	0	0	2	1		2	S	CSE2255
24	CIT2400	Cyber-Physical Systems	3	0	0	3		3	S	NIl
25	CIT2504	AI and Deep Learning for IoT	3	0	0	3		3	S/EM	CSE2264
26	CIT2502	Privacy and Security in IoT	3	0	0	3		3	S	CSE2502
27	CSE2271	Software Design and Development	3	0	0	3		3	S	Nil
Total No. of Credits						**64**				

Table 3.5: List of course in Project Work basket (PRW)						
S.No	Course Code	Course Name	L	T	P	C
1	CSE7000	Internship				2
2	CSE7100	Mini Project				4
3	CSE7300	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	-	-	-	0
2	LAW7601	Indian Constitution	-	-	-	0
3	CIV7601	Universal Human Values and Ethics	-	-	-	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	CSE3426	Front End Full Stack Development*	2	0	2	3	4	S/EM	CSE2260
2	CSE3427	Java Full Stack Development*	2	0	2	3	4	S/EM	CSE2260
3	CSE3428	.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	MAT2402
Track -5 Mandatory Non-Credited Course (Offered for Lateral Entry students in higher semester wherever applicable in MOOC mode)**									
1	LAW7601	Indian Constitution **	0	0	0	0	-	F	Nil
2	CHE7601	Environmental Studies **	0	0	0	0	-	F	Nil
3	CIV7601	Universal Human Values and Ethics **	0	0	0	0	-	F	Nil
*Mandatory for Students selected for Tech Mahindra and Capgemini									
** Offered for Lateral Entry students in higher semester wherever applicable in MOOC mode									
+Mandatory for Students Selected for Samsung Innovation Campus									

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

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

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

Baskets
HSMC - Humanities and Social Sciences (including Management courses) (HSMC)

BSC - Basic Science Courses
ESC - Engineering Science Courses
PCC - Professional Core Course
PEC - Professional Elective Courses
OEC - Open Elective Courses
EEC - Employment Enhancement Courses
MAC - Mandatory Course

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

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)										
CSE2002	Programming in Java	2	0	2	3	S/EM	-	-	-	-
CSE2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-

CSE2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
CSE2005	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

Code	Course	L	T	P	C					
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

Code	Course	L	T	P	C					
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

Code	Course	L	T	P	C					
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

Code	Name	L	T	P	C					
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	-	-	-

Code	Course	L	T	P	C	Sem				
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	-	-	MEC2008	-
MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
MEC2006	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-

Code	Course	L	T	P	C	Type				
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 Communicatio n	3	0	0	3	S/EM/ EN	HP	-	-	-
MGT2001	Business Analytics	3	0	0	3	S/ EM/EN	-	-	-	-
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/E N	-	-	-	-
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/E N	-	-	-	-
MGT2010	Managing People and Performance	3	0	0	3	S/EM/E N	HP/GS	-	-	-
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/HP/E S	-	-	-
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	-	-	-	-

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 conduct, 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
1.	12 weeks	3
2.	8 weeks	2
3	4 weeks	1

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

Table 3.9: MOOC Discipline Elective Courses

Sl. No	Course Code	Course Name	Credits	L-T-P-C
1	CSE3111	Artificial Intelligence: Search Methods for Problem Solving	3	3-0-0-3
2	CSE3112	Privacy and Security in Online social media	3	3-0-0-3
3	CSE3113	Computational Complexity	3	3-0-0-3
4	CSE3114	Deep Learning for Computer Vision	3	3-0-0-3
5	CSE3115	Learning Analytics Tools	3	3-0-0-3

6	CSE505	The Joy of Computing Using Python	3	3-0-0-3
7	CSE3119	Coding Skills in Python	3	3-0-0-3
8	CSE3121	Parallel Computer Architecture	3	3-0-0-3
9	CSE3124	Games and Information	3	3-0-0-3
10	CSE3140	Introduction to Industry 4.0 and Industrial Internet of Things	3	3-0-0-3
11	CSE3142	Affective Computing	3	3-0-0-3
12	CSE3196	Foundations of Cyber Physical Systems	3	3-0-0-3
13	CSE3197	Getting Started with Competitive Programming	3	3-0-0-3
14	CSE3198	GPU Architectures and Programming	3	3-0-0-3
15	CSE3199	Artificial Intelligence: Knowledge Representation and Reasoning	3	3-0-0-3
16	CSE3200	Programming in Modern C++	3	3-0-0-3
17	CSE3201	Circuit Complexity Theory	3	3-0-0-3
18	CSE3202	Basics of Computational Complexity	3	3-0-0-3
19	CSE3212	Introduction to Computer and Network Performance Analysis using Queuing	1	1-0-0-1
20	CSE3213	C Programming and Assembly Language	1	1-0-0-1
21	CSE3214	Python for Data Science	1	1-0-0-1
22	CSE3215	Software Conceptual Design	1	1-0-0-1
23	CSE3117	Industrial Digital Transformation	3	3-0-0-3
24	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
25	CSE3349	Technology for Lawyers	3	3-0-0-3
26	CSE3430	Deep Learning for Natural Language Processing	3	3-0-0-3
27	CSE3431	Machine Learning for Engineering and Science Applications	3	3-0-0-3
28	CSE3432	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
29	CSE3433	Introduction to Large Language Models (LLMs)	3	3-0-0-3
30	CSE3434	Quantum Algorithms and Cryptography	3	3-0-0-3
31	CAI3430	Responsible & Safe AI Systems	3	3-0-0-3
32	CCS3416	Practical Cyber Security for Cyber Security Practitioners	3	3-0-0-3
33	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

Sl. No.	Course code	Course Name	L	T	P	C
		Open Elective Courses Duration is 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)				
1	BBA2022	Supply Chain digitization	3	0	0	3
2	BBA2021	E Business	3	0	0	3
3	BBB2016	Business Analytics for Management Decisions	3	0	0	3
4	BBB2015	Artificial Intelligence for Investments	3	0	0	3
5	MEC3001	Design and Development of Product	1	0	0	1
6	ENG3004	Perspectives of Neurolinguistics	1	0	0	1
7	PPS4009	Working in Contemporary Teams	1	0	0	1
8	MGT3001	Data Analysis and Decision Making	3	0	0	3
9	MEC3001	Design and Development of Product	1	0	0	1

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

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of Skill	Pre-requisite	Basket
Semester 1 - PHY Cycle			**15**	**1**	**8**	**19**	**24**			
1	MAT2301	Calculus and Differential Equations	3	1	0	4	4	F	Nil	BSC
2	PHY2501	Optoelectronics and Quantum Physics	3	0	0	3	3	F	Nil	BSC
3	MEC1006	Engineering Graphics	2	0	0	2	2	S	Nil	ESC
4	ENG1900	English for Technical Communication	2	0	0	2	2	S	Nil	HSMC
5	CSE1500	Computational Thinking using Python	2	0	2	3	4	S	Nil	ESC
6	ECE2022	Digital Design	2	0	0	2	2	F/S	Nil	ESC
7	DES1146	Introduction to Design Thinking	1	0	0	1	1	F	Nil	HSMC
8	PHY2504	Optoelectronics and Quantum Physics Lab	0	0	2	1	2	F	Nil	BSC
9	PPS1025	Industry Readiness Program – I	0	0	2	0	2	SS	Nil	MAC

No	Course Code	Course Title	L	T	P	C				
10	ECE2052	Digital Design Lab	0	0	2	1	2	F/S	Nil	ESC
Semester 2 - CHE Cycle			**17**	**1**	**12**	**22**	**29**			
1	MAT2402	Probability and Statistics	3	1	0	4	4	F	Nil	BSC
2	CHE7601	Environmental Studies	0	0	0	0	0	F	Nil	MAC
3	CIV1200	Foundations of Integrated Engineering	2	0	0	2	2	S	Nil	ESC
4	CHE2501	Chemistry of Smart Materials	3	0	0	3	3	S	Nil	BSC
5	CSE2200	Problem Solving using C	2	0	0	2	2	S	Nil	PCC
6	ENG2501	Advanced English	2	0	0	2	2	S	Nil	HSMC
7	EEE1200	Basics of Electrical and Electronics Engineering	3	0	0	3	3	F/S	Nil	ESC
8	LAW7601	Indian Constitution	0	0	0	0	0	F	Nil	MAC
9	CSE2201	Problem Solving using C Lab	0	0	4	2	4	S	Nil	PCC
10	CHE2502	Chemistry of Smart Materials Lab	0	0	2	1	2	S	Nil	BSC
11	PPS1026	Industry Readiness Program – II	0	0	2	0	2	SS	Nil	MAC
12	EEE1250	Basics of Electrical and Electronics Engineering Lab	0	0	2	1	2	F/S	Nil	ESC
13	ECE1511	Design Workshop	1	0	2	2	3	S/EM	Nil	ESC
Semester 3			**18**	**1**	**10**	**23**	**29**			
1	MAT2303	Linear Algebra and Vector Calculus	3	1	0	4	4	EM	Nil	BSC
2	CSE2251	Data Communication and Computer Networks	3	0	0	3	3	S	Nil	PCC
3	CSE2252	Data Communication and Computer Networks Lab	0	0	2	1	2	S	Nil	PCC
4	CSE2253	Data Structures	3	0	0	3	3	S	Nil	PCC
5	CSE2254	Data Structures Lab	0	0	2	1	2	S	Nil	PCC
6	CSE2255	Object Oriented Programming Using Java	3	0	0	3	3	S/EM	Nil	PCC
7	CSE2256	Object Oriented Programming Using Java Lab	0	0	2	1	2	S/EM	Nil	PCC

No.	Course Code	Course Title	L	T	P	C			Prerequisite	Category
8	CSE2257	Computer Organization and Architecture	3	0	0	3	3	S	Nil	PCC
9	CSE2258	Web Technologies	3	0	0	3	3	S/EM	Nil	PCC
10	CSE2259	Web Technologies Lab	0	0	2	1	2	S/EM	Nil	PCC
11	CIV7601	Universal Human Values and Ethics	0	0	0	0	0	S	Nil	MAC
12	APT4002	Introduction to Aptitude	0	0	2	0	2	AT	Nil	MAC
Semester 4			**18**	**2**	**8**	**23**	**28**			
1	**MAT2404**	**Discrete Mathematics**	**3**	**1**	**0**	**4**	**4**	**F**	**Nil**	**BSC**
2	**CIT2500**	FoG Computing for IoT	**3**	**0**	**0**	**3**	3	S	**Nil**	PCC
3	**CSE2260**	**Database Management Systems**	**3**	**0**	**0**	**3**	3	S	**Nil**	PCC
4	**CSE2261**	**Database Management Systems Lab**	**0**	**0**	**2**	**1**	2	S	**Nil**	PCC
5	FIN1002	Essentials of Finance	3	0	0	3	3	S	Nil	HSMC
6	**CSE2262**	**Analysis of Algorithms**	3	1	0	4	4	S	**Nil**	PCC
7	**CSE2263**	**Analysis of Algorithms Lab**	**0**	**0**	**2**	**1**	2	S	**Nil**	PCC
8	**CSE2264**	**Essentials of AI**	**3**	**0**	**0**	**3**	3	S/EM	**Nil**	ESC
9	**CSE2265**	**Essentials of AI Lab**	**0**	**0**	**2**	**1**	2	S/EM	**Nil**	ESC
10	APT4004	Aptitude Training-Intermediate	0	0	2	0	2	AT	Nil	**MAC**
Semester 5			**21**	**0**	**6**	**25**	**27**			
1	**CSE2266**	**Theory of Computation**	**3**	**0**	**0**	**3**	3	S	**Nil**	PCC
2	CSE2502	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	CSE2255	PCC
	CIT2505	Mobile Application for IoT Lab	0	0	2	1	2	S	CSE2255	PCC
5	**CSE2269**	**Operating Systems**	3	0	0	3	3	S	Nil	PCC
6	**CSE2270**	**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

	Course Code	Course Name	L	T	P	C			Prereq	Category
9	CITXXXX	Professional Elective – I	3	0	0	3	3	S/EM	Nil	PEC
10	CSE7000	Internship	0	0	0	2	0	S/EM	Nil	PRW
11	APT4006	Logical and Critical Thinking	0	0	2	0	2	S/EM	Nil	HSMC
Semester 6			**18**	**0**	**6**	**21**	**24**			
1	**CSE2271**	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	**CSE2274**	**Competitive Programming and Problem Solving**	**0**	**0**	**4**	**2**	**4**	**S/EM**	**Nil**	**ESC**
5	CITXXXX	Professional Elective – II	3	0	0	3	3	S	Nil	PEC
6	CITXXXX	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
Semester 7			**12**	**0**	**2**	**17**	**14**			
1	CITXXXX	Professional Elective – IV	3	0	0	3	3	S	Nil	PEC
2	CITXXXX	Professional Elective – V	3	0	0	3	3	S	Nil	PEC
3	CITXXXX	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	**CSE7100**	**Mini Project**	**0**	**0**	**0**	**4**	**0**	**S**	**Nil**	**PRW**
Semester 8			**0**	**0**	**0**	**10**	**0**			
1	**CSE7300**	**Capstone Project**	**0**	**0**	**0**	**10**	**0**	**S/EM**	**Nil**	**PRW**
			119	**5**	**46**	**160**	**170**			

23. Course Catalogue

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

Course Code: MAT2301	Course Title: Calculus and Differential Equations Type of Course: BSC	L-T- P- C	3	1	0	4
Version No.						
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	Calculus and differential equations are used ubiquitously throughout mathematics, statistics and operations research. In this course, students can be able to build upon the foundations of calculus established to greatly enhance their repertoire of theory and practice in these areas. The application of calculus and differential equations in the description and modelling of real-world problems will also be considered. This unit will extend the problem-solving skills, range of knowledge and use of techniques in differential and integral calculus. The course focuses on the concepts of Calculus and Differential Equations with reference to specific engineering problems. The course is of both conceptual and analytical type in nature.					
Course Objective	The goal of the course Calculus and Differential Equations is to facilitate the students with a concrete foundation of differential calculus and to solve the first and higher-order ordinary differential equations enabling them to acquire the knowledge of these mathematical tools.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve. 2. Apply the principles of integral calculus to evaluate integrals. 3. Learn the notion of partial differentiation to calculate rate of change of multivariate functions and solve problems related to composite functions and Jacobian. 4. Solve first-order linear/nonlinear ordinary differential equations analytically using standard methods.					
Course Content:						

Module 1	ferential Calculus		(10 Classes)

Polar Coordinates, polar curves, angle between radius vector and the tangent, angle between two curves, pedal equations, curvature and radius of curvature.
Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 2	egral Calculus	Assignment	(10 Classes)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3	ultivariable Calculus		(10 lectures)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 4	ferential Equations	Assignment	(15 lectures)

Definition, types of Differential Equations, Applications, Variable Separable, Homogeneous, Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Linear differential equations of second and higher order with constant coefficients - Non-Homogeneous term of the type $Q(x) = e^{ax}$, Sin ax, Cosax, $e^{ax}v(x)$, $x^n v(x)$ - Method of variation of parameters.

Targeted Application & Tools that can be used:

Differential calculus is used extensively in science and engineering. It can solve problems related to motion, velocity, acceleration, angles of incline or curve on a surface, etc.

Differential Equations are used to model the behavior of electromagnetic fields, including in the design of antennas, microwave ovens, and other devices. Biology: PDEs are used to model biological processes, such as the spread of diseases and the development of biological tissues.

Tools Used: Python.

Assignment:

1. 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. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
2. Walter Ledermann, Multiple integrals, Springer, 1st edition
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

E-resources/ Web links:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_103205
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_106839
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_61605
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_134719
5. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
6. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving. This is attained through the assessment component mentioned in course handout.

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Course Code: PHY2504	Course Title: Optoelectronics and Quantum Physics Lab Type of Course: BSC	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: To understand electrical and optical properties of materials CO2: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices.					
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.

...vel 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.

...periment No. 7: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance.
...el 1: To study the I-V characteristics
...el 2: I-R characteristics of a solar cell as a function of the irradiance.

...periment No. 8: Calculate the numerical aperture and study the losses that occur in optical fiber cable. .
...el 1: Calculate the numerical aperture.
...el 2: study the losses that occur in optical fiber cable.

...periment No. 9: Plotting I-V characteristics in forward and reverse bias for LEDs
...d Determination of knee voltage.
...el 1: Plotting I-V characteristics in forward and reverse bias for LEDs
...el 2: Determination of knee voltage.

...periment No. 10: Determination of Stefan's constant and verification of Stefan-Boltzmann Law.
...el 1: Determination of Stefan's constant
...el 2: Verification of Stefan-Boltzmann Law.

...periment No. 11: Determination of dielectric constant of given materials.
...el 1: Determination of Stefan's constant
...el 2: compare the obtain results with other materials

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

...geted Application & Tools that can be used:
1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM.
2. Origin, excel and Mat lab soft wares for programming and data analysis.

...ject 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

- <mark>Self-Learning</mark>

Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons.

Write a report on importance of quantum entanglement in supercomputers.

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Course Code: PHY2501	Course Title: Optoelectronics and Quantum Physics Type of Course: BSC		L-T-P-C	3	0	0	3
Version No.							
Course Pre-requisites							
Anti-requisites	.						
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: To understand the concepts of electrical conducting properties of metal, semiconductor and superconductivity. CO2: To understand the principles of quantum mechanics. CO3: Discuss the quantum concepts used in quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields.						
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	Data collection on efficiency of solar cells.			12 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		12 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	Seminar on quantum computers.	11 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	Case study on medical applications of Lasers.	10 Sessions

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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
1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2024.
2. 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:
1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live
2. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live
3. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live
4. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live
5. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live

Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers.
for Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout.

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Course Code: MEC1006	Course Title: **Engineering Graphics** Type of Course: BSC		**L- T-P- C**	2	0	0	2
Version No.	1.2						
Course Pre-requisites	**NIL**						
Anti-requisites	**NIL**						
Course Description	The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Engineering Graphics" and attain SKILL DEVELOPMENT through Problem solving methodologies.						
Course Outcomes	On successful completion of this course the students shall be able to: 1. Demonstrate competency of Engineering Graphics as per BIS conventions and standards. 2. Comprehend the theory of projection for drawing projections of Points, Lines and Planes under different conditions. 3. Prepare multiview orthographic projections of Solids by visualizing them in different positions. 4. Prepare pictorial drawings using the principles of isometric projections to visualize objects in three dimensions.						

Course Content:

Module 1	Introduction to Drawing	Assignment	Standard technical drawing	**02 Sessions**
Topics: Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Line conventions, dimensioning, Selection of drawing sheet size and scale.				
Module 2	Orthographic projections of Points, Straight Lines and Plane Surfaces	Assignment	Projection methods Analysis	**10 Sessions**
Topics: Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points 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.				
Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	**10 Sessions**

Topics:
 Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron indifferent positions (Problems resting on HP only and First angle projection).

Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	8 Sessions

Topics:

Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects.

[8 Hours: Application Level]

Text Book:
1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.

References:
1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore.

2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.

3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.

Web resources:

https://nptel.ac.in/courses/112103019

Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

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ENG1900	English for Technical Communication	L- T- P- C	2	0	0	2

Version No.	1.0
Course Pre-requisites	
Anti-requisites	NIL
Course Description	This course enhances the technical communication skills of BTech students, focusing on clarity, precision, and conciseness in academic and professional settings. Students will learn to differentiate between general and technical communication, analyze technical content, develop structured writing skills, and deliver effective presentations. Through interactive activities such as TED Talk analyses, report writing, and presentation practice, the course provides hands-on experience for real-world applications. By the end, students will be equipped to communicate complex technical information effectively in various professional contexts.
Course Outcomes	On successful completion of the course the students shall be able to: 1. Differentiate between general and technical communication. 2. Explain key reading comprehension techniques to enhance understanding of technical texts. 3. Write clear, concise, and well-structured technical reports and documents. 4. Deliver technical presentations and implement peer feedback for continuous improvement. 5. Explain ethical practices in digital communication for professional use.

Course Content: Theory

Module 1	Technical communication	Quiz	Listening	9 Hours

Introduction to Communication
Technical vs. General Communication
Characteristics of technical communication
Importance of clarity, precision, and objectivity
Activity:
- Watching TED Talks/videos to identify differences in technical and general vocabulary

Module 2	Technical Reading	Assignment	Reading	12 Hours

Reading Comprehension
Note making & Notetaking
Content Analysis
Activity:
- Reading technical articles and answering comprehension questions
- Note making techniques

Module 3	Technical Writing	Assignment	Writing	12hours

Paragraph Writing
Structure of a paragraph (topic sentence, supporting details, coherence)
Report Writing
Structure of technical and project reports (Introduction, Methods, Results, Discussion)
Activity:
- Writing a structured paragraph on a technical topic
- Writing project reports

Module 4	Professional Presentation	Presentation	Speaking	12Hours

Introduction to Presentation Skills

Preparing a Presentation

- Structuring content (Introduction, Body, Conclusion)
- Designing effective slides (Text. visual aids, readability, and impact)

Delivering a Presentation

- Engagement techniques, Storytelling, narration, pitching ideas handling Q&A
- Conviction, commitment, generating interest through enthusiasm

Demonstration & Practice

- Giving presentations on topics based on their academic interest
- Evaluating and providing peer feedback

Activity:

- Analyze a real-world engineering issue and present solutions using a structured approach.

Targeted Application & Tools that can be used: YouTube, Instagram, Quill Bot, Grammarly, & Padlet.

References:

Text books:

1. Gupta, R.C. *Technical Communication.* 2nd ed., Cambridge University Press, 2021.
2. Lannon, John M., and Laura J. Gurak. *Technical Communication.* 15th ed., Pearson, 2022.

Reference Books:

1. Gerson, Sharon J., and Steven M. Gerson. Technical Communication: Process and Product. 9th ed., Pearson, 2020.
2. Lannon, John M., and Laura J. Gurak. Technical Communication. 15th ed., Pearson, 2022.
3. Markel, Mike, and Stuart A. Selber. Technical Communication. 13th ed., Bedford/St. Martin's, 2020.

Web Resources:

1. https://owl.purdue.edu/owl/subject_specific_writing/technical_writing.
2. https://journals.ieeeauthorcenter.ieee.org/.
3. https://www.stc.org/.
4. https://ocw.mit.edu/.https://www.ted.com/talks.

Topics Relevant to "employability": Teamwork and Collaboration, Critical Thinking and Problem- Solving

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

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Itgalpur, Rajankunte, Yelahanka, Bengaluru – 560064

Course Code: CSE1500	Course Title: Computational Thinking using Python Type of Course: ESC	**L-T-P-C**	2	0	2	3
Version No.						
Course Pre-requisites	Nil					
Anti-requisites	NIL					
Course Description	The course efficiently introduces fundamental ideas including conditionals, loops, functions, lists, strings, and tuples through some inspiring examples. It then discusses dynamic programming like handling exceptions and file usage. In terms of data structures, the course covers Python dictionaries, classes, and objects for constructing user-defined datatypes like linear and binary search.					
Course Object	The objective of the course is to familiarize the learners with the concepts of **Computational Thinking using Python** and attain **Skill Development** through **Participative Learning** techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe algorithmic solutions for basic computing issues.. (Understand) 2) Explain data types and operators. (Understand) 3) Demonstrate control structures and Functions. (Apply) 4) Apply the data structures for the given data. (Apply) 5) Demonstrate the file operations. (Apply)					

Course Content:

Module 1	Computational Thinking And Problem Solving	Assignment		Programming		6 Sessions

Topics:

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

Module 2	Datatypes, Expressions, Statements	Assignment		Programming		6 Sessions

Topics:

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

Module 3	Control flow, Functions, Strings	Assignment		Programming		6 Sessions

Topics:

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

Module 4	Lists, Tuples, Dictionaries	Assignment		Programming		6 Sessions

Topics:						

Topics:

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

Module 5	**Files**	Assignment		Programming	**6 Sessions**

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

Lab sheet :
1. Introduction to Python Programming.
2. Demonstration of Colabs or Jupiter environment.
3. Demonstrate Input function.
4. Demonstrate int method.
5. Demonstrate data types
6. Demonstrate operators.
7. Demonstrate simple programs for python environment.
8. Python program that takes an integer input and calculates the sum of its digits
9. Python program to count the number of times a given character appears in a string.
10. Python program to identify the data types of given variables.

A grocery store needs a billing system, write a python program that calculates the total bill amount based on the price of individual items and their quantities.

A car rental company wants to calculate the mileage (km per liter) for different vehicles based on distance traveled and fuel consumed. Write a Python program to calculate the mileage.

A company wants to calculate the net salary of an employee after deducting tax (10%) and provident fund (5%) from the gross salary. Write a Python program to calculate net salary.

In a student grading system where the final grade depends on whether the student has passed both the written and practical exams. You need to check if the student has passed based on certain conditions:
• The student must score at least 40 in the written exam.
• The student must score at least 50 in the practical exam.
• The student must have attended at least 75% of the classes
11. Write a Python program to check if a person is eligible to vote. The criteria are:
• The person must be at least 18 years old.
• The person should be a citizen of the country.
12. Write a Python program to classify a person into age groups:
• Child: 0 to 12 years
• Teenager: 13 to 19 years
• Adult: 20 years and above

A user authentication system that checks if the user is authorized based on certain conditions, like having a correct password and being over the age of 18. Write a Python program for the above scenario.

In a student registration system, a student must meet certain criteria to be eligible for course registration:
• The student must have a GPA of 3.0 or above.
• The student must have completed the prerequisite course (True/False).
13. An e-commerce store that offers discounts based on the following criteria:
• The customer must be a loyal customer (i.e., True).
• The total purchase amount must be greater than $100.
14. Python program to print the Fibonacci sequence up to n terms

15. Python program to print the Fibonacci sequence up to n terms using Recursion.
16. Apply slicing on the given data or dictionary.
17. Python Programs to create array and print the array.
18. Python program to check if a given number is an Armstrong number. An Armstrong number for a 3-digit number is one where the sum of the cubes of its digits is equal to the number itself.
A. The media platform wants to count the number of words in user-submitted posts to enforce character limits or to analyze the length of posts. .
B. In a bookstore inventory system, You need to implement a feature that checks if a book title is a palindrome. The bookstore wants to offer special discounts for books with titles that are palindromes. You need to create a Python function that reads the book title and determines if it's a palindrome.
C. In a library management system. The library has a database of books identified by unique numbers (IDs). The library staff wants to apply a special offer to books whose IDs are prime numbers. You need to create a Python program that finds all prime numbers between a given range of book IDs.
D. In a school management system that stores the marks of students for each subject. You are asked to compute the average marks of a student to evaluate their overall performance. Write a Python program that takes the marks of a student in different subjects and calculates the average.
E. A small inventory list where you need to search for a specific product ID. Since the list isn't sorted, you can use linear search, which checks each element sequentially until it finds the target. Write a python program to perform linear search.
F. A sorted list of product IDs and need to quickly find a specific product. Binary search is ideal for this scenario because it efficiently narrows down the search space by repeatedly dividing the list into two halves.

14. Demonstrate List, Tuple and Dictionary.

A. A supermarket wants to maintain a list of available products and update it when new products arrive or old products are sold out.

B. A library maintains book records using dictionaries, where the book title is the key and the quantity available is the value.

C. A school stores student grades in a list, and the teacher wants to see only the top 3 grades.

D. A restaurant receives online orders in a queue (list) and processes the first 3 orders at a time. Write a Python program to handle orders using list slicing.

E. A university has course details stored in tuples. The system should extract and display only the course codes. Write Python program to extract course code from tuples.
F. A fitness tracking app stores a user's daily step count for a week and extracts steps from Monday to Friday. WAP to extract weekly steps using slicing.

G. A school stores student marks in a list. Write a program to:
- Find the highest and lowest marks.
- Calculate the average marks.
- Count how many students scored above 75.
15. Write a Python program that asks for a voter's age. If the age is below 18, raise an exception

"Invalid Age: Must be 18 or older".

16. Write a Python program that counts the total number of lines, words, and characters in a given text file.

   17. Write a Python program that reads text file and finds the most repeated word.

   18. Write a program that searches for a word in a file ".txt" and replaces it with another word.

   19. Write a Python program that copies the content from "source.txt" to "destination.txt". If "destination.txt" does not exist, create it.

   20. Write a Python program that takes two numbers as command-line arguments and prints their sum.

   21. Write a Python program that asks for a user's name, age, and marks in three subjects, then formats and displays the result in a structured way. Generate report using string formatting.

   22. Create a module called "mymath.py" with functions add(a, b), subtract(a, b), and multiply(a, b). write a separate Python script that imports this module and uses these functions.

   23. Write a Python program that tries to read a file ".txt". If the file is not found, catch the exception and display a message.

---

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
W1.   https://onlinecourses.nptel.ac.in/noc20_cs70/preview

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

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Course Code: ECE2022	Course Title: Digital Design Type of Course: ESC		L- T-P- C	2	0	0	2
Version No.	1.0						
Course Pre-requisites	[1] Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra						
Anti-requisites	L						
Course Description	The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc. The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.						
Course Outcomes	On successful completion of this course the students shall be able to: i. Describe the concepts of number systems, Boolean algebra and logic gates. ii. Apply minimization techniques to simplify Boolean expressions. iii. Demonstrate the Combinational circuits for a given logic iv. Demonstrate the Sequential and programmable logic circuits						
Course Content:							
Module 1	ndamentals of Number systems- Boolean algebra and digital logic	plication Assignment	ta Analysis task		)6 classes		
Topics: Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. Introduction to HDL.							
Module 2	Boolean function simplification	plication Assignment	ta Analysis task		08 Classes		
Topics: Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders, HDL Models of combinational circuits.							
Module 3	Combinational Logic circuits:	plication Assignment	gramming Task & Data Analysis task		08 Classes		
Topics: Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. HDL Models of Sequential circuits.							
Targeted Application & Tools that can be used: Digital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, Home Automation, Communication in systems in industries Professionally Used Software: HDL/VHDL/Verilog HDL/ OOPS							
Text Book(s):							

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

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

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

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

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download
    (studymaterialz.in)
    1. eBook1: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
    2. {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download
}
    3. eBook2:Floyd   "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
    4. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
    5. Digital Logic Design PPT Slide 1 (iare.ac.in)
    6. Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video
CircuitVerse - Digital Circuit Simulator online
Learn Logisim➡ Beginners Tutorial | Easy Explanation! - Bing video
    Digital Design 5: LOGISIM Tutorial & Demo
    7. https://presiuniv.knimbus.com/user#/home
E-content:
    1. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
    2. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir   Ahmed   Tarique;Sultan   Uddin   Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)
    3. A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.
    4. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

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

Course Code: DES1146	Course Title: Introduction to Design Thinking Type of Course: Theory	L-T-P- C	1	0	0	1
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course aims to introduce students to the fundamental principles and processes of Design Thinking and will learn to apply Design Thinking methodologies to real-world challenges. The course emphasizes empathy, creativity, and collaboration, equipping students with essential skills for successful engineering practice.					
Course Objective	This course is designed to develop and familiarize the learners with the concepts of creating thinking and attain Entrepreneurship by using Participative Learning techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: 1) Understand the concept and importance of Design Thinking. 2) Differentiate between traditional problem-solving and Design Thinking. 3) Identify the core stages of the Design Thinking process.					
Course Content:	All assignments and projects must be developed using the reference materials available from the PU e-resource database – JSTOR, EBSCO, Library OPAC, NPTEL Videos, etc.					

Module 1	Introduction to Design Thinking	Visual journal, book of essays, context-specific assignment/project	Visual output generation, by Visual Journal and narrative development.	3 hours

Topic
1) Definition and Introduction to Design Thinking
2) Understand the Design Thinking Process

Module 2	Design Thinking in Action	Visual journal, book of essays, context-specific assignment/project	Visual output generation, by visual journal and narrative development.	12 hours

Topics:
1) Introduction to the steps of Design Thinking Process
2) Understand use cases of Design thinking
3) Design Thinking and Research Tools pertaining to Consumer Tech. , Home Tech. , Personal Tech. , Auto Tech. or Extended Reality.

Targeted Application & Tools that can be used:
1) Design ideation tools like Miro , SCAMPER etc.
2) Research Tools for Human Centric Design using forecasting tools like WGSN
3) Feedback tools like Google Forms , etc.
4) Expert Lectures

1. **Text Book**

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

3. https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=6&sid=18ab1f43-1f92-4d02-ae2e-a9c06dc06d8c%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=354920&db=nlebk

References

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

2. https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=4&sid=c80a7d79-eda4-4b7e-a0d6-afafe437962b%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=2433506&db=nlebk

3. The Pocket Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions by Bruce Hanington; Bella Martin. Minneapolis: Rockport Publishers. 2017. eBook., Database: eBook Collection (EBSCOhost)

https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=11&sid=f086b8c2-260e-4caa-8c48-d732c21a7724%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=1638693&db=nlebk

4. What Is Design Thinking and Why Is It Important? By Rim Razzouk and Valerie Shute - Review of Educational Research, Vol. 82, No. 3 (September 2012), pp. 330-348 (19 pages), Published by: American Educational Research Association

https://puniversity.informaticsglobal.com:2054/stable/23260048?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3Acb1be24976e25734cb5fc13a8af6fdfb&seq=1#metadata_info_tab_contents

5. Abductive Thinking and Sensemaking: The Drivers of Design Synthesis by John Kolko, Design Issues, Vol. 26, No. 1 (Winter, 2010), pp. 15-28 (14 pages), Published by: The MIT Press

https://puniversity.informaticsglobal.com:2054/stable/20627839?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3A0b89336ea274d63c010536b01316d7bb&seq=1#metadata_info_tab_contents

6. Designerly Ways of Knowing: Design Discipline versus Design Science by Nigel Cross, Design Issues, Vol. 17, No. 3 (Summer, 2001), pp. 49-55 (7 pages), Published by: The MIT Press

https://puniversity.informaticsglobal.com:2054/stable/1511801?Search=yes&resultItemClick=true&searchText=design+thinking&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddesign%2Bthinking%26so%3Drel&ab_segments=0%2FSYC-6168%2Ftest&refreqid=fastly-default%3A0d5b607b163f60876ca973ed90e22b1c&seq=1#metadata_info_tab_contents

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Course Code: PPS1025	Course Title: Industry Readiness Program – I (Audited Course) Type of Course: HSMC	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites	NIL					
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 Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Define** their career goals CO 2 **Practice ethical habits** for better career success CO3 **Demonstrate** effective email writing techniques					
Course Content						

Module 1	**Goal Setting & Grooming**	Classroom activities	**10 Hours**
Topics: SMART Goals, formal grooming through self-introduction activity **Activity:** Real world scenarios			
Module 2	**Habit Formation**	Role plays	**10 Hours**
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 Hours**
Topics: Types of prompts to generate effective or desired results for email etiquettes **Activity:** Individual student presenting various search prompts			
Faculty: L&D			

Targeted Application & Tools that can be used:
1. TED Talks
2. You Tube Links
3. 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

The topics related to skill development:
Students acquire knowledge on SMART goals, implement grooming standards, practice ethical behavior in class and campus, acquire hands-on experience to use AI tools to get search prompts for desired email etiquettes.

Course Code: ECE2052	Course Title: Digital Design Lab Type of Course: Theory &Integrated Laboratory	L- T-P- C	0	0	2	1
Version No.	1.0					
Course Pre-requisites	1]Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra					
Anti-requisites						
Course Description	The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc. The course enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Digital Design and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.					

Course Outcomes	On successful completion of this course the students shall be able to:
	  v. Implement various universal gates and Boolean functions circuits using logic gates.
	  vi. Implement various combinational and sequential logic circuits using logic gates.					

Course Content:	

List of Laboratory Tasks:

Experiment N0 1: Verify the Logic Gates truth table

Level 1: By using Digital Logic Trainer kit

Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 2: Verify the Boolean Function and Rules

Level 1: By using Digital Logic Trainer kit

Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 3: Design and Implementations of HA/FA

Level 1: By using basic logic gates and Trainer Kit

Level 2: By using Universal logic gates and Trainer Kit

Experiment No. 4: Design and Implementations of HS/FS

Level 1: By using basic logic gates and Trainer Kit

Level 2: By using Universal logic gates and Trainer Kit

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

Level 1: Specifications given in the form of Truth table

Level 2: Specification should be extracted from the given scenario

 Experiment No. 6: Study of Flip flops

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

Level 1: Specifications given in the form of Truth table

Level 2: Specification should be extracted from the given scenario

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

Level 1: Gate level Modeling

Level 2: Behavioral Modeling

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

Level 1: Gate level Modeling

Level 2: Behavioral Modeling

Targeted Application & Tools that can be used:

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

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

Text Book(s):

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

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

Reference(s):
Reference Book(s):
R1. Jain, R. P., "Modern Digital Electronics", McGraw Hill Education (India), 4th Edition
R2. Roth, Charles H., Jr and Kinney Larry L., "Fundamentals of logic Design", Cengage Learning, 7th
    Edition

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download
    (studymaterialz.in)
    8.   eBook1: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
    9.   {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download
}
    10.   eBook2:Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook-
    [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
    11.   NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
    12.   Digital Logic Design PPT Slide 1 (iare.ac.in)
    13.   Lab Tutorial: Multisim Tutorial for Digital Circuits - Bing video
CircuitVerse - Digital Circuit Simulator online
Learn Logisim➡ Beginners Tutorial | Easy Explanation! - Bing video
    Digital Design 5: LOGISIM Tutorial & Demo
    7. https://presiuniv.knimbus.com/user#/home
E-content:
    5.   Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
    6.   An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)
    7.   A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.
    8.   A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

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

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Course Code: MAT2402	Course Title: **Probability and Statistics** **Type of Course: BSC**	**L-T- P- C**	**3**	**1**	**0**	4
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	**NIL**					
Course Description	The course introduces the concepts of probability theory and statistical analysis, covering how to collect, organize, interpret, and draw inferences from data using mathematical models to understand randomness and uncertainty, with applications across various fields like science, engineering, economics, and social sciences.					
Course Objective	The objective of the course is to equip students with the foundational knowledge of probability theory and statistical methods, enabling them to collect, analyze, interpret data, and make informed decisions based on the likelihood of events occurring in various situations, often applied across different fields like science, engineering, and business.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Be able to compute conditional probabilities directly and using Bayes' theorem, and check for independence of events. 2. Be able to set up and work with discrete & continuous random variables; in particular, to understand the Bernoulli, binomial, geometric, Poisson distributions, uniform, normal, and exponential distributions. 3. Identifying different types of data relationships (linear, polynomial, exponential, logarithmic). 4. Be able to use specific significance tests, including z-test, t-test (one- and two-sample), and chi-squared test					

Course Content:

Module 1	**Basic Probability**		**(6 Classes)**
Probability of an Event, multiplication rule, combinations, permutations, Addition Law, Multiplication Law, Conditional Probability, Bayes's Theorem and Problems.			
Module 2	**Random Variables and Bivariate Distributions**	**Assignment**	**(15 Classes)**
Random Variables (discrete and continuous), Probability Mass/Density Functions, Mathematical Expectations, discrete probability distributions - Binomial distribution, Poisson distribution, geometric distribution, Continuous uniform distribution - exponential distribution, normal distribution, gamma distribution. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.			
Module 3	**Curve Fitting & Statistical Methods**		**(13 Classes)**
Curve Fitting (Straight Line ($y = a + bx$), Parabola ($y = a + bx + cx^2$), Exponential Curves ($y = ae^{bx}$, $y = ab^x$ and $y = ax^b$) Measures of Central tendency, Moments, skewness and Kurtosis, Correlation - Karl Pearson's coefficient of correlation and rank correlation (with & Without repetition, Multiple Correlation - Problems. Regression analysis - lines of regression, Multiple regression - Problems.			
Module 4	**Joint Probability Distribution and**	**Assignment**	**(15 Classes)**

	Sampling Theory		

Joint Probability distribution for two discrete random variables, expectation and covariance.

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 and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Targeted Application & Tools that can be used:

The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.

Tools Used: R software (Open Source)

Assignment:

1.   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. Ronald .E. Walpole, Raymond. H. Myers, Sharon. L Myers, and Keying E. Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Miller and Freund, Probability and Statistics for Engineers, Pearson Education Ltd.
2. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.
3. Douglas C. Montgomery & George Runger, Applied Statistics and Probability for Engineers, , Wiley Publications

E-resources/ Web links:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_10427

2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_100198

3. https://nptel.ac.in/courses/109104124
4. https://nptel.ac.in/courses/111106051
5. https://nptel.ac.in/courses/111102137
6. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
7. https://www.scu.edu.au/study-at-scu/units/math1005/2022/
8. Presidency University's Knimbus library URL is: presiuniv.knimbus.com

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of Vector calculus and Linear Algebra 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 the course handout.

| Course Code: CHE7601 | Environmental Studies | L- T- P- C | - | - | - | - |
| | Type of Course: MOOC course | Contact hours | - | - | - | - |

Course Pre-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 fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. **This course is designed to cater to Environment and Sustainability**
Course Objective	The objective of the course is **'SKILL DEVELOPMENT'** of the student by using **'PARTICIPATIVE LEARNING'** techniques
Course Outcomes	On successful completion of this course the students shall be able to: 1. Describe the issues related to natural resources, ecosystems and biodiversity 2. Identify environmental hazards affecting air, water and soil quality 3. Recognize the importance of healthy environment and finding the sustainable methods to protect the environment 4. Convert skills to address immediate environmental concerns through changes in environmental processes, policies, and decisions
Course Content:	

Module 1	Understanding Environment, Natural Resources, and Sustainability			

Topics:

Classification of natural resources, issues related to Population growth and their overutilization, and strategies for their conservation. Water, air, soil, mineral, energy and food source. Effect of human activities on natural resources.

Concept of sustainability- Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Sustainable practices in managing resources, including deforestation, water conservation, Desalination – types, energy security, and food security issues, Life Cycle thinking and Circular Economy.

Module 2	Ecosystems, Biodiversity, and Sustainable Practices			

pics:

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	vironmental 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.

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Itgalpur, Rajankunte, Yelahanka, Bengaluru – 560064

Course Code: CIV1200	Course Title: Foundations of Integrated Engineering Type of Course: ESC	L- T-P- C	2	0	0	2
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
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 this course the students shall be able to: 1] Recall key principles of Agile, DevOps, and bioinformatics used in interdisciplinary engineering contexts. 2] Explain the role of GIS, LiDAR, and sustainable materials in designing smart infrastructure and disaster management systems. 3] Describe core components of mechanical systems and their real-world applications. 4] Describe the functionality of IoT-enabled wearable devices, embedded systems, and renewable energy integration in smart grids. 5] List foundational IT concepts such as cloud computing architectures, cybersecurity threats, and blockchain applications.					
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

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Course Code: CHE2501	Course Title: Chemistry of Smart Materials Type of Course: Theory - BSC	L-T- P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
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 this course the students shall be able to: **1.** Relate the knowledge of chemistry to computational approaches to identify materials functionalities and properties **2.** Recognize and interpret solutions for the challenges connected to memory, display, smart, green and sustainable technologies. **3.** Explain the quality parameters of engineering materials associated with environment and sensors. 4. Interpret the knowledge of sustainable chemistry for E- waste management. 5. Analyse the importance of various electrochemical sources in energy systems.					
Course Content:						
Module 1	**Computational Chemistry**	Assignment	Data Collection and analysis	09 classes		

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	aterials for Memory and Display Systems	Assignment	ata Collection and analysis	09 Classes

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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 Classes

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 Classes

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 Classes

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

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- End Term Exam
- Self-learning

Text Book

10. Wiley, "Engineering Chemistry", Wiley.
11. 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

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

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Course Code: CSE2200	Course Title: Program Solving Using C Type of Course: Theory - PCC			**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 complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.							
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.							
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Write algorithms and to draw flowcharts for solving problems 2. Demonstrate knowledge and develop simple applications in C programming constructs 3. Develop and implement applications using arrays and strings 4. Decompose a problem into functions and develop modular reusable code 5. Solve applications in C using structures and Union 6. Design applications using Sequential and Random Access File Processing.							
Course Content:								

Module 1	Introduction to C Language	Quiz	Problem Solving	**6 Sessions**

Topics:
Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.

Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	**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	Quiz	Problem Solving	**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.

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Module 4	Structures and Union	Quiz	Problem Solving	6 Sessions

Topics:

Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – **Union:** Introduction – Defining and Declaring Union – Difference Between
Union and Structure.

Module 5	File handling	Case Study	Problem Solving	6 Sessions

Topics:

Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files

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

Reference Book(s):
1. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
2. 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
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.   https://nptel.ac.in/courses/106/105/106105171/
2.   https://archive.nptel.ac.in/courses/106/104/106104128/

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Course Code: CSE2201	Course Title: Program Solving Using C Lab Type of Course: Lab - PCC	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 complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem SolvingUsing C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Write algorithms and to draw flowcharts for solving problems 2. Demonstrate knowledge and develop simple applications in C programmingconstructs 3. Develop and implement applications using arrays and strings 4. Decompose a problem into functions and develop modular reusable code 5. Solve applications in C using structures and Union 6. Design applications using Sequential and Random Access File Processing.					
Course Content:						

List of Practicals:
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

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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: Input and Display Array of Structures
Program 3: Array Inside Structure (Student Marks)
Program 4: Structure with Nested Structures (Date of Birth)
Program 5: Union Example and Member Access

Lab Sheet 6: 10 Sessions
Program 1: Write to a File (Text Mode)
Program 2: Read from a File (Text Mode)
Program 3: Append Data to a File
Program 4: Count Characters, Words and Lines in a File
Program 5: Write and Read Structure to/from a Binary File
Program 6: Random Access in File (Update a Record)

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):

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

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

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Course Code: CHE2502	Course Title: Chemistry of Smart Materials Lab		L-T-P- C	0	0	2	1
	Type of Course: Laboratory – BSC						
Version No.	1.0						
Course Pre-requisites	Before undertaking this Chemistry of Smart Materials Lab course, students are expected to possess foundational knowledge of chemistry, including an understanding of acids and bases, metals and metal ions, oxidizing and reducing agents, various types of instrumental analysis, and the proper use of laboratory glassware. Additionally, students should be familiar with handling chemicals and glassware safely and adhering to essential laboratory safety precautions.						
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 (COs)	**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:	**Total 30 sessions**						
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	perimental	ta Collection	Analysis and Interpretation
Estimation of copper from PCBs by using colorimeter (Optical Sensor).			

Experiment 5	Experimental	Data Collection	Analysis and Interpretation
Conductometric estimation of mixture of acids in Recycling process of E- waste.			
Experiment 6	Experimental	Data Collection	Analysis and Interpretation
Determination of viscosity coefficient of a given organic liquid using Ostwald's Viscometer (viscoelastic property).			
Experiment 7	Experimental	Data Collection	Analysis and Interpretation
Recovery of valuable metals (copper) from e- waste by Iodometric titration.			
Experiment 8	Experimental	Data Collection	Analysis and Interpretation
Estimation of iron in electronic devices using Std. Potassium permanganate solution.			
Experiment 9	Experimental	Data Collection	Analysis
Flame photometric estimation of sodium (Battery Recycling- Optical Sensor).			
Experiment 10	Experimental	Data Collection	Analysis
Synthesis of conducting polyaniline for gas sensor applications (Demonstration experiment).			
Experiment 11	Experimental	Data Collection	Analysis
Green synthesis of nanomaterials (Demonstration experiment).			
Experiment 12	Experimental	Data Collection	Analysis
Recovery of valuable metals from e- waste by eletroless method (Demonstration experiment).			
Any 8 experiments will be conducted out of 12			

Continuous Internal Assessment:
- Midterm exam
- Experimental Evaluation
- Viva-voce
- Endterm exam

Text Book
1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S. Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi

References
1. Engineering Chemistry Laboratory Manual (English, Paperback, Dr Manoj Kumar Solanki), Edu-creation Publishing

E-resources:
1. https://books-library.net/files/download-pdf-ebooks.org-kupd-679.pdf

Video Links:
1. https://www.youtube.com/watch?v=gd1YQr-74sw
2. https://www.youtube.com/watch?v=wVJ8WQax0rQ
3. https://www.youtube.com/watch?v=aWwEGCNtKwk
4. https://www.youtube.com/watch?v=JhBs_8DrPYo
5. https://www.youtube.com/watch?v=5bFAx2b_6A8
6. https://www.youtube.com/watch?v=_IVVZnAFfrM
7. https://www.youtube.com/watch?v=BBhuXOh9vOM
8. https://www.youtube.com/watch?v=j-nW3Jhc794

The topics related to Skill Development

All the experiments are relevant to Skill Development through Experiential Learning Techniques. This is attained through assessment component mentioned in course handout.

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Itgalpur, Rajankunte, Yelahanka, Bengaluru – 560064

Course Code: ENG2501	**Advanced English**		**L- T- P- C**	2	0	0	2
Version No.	2.0						
Course Pre-requisites	ENG1900 - English for Technical Communication						
Anti-requisites	**NIL**						
Course Description	This course is designed to equip students to enhance their communication abilities in Listening, Speaking, Reading, and Writing. The curriculum covers interpersonal communication principles, the art of speech writing and delivery (including impromptu speaking), strategic approaches to critical reading, the identification of logical fallacies, and persuasive writing. Furthermore, the course will introduce students to the potential of AI tools and the techniques of prompt engineering to elevate their communication skills in the digital age. Upon course completion, students will be well-prepared to communicate effectively and critically in both academic and professional environments.						
Course Out Come	On successful completion of the course the students shall be able to: 1. Recognize the elements of interpersonal and cross-cultural communication to address communication challenges effectively. 2. Demonstrate the ability to deliver structured and impromptu speeches using effective speaking techniques. 3. Interpret textual and visual materials using critical reading strategies to evaluate arguments, logic, and persuasion. 4. Produce persuasive and analytical essays using effective argumentation techniques and structured writing strategies.						

Course Content:

Module 1	undations of Effective Communication	Case Studies/ Role play	Cross-Cultural Competency	12 Classes

Topics:
- Fundamentals of Interpersonal Communication
- Verbal, Non-verbal, and Paraverbal communication.
- Cultural dimensions theory (Hofstede's Cultural Dimensions).
- Active Listening Techniques
- Common Errors in Communication

Activities:
- Instagram/YouTube Vocabulary Activity
- Charades with a Twist/Tone and Emotion Experiment/Mixed Messages

Challenge/Role Reversal Conversations/Observation Exercise

Module 2	Mastering Speech Delivery	JAM	Public Speaking Confidence	12 Classes

Topics:
- Introduction to Prompt Engineering
- Speech Preparation and Organization
- Techniques for Effective Impromptu Speaking

Module 3	**Critical Reading and Logical Analysis**	Worksheet	**Critical Thinking and Analysis**	**12 Classes**

Topics:
- Critical Reading Strategies: Contextualizing, Figurative Language, Evaluating Logic of an Argument, Recognizing Emotional Manipulation, Analysing Visuals
- Recognizing Logical Fallacies: Slippery Slope, False Dilemma, Post Hoc, Hasty Generalization, Ad Hominem, Straw Man, Bandwagon, No True Scotsman, Red Herring, Appeal to Authority, Sunk Cost, Appeal to ignorance

Activities:

- Critical Reading Worksheet/Identifying Bias in News Articles

Module 4	**Writing Effective Arguments**	Assignment	**Clear and Coherent Writing**	**9 Classes**

Topics**:**
- Understanding Critical Writing
- Building Arguments (Pathos, Ethos, Logos)
- Techniques for Persuasion

Activities:

- Causes or Effects/Appeal Mash-Up/Debates on Controversial Topics
- Opinion Writing

Targeted Application & Tools that can be used: Quizziz, Chatgpt, Gemini, Youtube, Instagram, Quillbot, Grammarly, Padlet

References
1. Adler, R. B., Rodman, G., & DuPré, A. (2019). *Understanding human communication (14th ed.)*. Oxford University Press.
2. Moore, B. N., & Parker, R. (2020). *Critical thinking* (13th ed.). McGraw-Hill Education.
3. Hamilton, C. (2020). *Communicating for success* (2nd ed.). Routledge.
4. Ting-Toomey, S., & Dorjee, T. (2018). Intercultural competence: A model for teaching and assessing cross-cultural communication. *Journal of Intercultural Communication, 47*(2), 213–229. https://doi.org/10.1016/j.jicc.2018.03.004
5. https://www.ted.com/

Topics Relevant to "employability": Teamwork and Collaboration, Critical Thinking and Problem-Solving
Topics Relevant to "Human Values and Professional Ethics": Critical reasoning, Inclusivity and Fairness

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Course Code: EEE1200	Course Title: Basics of Electrical and Electronics Engineering. Type of Course: Theory - ESC	L-T-P-C	3	0	0	3
Version No.						
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This is a fundamental Course which is designed to know the use of basics of electrical and electronics engineering principles occurs in various fields of Engineering. The course 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 this course the students shall be able to: Apply basic laws of Electrical Engineering to compute voltage, currents and other parameters in the circuits. Discuss various fundamental parameters appearing in the characteristics of semiconductor devices and their applications. Summarize the operations of different biasing configurations of BJTs and amplifiers. Discuss the performance characteristics and applications of various electrical Machines.					
Course Content:						
Module 1	Introduction to Electrical Circuits	Assignment/ Quiz	Numerical solving Task	10 Sessions		
DC Circuits: Concept of Circuit and Network, Types of elements, Network Reduction Techniques- Series and parallel connections of resistive networks, Star–to-Delta Transformations, Mesh Analysis, 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	Assignment/ Quiz	Memory Recall based Quizzes	10 Sessions		
Mass Action Law, Charge densities in a semiconductor, Types of SC, Junction diodes -Ideal						

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and practical behaviour, Modelling the Diode Forward Characteristic, and Diode applications like rectifiers, Zener diode, characteristics and its applications like voltage regulator.

Module 3	Transistors and its Applications	Assignment/ Quiz	Memory Recall-based Quizzes	10 Sessions

Transistor characteristics, Current components, BJT Configurations (CB, CC, CE configurations) and their current gains. Operating point, Biasing, Fixed Bias, and load line analysis. Single Stage amplifier. 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	Assignment/ Quiz	Numerical solving Task	10 Sessions

Electrical Machines: Single phase transformers: principle of operation and EMF equation, Numerical examples. DC Motor: principle of operation, Back EMF, torque equation, Numerical examples. AC Motor: Principle operation of Induction Motors and its Applications.

Self-Learning Topics:
- Clipping and clamping circuits, Stabilization Techniques, Voltage divider bias and its stability factor, Multistage amplifier, Darlington pair.
- Special Machines: Introduction to special electrical machines and its applications.

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: Multisim/ P Spice
- Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis..

Project Work/ Assignment:

1. Article review: At the end, of course an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format.
2. Presentation: There will be a group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.
3. Case Study: - At the end of the course students will be given a 'real-world' application based circuits like Power Amplifier, Signal/Function Generator etc. as a case study. Students will be submitting a report which will include Circuit Diagrams, Design, Working Mechanism and Results etc. in appropriate format

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Text Book(s):

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

Reference Book (s):

- John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011
- Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.
- K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd
- R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.
- A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition
- A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition
- Online Resources (e-books, notes, ppts, video lectures etc.):
- https://presidencyuniversity.linways.com
- https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"
- Seminar Topic: https://nptel.ac.in/courses/108/105/108105153/ "Electrical Measurements"
- Video lectures on "Electronic Devices" by Prof. Dr. A. N. Chandorkar, IIT Bombay http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html
- Video lectures on "Analog Electronics" by Prof. S.C. Dutta Roy, IIT Delhi https://nptel.ac.in/courses/108/102/108102095/
- Video lectures on "Diodes", by Prof. Chitralekha Mahanta, IIT Guwahati,
- https://nptel.ac.in/courses/117/103/117103063/
- E-content:
- "Introduction to Electrical Machines https://nptel.ac.in/courses/108/102/108102146/"
- M. -Y. Kao, H. Kam and C. Hu, "Deep-Learning-Assisted Physics-Driven MOSFET Current Voltage Modeling," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 974-977, June 2022, doi: 10.1109/LED.2022.3168243
- https://ieeexplore-ieee-org-resiuniv.knimbus.com/document/9758727

- F. Bonet, O. Aviñó-Salvadó, M. Vellvehi, X. Jordà, P. Godignon and X. Perpiñà, "Carrier
- Concentration Analysis in 1.2 kV SiC Schottky Diodes Under Current Crowding," in IEEE Electron Device Letters, vol. 43, no. 6, pp. 938-941, June 2022, doi: 10.1109/LED.2022.3171112. https://ieeexplore-ieeeorg-presiuniv.knimbus.com/document/9764749
- M. Chanda, S. Jain, S. De and C. K. Sarkar, "Implementation of Subthreshold Adiabatic Logic for Ultralow-Power Application," in IEEE Transactions on Very Large Scale Integration (VLSI) Systems, vol. .23, no. 12, pp. 2782-2790, Dec. 2015.
- https://ieeexplore.ieee.org/document/7018053
- R. Raut and O. Ghasemi, "A power efficient wide band trans-impedance amplifier in submicron
- CMOS integrated circuit technology," 2008 Joint 6th International IEEE Northeast Workshop on Circuits and Systems and TAISA Conference, 2008, pp. 113-116, doi: 0.1109/NEWCAS.2008.4606334. https://ieeexplore.ieee.org/document/4606334

Topics relevant to "SKILL DEVELOPMENT": Performing suitable experiments to compute the electric circuit parameters, performance operation of machines, and operation of semiconductor devices for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course plan.

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Course Code EEE1250	Course Title: Basics of Electrical and Electronics Engineering Laboratory Type of Course: Laboratory - ESC	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, instrument and materials.** 9) Locate faults in systems. 10) Manipulative 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 Out Comes	**On successful completion of the course the students shall be able to:** 1. Apply basic laws of Electrical Engineering to compute voltage, currents, and other parameters in the circuits. 2. Demonstrate the working of electrical machines to observe performance characteristics. 3. Demonstrate the working of electronic circuits to obtain the V-I Characteristics of various semiconductor devices. 4. Sketch the characteristics and waveforms relevant to standard electrical and electronic circuits					
Course Content:						
	List of Laboratory Tasks: **Experiment No 1:** Verification of KVL and KCL for a given DC circuit. **Level 1:** Study and Verify KVL and KCL for the given electrical Circuit. **Level 2:** For the same circuit considered in level 1, perform the simulation using NI					

LabVIEW/Multisim/MATLAB.

Experiment No 2: Analyse AC series circuits – RL, RC and RLC .

Level 1: Conduct an experiment to perform and verify the impedance, current and power of Series RL and RC circuits

Level 2: Conduct an experiment to perform and verify the impedance and current of RLC series circuits.

Experiment No 3: Calculation of power and power factor of the given AC Circuit.

Level 1: Conduct an experiment to measure the power and power factor for given resistive load.

Level 2: Conduct an experiment to measure the power and power factor for given inductive load.

Experiment No 4: Perform the experiments on given Transformer.

Level 1: Verify the EMF equation of a transformer and compute the voltage transformation ratio.

Level 2: Study the effect of load on the secondary side of the transformer and verify the EMF equation under load conditions.

Experiment No 5: Load test on DC shunt motor

Level 1: Conduct load test on DC shunt motor and find its efficiency at different loads

Level 2: Conduct load test on DC shunt motor and plot the performance characteristics.

Experiment 6: Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions.

Level 1: Carry out an experiment to plot VI Characteristics and hence find the cut-in voltage on forward characteristics for the Silicon P-N Junction diode.

Level 2: Carry out an experiment to plot VI Characteristics of Zener diode and hence find the zener voltage on reverse characteristics for the Silicon P-N Junction zener diode.

Experiment No. 7: To observe the output waveform of half wave and full wave rectifier circuit and compute ripple factor and efficiency

Level 1: Identify the components required for a rectifier circuit, rig up the circuit, and sketch the output waveforms without filter.

Level 2: Rig up the rectifier circuit with RC filter, observe the output waveforms, determine the efficiency and ripple factor.

Experiment 8: To construct clipping and clamping circuits for different reference voltages and to verify the responses.

Level 1: Identify the components required for building a Clipper / Clamper circuit. Rig up the circuit according to the circuit diagram given and sketch the output waveform.

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

Experiment 9: To calculate various parameters of emitter follower circuit using BJT

Level 1: Identify the components required to implement an emitter follower circuit. Rig up the circuit and observe the variations in output waveform with respect to the variations in input waveform.

Level 2: Determine the values of Z_{in} input impedance and Z_{out} output

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

Targeted Application & Tools that can be used:

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

Professionally Used Software: Multisim/ P Spice

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:

2.   Kothari D. P. & Nagrath I. J., "Basic Electrical and Electronics Engineering", Tata McGraw-Hill

3.   John Hiley, Keith Brown and Ian McKenzie Smith, "HUGHES Electrical and Electronic Technology", 10th Edition (Indian Edition published by Dorling Kindersley), Pearson,2011

4.   Samarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, Prentice Hall India, 2007.

5.   K Uma Rao, A Jaya Lakshmi, "Basic Electrical engineering" IK International publishing house Pvt. Ltd

6.   R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India 7th Edition.

7.   A K. Maini, V. Agrawal, "Electronic Devices & Circuits", Wiley, 2nd Edition

8.   A.S Sedra, K. C. Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition

Online Learning Resources:

9.   https://presidencyuniversity.linways.com

10.   https://www.digimat.in/nptel/courses/video/108105112/L01 "Fundamentals of Electrical Engineering-Basic Concepts, Examples"

11.   Video lectures on "Diodes", by Prof. Chitralekha Mahanta, IIT Guwahati, https://nptel.ac.in/courses/117/103/117103063/

Topics relevant to "SKILL DEVELOPMENT": 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.

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Course Code: LAW7601	Indian Constitution Type of Course: MOOC course	L- T- P- C	-	-	-	0
		Contact hours	-	-	-	-
Course Pre-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 this course the students shall be able to: 1. Describe the basic understanding of the Indian Constitution and the concepts and issues relevant to day-to-day life of the nation and to equip the Citizen with the zeal of capacity building. Recognizing and identify the values of the Constitution of India. 2. Enabling the Citizen-centric Awareness of Rights and Responsibilities of the State 3. Explain the role of the State actors in building India. 4. Understanding the Gandhian vision over the power of the LSG (Local Self-Governance)					
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)
Reference 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

Resources:

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

Topics relevant to Skill Development:

1. An attitude of inquiry.
2. Write reports

The topics related to Constitutional Studies and its application :

All topics in theory component are relevant to Indian Constitution.

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Course Code: PPS1026	Course Title: Industry Readiness Program – II (Audited Course) Type of Course: Practical Only Course	L- T - P- C	0	0	2	0
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	This course is designed to enable students learn styles of communication, team building and use empathy in leadership. The course will benefit learners in preparing themselves effectively through various activities and learning methodologies.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Industry Readiness for Young Professionals" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.**					
Course Out Comes	**On successful completion of this course the students shall be able to:** CO 1 **Apply** different communication skills for success in workplace CO 2 **Practice team building skills** for career success CO3 **Demonstrate** ethical leadership skills in workplace					
Course Content						

Module 1	**Effective Communication**	Classroom activities	**10 Hours**

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 Hours**

Topics: Skills of an effective team player

Activity: Student group activity to build class networking

Module 3	**Leadership**	Case study	**10 Hours**

Topics: Types of leadership, using empathy in leadership

Activity: Individual presentation by students on corporate leaders.

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Targeted Application & Tools that can be used:

4. TED Talks
5. You Tube Links
6. 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

The topics related to skill development:

Students acquire knowledge on effective communication skills, team building skills and how to prepare themselves to be leaders in workplace using empathy and implement various skill sets during the course of their time in the university.

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Course Code: ECE1511	Course Title: Design Workshop Course Type :ESC			L- T-P- C	1	0	2	2
Version No.								
Course Pre-requisites	NIL							
Anti-requisites								
Course Description	This course is designed to provide an in-depth understanding of Arduino, microcontrollers Raspberry pi and their application in various real time projects involving sensors. Throughout the course, students will learn the fundamentals of Arduino and Raspberry Pi programming and gain hands-on experience with a wide range of sensors. Students will explore how to connect and interface sensors with Arduino and Raspberry Pi boards, read sensor data, and use it to control various output devices This course is suitable for beginners who are interested in exploring the world of electronics and developing practical applications using Arduino, Raspberry Pi and sensors.							
Course Objective	The objective of the course is **Employability Skills** of student by using **PARTICIPATIVE LEARNING** techniques.							
Course Outcomes	**On successful completion of the course the students shall be able to** 1. Explain the main features of the Arduino & the Raspberry Pi prototype board. 2. Demonstrate the hardware interfacing of the peripherals to Arduino and Raspberry Pi system. 3. Understand the types of sensors and its functions 4. Demonstrate the functioning of live projects carried out using Arduino and Raspberry Pi system.							
Course Content:								

Module 1	**Basic concepts of Microcontrollers**	Hands-on	Interfacing Task and Analysis	**3 Sessions**

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

Module 2	nsory Devices	nds-on	erfacing Task and Analysis	essions

   Arduino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino.
   Introduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with AutoCAD/Fusion 360 Simulator.

Module 3	roduction to Micro python	nds-on	erfacing Task and Analysis	sessions

Topics:
 Introduction to MicroPython, Comparison with other programming languages, Setting up the MicroPython development environment, Basics of MicroPython syntax and structure.

Module 4	orking with Raspberry-pi	nds-on	erfacing Task and Analysis	essions

   Introduction to raspberry pi boards, pin-diagram, different types of raspberry pi boards and its application, LED and switch control. Mastering Modules, Setup Raspberry - PuTTY SSH,VNC Viewer to interface with

Lab: Name of the Experiments:
1. **Introduction Lab 1:**
Level 1: Overview on Arduino based Micro-controller, and sensors.
Level 2: Interfacing of Arduino and ESP boards with sensors and other components.
2. **Lab 2: Smart Plant Monitoring**
Level 1- Push button-controlled LED.
Level 2- Automatic Irrigation and monitoring System using Arduino
3. **Lab 3: Robotics with Arduino**.
Level 1- Servo Motor control using Arduino
Level 2: DC Motor Control Using Arduino for Robotics.
4. **Lab 4: Environmental pollution using ESP.**
Level 1 - IoT based air Pollution Monitoring System.
Level 2- IoT Based water pollution system
5. **Introduction Lab for raspberry pi:**
Level 1: Overview on Different Raspberry Pi Boards, and sensors.
Level 2: Configuring the Raspberry Pi and Interfacing with sensors and other components.
6. **Lab 7:** Raspberry Pi based Object Detection using TensorFlow and OpenCV.
7. **Lab 8:** Speech Recognition on Raspberry Pi for Voice Controlled Home Automation.
8. **Lab 9:** Design the website using HTML and CSS, and host the website on Raspberry Pi.
9. **Introduction Lab for 3D printing:**
Overview of 3D printing. Design of 3D structure using the CAD. Understand the steps of fabrication of simple rectangular box using 3D printer.
10. **Lab 10:** Design and print of Hollow Cylindrical structure using 3D CAD and 3D printer.
11. **Lab 11** Demonstration of Jetson nano board and its capability. **(OPTIONAL)**
12. **Lab 12:** Revision
13. **Lab 13:** Revision
14. **Lab 14:** Mini Project
15. **Lab 15:** Mini Project Evaluation.

Topics: Types of Arduino boards, Thonny Python, Python IDLE, **sensors, 3D Printer**

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

   Home Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino, Raspberry Pi and sensors can be applied. The flexibility and affordability of Arduino, and Raspberry Pi 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's Arduino IDE and Tincker CAD, Thonny Python, Python IDLE etc.

Project work/Assignment:

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

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

Textbook(s):

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1. Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition
2. Monk Simon "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions", Publisher(s): O'Reilly Media, Inc. ISBN: 9781098130923 fourth Edition.

References

Reference Book(s)

1. Neerparaj Rai "Arduino Projects for Engineers" BPB publishers,first edition, 2016.
2. Ryan Turner "Arduino Programming " Nelly B.L. International Consulting Ltd. first edition,2019.
3. Charles Bell Micro Python for the Internet of Things: A Beginner's Guide to Programming with Python on Microcontrollers" by" Edition 1, 2017, ISBN 978-1-4842-3123-4
4. Stewart Watkiss "Learn Electronics with Raspberry Pi " Apress Berkeley, CA . second edition,2020. ISBN978-1-4842-6348-8
5. Jo Prusa, "Basic of 3D printing", Prusa Research, 3rd edition.
6. Volker Ziemann, "A Hands-On Course in Sensors Using the Arduino and Raspberry Pi (Series in Sensors)", CRC Press, 1st Edition. 2018.

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 things< https://nptel.ac.in/courses/106105166>

E-content:

1. Cattle Health Monitoring System Using Arduino and IOT (April 2021| IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002)
2. M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh" IOT BASED SMART SECURITY SYSTEM USING ARDUINO" 2021 JETIR August 2021, Volume 8, Issue 8.
3. R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. Amiri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer Management Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. **https://ieeexplore.ieee.org/document/8494144**.
4. Yaser S Shaheen,Hussam., " Arduino Mega Based Smart Traffic Control System ," December 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): 43-52, 2021):15(12): 43-52, 2021.
5. Basil, Eliza Sawant, S.D. "IoT based traffic light control system using Raspberry Pi " DOI 10.1109/ICECDS.2017.8389604
6. Supriya S, 2Dr. Aravinda " Green leaf disease detection and identification using Raspberry Pi https://www.irjet.net/archives/V9/i8/IRJET-V9I847.
7. Dr. E.N. Ganesh., "Health Monitoring System using Raspberry Pi and IOT" DOI : http://dx.doi.org/10.13005/ojcst12.01.03

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

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Course Code: MAT2303	Course Title: Linear Algebra & Vector Calculus Type of Course:BSC	L-T- P- C	3	1	0	4
Version No.	1.0					
Course Pre-requisites	Basic Concepts of Limits, Differentiation, Integration, Matrices (PU Level)					
Anti-requisites	NIL					
Course Description	This course explores the fundamental concepts of vectors, matrices, and their operations within the context of calculus, including vector differentiation and integration, while applying these tools to solve problems related to linear systems, transformations, and geometric interpretations in higher dimensions, often with applications in fields like physics, engineering, and computer graphics; key topics include vector algebra, matrix operations, determinants, eigenvalues, eigenvectors, gradients, divergence, curl, line integrals, surface integrals, and the fundamental theorems of vector calculus like Green's Theorem, Stokes' Theorem, and the Divergence Theorem.					
Course Objective	The course is intended to develop computational proficiency involving procedures in Matrices, Linear Algebra and Vector Calculus which are useful to all engineering disciplines. This course is to equip students with the ability to understand and manipulate vectors in multidimensional space, apply matrix operations to solve systems of linear equations, and utilize concepts like gradients, divergence, and curl to analyze physical phenomena, all while developing a strong foundation for applying these tools in various scientific and engineering fields like physics, mechanics, and computer graphics.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1 - Use matrix methods and certain techniques to solve the system of linear equations and to find eigen values, eigen vectors of a matrix to check whether it is diagonalizable. CO2 - Understand the abstract notions of vector space and dimensionality of it. CO3 - find the matrix representation of a linear transformation given bases of the relevant vector spaces. CO4 - Learn different notions of vector and scalar fields with their properties. Understanding the major theorems (Green's, Stokes', Gauss') and some applications of these theorems.					
Course Content:						

Module 1	Systems of Linear Equations			6.		Classes)

Systems of Linear Equations, Matrices and Elementary Row Operations, Echelon forms, Matrix operations, invertible matrices, Determinants and their properties, Cramer's Rule, LU-decomposition, Applications of Systems of Linear Equations.

Module 2	Vector Space	Assignment				(9Classes)

Linear Combinations and Linear Independence, Vectors in n R^n, Linear Combinations, Linear Independence Vector Spaces, Definition of a Vector Space, Subspaces, Basis and Dimension, Coordinates and Change of Basis, Orthogonal bases and orthogonal projections.

Module 3	Linear Transformations					(15 lectures)

Linear Transformations, Algebra of transformations, The Null Space and Range, Isomorphisms, Matrix Representation of Linear Transformations, Similarity Eigenvalues and Eigenvectors, Eigen values and

Eigen vectors, Diagonalization.

Inner Product Spaces, The Dot Product on R^n and Inner Product Spaces, Orthonormal Bases, Orthogonal Complements, Application: Least Squares Approximation, Diagonalization of Symmetric Matrices, Application: Quadratic Forms.

Singular Value Decomposition: Singular values, computing singular value decomposition, and Introduction to principal component analysis.

Module 4	Vector Calculus	Assignment	*(15 lectures)*

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, Green`s Theorem in the plane, Surface Integrals, Divergence Theorem of Gauss, Stokes`s Theorem.

Targeted Application & Tools that can be used:

- Solve systems of linear equations using various methods including Gaussian and Gauss Jordan elimination and inverse matrices.
- Perform matrix algebra, invertibility, and the transpose and understand vector algebra in R^n.
- Determine relationship between coefficient matrix invertibility and solutions to a system of linear equations and the inverse matrices.
- Find eigenvalues and eigenvectors and use them in applications.
- Find the dimension of spaces such as those associated with matrices and linear transformations.
- Understand real vector spaces and subspaces and apply their properties.
- Compute inner products in a real vector space and compute angle and orthogonality in inner product spaces.
- Create orthogonal and orthonormal bases: Gram-Schmidt process and use bases and orthonormal bases to solve application problems.
- Prove basic results in linear algebra using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity, injectivity and subjectivity of functions; and properties of eigenvectors and eigenvalues.

Assignment:

Preparation of power-point slides, which include videos, animations, pictures, graphics for better erstanding the applications of Linear Algebra and Vector Calculus to engineering applications – The faculty allocate chapters/ parts of chapters to groups of students so that the entire syllabus of Linear Algebra and tor Calculus is covered.

Text Book

1. Gilbert Strang, Linear Algebra and its applications, Wellesley-Cambridge Press,U.S.; 6th edition.
2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

1. Introduction to Linear Algebra with Application, Jim Defranza, Daniel Gagliardi, Tata McGraw-Hill
2. Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition.
3. Advanced Engineering Mathematics, Erwin Kreysig, Wiley Publication.
4. Elementary Linear Algebra, Ron Larson, Cengage Learning .
5. Linear Algebra and its Applications, David C. Lay, Pearson Education.

E-resources/ Web links:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_9607

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2.	https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_143156
3.	https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_EBSCO_29052023_270975
4.	https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_94555
5.	https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_243864
6.	https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_224531
7.	NPTEL Video Lectures Matrices and Linear Algebra:
8.	https://nptel.ac.in/courses/111106051/
9.	NPTEL Video Lectures Differential Equations:
10.	https://nptel.ac.in/courses/111106100/
11.	NPTEL Vector Calculus:
12.	https://nptel.ac.in/courses/111/105/111105122/
13.	https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
14.	https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of Vector calculus and Linear Algebra 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 the course handout.

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Course Code: CSE2251	Course Title: Data Communications and Computer Networks Type of Course: Theory / PCC		L- T-P-C	3	0	0	3
Version No.	1.0						
Course Pre-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.						
Course Outcomes	On successful completion of the course, the students shall be able to: 1] Ilustrate the Basic Concepts Of Data Communication and Computer Networks. 2] Analyze the functionalities of the Data Link Layer. 3] Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. 4] Demonstrate the working principles of the Transport layer and Application Layer.						
Course Content:							
Module 1	Introduction and Physical Layer- CO1	Assignment	Problem Solving		7 Sessions		

Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media –Reference Models -OSI Model – TCP/IP Suite.
Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.

Module 2	Reference Models and Data Link Layer – CO2	Assignment	Problem Solving	7 Sessions

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

Module 3	Network Layer – CO3	Assignment	Problem Solving	10 Sessions

Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing – RIP-BGP-Link

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State Routing –OSPF-Multi cast Routing-MOSPF- DVMRP – Broad Cast Routing. EVPN-VXLAN, VPLS, ELAN.

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

Transport Layers - Connection management – Flow control – Retransmission, UDP, TCP, congestion control, – Congestion avoidance (DECbit, RED)

The Application Layer: Domain Name System (DNS), Domain Name Space, SSH, FTP, Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – – SNMP, Web Services, Virtual Networking.

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

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

Problem Solving: Choose and appropriate devices and implement various network concepts.

Programming: Simulation of any network using NS2.

Text Book(s):

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

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

Reference(s):

1.References

1. "Computer Networking: A Top-Down Approach", Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.

2. William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.

3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

E- Resources:

1. https://archive.nptel.ac.in/courses/106/105/106105183/
2. http://www.nptelvideos.com/course.php?id=393
3.https://www.youtube.com/watch?v=3DZLItfbqtQ
4.https://www.youtube.com/watch?v=_fIdQ4yfsfM
5. https://www.digimat.in/keyword/106.html
6. https://puniversity.informaticsglobal.com/login

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Course Code: CSE2252	**Course Title:** Data Communications and Computer Networks Lab **Type of Course: Lab / PCC**	**L- T-P-C**	0	0	2	1
Version No.	1.0					
Course Pre-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: 1. Design and configure basic network topologies using routers, switches, and end devices to meet specified requirements. 2. Analyze and troubleshoot network connectivity and performance issues using tools such as Wireshark and network simulators. 3. Demonstrate understanding of key networking protocols (e.g., TCP/IP, ARP, ICMP, DHCP) through practical implementation and observation. 4. Apply IP addressing and subnetting techniques to efficiently allocate and manage network resources in various networking scenarios.					
Course Content:						

Module 1,2,3,4	Physical Layer, Network Layer, Transport Laye	Lab Assignment	Problem Solving	**24 Sessions**

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]

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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

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

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

Problem Solving: Choose and appropriate devices and implement various network concepts.

Programming: Simulation of any network using NS2.

Text Book(s):

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

Reference(s):

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

E- Resources:

1. https://archive.nptel.ac.in/courses/106/105/106105183/
2. http://www.nptelvideos.com/course.php?id=393
3. https://www.youtube.com/watch?v=3DZLltfbqtQ
4. https://www.youtube.com/watch?v=_fIdQ4yfsfM
5. https://www.digimat.in/keyword/106.html
6. https://puniversity.informaticsglobal.com/login

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Course Code: CSE2253	Course Title: Data Structures					
	Type of Course: Theory	L-T- P- C	3	0	0	3
Version No.						
Course Pre-requisites						
Anti-requisites						
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.					
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques					
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the concept of basic data structure, stacks, queues, and arrays and their operations. [Understand] CO2: Utilize linked lists for real-time scenarios. [Apply] CO3: Apply an appropriate non-linear data structure for a given scenario. [Apply] CO4: Demonstrate different searching and sorting techniques. [Apply]					
Course Content:						
Module 1	Introduction to Data Structure and Linear Data Structure – Stacks and Queues	ignment	Program activity			9 Hours

Introduction – Introduction to Data Structures, Types and concept of Arrays.
Stack - Concepts and representation, Stack operations, stack implementation using array and Applications of Stack.
Queues - Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.

Module 2	Linear Data Structure- Linked List	ignment	Program activity	12 Hours

Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list.
Recursion - Recursive Definition and Processes.

Module 3	Non-linear Data Structures - Trees	ignment	Program activity	12 Hours

Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.

Module 4	Non-linear Data Structures - Graphs and	ignment	Program activity	Hours

	Hashing			

Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure.

Hashing: Introduction, Static Hashing, Dynamic Hashing

Module 5	**Searching & Sorting**	Assignment	Program activity	**6 Hours**

Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.

List of Laboratory Tasks:

Lab sheet -1
Level 1: Prompt the user, read input and print messages.Programs using class, methods and objects
Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.

Lab sheet -2
Level 1: Programming Exercises on Stack and its operations
Level 2: Programming Exercises on Stack and its operations with condition

Lab sheet -3
Level 1: Programming on Stack application infix to postfix Conversion
Level 2: -

Lab sheet -4
Level 1: Programming on Stack application – Evaluation of postfix

Lab sheet -5
Level 1: Programming Exercises on Queues and its operations with conditions
Level 2: -

Lab sheet -6
Level 1: Programming Exercises on Linked list and its operations.
Level 2: Programming Exercises on Linked list and its operations with various positions

Lab sheet -7
Level 1: Programming Exercises on Circular Linked list and its operations.
Level 2: Programming Exercises on Circular Linked list and its operations with various positions

Lab sheet -8
Level 1: Programming Exercises on factorial of a number
Level 2: Programming the tower of Hanoi using recursion

Lab sheet -9
Level 1: -
Level 2: Programming the tower of Hanoi using recursion

Lab sheet -10
Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -

Lab sheet -11
Level 1: Program to Construct Binary Search Tree and Graph
Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS

Lab sheet -12

Level 1:   Program to Implement the Linear Search & Binary Search **Level 2:**   Program to Estimate the Time complexity of Linear Search **Lab sheet -13** **Level 1:**   Program to Implement and Estimate the Time complexity of Selection Sort **Level 2:**   Program to Implement and Estimate the Time complexity of Insertion Sort **Lab sheet -14 (Beyond syllabus activity)** **Level 1:** Program to Construct AVL Tree **Level 2:** **Lab sheet -15 (Beyond syllabus activity)** **Level 1:** Program to Construct RED BLACK Tree
Targeted Application & Tools that can be used Use of PowerPoint software for lecture slides and use of Modern IDE like VS Code and Eclipse for lab programs to execute.
Project work/Assignment:
Assignment: Students should complete the lab programs by end of each practical session and module wise assignments before the deadline.
Text Book **T1**   Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018. **T2** Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

References
 R1   Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017.
R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019.
Web resources:
    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**

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Course Code: CSE2254	Course Title: Data Structures Lab Type of Course:Lab		L-T- P- C	0	0	2	1
Version No.							
Course Pre-requisites							
Anti-requisites							
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.						
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques						
Course Out Comes	**On successful completion of the course the students shall be able to:** CO1: Describe the concept of basic data structure, stacks, queues, and arrays and their operations. **[Understand]** CO2: Utilize linked lists for real-time scenarios. **[Apply]** CO3: Apply an appropriate non-linear data structure for a given scenario. **[Apply]** CO4: Demonstrate different searching and sorting techniques. **[Apply]**						
Course Content:							

Module 1	Introduction to Data Structure and Linear Data Structure – Stacks and Queues	Assignment	Program activity	9 Hours

Introduction – Introduction to Data Structures, Types and concept of Arrays**.**
Stack - Concepts and representation, Stack operations, stack implementation using array and Applications of Stack**.**
Queues - Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue**.**

Module 2	Linear Data Structure- Linked List	Assignment	Program activity	12 Hours

Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list.
Recursion - Recursive Definition and Processes.

Module 3	Non-linear Data Structures - Trees	Assignment	Program activity	12 Hours

Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal, Binary Serach Tree, AVL Trees - Red Black Tree, Expression Tree , Heaps.

Module 4	Non-linear Data Structures - Graphs and	Assignment	Program activity	6 Hours

	Hashing			

Topics: Graphs: Basic Concept of Graph Theory and its Properties, Representation of Graphs . ADT, Elementary graph operations, Minimum Cost spanning trees, Shortest path and Transitive closure.
Hashing: Introduction, Static Hashing, Dynamic Hashing

Module 5	Searching & Sorting	Assignment	Program activity	6 Hours

Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort, Quick sort, Merge Sort, Bubble sort.

List of Laboratory Tasks:

Lab sheet -1
Level 1: Prompt the user, read input and print messages.Programs using class, methods and objects
Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.

Lab sheet -2
Level 1: Programming Exercises on Stack and its operations
Level 2: Programming Exercises on Stack and its operations with condition

Lab sheet -3
Level 1: Programming on Stack application infix to postfix Conversion
Level 2: -

Lab sheet -4
Level 1: Programming on Stack application – Evaluation of postfix

Lab sheet -5
Level 1: Programming Exercises on Queues and its operations with conditions
Level 2: -

Lab sheet -6
Level 1: Programming Exercises on Linked list and its operations.
Level 2: Programming Exercises on Linked list and its operations with various positions

Lab sheet -7
Level 1: Programming Exercises on Circular Linked list and its operations.
Level 2: Programming Exercises on Circular Linked list and its operations with various positions

Lab sheet -8
Level 1: Programming Exercises on factorial of a number
Level 2: Programming the tower of Hanoi using recursion

Lab sheet -9
Level 1: -
Level 2: Programming the tower of Hanoi using recursion

Lab sheet -10
Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -

Lab sheet -11
Level 1: Program to Construct Binary Search Tree and Graph
Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-

order) and implement BFS and DFS

Lab sheet -12

Level 1:   Program to Implement the Linear Search & Binary Search
Level 2:   Program to Estimate the Time complexity of Linear Search

Lab sheet -13

Level 1:   Program to Implement and Estimate the Time complexity of Selection Sort
Level 2:   Program to Implement and Estimate the Time complexity of Insertion Sort

Lab sheet -14 (Beyond syllabus activity)

Level 1: Program to Construct AVL Tree

Level 2:

Lab sheet -15 (Beyond syllabus activity)

Level 1: Program to Construct RED BLACK Tree

Targeted Application & Tools that can be used

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

Project work/Assignment:

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

Text Book

T1   Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, reprint 2018.
T2 Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

References

 R1   Data structures and program design in C by Robert Kruse, Tondo C L, Bruce Leung, Pearson education publishers, 2017.
R2 Programming and Data Structure by Jackulin C Salini etal., Ane books publishers, 2019.
Web resources:

   3.   For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
   4.   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

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Course Code: CSE2255	**Course Title:** Object Oriented Programming Using Java **Type of Course: Theory - 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 Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Describe the basic programming concepts. [Understand] **CO2:** Apply the concept of classes, objects and methods to solve problems. [Application] **CO3:** Apply the concept of arrays and strings. [Appy] **CO4:** Implement inheritance and polymorphism building secure applications. [Apply] **CO5:** Apply the concepts of interface and error handling mechanism. [Apply]					
Course Content:						

Module 1	**Basic Concepts of Programming and Java**	Assignment	Problem Solving	**9 Sessions**

Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/Output functions, Control Statements: Branching and Looping.

Module 2	**Classes, objects, methods and Constructors**	Assignment	Problem Solving	**10 Sessions**

Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods.
Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.

Module 3	**Arrays, String and String buffer**	Assignment	Problem Solving	**8 Sessions**

Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.

Module 4	**Inheritance and Polymorphism**	Assignment	Problem Solving	**10 Sessions**

Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic

Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.

Module 5	Input & Output Operation in Java	Assignment	Problem Solving	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

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

References

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

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**
s://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q
s://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.

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

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Course Code: CSE2256	**Course Title:** Object Oriented Programming Using Java Lab **Type of Course: Lab - 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 Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Demonstrate basic programming concepts. [Apply] **CO2:** Apply the concept of classes, objects and methods to solve problems. [Application] **CO3:** Apply the concept of arrays and strings. [Appy] **CO4:** Implement inheritance and polymorphism building secure applications. [Apply] **CO5:** Apply the concepts of interface and error handling mechanism. [Apply]					
Course Content:						
Module 1	**Basic Concepts of Programming and Java**	Assignment	Problem Solving		**12 Sessions**	
Download Eclipse IDE to run Java programs, Sample programs on 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**	Assignment	Problem Solving		**14 Sessions**	
Problem solving using Classes, Objects and Methods: defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Use 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**	Assignment	Problem Solving		**10 Sessions**	
Using Arrays and Strings : 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**	Assignment	Problem Solving		**12 Sessions**	
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	Assignment	Problem Solving	12 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.

P1: Programming Exercises on Basic Concepts.
LEVEL 1: Discuss about datatypes and variables.
LEVEL 2: Demonstrate a simple java program
P2: Programming Exercises on Basic Concepts.
LEVEL 1: Discuss about datatypes and variables.
LEVEL 2: Demonstrate a simple java program
P3: Programming Exercises on operators, expressions based on a given scenario.
LEVEL 1: Explain operators, expressions.
LEVEL 2: Demonstrate operators
P4: Programming Exercises Command Line Arguments based on a given scenario.
LEVEL 1: Explain command line arguments
LEVEL 2: Demonstrate command line arguments
P5: Programming Exercises on basic Input/ Output functions and Control Statements: Branching
LEVEL 1: Explain Input/ Output functions
LEVEL 2:Demonstrate Control Statements: Branching
P6: Programming Exercises on Control Statements: Looping
LEVEL 1: Explain variour loops.
LEVEL 2:Demonstrate Control Statements: Looping
P7: Programming Exercises on Creating Objects, classes on a given scenario.
LEVEL 1: Illustrate class, object and methods.
LEVEL 2: Execute java program using class and objects
 P8: Programming Exercises on Adding methods and Constructors to the class based on a given scenario.
LEVEL 1: Illustrate methods and constructors
LEVEL 2: Execute java program using methods and constructors
P9: Programming Exercises on methods based on a given scenario.
LEVEL 1: Illustrate method overloading
LEVEL 2: Apply method overloading for the given scenario.
P10: Programming Exercises on methods based on a given scenario.
LEVEL 1: Illustrate constructors overloading
 LEVEL 2: Apply constructor overloading for the given scenario
P11: Programming Exercises on methods for static members bassed on a given scenario.
LEVEL 1: Benefits of usage static members
LEVEL 2: Usage of Static Members for the given scenario
P12: Programming Exercises on static methods based on a given scenario.
LEVEL 1: Benefits of usage static methods
LEVEL 2: Usage of Static Methods for the given scenario.
P13: Programming Exercises on nested Classes based on a given scenario.
LEVEL 1: Benefits of usage nested classes
LEVEL 2: Apply the concept of usage of nested classes for the given scenario
P14: Programming Exercises on Arrays and its built-in functions based on a given scenario.
LEVEL 1: Illustrate one dimensional arrays and its functions.

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LEVEL 2: Demonstrate programs with single-dimensional arrays and operations.
P15: Programming Exercises on Arrays and its built-in functions based on a given scenario.
LEVEL 1: Illustrate multi dimensional arrays and its functions.
LEVEL 2: Demonstrate programs with multi-dimensional arrays and operations.
P16: Programming Exercises on String Class and its built-in functions based on a given scenario.
LEVEL 1: Explain about String class and String methods.
LEVEL 2: Execute simple java applications for String and StringBuffer operations
P17: Programming Exercises on String Buffer Class and its built-in functions based on a given scenario.
LEVEL 1: Explain about StringBuffer class and String methods.
LEVEL 2: Execute simple java applications for String and StringBuffer operations
P18: Programming Exercises on String Builders and its built-in functions based on a given scenario.
LEVEL 1: Explain about String Builders.
LEVEL 2: Execute java applications for String Builders
P19: Programming Exercises on single, multi level Inheritance and super keyword based on given scenario.
LEVEL 1: Explain single and multi level inheritance.
LEVEL 2: Demonstrate simple applications for the different types of inheritance
P20: Programming Exercises hierarchical Inheritance and super keyword based on given scenario.
LEVEL 1: Explain hierarchical inheritance.
LEVEL 2: Demonstrate simple applications for hierarchical inheritance
P21: Programming Exercises on Overriding.
LEVEL 1: Differentiate method overloading and method overriding.
LEVEL 2: Demonstrate simple program with dynamic method dispatch.
P22: Programming Exercises on Final based on given scenario.
LEVEL 1: Implement programs using concept of final.
LEVEL 2: Use final keyword for the given problem
P23: Programming Exercises on Abstract keyword based on given scenario.
LEVEL 1: Implement programs using concept of Abstract.
LEVEL 2: Use abstract keyword for the given problem
P24: Programming Exercises on Interface based on a given scenario.
LEVEL 1: Differentiate abstract class about interface
LEVEL 2: Implement interfaces in the given problem
P25: Programming Exercises on Exception Handling based on a given scenario.
LEVEL 1: Explain exception handling
LEVEL 2: Solve the given problem using exception handling mechanism.
P26: Programming Exercises on Character Stream Classes based on a given scenario.
LEVEL 1: Explain Character Stream Classes
LEVEL 2: Solve the given problem using Character Stream Class.
P27: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P28: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P29: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.
P30: Programming Exercises on Read/Write Operations with File Channel based on a given scenario.
LEVEL 1: Explain Read/Write Operations with File Channel
LEVEL 2: Solve the given problem using Read/Write Operations with File Channel.

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

Text Book

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

References

R1. Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Tenth Edition, Pearson 2015.

R2: James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers.4th Edition, 2000.

R3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill Education, 6th Edition, 2019.

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

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

Course Code: CSE2257	Course Title: Computer Organization and Architecture Type of Course: PCC	L- T-P- C	3	0	0	3
Version No.						
Course Pre-requisites	nil					
Anti-requisites						
Course Description	This course introduces the core principles of computer architecture and organization from basic to intermediate level. This theory based course emphasizes on understanding the interaction between computer hardware and software. It equips the students with the intuition behind assembly-level instruction set architectures. It helps the students to interpret the operational concepts of computer technology as well as performance enhancement.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Computer Organization and Architecture** and attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the basic components of a computer and their interconnections. [Remember] 2] Explain Instruction Set Architecture and Memory Unit[Understand] 3] Apply appropriate techniques to carry out selected arithmetic operations [Apply] 4] Explain the organization of memory and processor sub-system [Understand]					
Course Content:						

Module 1	Basic Structure of Computer	Assignment	Data Analysis task	**12 Sessions**

Topics:
Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.

Module 2	Instruction Set Architecture and Memory Unit	..ignment	..alysis, Data Collection	**12 Sessions**

Topics:
Instruction Set Architecture: Addressing Modes, Stacks and Subroutines.
Memory System: Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.

Module 3	Arithmetic And Input/output Design	..e Study	..a analysis task	**10 Sessions**

Topics:
Arithmetic: Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations.
Input/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits

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

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

Targeted Application & Tools that can be used:	

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

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

Project work/Assignment:

Each batch of students (self-selected batch mates – up to 4 in a batch) will be allocated case studies/assignments

Textbook(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Sixth Edition, McGraw-HillHigher Education, 2023 reprint.
2. William Stallings, "Computer Organization & Architecture – Designing for Performance", 11thEdition, Pearson Education Inc., 2019.

References

1. David A. Patterson & John L. Hennessy, "Computer Organization and Design MIPS Edition-TheHardware/Software Interface", 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020.
2. Web References:
3. NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta,Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163
4. NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman.
5. https://nptel.ac.in/courses/106106092
6. https://puniversity.informaticsglobal.com:2229/login.aspx

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

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Course Code: CSE2258	Course Title: Web Technologies		L-T- P- C	3	0	0	3

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

Module 1	Introduction to XHTML	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications		20 Sessions
	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, Demonstration of applications using XHTML for Responsive web pages.				
Module 2	**Advanced CSS**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages		**20 Sessions**

Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks				

XML: Basics, Demonstration of applications using XML with XSLT.

Module 3	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**20 Sessions**

PHP: Introduction to server-side Development with PHP, Arrays, Superglobal Arrays, $GET and $ POST,

$_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object Oriented Design, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP, Applications.

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

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

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

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

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.

Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

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

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

Project work/Assignment:

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

Textbook(s):

1] Robert. W. Sebesta, "*Programming the World Wide Web"*, Pearson Education, 9th
   Edition, 2016.
2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program",
   Fifth Edition, Pearson Education, 2021.

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

4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition,
Pearson

Education, 2021.

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

 R2. Jeffrey C. Jackson,"Web Technologies: A Computer Science Perspective", Pearson
Education, 1st
      Edition,2016.
Additional web-based resources
 W1. W3schools.com
 W2. Developer.mozilla.org/en-US/docs/Learn
 W3. docs.microsoft.com
 W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking
https://presiuniv.knimbus.com/user#/home

Topics related to development of "FOUNDATION":
1. Web, WWW, Web browsers, Web servers, Internet.
2. CSS, PHP.
3. Designing the website for healthcare.

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

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Course Code: CSE2259	Course Title: Web Technologies Lab		L-T- P- C	0	0	2	1
Version No.	1.0						
Course Pre-requisites	NIL						
Anti-requisites	NIL						
Course Description	This course highlights the comprehensive introduction to scripting languages that are used for creating web-based applications. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.						
Course Outcomes	**On successful completion of this course the students shall be able to:** **CO1:** Implement web-based application using client-side scripting languages. **(Apply)** **CO2**: Apply various constructs to enhance the appearance of a website. **(Apply)** **CO3:** Apply server-side scripting languages to develop a web page linked to a database. **(Apply)**						
Course Content:							
Module 1	**Introduction to XHTML Features**	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications				**8 Sessions**
Standard XHTML Document Structure, Basic Text Markup such as headings, paragraphs, lists, tables, forms, and semantic tags.							
Module 2	**CSS Styling**	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages				**10 Sessions**
Apply CSS3 to style HTML elements, including layout techniques, color schemes, typography, and responsive design principles.							

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XML: Basics, Demonstration of applications using XML with XSLT.				
Module 3	**PHP – Application Level**	Quizzes and assignments	Application of PHP in web designing	**12 Sessions**

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

List of Laboratory Tasks:

Experiment No. 1: Demonstration of XHTML features

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

Experiment No. 2: Application of CSS in web designing

Level 1: Design a document using XHTML and CSS to create a catalog of items for online electronic shopping.

Level 2: Create and save XML document for students' information and display the same using cascaded style sheet.

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

Level 1: Write a PHP program to read the personal information of a person such as first name, last name, age, permanent address, and pin code entered by the user into a table created in MySQL. Read the same information from the database and display it on the front end.

Level 2: Using PHP develop a web page that accepts book information such as ISBN number, title, authors, edition, and publisher and store information submitted through the web page in MySQL database.

Experiment No. 4: Building a website.

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

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

Project work/Assignment:

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

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Textbook(s):

1] Robert. W. Sebesta, "*Programming the World Wide Web"*, Pearson Education, 9th Edition, 2016.

2]Paul Deitel, Harvey Deitel, Abbey Deital,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

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

4]Deitel, Deitel, Goldberg,"*Internet & World Wide Web How to Program*", Fifth Edition, Pearson

Education, 2021.

Reference Book(s):

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

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

Additional web-based resources

W1. W3schools.com

W2. Developer.mozilla.org/en-US/docs/Learn

W3. docs.microsoft.com

W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking

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

Topics related to development of "FOUNDATION":

4. Web, WWW, Web browsers, Web servers, Internet.
5. CSS, PHP.
6. Designing the website for healthcare.

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

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Course 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: CO.1 Recognize the importance of Value Education through the process of self-exploration CO.2 Explain the human being as the co-existence of the self and the body in harmony. CO.3 Describe the role of foundational values in building harmonious relationships. CO.4 Summarize the importance of a holistic perspective in developing ethical professional behavior.					
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

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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*:
3)   UHV II -
https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So&pp=0gcJCWMEOCosWNin
4)   Lecture by Dr. Kumar Sambhav, NPTEL course: Universal Human Values,
https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
5)   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
12.   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
13.   Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2019.
14.   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.
6. 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 Title: Introduction to Aptitude (Audited)	L-T- P- C	0-2-0-0
Version No.	1.0		
Course Pre-requisites	Students should know the basic Mathematics & aptitude along with understanding of English		
Anti-requisites	Nil		
Course Description	The objective of this course is to prepare the trainees to tackle the questions on various topics and various difficulty levels based on Quantitative Ability, and Logical Reasoning asked during the placement drives. There will be sufficient focus on building the fundamentals of all the topics, as well as on solving the higher order thinking questions. The focus of this course is to teach the students to not only get to the correct answers, but to get there faster than ever before, which will improve their employability factor.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.		

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Course Outcomes	On successful completion of the course the students shall be able to:
	CO1] **Recall** all the basic mathematical concepts they learnt in high school. CO2] **Identify** the principle concept needed in a question.
	CO3] **Solve** the quantitative and logical ability questions with the appropriate concept.
	CO4] **Analyze** the data given in complex problems.
	CO5] **Rearrange** the information to simplify the question

Course Content:				

Module 1	Quantitative Ability	Assignment	Bloom's Level : Application	**12 Hours**

Topics:
Introduction to Aptitude, working of Tables, Squares, Cubes

Module 2	Logical Reasoning	Assignment	Bloom's Level : Application	**18 Hours**

Topics:
Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars, Number Series, Wrong number series, Visual Reasoning

Targeted Application & Tools that can be used:
Application area: Placement activities and Competitive examinations. Tools: LMS

Text Book
1. Quantitative Aptitude by R S Aggarwal
2. Verbal & Non-Verbal Reasoning by R S Aggarwal

References
1. www.indiabix.com
2. 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: MAT2404	Course Title: Discrete Mathematics Type of Course: Theory - BSC	L-T- P- C	3	1	0	4

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Version No.	1.0		
Course Pre-requisites	nil		
Anti-requisites	**NIL**		
Course Description	The course explores the study of mathematical structures that are fundamentally discrete (not continuous), focusing on concepts like set theory, logic, graph theory, combinatorics, and number theory, with applications primarily in computer science fields like algorithms, software development, and cryptography; it covers topics such as propositional logic, proof techniques, relations, functions, counting principles, and basic graph algorithms, providing a foundation for analyzing discrete problems and structures within computer science.		
Course Objective	The main objective of the course is that students should learn a particular set of mathematical facts and how to apply them. It teaches students how to think logically and mathematically through five important themes: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful discrete mathematics course should carefully blend and balance all five themes.		
Course Outcomes	On successful completion of the course the students shall be able to: CO1 - Explain logical sentences through predicates, quantifiers and logical connectives. CO2 - Deploy the counting techniques to tackle combinatorial problems CO3 - Comprehend the basic principles of set theory and different types of relations. CO4 - Apply different types of structures of trees for developing programming skills		
Course Content:			
Module 1	**Fundamentals of Logic**		**(10 Classes)**

Basic Connectives and Truth Tables, Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

Module 2	**Principle of Counting**	**Assignment**	**(15 Classes)**

The Well Ordering Principle – Mathematical Induction
The Basics of Counting, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations
Advanced Principle Counting: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

Module 3	**Relations and Functions**		**(10 Classes)**

Cartesian Products and Relations, Functions, One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders, Lattice, Hasse Diagrams, Equivalence Relations and Partitions.

Module 4	**Recurrence Relations and Generating Functions**		**(10 Classes)**

Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating

functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.

Module 5	Graph Theory & Algorithms on Networks	Assignment	(15 Classes)

Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Sub graphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity, Euler and Hamilton Paths, Shortest-Paths.
Tree - Definitions, Properties, and Examples, Routed Trees, Binary search tree, Decision tree, spanning tree: BFS, DFS.
Algorithms on Networks - Shortest path algorithm- Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.

Targeted Application & Tools that can be used:
Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems.

Assignment:

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

Text Book :
1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill,s 8th Edition,2019.
2. Harary – Graph Theory, Addison-Wesley Publishing Company.

References:
1. Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall.
2. K.D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd.
3. Ralph. P. Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia.

E-resources/ Web links:
1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_54588
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_375
3. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html
4. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to SKILL DEVELOPMENT: The course focuses on the concepts of calculus and differential equation with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem solving**.** This is attained through the assessment component mentioned in course handout.

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Course Code: CSE2260	Course Title: Database Management Systems Type of Course: Theory only - 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 foundational principles of database management systems, including data models, schemas, and architectures. This course provides a solid foundation on the relational model of data and the use of relational algebra. It develops skills in SQL for data definition, manipulation, and control, enabling students to construct and execute complex queries. The course also introduces the concept of object oriented and object relational databases and modern database technologies like **NoSQL.** The also course allows the students to gain insights into data storage structures and indexing strategies for optimizing query performance.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Describe the fundamental elements of relational database management systems. [Understand] 2. Examine databases using SQL query processing and Optimization. [Apply] 3. Design simple database systems applying the normalization constraints and demonstrate the database transaction processing, recovery, and security. [Apply] 4. Interpret the concept of advanced databases and its applications. [Apply]					
Course Content:						

Module 1	Introduction to Database Modelling and Relational Algebra(Understand)	Assignment	**Problem Solving**	**10 Sessions**

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

Module 2	Fundamentals of SQL and Query Optimization (Apply)	Assignment	**Programming**	**11 Sessions**

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

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Module 3	Relational Database Design & Transaction Management (Apply)	Assignment	Problem Solving	12 Sessions

Topics:

Relational database design: Problems in schema design, redundancy and anomalies, Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions, Database De-normalization.

Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; The write-ahead log protocol; Check pointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Module 4	Advanced DBMS Topics (Apply)	Assignment	Case Study	12 Sessions

Topics:

Advanced topics: Object oriented database management systems, Deductive database management systems, Spatial database management systems, Temporal database management systems, Constraint database management systems.

New database applications and architectures such as Data warehousing, Multimedia, Mobility, NoSQL, Native XML databases (NXD), Document-oriented databases, Statistical databases.

Targeted Application & Tools that can be used:

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

Tools/Simulator used: MySQL DB for student practice.

Also demonstration of ORACLE DB on object-relational database creation and JDBC connection.

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

Text Books:

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

T2. RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.

T3. W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.

References

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

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

Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB.

Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications

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

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Course Code: CSE2261	Course Title: Database Management Systems Lab Type of Course: 1) Laboratory - PCC	L-T-P-C				
			0	0	2	1

Version No.	1.0
Course Pre-requisites	Foundational understanding of data types, basic programming knowledge, operating systems and file management.
Anti-requisites	NIL
Course Description	The Database Management Systems (DBMS) Laboratory is designed to provide students with hands-on experience in database design, implementation, and management using SQL and database management tools such as MySQL. The lab complements theoretical concepts learned in database courses by allowing students to practice database creation, querying, and optimization techniques. The DBMS Lab enables students to develop industry-relevant skills in database management, preparing them for careers in **software development, data engineering, and database administration**.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain **Employability** through **Problem Solving** Methodologies.
Course Out Comes	On successful completion of the course the students shall be able to: 5. Demonstrate the database concepts, practice, and SQL queries. [Apply] 6. Design and implement database schemas while applying normalization techniques to optimize structure. [Apply]] 7. Develop and implement stored procedures, triggers, and views for automation and efficiency. [Apply] 8. To Design and build database applications for real world problems. [Apply]
Course Content:	

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

Labsheet-1 [3 Practical Sessions]
Experiment No 1: [1 Session]
1.   To study and implement the different language of Structured Query Language.
Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.
Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]
Experiment No. 2: [2 Sessions]
2.   To study and implement the concept of integrity constraints in SQL.
Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.
Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical Sessions]
Experiment No. 3: [1 Session]
3.   Implement complex queries in SQL.
Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database.

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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)

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

Labsheet-8 [1 Sessions]
12. Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc.
Level 1: Implement the real time database.
Level 2: Analyze the working of database in real time.

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

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

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

Text Books:
T1. Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018.
T2. RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.
T3. W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.

References
R1 Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.
R2 M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017.

Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database design using ER- Relational mapping, Implementation of given database scenario using MYSQLDB.

Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications

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

Course Code: CIT2500	Course Title: Fog Computing for IoT	L- T -P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					

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Course Description	The course will provide a solid base for understanding the challenges and problems underlying the design and development of fog computing systems and applications. Thus, this course will teach how to specify, design, program, analyze and implement such systems and applications. Fog computing is a decentralized computing infrastructure in which data, compute, storage and applications are located somewhere between the data source and the cloud. Like edge computing, fog computing brings the advantages and power of the cloud closer to where data is created and acted upon. Many people use the terms fog computing and edge computing interchangeably because both involve bringing intelligence and processing closer to where the data is created. This is often done to improve efficiency, though it might also be done for security and compliance reasons.			
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Network Slicing, Big Data Analytics and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the basic principles and concepts of fog computing systems and their relation to other models such as Cloud Computing and Near-Far computing. [Understand] 2] Identify the challenges of developing fog-based applications and middleware, and the possible solutions. [Apply] 3] Solve various issues related to fog computing, programming model and Software Defined Network. [Apply] 4] Apply best approach for a particular problem regarding the design and development of a fog computing system.[Apply]			
Course Content:				
Module 1	INTRODUCTION TO FOG COMPUTING	Assignment	Programming activity	10 Sessions
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.				
Module 2	FOG ARCHITECTURE	Assignment	Programming activity	10 Sessions
pics: mmunication 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.				
dule 3	NAGEMENT AND ORCHESTRATION	ignment	gramming activity	10 Sessions
pics: nagement 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.				
Module 4	FOG INTEGRATION TECHNOLOGIES WITH IOT	Assignment	Programming activity	10 Sessions

pics:

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

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

erence Books:
1. 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
3. 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

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
5. https://csharp-station.com/

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pics relevant 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.

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Course Code: FIN1002	Course Title: Essentials of Finance Type of Course: HSMC		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.						
Anti-requisites							
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	Upon successful completion of this course, students will be able to: • 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	List the course outcomes On successful completion of this course the students shall be able to: 1. Understand the basic concepts of finance and financial markets and organizations. 2. Apply and interpret financial information for business decision making. 3. Identify various heads of income and deduction under Income Tax Act, 1961.						
Course Content:							

Module 1	Introduction to Finance	Assignment/ Quiz	Numerical solving Task	10 Sessions

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	ancial Management	signment/ Quiz	merical solving Task	**Sessions**

Capital Budgeting Decisions: Payback Period, Net Present Value (NPV), Profitability Index (PI), Internal Rate of Return (IRR); Leverage- Basic Numerical; Capital Structure Decisions:

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Optimal Capital Structure, Trade-off Theory of Capital Structure; Cost of Capital: Equity, Debt, WACC; Dividend Policy: Factors influencing Dividend Policy.

Module 3	Taxation	Assignment/ Quiz	Numerical solving Task	**17 Sessions**

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 Application & Tools that can be used:
Textbooks, PPT, Spreadsheet Software (e.g., Microsoft Excel), Official Website of Income Tax Department.

Project Work/ Assignment:

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

2. Case Study: - At the end of the course students will be given a 'real-world' cases like business models of successful companies or tax evasion by reputed companies on which they have to come up with detailed analysis and assessment.

Text Book(s):
1. Dr. Vinod K. Singhania & Dr. Monica Singhania. (Latest Assessment Year Edition). *Students' Guide to Income Tax including GST*. Taxmann Publications.
2. Pandey, I. M. (2025). *Financial Management*. Vikas Publishing House.

Reference Book (s):
1. Bhole, L.M., & Mahakud, J. (Current Edition). *Financial Institutions and Markets: Structure, Growth and Innovations*. McGraw Hill Education India.
2. Mehrotra, H.C., & Goyal, S.P. (Latest Assessment Year Edition). *Income Tax Law & Practice*. Sahitya Bhawan Publications.
3. Gordon, E., & Natarajan, K. (Current Edition). *Financial Markets and Services*. Himalaya Publishing House.

Online Resources (e-books, notes, ppts, video lectures etc.):
1. https://presidencyuniversity.linways.com
2. https://onlinecourses.nptel.ac.in/noc24_ec01/preview
3. https://www.incometax.gov.in/iec/foportal/

Topics relevant to "**SKILL DEVELOPMENT**": This course is designed to provide practical financial skills through participative learning techniques. Students will engage in performing suitable calculations to determine financial parameters (e.g., time value of money, investment returns, tax liabilities) and analysing financial statements to assess organizational performance and make informed decisions.

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Course Code: CSE2262	Course Title: Analysis of Algorithms Type of Course: Theory PCC		L-T-P- C	3	1	0	4
Version No.	1.0						
Course Pre-requisites							
Anti-requisites	Nil						
Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. This course discusses the classic approaches for algorithm design such as Divide and Conquer, Dynamic Programming, Greedy method. This course also describes other basic strategies searching solution space. The core concepts of analyzing algorithms and classifying them into various complexity classes is covered in the end.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Analysis of Algorithms and attain Skill Development through Problem Solving Methodologies.						
Course Out Comes	On successful completion of the course the students shall be able to: 1. Compute efficiency of a given algorithm.[Apply] 2. Apply divide and conquer technique for searching and sorting Problems.[Apply] 3. Apply the Dynamic Programming technique for a given problem. [Apply] 4. Apply greedy technique for solving a Problem.[Apply] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Apply]						
Course Content:							

Module 1	**Introduction**	Assignment	Simulation/Data Analysis	**10 Sessions**
Introduction, Asymptotic Notations and its properties, Best case, worst case and average case-Sequential search, Sorting; Mathematical analysis for Recursive and Non-recursive algorithms: Substitution method and Master's Theorem.				

Module 2	**Divide-and-conquer**	Assignment	Simulation/Data Analysis	**08 Sessions**
Introduction. Insertion Sort; Merge sort, Quick sort, Binary search.				

Module 3	**Dynamic programming**	Term paper/Assignment	Simulation/Data Analysis	**10 Sessions**
Introduction with examples, Principles of Memoization, 0-1 Knapsack Problem, Bellman-Ford algorithm, Floyd-Warshall's Algorithms. Chain Matrix Multiplication.				

Module 4	**Greedy technique**	Term paper/Assignment	Simulation/Data Analysis	**09 Sessions**
Introduction, Fractional Knapsack Problem, Minimal Spanning Tree: Prim's Algorithm and Kruskal's Algorithm, Single-source Shortest Path: Dijkstra's Algorithm				

Module 5	**Complexity Classes**	Term paper/Assignment	Simulation/Data Analysis	**08 Sessions**
Complexity Classes- P,NP- NP Hard and NP Complete - Boolean Satisfiability Problem (SAT). nch and Bound: Knapsack problem; Backtracking, - N-Queens problem.				

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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.

References

1. J. Kleinberg and E. Tardos, "*Algorithm Design*", Addison-Wesley, 2005.
2. Tim Roughgarden, *"Algorithms Illuminated"* (books 1 through 3), "Operating Systems Design and Implementation", Soundlikeyourself Publishing, 2017-2019.
3. AV Aho, J Hopcroft, JD Ullman, *"The Design and Analysis of Algorithms"*, Addison-Wesley, 1974.
4. Donald E. Knuth, "*The Art of Computer Programming",* Volumes 1and 3 Pearson.

Web-Resources

1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2. Coursera: Analysis of Algorithms by Princeton University
3. Algorithms Specialization in Coursera by Stanford University(Group of 4 courses).
4. Algorithms Coding Contest Links maintained by Prof Gerth Stølting Brodal of Aarhus University

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: CSE2263	**Course Title: Analysis of Algorithms Lab** **Type of Course: Lab - PCC**		**L- T-P- C**	0	0	2	1
Version No.	1						
Course Pre-requisites	**Nil**						
Anti-requisites	NIL						
Course Description	This course introduces techniques for the design and analysis of efficient algorithms and methods of applications. This course discusses the classic approaches for algorithm design such as Divide and Conquer, Dynamic Programming, Greedy method. This course also describes other basic strategies searching solution space. The core concepts of analyzing algorithms and classifying them into various complexity classes is covered in the end.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of ==Analysis of Algorithms== and attain ==Skill Development== through ==Experiential Learning== Methodologies.						
Course Out Comes	**On successful completion of the course the students shall be able to:** 1. Compute efficiency of a given algorithm. [Applying] 2. Apply divide and conquer technique for searching and sorting Problems.[Applying] 3. Apply the Dynamic Programming technique for a given problem. [Applying] 4. Apply greedy technique for solving a Problem.[Applying] 5. Demonstrate Back tracking technique and limitations of Algorithms.[Applying]						
Course Content							
Module 1	**Introduction**	**3 Sessions**					
Measuring running time of an algorithm, Compare running time of algorithms, Implement sorting algorithms such as bubble sort, selection sort							
Module 2	**Divide-and-conquer**	**3 Sessions**					
Compare searching algorithms: Linear Search, Binary Search; Compare Sorting algorithms: Insertion Sort, Merge Sort, QuickSort.							
Module 3	**Dynamic programming**	**3 Sessions**					
Introduction and memorization: Factorial; Coin Change Problem ; Floyd-Warshall's Algorithm.							
Module 4	**Greedy technique**	**3 Sessions**					
Fractional Knapsack Problem; Minimal Spanning Tree Algorithms-Prim's Algorithm, Kruskal's algorithm							
Module 5	**Complexity Classes**	**3 Sessions**					
Branch and Bound: Knapsack problem; Backtracking, - N-Queens problem.							
	List of Laboratory Tasks: 1. Measuring running time of an algorithm Objective: To experimentally determine the running time of basic algorithms for input size n=10, 100, 1000, etc. by taking difference of starting time and ending							

2. Compare running time of algorithms

        Objective: To execute two algorithms to solve the same problem, and to comparatively evaluate the better algorithm for large values of N.

3. Implement sorting algorithms such as bubble sort, selection sort

        Objective: To implement comparison based sorting strategies.

4. Compare searching algorithms

        Objective: To implement two searching strategies and compare their performance.

5. Compare Sorting algorithms

        Objective: To implement searching strategies that follow top down design approach(Insertion sort, merge sort).

6. Quick Sort

        Objective: To demonstrate Quick sort and its variants, and their impact on running time.

7. Dynamic Programming

        Objective: To demonstrate Dynamic Programming approach with the help of Factorial algorithm.

8. Coin Change Problem

        Objective: To implement an efficient algorithm for the Coin Change problem.

9. Floyd-Warshall's Algorithm

        Objective: To demonstrate how dynamic programming is used with the help of Floyd-Warshall's algorithm.

10. Fractional Knapsack Problem

        Objective: To demonstrate how greedy method can be used to solve the Fractional Knapsack Problem.

11. Minimal Spanning Tree Algorithm

        Objective: To implement greedy strategy to solve the Minimal Spanning Tree problem using Prim's Algorithm.

12. Kruskal's Minimal Spanning Tree Algorithm

        Objective: To implement greedy strategies to solve the Minimal Spanning Tree problem using Kruskal's Algorithm.

13. Knapsack Problem

        Objective: To implement Knapsack problem using branch and bound technique.

14. N-Queen's Problem

        Objective: To demonstrate backtracking method with the help of N-Queen's problem.

15. Case Study

        Objective: To demonstrate how various techniques can be used to solve the same problem with the help of Knapsack problem.

Targeted Application & Tools that can be used

   1.   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.

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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: CSE2264	Course Title: Essentials of AI Type of Course: Program Core Course -Theory	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 student to the basics of artificial intelligence. In this course, the student first learns the various search methods for problem solving, followed by knowledge-based logic representations. After that, the student will learn about uncertainty in AI, as well as approaches to solve such challenges such as Naïve Bayes Classifier and Hidden Markov Models. Topics: Uninformed search, Heuristic search, Local search, Adversarial search, Constraint satisfaction, logic, First Order Resolution, Probability, Naïve Bayes Classifier, and Hidden Markov Model (HMM).					
Course Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1. Explain different methods of searching, proving, and analysis in AI [Understand] 2. Implement various graphical and adversarial search algorithms. [Apply] 3. Prove, by resolution, different situations using First Order Logic [Apply] 4. Solve sequence labeling problems using HMM [Apply]					

Course Content:

dule 1	rch Methods for Problem-Solving	blem-Solving Tests	TEL Assignments	No. of Sessions: 13

Introduction – History of AI, Agents and Environment, Types of AI and Learning. State Space Search; General Formulation of Search Problems; Data Structures used in Searching. **Uninformed Search Algorithms** – Breadth First Search, Depth First Search, Uniform Cost Search, Generalized Uniform Cost Search (a.k.a Dijkstra's Single-Source Shortest Path), Iterative Deepening Depth-First Search, Time and Space Complexity Analysis of Uninformed Search Algorithms. **Heuristic Search Algorithms** – Heuristics and Admissibility, Greedy Best-First Search, A* Search and weighted A* Search.

dule 2	vanced Search Methods	blem-Solving Tests	TEL Assignments	No. of Sessions: 12

Local Search – Local Search, Hill Climbing, Genetic Algorithms, Gradient Descent. **Adversarial Search** – Minimax Search, Alpha-Beta Pruning, Ideal Ordering. **Constraint Satisfaction** – Constraint Satisfaction Problems Definitions and Examples – Map Colouring, N Queens, Cryptarithmetic, Generalized CSP; Back-tracking Heuristics; Arc Consistency and Path Consistency

dule 3	owledge-Based Logic Representation	tomated Theorem Proving using FOL Resolution	TEL Assignments	No. of Sessions: 10

Propositional Logic – Syntax and Semantics of Propositional Logic. Logical connectives. Inference Rules. Conjunctive and Disjunctive Normal Forms. **First Order Logic** – Syntax and Semantics of Propositional Logic. Logical connectives. Inference Rules. Conjunctive and Disjunctive Normal Forms. **Resolution** – Resolution Principle. Propositional and First Order Resolution. Applications for solving story problems using Resolution

dule 4	certainty in AI	presenting problems as HMM	TEL Assignments	No. of Sessions: 06

Probability – Probability Definitions. Conditional Probability. Bayes Theorem. Naïve Bayes Classifier. Using Naïve Bayes Classifier for Supervised Learning. **Hidden Markov Models** – Definition of HMM. Sequence Labeling and Markov Assumption. Sub-Problems in HMM and their solutions – Forward Probability and Viterbi Algorithm. Applications of Sequence Labeling in Natural Language Processing (Eg. Part-of-Speech Tagging). **Introduction to Deep Learning** – Artificial Neurons, Activation Functions, Multilayer Perceptron.

Targeted Application & Tools that can be used:
1. Implementation of a shortest-path finder using different search algorithms.
2. Implementation of a sequence labeler using Viterbi Algorithm.

ject 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).

tbook(s):
1. Stuart Russel and Peter Norvig. *Artificial Intelligence: A Modern Approach*. 4th Edition. Pearson Education. 2022.
2. Lavika Goel. *Artificial Intelligence: Concepts and Applications*. 1st Edition. Wiley. 2021.
3. Elaine Rich, Kevin Knight and Shivashankar B Nair. *Artificial Intelligence*. 4th Edition. MedTech Science Press. 2024.

ferences:
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.
3. George Luger. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*. 6th Edition. Pearson Education. 2021.

blinks
1. NPTEL Courses: Mausam (IIT Delhi), "An Introduction to Artificial Intelligence" Link: https://nptel.ac.in/courses/106102220.
2. Shyamanta M. Hazarika (IIT Guwahati), "Fundamentals of Artificial Intelligence". Link: https://nptel.ac.in/courses/112103280. Useful for the full course.
3. Deepak Khemani (IIT Madras), "Artificial Intelligence: Search Methods for Problem-Solving". Link: https://nptel.ac.in/courses/106106226. Useful for Module 1 and 2
4. Deepak Khemani (IIT Madras), "Artificial Intelligence: Knowledge Representation and Reasoning". Link: https://nptel.ac.in/courses/106106140. Useful for Module 3.
5. Deepak Khemani (IIT Madras), "AI: Constraint Satisfaction". Link: https://nptel.ac.in/courses/106106158. Useful for Module 2.

Course Code: CSE2265	Course Title: Essentials of AI Lab Type of Course: Program Core Course - Lab	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 student to the basics of artificial intelligence. In this course, the student first learns the various search methods for problem-solving, followed by knowledge-based logic representations. After that, the student will learn about uncertainty in AI, as well as approaches to solve such challenges such as Naïve Bayes Classifier and Hidden Markov Models. Topics: Uninformed search, Heuristic search, Local search, Adversarial search, Constraint satisfaction, logic, First Order Resolution, Probability, Naïve Bayes Classifier, and Hidden Markov Model (HMM).					
Course Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 　1.　Explain different methods of searching, proving, and analysis in AI [Understand] 　2.　Implement various graphical and adversarial search algorithms. [Apply] 　3.　Prove, by resolution, different situations using First Order Logic [Apply] 　4.　Solve sequence labeling problems using HMM [Apply]					
Course Content:			No. of Sessions: 15 (30 hours)			

Experiment No. 1: File Handling
Level 1: Read text files using Python
Level 2: Parse text files using Python

Experiment No. 2: Implementation of Graph Representations
Level 1: Implement graph representations by taking input from the console
Level 2: Implement graph representations by taking input from files.

Experiment No. 3 & 4: Implementation of Uninformed Search Algorithms
Level 1: Implement uninformed search algorithms – BFS and DFS – on unweighted graphs.
Level 2: Implement uninformed search algorithms – Uniform Cost Search and Dijkstra's SSSP – on weighted graphs

Experiment No. 5: Implementation of Heuristic Search Algorithms
Level 1: Calculate the upper-bounds of admissible heuristics using Dijkstra's SSSP.

Level 2: Implement Greedy Best-First Search and A* Search Algorithms.

Experiment No. 6 & 7: Implementation of Adversarial Search
Level 1: Implement a Game Tree
Level 2: Perform Alpha-Beta Pruning and Ideal Ordering

Experiment No. 8 & 9: Implementation of a CSP Solver
Level 1: Implement a CSP solver to solve a cryptarithmetic problem
Level 2: Implement a CSP solver for map colouring

Experiment No. 10: Using Python Packages for CSP
Level 1: Implement a CSP solver for Sudoku
Level 2: Implement a CSP solver for Addoku

Experiment No. 11: Implement a Family Tree Parser
Level 1: Perform logic programming using logpy.
Level 2: Implement a family tree parser

Experiment No. 12 & 13: Implement a Decision Maker
Level 1: Implement a Minesweeper solver
Level 2: Implement a Battleship solver

Experiment No. 14 & 15: Hidden Markov Model
Level 1: Implement a generic HMM
Level 2: Build a PoS Tagger using a HMM with the Brown Corpus and the Universal Dependencies Tagset.

Targeted Application & Tools that can be used:
3. Google Colab
4. Python IDEs like PyCharm

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.

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 Title:** 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.					
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 Out Comes	**On successful completion of this course the students shall be able to:** CO1: Recall all the basic mathematical concepts. CO2: Identify the principle concept needed in a question. CO3: Solve the quantitative and logical ability questions with the appropriate concept. CO4: Analyze the data given in complex problems.					
Course Content:						

Module 1	**Quantitative Ability 1**	Assignment	**16 Hours**

Topics:

Number System, Percentage, Ratio and Proportion, Average, Mixture and Allegation, Time and Work, Profit and Loss

Module 2	Quantitative Ability 2	Assignment	**14 Hours**

Topics:
Time Speed and Distance, Boats and Streams, Simple Interest, Compound Interest, Probability, Permutation and Combination

Targeted Application & Tools that can be used:
Application area: Placement activities and Competitive examinations. Tools:
LMS

Continuous Evaluation:

CA1 – Online Test
CA2 – Online Test
CA3 – Online Test
Assignment

Text Book:
 1. Fast Track Objective by Rajesh Verma
 2. R S Aggarwal
 3. Rakesh Yadav

References:
 1. **www.indiabix.com**
 2. **www.testbook.com**
 3. **www.youtube.com/c/TheAptitudeGuy/videos**

Topics relevant to Skill Development: Quantitative aptitude for Skill Development through Problem solving Techniques. This is attained through components mentioned in course handout**.**

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Course Code: CSE2266	Course Title: Theory of Computation Type of Course: Theory Only	L- T-P- C	3	0	0	3
Version No.	2.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	The course deals with introduction of formal languages and the correspondence between language classes and the automata that recognize them. Topics include: Formal definitions of grammars and acceptors, Deterministic and Nondeterministic systems, Grammar ambiguity, finite state and push-down automata; normal forms; Turing machines and its relations with algorithms.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Theory of Computation as mentioned above and attain Skill Development through Problem Solving Methodologies.					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Describe various components of Automata. (Knowledge) 2. Illustrate Finite Automata for the given Language. (Application) 3. Distinguish between Regular grammar and Context free grammar. (Comprehension) 4. Construct Push down Automata. (Application) 5. Construct Turing machine for a Language. (Application)					
Course Content:						

Module 1	Introduction to automata theory	Assignment	Problems on Strings and Language operations	6 classes

Topics:

Introduction to Automata Theory, Applications of Automata Theory, Alphabets, Strings, Languages & operations on languages, Representation of automata, Language recognizers, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs

Topics:

Basic concepts of Finite automata, DFA- definitions of DFA, Deterministic Accepters Transition Graphs and Languages

and DFA's, Regular Languages, NFA- Definition of a Nondeterministic Accepter, Languages and NFA's Why Non- determinism? Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.

Module 3	Regular Expressions & Context Free Grammar	Assignment	Problems on RE, CFG, PT, PL and Ambiguity	12 Sessions

Topics:

Formal Definition of a Regular Expression, Languages Associated with Regular Expressions, Languages, Regular Languages (RL) and Non-regular Languages: Closure properties of RLs, to show some languages are not RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and Derivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity, Chomsky Normal Form, Gribiche Normal Form.

Module 4	Push down Automata	Assignment	Problems on pushdown Automaton	08 Sessions

Topics:

Definition of a Pushdown Automaton, Language Accepted by a Pushdown Automaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack Equivalence of PDA's and CFG's: From Grammars to Pushdown Automata.

Module 5	Turing Machine	Assignment	Problems on Turning Machine	07 Sessions

Topics:

Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing

machine, Turing Machines as Transducers, Halting Programming Techniques for Turing Machines

Targeted Application & Tools that can be used:

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Targeted Application:

1. Text Processing

2. Compilers

3. Text Editors

4. Robotics Applications

5. Artificial Intelligence

Tools:

1. JFLAP (Java Formal Language and Automata Package) Software simulation tool. It's interactive educational

software written in Java to experiment topics in automata theory.

2. Turing machine Online simulators.

Text Book(s):

1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6th Ed, 2018.

Reference(s):

1. Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008.

2. Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014.

E-Resources

NPTEL course – https://onlinecourses.nptel.ac.in/noc21_cs83/preview

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40 YEARS OF ACADEMIC WISDOM

Course Code: CSE2502	Course Title: Cryptography and Network Security Type of Course: Theory - PCC		L- T-P- C	3	0	0	3
Version No.	2.0						
Course Pre-requisites	CSE2251						
Anti-requisites	**NIL**						
Course Description	The Course deals with the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cryptography and Network Security above and attain Skill Development through Problem Solving methodologies.						
Course Outcomes	On successful completion of this course the students shall be able to: 1. Describe the basic concept of Cryptography 2. Classify different types of Cryptographic Algorithms 3. Solve Mathematical problems required for Cryptography 4. Illustrate Network Security concepts						
Course Content:							
Module 1	Introduction to Cryptography	Assignment	Recognize the techniques	**7 Sessions**			
Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active attacks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution Ciphers : Play-fair and Hill Cipher, Vigenere cipher, Introduction to Block Cipher and Stream Cipher, Feistel Structure, ECB modes of block cipher.							
Module 2	Symmetric Encryption Algorithm	Assignment	Analysis of solutions	9 Sessions			
Overview of Public Key Cryptography, RSA, Diffie-Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Ei-gamal Encryption, Elliptic curve cryptography overview.							
Module 3	Public Key Cryptography	Assignments	Analysis of solutions	9 Sessions			
Overview of Public Key Cryptography, RSA, Diffie-Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Ei-gamal Encryption, Elliptic curve cryptography overview							
Module 4	Network Security	Assignment	Analysis of solutions	05 Sessions			

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Topics:

Network Security fundamentals, Network Security applications: Authentication: Kerberos, PKI, Network Security applications: e-mail security: PGP, MIME, Network Security applications: IP Security: IPSec architecture, Network Security applications: DNS Security.

Targeted Application & Tools that can be used:

Students get the knowledge about cryptography techniques followed, the algorithms used for encryption and decryptions & the techniques for authentication and confidentiality of messages.

Text Book(s):

T1 William Stallings, "Cryptography and Network Security - Principles and Practices", 7th Edition, Pearson publication, ISBN: 978-93-325-8522-5, 2017

Reference(s):

R1 Bruice Schneier, "Applied Cryptography – Protocols, Algorithms and Source code in C", Second Edition, Wiley

Publication, ISBN: 978-81-265-1368-0, 2017

R2 Cryptography and Network Security, Express Learning, ITL Education Solution Limited.

R3 e-pg pathshala UGC lecture series

Web references:
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&site =ehost-live

https://nptel.ac.in/courses/106105031.

Topics relevant to "Skill Development": Topics relevant to "Skill Development":

1. Play-fair and Hill Cipher

2. Euclidean and Extended Euclidean Algorithm

3. Secure Hash Algorithm

4. Diffie-Helman Key exchange

5. Totient Function.

6. Fermat's little theorem

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY GROUP
OVER
40
YEARS
OF ACADEMIC
WISDOM

Course Code: CIT2501	Course Title: Wireless Communication in IOT			
		L- T-P- C	3-0-0-3	
Version No.	1.2			
Course Pre-requisites	CSE2251			
Anti-requisites	NIL			
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: 1] **Describe** the basic components of a wireless communication, their protocols [Comprehension] 2] **Apply** appropriate communication technique based on IEEE 802.11 standard [Application]. 3] **Explain** the architecture, functioning, protocols, capabilities and application of various wireless communication networks [Comprehension].			
Course Content:				
Module 1	erview of Wireless Sensor Networks	ignment	alysis- various sensors and pin configuration	8 Classes

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	based Wireless communication Architecture	ignment	alysis –suitable wireless architecture	10 Classes

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	reless Communication	e Study	alysis – IOT protocols for adhoc applications	10 Classes

Protocols in IOT				

Topics:

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, integration of sensors and data processing by IoT protocols.

Module 4	reless communication technologies	ignment	e study	**8 Classes**

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 Application & Tools that can be used:

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.

Text Book

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

2. 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.

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 Title: Mobile Application for IoT	L-T-P-C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	CSE2255		
Anti-requisites	NIL		

Course Description	Mobile Application is the essential part for IoT infrastructure, which helps in understanding the architectural overview of IOT. The purposeof 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 andits motion while carrying out creative design functions.
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Mobile and Application for IoT** and attain **Skill Development** through **Participative Learning** techniques.
Course Out Comes	On successful completion of the course the students shall be able to: 1. understand the application areas of IOT 2. realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks 3. understand building blocks of Internet of Things and characteristics. 4. Learn about android application development
Course Content:	

Module 1	Overview	Assignment	Programming Task	9 Sessions

Topics:

   IoT-An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2Mand IoT Analytics, Knowledge Management

Assignment: Case study on Business processes in IoT.

Module 2	Basic Design	Assignment	Data Collection/Excel	10 Sessions

Topics:

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

Assignment: Recent trends In mobile application development

Module 3	IOT mobile apps	Assignment	Programming/Data analysistask	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 forIoT mobile apps IoT App Design Solutions

Assignment: Challenges faced during mobile application development

Module 4	TECHNOLOGY I-ANDROID	Assignment	Programming/Data analysistask	10 Sessions

Topics:

 Introduction Establishing the development environment Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment Interaction with server side applications Using Google Maps, GPS and Wifi Integration with social media applications.

Targeted Protocols & Tools that can be used:
Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread

Text Book
T1: "From machine to machine to the internet of things: Introduction to the new age of intelligence",1st edition, Academic press, 2014. T2: Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

References
R1: Bernd Scholz- -3-642-19156-5 e-ISBN 978-3- 642-19157-2, Springer R2: Andrea Goldsmith, "Android in practice," Cambridge University Press, 2005 **Weblinks:** W1: https://relevant.software/blog/mobile-iot-apps/ W2: https://medium.com/@its.mattfitzgerald/top-14-iot-mobile-app-development-trends-to-expect-in-2020-7fd7718155dc W3:https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2Flogin.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.

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Course Code: CIT2505	Course Title: Mobile Application for IoT Lab	L-T- P- C	0	0	2	1
Version No.	1					
Course Pre-requisites	CSE2255					
Anti-requisites	Nil					
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 Out Comes	**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. CO2: Demonstrate use of Mobile interface IoT devices for simple application CO3: Compare and contrast the deployment of smart objects and the technologies to connect them to network. CO3: Illustrate different sensor technologies for sensing real world entities and identify the applications of mobile interface IoT in Industry					
Course Content:						

Targeted Application & Tools that can be used:
- **Android IDE** (Emb C)
- **NodeMCU / ESP32 / Arduino**
- **Firebase / ThingSpeak / Blynk / MQTT Broker**
- **IoT Sensors** (DHT11, PIR, LDR, Gas, etc.)
- **Bluetooth Module** (HC-05), Wi-Fi modules

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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)]

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 Edition, Pearson Education (CiscoPress 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

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Course Code: CSE2269	Course Title: Operating Systems		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 concepts of operating system operations, operating system structure and its design and implementation. It covers the classical operating systems internal algorithms such as process scheduling, synchronization, deadlocks detection and recovery and memory management. The course also enhances the problem solving, systems programming ability and case studies.						
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain **Employability** through **Problem Solving** Methodologies.						
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe the fundamental concepts of operating Systems and case studies. **[Knowledge]** 2] Demonstrate various CPU scheduling algorithms. .[**Application**] 3] Apply various tools to handle synchronization problems.[**Application**] 4] Demonstrate deadlock detection and recovery methods **[Application]** 5] Illustrate various memory management techniques.[**Application**]						
Course Content:							

Module 1	Introduction to Operating System	Assignment	Programming	**9 Hours**

Topics:
Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system

Module 2	Process Management	Assignment/Case Study	Programming/Simulation	**11 Hours**

Topics:
Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.

Module 3	Process Synchronization and Deadlocks	Assignment	Programming	**11 Hours**

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

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

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

Targeted Application:

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

Software Tools:

    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.

Project work/Assignment

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

Text Book

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

References

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

E-resources/Weblinks

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

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Course Code: CSE2270	Course Title: Operating Systems Lab	L-T- P- C	0	0	2	1
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	**NIL**					
Course Description	This laboratory course provides hands-on experience with the core concepts of operating systems through practical assignments, simulations, and case studies. It covers foundational aspects such as system calls, process and thread management, inter-process communication, synchronization, deadlocks, memory management, and file systems. Students will implement and simulate real-time OS components and scheduling algorithms, fostering deeper understanding of OS architecture and design. The lab also introduces modern OS tools, programming interfaces, and the basics of open-source OS environments.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain **Employability** through **Problem Solving** Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Demonstrate system-level programming using system calls and OS structures. [**Apply**] 2] Simulate process scheduling and multithreading techniques. [**Apply**] 3] Apply various tools to handle synchronization problems using semaphores and shared memory. [**Apply**] 4] Demonstrate memory management and file system concepts using simulation or scripting. [**Apply]**					
Course Content:						

Targeted Application:
Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.
 Software Tools:
   Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS.

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

of Laboratory Tasks:

sheet -1

  L1: Write a program to demonstrate the use of fork() and exec() system calls in process creation.

  L2: A system has limited memory and high-priority real-time processes. Design a scheduling algorithm that ensures responsiveness while preventing starvation.

sheet -2

  L1: Implement First-Come-First-Serve (FCFS) process scheduling using C or Python.

  L2: You are designing a server that handles thousands of client connections. Compare

sheet -3

L1: Implement Round Robin Scheduling with a fixed time quantum.

L2: In a banking system, concurrent access to accounts leads to data corruption. Design a synchronization solution to avoid race conditions.

sheet -4

L1: Write a program to create threads using Pthreads or Python's threading module.

L2: You're tasked with building a file access tracker in an OS. Implement a system to log file access patterns and identify frequent accesses.

sheet -5

L1: Demonstrate inter-process communication (IPC) using pipes.

L2: A simulation tool needs to emulate process suspension and resumption. Design and implement such a mechanism using signals or condition variables.

sheet -6

L1: Simulate the Producer-Consumer problem using semaphores.

L2: You're developing a system where sensor devices (producers) generate temperature readings, and data processors (consumers) store and process these readings. To prevent race conditions and ensure buffer safety, implement a synchronization mechanism using semaphores.

sheet -7

L1: Implement Dining Philosophers Problem using threads and synchronization.

L2: In a multi-threaded cafeteria simulation, five philosophers sit around a circular table, each alternating between thinking and eating. To eat, a philosopher must hold two forks (represented by shared resources). Your task is to avoid deadlock and ensure no philosopher starves using thread synchronization techniques.

sheet -8

L1: Write a program to simulate First Fit, Best Fit, and Worst Fit memory allocation strategies.

L2: A system with limited memory blocks needs to allocate memory to processes arriving with various size requests. Your task is to implement three classic memory allocation strategies—First Fit, Best Fit, and Worst Fit—to allocate memory to each process efficiently. Simulate and compare how memory gets allocated in each strateg

sheet -9

L1: Demonstrate paging using a simple page table simulation.

L2: A program has a logical address space divided into pages. The system's memory is divided into equal-sized frames. When a program executes, its pages are loaded into available frames in main memory. Simulate the address translation process using a page table and demonstrate

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how a logical address is converted to a physical address.

sheet -10

L1: Write a program to simulate page replacement algorithms like FIFO and LRU.

L2: In a virtual memory system, a process accesses pages in a specific order. The memory can only hold a limited number of pages (frames). When a page is needed and the memory is full, a page replacement algorithm is used to decide which page to evict. Simulate and compare FIFO and LRU algorithms for a given page reference string.

sheet -11

L1: Simulate file directory structure (single level/two level).

L2: A university campus computer lab has limited memory space available for each student login session. When students open files or run programs, memory pages are loaded into available memory frames. Due to the limited number of frames, some pages must be replaced when new ones are needed. The lab system uses page replacement algorithms to decide which pages to evict when memory is full..

sheet -12

L1: Write a shell script to demonstrate file handling commands in Linux.

L2: Design a command-line mini shell that can run background and foreground processes and handle basic built-in commands like cd, pwd, exit.

Project work/Assignment

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

Text Book

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

References

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

E-resources/Weblinks

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

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Course Code: CIT2400	Course Title: Cyber-Physical Systems		L- P- T-C	3	0	0	3

Version No.	
Course Pre-requisites	Nil
Anti-requisites	NIL
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 Outcomes	On successful completion of this course the students shall be able to: 1. Describe the need and purpose of the different components of Cyber Physical Systems. (Understand). 2. Scribe the ability to interact with Cyber Physical System (Understand). 3. Demonstrate a new system and with which a product can be made. (Apply). 4. Classify common methods used to secure cyber-physical systems. (Understand)

Course Content:

Module 1	Introduction	Assignment		12 Sessions

Topics:

Sensors and Actuators, Embedded Processors and Memory Models, Input/Output and Device Interfaces, Finite State Machines in Hardware, Hybrid Systems: Modal Models, Concurrency Models: Synchronous-Reactive, Timed, Dataflow, Hierarchical State Machines, Multitasking and Threads, Message Passing and Synchronization, Deadlocks and Race Conditions, Timed Automata, Design Case Study

Module 2	undations of CPS	signment		Sessions

Topics:

Introduction to Cyber-Physical Systems (CPS), CPS Characteristics and Applications, Reactive Systems and Concurrency, Synchronous Models: Components, Inputs/Outputs, Extended State Machines, Finite-State and Nondeterministic Systems, Composition of Components, Modeling Behaviors: Traces and Execution, Continuous-Time Models & Newtonian Mechanics, Linear and Non-linear Dynamics, Overview of Model-Based Design

Module 3	Scheduling, Real-Time Systems, and Verification	Assignment		12 Sessions

Topics:

Real-Time Constraints and Requirements, Periodic Job Models, Rate Monotonic Scheduling, Earliest Deadline First Scheduling, Multiprocessor Scheduling, Mutual Exclusion and Resource Sharing, Temporal Logic (LTL), Safety and

	Invariant Properties, Model Checking (Reachability & Liveness), Symbolic Techniques & BDDs, Formal Verification Tools Overview				
Module-4	**Applications**	Assignm ent		**10 Sessions**	

Topics:

Hybrid Systems and Zeno Behavior, Stability and Controller Design, Feedback and PID Controllers, Simulation and Numerical Methods, Distributed Coordination and Consensus, Leader Election and Reliable Messaging, CPS Security Principles, Software and Network Security in CPS, Fault Tolerance and Robustness, Case Study: Automotive or Medical CPS

Project work/Assignment:

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

REFERENCE MATERIALS:
TEXTBOOKS
 1. Rajeev Alur, "Principles of Cyber Physical Systems", MIT Press, 2023, ISBN: 9780262548922
 2. 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
REFERENCES

 1. Pedro H. J. Nardelli, "Cyber-physical Systems: Theory, Methodology, and Applications", wiley publications, 2022,
JOURNALS/MAGAZINES
 I. IEEE Transactions on Industrial Cyber-Physical Systems

 https://www.ieee-ies.org/pubs/transactions-on-industrial-cyberphysical-systems
 II. ACM Transactions on Cyber-Physical Systems

 https://dl.acm.org/journal/tcps
 III. 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:**CSE7000**	**Course Title: Internship****Type of Course:**	**L- T-P- C**	-	-	-	2
Version No.	1.0					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					

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Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate)

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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.					
	CO2] **Apply** the concepts in problem solving (Bloom's taxonomy Level 3)					
	CO3] **Analyze** and structure the reasoning techniques and spatial visualization skills					

Course Content:

Module 1	Logical Thinking	Assignment		**16 Hours**
	Topics:			
	Syllogisms, Cubes and Dices, Mirror and Water images, Paper cutting and Folding, Embedded figures & Completion of figures, Data Interpretation, Data sufficiency			
Module 2	Critical Thinking	Assignment		**14 Hours**
	Topics:			
	Analogy, Symbol and Notations, Statement and assumption, Cause of action, Statement and conclusion, Puzzles			
	Targeted Application & Tools that can be used:			
	Application area: Placement activities and Competitive examinations.			
	Tools: LMS			
Evaluation	**Continuous Evaluation**			
	· Topic wise evaluation			

	· Internal Assessments
	Text Book
	1. A new approach to reasoning verbal, non-verbal & analytical by BS Sijwali
	2. R S Aggarwal
	3. Kiran publications
	References
	1. www.indiabix.com
	2. www.testbook.com
	3. www.youtube.com/c/TheAptitudeGuy/videos
	Topics relevant to Skill Development Logical reasoning and Critical thinking for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

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Course Code: CSE2271	Course Title: Software Design and Development	L-T- P- C	3-0-0-3
Version No.	1.0		
Course Pre-requisites	NIL		
Anti-requisites	NIL		
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.		
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.		
Course Out Comes	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)		

Module 1	Introduction to Software Engineering and Process Models (Knowledge level)	Quiz		10 Hours

Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle
Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model- Spiral, Prototype.

Module 2	Software Requirements, Analysis and Design (Comprehension level)	Assignment	Development of SRS documents for a given scenario	12 Hours

Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment.
Design: Design concepts, Architectural design, Component based design, User interface design.

Module 3	Agile Principles & Devops (Knowledge level)	Quiz		10 Hours

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Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method.

Devops: Introduction, definition, history, tools.

Module 4	Software Testing and Maintenance (Application Level)	Assignment	Apply the testing concepts using Programing	13 Hours

Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.

Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).

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

Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools

Text Book

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, McGraw-Hill, 7.

2. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, McGraw-Hill, 8.

References

1. Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private limited, 2015.
2. Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011.
3. Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002

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

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Course Code: CIT2504	Course Title: AI and Deep Learning for IoT					
		L-T-P-C	3	0	0	3

Version No.	
Course Pre-requisites	CSE2264
Anti-requisites	
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 Out Comes	On successful completion of the course the students shall be able to: 1 Understand the concepts of AIoT and their significance in modern industries. 2. Apply techniques to connect mobile devices to IoT gateways, bridging the gap between different networks. 3. Analyze sensor technologies in IoT and their academic foundations to showcase practical understanding. 4. Develop and Evaluate AIoT applications to address real-world challenges.
urse Content	

Module 1	roduction to Artificial Intelligence and Internet of Things (AIoT)	Assignment	Problem Solving	2 Classes

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	Problem Solving	Classes

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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 mobileto-IoT connections.

Module 3	Sensor Technologies and Academic Concepts	Assignment	Problem Solving	Classes

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	Classes

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 Application & Tools that can be used:

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

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.

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Course Code: CIT2502	Course Title: Privacy and Security in IoT		L- T-P- C	3-0-0-3
Version No.	1.0			
Course Pre-requisites	CSE2502			
Anti-requisites	NIL			
Course Description	The purpose of this course is to enable the students to appreciate the need for cryptography and to identify the applications of cryptography in Internet of Things (IoT). The course is both conceptual and analytical in nature and needs fair knowledge of mathematics and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in IoT and attain Skill Development through Problem Solving Methodologies.			
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. **Explain** benefits of modern cryptographic algorithms 2. **Apply** the Elliptic curve Diffie Hellman and digital signature algorithms to encrypt-decrypt , generate and verify the signatures 3. **Estimate** the performance of ECC with other traditional cryptography algorithms.			
Course Content:				
Module 1	Introduction to Elliptic Curves	Quiz	Comprehension based Quizzesand assignments;	**15 Classes**
Topics: **Elliptic Curve Cryptosystems (ECC):** Introduction to ECC, Method of Diophantus, Elliptic curves in Cryptography, Discrete Logarithms in Finite Fields, Elliptic Curve on a finite set of Integers, Definition of Elliptic curves,Genera form of a EC, Weierstrass Equation, Points on the Elliptic Curve (EC),The Abelian Group, Operations on ECC- Point addition, Point doubling.				
Module 2	Elliptic Curve Cryptosystems	Quizzes and assignments	Comprehension based Quizzes and assignments;	**15 Classes**
Topics: E**lliptic Curve Cryptosystems (ECC):** Public-Key Cryptosystems, Public-Key Cryptography, What Is Elliptic Curve Cryptography (ECC)?,Using Elliptic Curves In Cryptography, Generic Procedures of ECC, Example – Elliptic Curve Cryptosystem Analog to El Gamal, Diffie-Hellman (DH) Key Exchange, ECC Diffie-Hellman, Example – Elliptic Curve Diffie-Hellman Exchange, Elliptic Curve Digital Signature Algorithm (ECDSA) Why use ECC?, Security of ECC, Applications of ECC, Benefits of ECC.				
Module 3	IOT Protocols	Assignment and Labprojects with presentation	Project implementations insoftware, batch wise presentations	**10 Classes**

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Topics:
IoT Communication model and Protocols :   Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (COAP), Advanced Message Queuing Protocol (AMQP), Extensible Messaging andPresence Protocol (XMPP), Introduction, Principle of RFID, Components of an RFID system.
Targeted Application & Tools that can be used: Application areas are to secure crypto currency- Bitcoin, Ethereum and Ripple using ECC in key agreement, digital signatures.   Professionally Used Software: elliptic2   : https://www.graui.de/code/elliptic2/
Project work/Assignment:
Each batch of students (self-selected batch mates) will identify projects from searching on Google, and implement with the most suitable 2 or 3 NIST /SECP curves   Project Assignment: Assignment: 1] Collect the running time of ECC on different standard NIST curves.   Assignment 2: Prepare a compressive report on the efficiency of NIST Vs SECP curves.

Textbook(s):
    1. I. Blake, G. Seroussi, N. Smart, Elliptic Curves in Cryptography , Cambridge University 2020
    2. Arshdeep Bagha, Vijay Madisetti, "Internet of Things - A hands on approach", Universities Press, 2021.

References
    1. Joseph H Silver man The Arithmetic of Elliptic Curves: Springer; 2nd Edition April 2016
    2. Darrel Hankerson, Scott Vanstone, Alfred J. Menezes Guide to Elliptic Curve Cryptography Springer 2018

Topics related to development of "SKILL DEVELOPMENT": IOT Protocols, Elliptic Curve Cryptosystem, for Skill Development through Participative Learning Techniques. This is attained through assessment components as mentioned in the course handout.

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Course Code: CSE2274	**Course Title:** Competitive Programming and Problem Solving	L-T-P-C	0	0	4	2
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	**NIL**					
Course Description	The **Competitive Programming and Problem Solving** course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Competitive Programming and Problem Solving** and attain **Skill Development** through **Experiential Learning** techniques.					

Module 1: Introduction to Competitive Programming

Overview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL

Module 2: Number Theory for Problem-Solving

Use of Number Theory for problem-solving: reducing time/space complexity of brute force coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding for Permutation Combination; XORing based and pattern-based solutions.

Module 3: Optimizing Time & Space Using Sequential Storage

Coding for Optimizing time and Space using Sequential Storage: two pointer approach; problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string matching algorithms; Kadane's algo, stacks, priority-queues and hashing based efficient coding; median based problems and alternate solutions.

Module 4: Non-Linear Data Structures

Applying Non-Linear Data Structures for real-life problems: design of efficient solutions for problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path algos for CP problems with reduced time/space complexity.

Module 5: Problem Solving using Advanced Topics

CP Problem Solving using Advanced Topics: concept of disjoint sets and their efficient representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and applying them for CP problems using bottom-up dynamic programming.

List of Laboratory Tasks:

1. You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.

2. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.

3. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).

4. The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.

5. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.

6. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.

7. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.

8. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary

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exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.

9. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.

10. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics (permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.

11. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).

12. In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.

13. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.

14. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.

15. Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).

16. Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.

17. An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.

18. The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.

19. A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).

20. In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). **Focus:** Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.

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21.   A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).

22.   Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. **Focus:** Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.

23.   An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.

24.   Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.

25.   In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. **Focus:** Disjoint set union (DSU) data structure, basic connectivity checks.

26.   Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.

27.   A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. **Focus:** Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.

28.   In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.

 Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.

29.   In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.

30.   In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. **Focus:** Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

Targeted Application & Tools that can be used:

1.   C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).

2.   IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.

3.   Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions.

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4. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.

5. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).

6. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.

7. **String Libraries:** Familiarize students with the string manipulation functions available in C++.

8. **Graph Visualization Tools:** Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.

9. **DP Debugging Techniques:** Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.

Text Books:

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

Reference Books:

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

Web Resources

1. https://nptel.ac.in/courses/106106231
2.

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

Assessment Type

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)
- Quiz
- End Term Exam
- Self-Learning

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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 CO2] **Identify** the principle concept needed in a question CO3] **Solve** the quantitative and logical ability questions with the appropriate concept.					
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						

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Text Book
1. Fast track objective by Rajesh Verma
2. R S Aggarwal
3. S.P Bakshi

References
1. www.indiabix.com
2. www.testbook.com
3. 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.

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Course Code: PPS 3018	Course Title: Preparedness for Interview Type of Course: Practical Only Course		L- T- P- C	0	0	2	1
Version No.		1.0					
Course Pre-requisites		Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.					
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 Out Comes		On successful completion of this course the students shall be able to: CO1: Develop professional Resumes CO2: Illustrate Resumes effectively CO3: Apply skills and knowledge learnt for active and effective Group Discussions and Interview					
Course Content:							

Module 1	Resume Building	Classroom activity		10 Hours
	Topics: Resume structure, use of templates, Do's and Don'ts, ATS methods, Cover Letter and Video Resume **Activity:** Real world scenarios			

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Module 2	**Group Discussion**	**Mock G D**		9 Hours
	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 Hours
	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 Hours
	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** Techniques. This is attained through assessment Component mentioned in course handout.			

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Course Code: CSE7100	Course Title: Mini Project Type of Course:	L- T-P- C	0	0	0	4
Version No.	1.0					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify the engineering problems related to local, regional, national or global needs. (Understand) 2. Apply appropriate techniques or modern tools for solving the intended problem. (Apply) 3. Design the experiments as per the standards and specifications. (Analyze) 4. Interpret the events and results for meaningful conclusions. (Evaluate) 5. Appraise project findings and communicate effectively through scholarly publications. (Create)					

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Course Code: CSE7300	Course Title: Capstone Project Type of Course:	L- T-P- C	0	0	0	10

Version No.	1.0
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**
Anti-requisites	**NIL**
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify problems based on societal /research needs. (Understand) 2. Apply Knowledge and skill to solve societal problems in a group. (Apply) 3. Develop interpersonal skills to work as member of a group or leader. (Apply) 4. Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) 5. Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) 6. Improve in written and oral communication. (Create) 7. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)

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Course Code: CIT2508	Course Title: Wireless Sensor Networks (WSN) & IoT Standards	L-T- P- C	3	0	0	3
Version No.						
Course Pre-requisites	CSE2251					
Anti-requisites						
Course Description	This course provides an in-depth understanding of Wireless Sensor Networks (WSNs) and the evolving standards that govern the Internet of Things (IoT). It explores the architecture, protocols, and communication mechanisms of WSNs, emphasizing energy efficiency, scalability, and data-centric design. The course also delves into IoT architecture, protocols such as MQTT, CoAP, and 6LoWPAN, and standardization efforts led by bodies like IEEE, IETF, and oneM2M. Emphasis is placed on real-world applications, interoperability challenges, and security and privacy concerns in sensor and IoT systems. Students will gain the knowledge and skills required to design, evaluate, and deploy WSN and IoT solutions in practical environments.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Wireless Sensor Networks & IoT Standards attain Skill Development through Participative Learning techniques					
Course Out Comes	CO1: Understand the architecture and functioning of wireless sensor networks. CO2: Analyze and apply various protocols in WSN based on application requirements. CO3: Comprehend the structure and working of IoT systems and protocols. CO4: Evaluate IoT communication technologies and interoperability issues.					
Course Content:						
Module 1	Introduction to Wireless Sensor Networks			13 sessions		
Overview of Wireless Sensor Networks, Applications and challenges in WSN, Sensor node architecture and design, Network architectures: flat, hierarchical, and cluster-based, WSN communication protocols overview						
Module 2	MAC & Routing Protocols for WSN			12 sessions		
MAC protocols: S-MAC, T-MAC, B-MAC, Energy-efficient communication, Routing techniques: Flooding, Gossiping, LEACH, PEGASIS, Data-centric and geographic routing, Transport protocols for WSNs						
Module 3	IoT Fundamentals			9 Session		

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Introduction to IoT, IoT reference architecture (three-layer, five-layer models), Sensing, Actuation, and Communication technologies, IoT devices and gateways, Applications of IoT in smart cities, healthcare, agriculture, Role of WSN in IoT ecosystems, hardware platforms: Arduino, Raspberry Pi

Module 4	IoT Communication & Networking Standards			11 Sessions

M2M Communication, Protocols: MQTT, CoAP, 6LoWPAN, XMPP, AMQP, IEEE 802.15.4, ZigBee, BLE, LoRa, NB-IoT, IPv6 addressing in IoT, Edge and Fog computing in IoT networks

Text Book

T1: Kazem Sohraby, Daniel Minoli, Taieb Znati, *Wireless Sensor Networks: Technology, Protocols, and Applications*, Wiley, 2007.
T2: Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Universities Press, 2015.
T3: Adrian McEwen and Hakim Cassimally, *Designing the Internet of Things*, Wiley, 2013.

Reference Books:
1. "Protocols and Architectures for Wireless Sensor Networks" – Holger Karl, Andreas Willig

2. "Architecting the Internet of Things" – Dieter Uckelmann et al.

3. IETF and IEEE standard documents (6LoWPAN, RPL, CoAP)

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

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: 1. Understand how the IoT is different from traditional systems. 2. Demonstrate the revolution of internet in mobile and cloud. 3. Examine the architecture and operation of IoT. 4. Explore various tools and programming paradigms for IoT applications.							
Course Content								
Module 1	Design Principles of IoT and Prototyping the Embedded Devices for IoT	Assignment	Problem Solving	12 Classes				

Design Principles of IoT: Design principles of connected devices, data acquiring organizing and analytics in IoT, system architecture of IoT.
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 Classes

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 Classes

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 IoT physical Devices	Assignment	Problem Solving	11 Classes

Tools for IoT: Introduction, chef puppet, NETCONF - YANG case studies. **IoT physical Devices:** Basic building blocks of an IoT device and endpoints, family of pIoT devices, pcDuino, Beagle bone black,

7

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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 t**echniques. This is attained through the assessment component mentioned in the course handout.

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Course Code: CIT3401	Course Title: Intelligent Sensor and System		L-T-P-C	3	0	0	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						
Course Out Comes	On successful completion of the course the students shall be able to: 1. Analyze the sensors available in IoT based on application requirements and the Sensing methods. 2. Create a Real-time application by choosing appropriate sensors for temperature monitoring. 3. Interfacing different types of Sensors with MCU. 4. Infer Wireless Sensing, RF Sensing and RF MEMS.						
Course Content							
Module 1	Basics of Sensors and Application Specific Sensors	Assignment	Problem Solving		**12 Classes**		
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 – photoresistorCCD and CMOS image sensors, Temperature Sensors: thermos-resistive sensors – thermoelectric contact sensor.							
Module 2	Sensor with Microcontroller	Assignment	Problem Solving		**11 Classes**		
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.							
Module 3	Wireless Sensing	Assignment	Problem Solving		**12 Classes**		
Wireless Sensing: Wireless Data and Communications, Wireless Sensing Networks, Industrial Wireless Sensing Networks, RF Sensing, Telemetry, RF MEMS, Complete System Consideration.							
Module 4	Smart Applications and System	Assignment	Problem Solving		**10 Classes**		

Requirements				

Smart Applications and System Requirements: Automotive Applications, Industrial (Robotic) Applications, Consumer Applications, Future Sensor Plus Semiconductor Capabilities, Future System Requirements.

Targeted Application & Tools that can be used:

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 t**echniques. This is attained through the assessment component mentioned in the course handout.

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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, M QTT, 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: 1. Comprehend the essentials of IoT and its applications 2. Explain the concepts of IoT Architecture Reference model and IoT Reference Architecture 3. Analyse various IoT Application layer Protocols. 4. Apply IP based protocols for IoT based systems.						
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 Book
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: CIT3405	Course Title: Edge and Fog Computing for IoT					
		L-T-P-C	3	0	0	3
Version No.						
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: 1. Explore technologies behind the communication and management of fogs and edge resources. 2. Learn the techniques for storage and computation in fogs, edges, 5G and clouds.					

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	3. Implement Internet of Everything (IoE) applications through fog computing architecture and use optimization techniques for the same. 4. Analyze the performance and issues of the applications developed using fog and edge architecture.			
Course Content				
Module 1	Internet of Things (IoT) and New Computing Paradigms and Challenges in Federating Edge Resources	Assignment	Problem Solving	**12 Classes**
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 Classes**
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 Classes**
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 Classes**
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				

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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 t**echniques. 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: 1. To learn the internal architecture and programming of an embedded processor. 2. To introduce interfacing I/O devices to the processor. 3. To introduce the evolution of the Internet of Things (IoT). 4. To build a small low-cost embedded and IoT system using Arduino/RaspberryPi/ openplatform.						
Course Content							
Module 1	8-BIT EMBEDDED PROCESSOR and EMBEDDED C PROGRAMMING	Assignment	Problem Solving			**10 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	10 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	06 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	04 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
1. **Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin D. McKinlay** – *The 8051 Microcontroller and Embedded Systems Using Assembly and C* (2nd Edition, Pearson)
2. **Raj Kamal** – *Internet of Things: Architecture and Design Principles* (McGraw Hill)
3. **Jonathan Valvano** – *Embedded Systems: Introduction to ARM Cortex-M Microcontrollers* (CreateSpace)
4. **Michael Margolis** – *Arduino Cookbook* (O'Reilly Media)
5. **Simon Monk** – *Programming the Raspberry Pi: Getting Started with Python* (McGraw Hill)

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.

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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.						
Course Objective	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.						
Course Out Comes	On successful completion of the course the students shall be able to: 1. Understand the basic concepts, principles and challenges in IoT. 2. Describe the functioning of hardware devices and sensors used for IoT. 3. Analyze network communication aspects and protocols used in IoT. 4. Apply IoT for developing real life applications using Arduino programming.						
Course Content							
Module 1	Introduction to Internet of Things (IoT) and Hardware for IoT	Assignment	Problem Solving			11 Classes	
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							
Module 2	IoT Protocols and Arduino Programming	Assignment	Problem Solving			11 Classes	
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							
Module 3	IoT Data Management and Analytics	Assignment	Problem Solving			12 Classes	

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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

Module 4	Challenges in IoT Design challenges	Assignment	Problem Solving	11 Classes

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.

Targeted Application & Tools that can be used:

Text Book

1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", willey.

References

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: 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						

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	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: 1. Understand the fundamental concepts of IoT and how sensors and actuators work with Arduino. 2. Understand cloud computing and how to manage, store, and process data on cloud platforms. 3.Work with major cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform. 4. Understand the core architecture of AWS and its services such as Lambda, EC2, and S3 for building and scaling cloud-based IoT applications.
Course Content	

Module 1	Introduction of IoT	Assignment	Problem Solving	**12 Classes**

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 Classes**

Updation in IoT Systems Basic Networking with ESP8266 WiFi 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 Classes**

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 Classes**

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
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. 2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. 3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

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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 t**echniques. 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: 1. Understand the fundamentals of IoT Analytics and Challenges 2. Understand and analyze IoT Devices and Networking Protocols 3. Understand exploring and visualizing data 4.Apply IoT Analytics for the Cloud					
Course Content						
Module 1	Defining IoT Analytics and Challenges and IoT Devices and Networking Protocols	Assignment	Problem Solving			**12 Classes**

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.

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Module 2	Exploring IoT Data	Assignment	Problem Solving	12 Classes

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 Classes

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 Classes

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 t**echniques. This is attained through the assessment component mentioned in the course handout.

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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.							
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: 1. Enumerate different communication technologies used in Industry 4.0. 2. Perform edge, and cloud computing and visualize the data 3. Introduce the concept of Digital Twins in manufacturing the industry 4. Design Digital Twins for discrete and process industries						
Course Content							
Module 1	Introduction	Assignment	Problem Solving			**12 Classes**	
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 Classes**	
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 Classes**	
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 Classes**	
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							

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Twins of a plant, Digital Thread in Process Industry.

Targeted Application & Tools that can be used:

Text Book
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.						
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: 1. Understand IoT ecosystem in robotic paradigm 2. Analyze IoT infrastructure and develop IoRT applications 3. Apply IoT in robotics over different platforms 4. Implement Cloud robotics in automations					

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Course Content				
Module 1	Introduction to IoT and Vision systems and Robotic Sensors	Assignment	Problem Solving	**12 Classes**

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 Classes**

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 Classes**

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 Classes**

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 Book
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 t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3410	Course Title: SecureIoT Type of Course: Theory		L-T-P-C	3	0	0	3
Version No.							
Course Pre-requisites	CSE2502						
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: 1. Identify different Internet of Things technologies and their applications. 2. Assess the need for Privacy and security model for the Internet of Things. 3. Explore various Trust Model for IoT and customize real time data for IoT applications. 4. Design security framework and solve IoT security issues						
Course Content							
Module 1	Security in IoT and Network Robustness and Malware Propagation Control in IoT	Assignment	Problem Solving			8 Classes	

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.

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

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 Classes

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 Classes

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:

Text Book

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.

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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' <u>SKILL DEVELOPMENT</u> by using <u>EXPERIENTIAL LEARNING</u> techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Demonstrate IOT Data Analytics and machine learning application in IOT (Apply) CO2: Apply appropriate Hadoop Ecosystem tools to perform data analytics for a given problem (Apply) CO3: Explain the concepts of cloud based IOT and its environment (Understand) CO4: Discuss Strategies and Techniques in Data collection (Understand)					
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						

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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

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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.

(iii) web resources

W1. NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs92/preview

W2. Coursera: https://www.coursera.org/learn/big-data-introduction

W3. EDX: https://www.edx.org/course/big-data-fundamentals

W4. E-book Link : https://www.wiley.com /en-us/Internet+of+Things+and+ Data+ Analytics + Handbook -p-9781119173625

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

Topics relevant to "Skill Development": Organize IOT data – Linked analytics datasets – Managing data in cloud.

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Course Code: CIT3412	Course Title: IoT for healthcare and Wearable Technology Type of Course: Theory		L-T-P-C	3	0	0	3
Version No.							
Course Pre-requisites	CSE2251						
Anti-requisites	NIL						
Course Description	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						
Course Objective	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						
Course Out Comes	On successful completion of the course the students shall be able to: 1. To provide a basic understanding of evolution of IoT and its functional modules. 2. To develop skillset to implement IoT systems for wearable applications. 3. To identify the real world problem and give IoT solutions. 4. To analyse and select appropriate protocols, wireless techniques for the problem						
Course Content							
Module 1	Role of IoT in wearable devices and IoT supported technologies: Internet/Web and networking basics	Assignment	Problem Solving			12 Classes	
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 Classes	
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 Classes

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 Classes

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:

Text Book
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.						
Course Pre-requisites	CSE2251					
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					

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	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: 1. Identify the Key opportunities and benefits in Industrial IoT 2. Apply virtual network to demonstrate the use of Cloud in Industrial IoT 3. Analyze industrial IoT Three tier topology and data management system 4. Summarize Legacy Industrial and Modern Communication Protocols			
Course Content				
Module 1	Introduction	Assignment	Problem Solving	**12 Classes**
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 Classes**
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 Classes**
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 Classes**
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	CSE2251					
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: 1. Understand various energy sources, consumption patterns, and management techniques in IoT systems. 2. Analyze energy-efficient hardware and software solutions for IoT energy optimization. 3. Design and implement energy-efficient IoT solutions using renewable energy sources. 4. Evaluate real-world applications of IoT energy management in smart cities, industries, and sustainable development.					

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Course Content				
Module 1	**Energy Management Basics in IoT**	Assignment	Problem Solving	**12 Classes**
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 Classes**
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 Classes**
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 Classes**
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.				

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Course Code: CSE3426	Course Title: Front-end Full Stack Development		L- T-P- C	2	0	2	3
Version No.	1.0						
Course Pre-requisites	CSE2260						
Anti-requisites	NIL						
Course Description	This intermediate course enables students to perform front-end full stack development, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Front-end Full Stack Development** and attain **Employability Skills** through E**xperiential Learning** techniques.						
Course Outcomes	On successful completion of the course the students shall be able to: CO1. Design and develop static web pages using HTML5 elements and CSS3 [Apply] CO2.Develop responsive web pages using CSS, JavaScript and bootstrap. [Apply] CO3.Demonstrate the concepts of Angular.js to develop a web front-end. [Apply] CO4.Illustrate the concepts of React.js to develop a web front-end. [Apply]						
Course Content:							
Module 1	Introduction to web technology	Project	Programming		15Sessions [7L +8P]		
Topics: HTML5 – Syntax,Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform.							

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Module 2	Responsive web design	Project	Programming	15 Sessions [7L+8P]

Topics:

BootStrap for Responsive Web Design; JavaScript – Core syntax,JavaScript – Core syntax,HTML DOM, objects, classes,HTML DOM, objects, classes, Async; Ajax ,jQuery Introduction.

Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society.

Module 3	JavaScript Frameworks	Project	Programming	20Sessions [10L+10P]

Topics:

Setting up Development & Build Environment: Node.js and NPM; Introduction to TypeScript;

Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications;Components& Databinding in Depth; Angular Directives; Using Services & Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication & Route Protection; Dynamic Components;Angular Modules & Optimizing Angular Apps;AngularAnimations;Adding Offline Capabilities with Service Workers; React.js ; Developing single page application

Assignment: Develop a software tool to do inventory management in a warehouse.

Module 4	Fundamentals of DevOps and Project Management	Project	Programming	10 Sessions [6L+4P]

Topics:

Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals;DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes. Review of GIT source control. Deploying an Angular/React App; Unit Testing in Angular Apps (Jasmine, Karma).

Assignment: Develop a web-based application to book movies/events (like bookmyshow).

List of Laboratory Tasks:(7 X 2= 14 Sessions)

Experiment No. 1: [3 + 1 Practical Sessions]

- **Level 1:** Familiarization of HTML and CSS basics.

- **Level 2:** Create an HTML webpage showcasing biodata with CSS styling.

Experiment No. 2: [3 + 1 Practical Sessions]

- **Level 1:** Design an interactive web page for a new restaurant using CSS3 features.

- **Level 2:** Create a simple web form to gather user information.

Experiment No. 3: [4 + 1 Practical Sessions]

- **Level 1:** Practice basic JavaScript exercises, including creating a canvas drawing application.

- **Level 2:** Implement JavaScript exercises for form validation.

Experiment No. 4 [3 + 1 Practical Sessions]

- **Level 1:** Create a student registration form using JavaScript.

- **Level 2:** Design an RSVP form using Bootstrap form controls.

Experiment No. 5 [3 + 1 Practical Sessions]

- **Level 1:** Create a responsive image grid using Bootstrap 5.

- **Level 2:** Write a JavaScript program using AJAX to dynamically load content and implement jQuery effects like fading.

Experiment No. 6 [3 + 1 Practical Sessions]

- **Level 1:** Create an AngularJS application module and controller in app.js.

- **Level 2:** Design an "AngularJS Solar System Explorer" for planet data visualization.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Replit

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Project work/Assignment:

1. **Problem Solving: Design of Algorithms and implementation of programs.**

2. **Programming: Implementation of given scenario using Java.**

Text Book:

T1. Fender, Young, "*Front-end Fundamentals",*Leanpub, 2015

T2. Northwood, Chris, "*The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer",*APress, 2018

References:

R1. Flanagan D S, *"Javascript : The Definitive Guide"* 7th Edition. 7th ed. O'Reilly Media; 2020.

R2. Alex Libby, Gaurav Gupta, and AsojTalesra. *"Responsive Web Design with HTML5 and CSS3 Essentials",*Packt Publishing, 2016

R3. Duckett J Ruppert G Moore J. *"Javascript&Jquery : Interactive Front-End Web Development.";* Wiley; 2014.

R4. Greg Sidelnikov, *"React.js Book_ Learning React JavaScript Library"*, 1 edition, Scratch-River Tigris LLC 2016

R5. Web Reference:
https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2

Course Code: CSE3427	Course Title: Java Full Stack Development				
		L- P- C	2	2	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	CSE2260				

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Course Description	This advanced level course enables students to perform full stack development using Java, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Outcomes	**On successful completion of the course the students shall be able to:** **1] Practice the use of Java for full stack development [Application]** **2] Show web applications using Java EE. [Application]** **3] Solve simple applications using Java Persistence and Hibernate [Application]** **4] Apply concepts of Spring to develop a Full Stack application. [Application]** **5] Employ automation tools like Maven, Selenium for Full Stack development. [Application]**
Course Content:	

Module 1	Introduction	Project	Programming	**03 Sessions**

Topics:
Review of Java; Advanced concepts of Java; Java generics; Java IO; New Features of Java. Unit Testing tools.

Module 2	Java EE Web Applications	Project	Programming	**05 Sessions**

Topics:
Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App
Assignment: Develop an application for managing HR policies of a department.

Module 3	Java Persistence using JPA and Hibernate	Project	Programming	**06 Sessions**

Topics:
Fundamentals of Java Persistence with Hibernate; JPA for Object/Relational Mapping, Querying, Caching, Performance and Concurrency; First & Second Level Caching, Batch Fetching, Optimistic Locking & Versioning; Entity Relationships, Inheritance Mapping & Polymorphic Queries; Querying database using JPQL and Criteria API (JPA)
Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society..

Module 4	Spring Core	Project	Programming	**10**

Topics:

Spring Core, Spring MVC, Spring Boot REST API; Understanding Spring Framework; Using Spring MVC; Building a Database Web App with Spring and Hibernate o Spring AOP (Aspect Oriented Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development

Assignment: Develop a software tool to do inventory management in a warehouse.

Module 5	Automation tools	Project	Programming	06 Sessions

Topics:

Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup - Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands

Assignment: Illustrate the use of automation tools in the development of a small software project.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.

Project work/Assignment:

1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using Java.**

Text Book:

   T1. Fender, Young, *"Front-end Fundamentals",* Leanpub, 2015

References

   R1. Soni, Ravi Kant. *"Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful."* , Apress, 2017.

   R2.   Mardan, Azat. *"Full   Stack   JavaScript: Learn   Backbone.js,   Node.js   and MongoDB.",* Apress, 2015

Course Code: CSE3428	Course Title: .NET Full Stack Development		L- P- C	2	2	3
Version No.	1.0					

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Course Pre-requisites	**Nil**
Anti-requisites	**CSE2260**
Course Description	This advanced level course enables students to perform full stack development using .NET, with emphasis on employability skills. The key technologies used for Full Stack development is based on either Java technology or .NET technology. In this course, the focus is on using .NET and the related technologies/tools like C#, ASP.NET, Entity Framework Core, etc. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Outcomes	**On successful completion of the course the students shall be able to:** **1] Practice the use of C# for developing a small application [Application]** **2] Show web applications using Entity Framework. [Application]** **3]Solve simple web applications that use SQL and ASP.NET [Application]** **4] Apply concepts of ASP.NET to develop a Full Stack application. [Application]**
Course Content:	

Module 1	C# Programming for Full Stack Development	Project	Programming	**10 Sessions**

Topics:
.NET Framework Fundamentals, Visual Studio IDE Fundamentals, C# Language Features, Working with arrays and collections, Working with variables, operators, and expressions, Decision and iteration statements, Managing program flow and events, Working with classes and methods, OOP concepts, Properties, Auto Implemented, Delegates, Anonymous Methods and Anonymous Types, Extension methods, Sealed Classes/Methods, Partial Classes/Methods, Asynchronous programming and threading, Data validation and working with data collections including LINQ, Handling errors and exceptions, Working with Files, Unit Testing – Nunit framework
Assignment: Develop a small application for managing library using C#.

Module 2	Entity Framework Core 2.0	Project	Programming	**06 Sessions**

Topics:
Entity Framework Core 2.0 Code First Approach; Introduction To Entity Framework and EDM; Querying the EDM; Working With Stored Procedures; Advanced Entity Framework - DbContext [EF6]; Advanced Operations; Performance Optimization; Data Access with ADO.NET
Assignment: Develop an application for managing HR policies of a department.

Module 3	ASP.NET	Project	Programming	**06 Sessions**

Topics:
ASP.NET Core, ASP.Net Core 3.1 MVC, ASP.NET Core Middleware and Request pipeline, Review of SQL using MS SQL, Working With Data In Asp.Net, Razor View Engine, State Management In Asp. Net MVC & Layouts;

Assignment: Develop a web application to mark entry/exit of guests in a building.

Module 4	ASP.NET	Project	Programming	08 Sessions

Topics:
Introduction To Models, Validations In Asp.Net MVC, Authentication and Authorization In Asp.Net MVC, Advanced Asp. Net MVC - Ajax Action Link In MVC, Advanced Asp.Net MVC - Ajax Forms In MVC, Microsoft Testing Framework – Unit Testing the .NET Application
Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: Visual Studio

Project work/Assignment:

1. **Problem Solving: Design of Algorithms and implementation of programs.**
2. **Programming: Implementation of given scenario using .NET.**

Text Book:

T1. Fender, Young, "*Front-end Fundamentals",* Leanpub, 2015

T2. Valerio De Sanctis, *"ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11"*, 4th Edition, Packt, 2021.

References

R1. Benjamin Perkins, Jon D. Reid, *"Beginning C# and .NET"*, Wiley, 2021 Reid, 2021.

R2. Piotr Gankiewicz, *"Full Stack .NET Web Development"*, Packt Publishing, 2017.

R3. Tamir Dresher, Amir Zuker, Shay Friedman, *"Hands-On Full-Stack Web Development with ASP.NET Core"*, Packt Publishing, 2018.

R4. Dustin Metzgar, *"Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core"*, Manning, 2017.

Course Code: CAI3427	Course Title: Language Models for Text Mining	L-T-P-C	2	0	2	3
Version No.	1.0					

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Course Pre-requisites	CSE2264
Anti-requisites	NIL
Course Description	This course introduces the basics of Text Mining and Natural Language Processing. The course will teach students different concepts such as text mining, NLP, Sequence Labeling, etc. Topics: Text Mining, NLP, Tokenization, Lemmatization, Stemming, One-hot encoding, Language modelling, Bag-of-words, Term-document Matrix, Cosine similarity, Viterbi Algorithm, etc.
Course Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.
Course Out Comes	On successful completion of this course the students shall be able to: 5. **Process** text data to derive information from text. [Apply] 6. **Apply** insights from textual information to real-world business. [Apply] 7. **Develop** solutions for a particular NLP problem using different machine learning and deep learning techniques. [Apply] 8. **Utilize** different NLP tools and packages. [Apply]

Course Content:

Module 1	Text Mining	Adversarial Quiz Tests	Module Tests	No. of Sessions: 09

Introduction to Text Mining. Text Mining vs. NLP. Text Mining Algorithms. Steps in Text Mining - Extraction, Preprocessing, Analysis and Evaluation. Lexical Resource Creation (NEW). Data collection. String Manipulation to Clean Data. Natural Language Processing. Research Paradigms in NLP. Sequential Data. Sequence Labeling (NEW). Viterbi Algorithm (NEW). Corpus. Building a HMM using a Corpus (NEW). Unknown word handling (NEW).

Module 2	Text Preprocessing	Adversarial Quiz Tests	Module Tests	No. of sessions: 06

Introduction to Preprocessing. Tokenization. Stop Words Removal. Lemmatization and Stemming. PoS Tagging. Integer Encoding. Padding. One-Hot Encoding.

Module 3	Text Representations	Adversarial Quiz Tests	Module Tests	No. of sessions: 08

Language Modeling. N-Gram Language Model. Bag-of-Words Model. Term-Document Matrix. Term Frequency. Inverse Document Frequency. TF-IDF. Cosine Similarity. Naive Bayes Classifier using Bag-of-Words. Topic Modeling. Latent Semantic Analysis. Singular Value Decomposition. Truncated SVD and Topic Vector. LDA Algorithm.

Module 4	Natural Language Processing with Keras	Adversarial Quiz Tests	Module Tests	No. of Sessions: 06

Word Embeddings vs. One-Hot Encoding. Contextual Bag of Words (CBOW). Skipgram. Deep Learning

for Document Classification.

List of Laboratory Tasks:

Experiment No. 1: File Handling
Level 1: Read text files using Python and extract meaningful content.
Level 2: Parse text files using Python to preprocess the data for NLP tasks.

Experiment No. 2: Introduction to NLP Tools
Level 1: Install and use NLTK for basic text processing.
Level 2: Install and use SpaCy for tokenization, PoS tagging, and Named Entity Recognition.

Experiment No. 3: Corpus Cleaning Techniques
Level 1: Use NLTK for corpus cleaning techniques such as tokenization, stopword removal, and stemming.
Level 2: Prepare cleaned text data for downstream NLP tasks like classification or translation.

Experiment No. 4: Word Vector Usage
Level 1: Download and use pre-trained word vectors (e.g., Word2Vec, GloVe, or FastText).
Level 2: Compute similarity between two words, find the most similar word, and complete word analogies (e.g., king - man + woman = queen).

Experiment No. 5 & 6: Language Identification
Level 1: Build a simple language identifier using Bag-of-Words (BoW) features.
Level 2: Predict the language of a given text using the trained model.

Experiment No. 7 & 8: Lexical Simplification
Level 1: Implement a lexical simplifier to replace complex words with simpler alternatives.
Level 2: Generate a simplified version of a given word or sentence while preserving meaning.

Experiment No. 9 & 10: Sentiment Analysis
Level 1: Implement a basic sentiment classifier using a lexicon-based or machine learning approach.
Level 2: Compare the performance of an existing sentiment classifier (e.g., VADER, TextBlob, or a pre-trained Transformer model).

Experiment No. 11: Named Entity Recognition (NER)
Level 1: Extract named entities from a text using NLTK.
Level 2: Extract named entities using SpaCy and compare results.

Experiment No. 12 & 13: Implement a Hidden Markov Model (HMM)
Level 1: Implement a generic HMM for sequence prediction.
Level 2: Calculate the forward probability of a given sequence using HMM.

Experiment No. 14: Linguistic HMM
Level 1: Develop a Hidden Markov Model (HMM) for NLP tasks such as PoS tagging.
Level 2: Evaluate the performance of the HMM on a specific NLP task (e.g., Named Entity Recognition or Chunking).

Experiment No. 15: Machine Translation
Level 1: Implement Machine Translation (MT) using a pre-trained model from Hugging Face Transformers.

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Level 2: Evaluate the quality of MT output via Round-Trip Translation (translate text to another language and back to check accuracy).

Targeted Application & Tools that can be used:
1. Google Colab 2. Python IDEs like PyCharm

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
1. Group project on some NLP Task like text classification (Creating a Simple Text Classifier: Use Scikit-learn to classify positive vs. negative reviews from a dataset), sentiment analysis, etc.

Textbook(s):
4. Daniel Jurafsky, James H. Martin. "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech, Pearson Publication, 2025 (3rd Edition Draft). 5. Aditya Joshi, Pushpak Bhattacharyya. "Natural Language Processing", Wiley Publication, 2023 (1st Edition).

References:
R1. Chris Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", 1st Edition, MIT Press. 1999. R2. Pawan Goyal. "Natural Language Processing". 1st Edition, 2016. **Weblinks** **W1**. E-Book link or R2: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view **W2**. Web Resource for T1: https://web.stanford.edu/~jurafsky/slp3/ - VERY VERY IMPORTANT!!! **W3**. NPTEL Courses: https://nptel.ac.in/courses/106106211 CMI), https://nptel.ac.in/courses/106105158 (IIT Kgp), https://nptel.ac.in/courses/106101007 (IITB), https://nptel.ac.in/courses/106105572 (IIT Kgp - NEW)

Course Code: CAI3428	**Course Title: Practical Deep Learning with TensorFlow**	**L- T-P- C**	**2**	**0**	**2**	**3**
Version No.						
Course Pre-requisites	CSE2264					
Anti-requisites	NIL					

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Course Description	This course introduces students to the concepts of deep neural networks and state of the art approaches to develop deep learning models. In this course students will be given an exposure to the details of neural networks as well as deep learning architectures and to develop end-to-end models for such tasks. It will help to design and develop an application-specific deep learning models and also provide the practical knowledge handling and analyzing end user realistic applications.			
Course Objective	This course is designed to improve the learners <u>EMPLOYABILITY SKILLS</u> by using <u>EXPERIENTIAL LEARNING</u> techniques.			
Course Outcomes	On successful completion of this course the students shall be able to: 1. Implement backpropagation and gradient descent techniques to train neural networks effectively. (Apply) 2. Build and train deep learning models using Python libraries such as TensorFlow and Keras for real-world applications. (Apply) 3. Utilize deep learning techniques for image classification, object detection, sentiment analysis, and language modeling. (Apply)			

Course Content:

Module 1	Basics of Neural Networks	Assignment		18[8L+10P] Sessions

Topics:
Understanding Perceptron with Excel, Understanding Multilayer Perceptron with Excel, From Multilayer Perceptron to Deep Learning, Error Backpropagation and Gradient Descent to reduce errors, Activation Functions, Deep Learning, Problems with Deep Learning with solutions.

Module 2	TensorFlow Basics	Assignment		14[7L+7P] Sessions

Topics:
Introduction to TensorFlow, TensorFlow dataset, Machine Learning with TensorFlow

Module 3	Deep Learning methods with Tensor Flow and Keras	Assignment		14[6L+8P] Sessions

Topics:
Main Features of TensorFlow, Keras basics, AI with Keras.

Project work/Assignment:
1. **Assignment 1 on (Module 1 and Module 2)**
2. **Assignment 2 on (Module 3)**

List of Laboratory Tasks:

Lab 1: Working with Deep Learning Frameworks

Objective: Explore various Deep Learning Frameworks
Tasks: Identify deep learning frameworks (Keras, Tensorflow, Matplotlib, etc)
Activity: Practice with various methods available in DL Frameworks to develop a Model.

Lab 2: Build a Basic Artificial Neural Network
Objective: Create a ANN with DL frameworks.
Task: Identify suitable ANN Layers using Keras and Tensorflow.
Activity: Design a basic Artificial Neural Networks using Keras with TensorFlow (pima-indians-diabetes)

Lab 3: Build a MultiLayer Perceptron
Objective: Create a MLP for classification task.
Task: Identify suitable model for house price prediction.
Activity: Design a MLP for implementing classification and fine-tuning using House price.csv

Lab 4: Create a Tensor in TensorFlow using List or Numpy array.
Objective: To understand how to create a tensor in TensorFlow using a Python list or NumPy array
Task: Create a simple tensor using both a Python list and a NumPy array in TensorFlow.
Activity: Create a tensor using a Python list and Numpy array

Lab 5: Apply math operations on tensor using various mathematical functions.
Objective: To learn how to apply mathematical operations on tensors using various TensorFlow mathematical functions.
Task: Perform basic mathematical operations (addition, subtraction, multiplication, division) and advanced functions (square, square root, exponential) on tensors.
Activity: Perform basic math operations: Add, Subtract, Multiply, Divide and Apply advanced math functions: Square, Square root, Exponential.

Lab 6: Connecting two tensors in dataset.
Objective: Combine two tensors using concatenation and stacking operations in TensorFlow.
Task: Combine two tensors using concatenation and stacking operations in TensorFlow
Activity: Concatenate them along a specific axis and Stack them along a new axis.

Lab 7: Building dataset from a file stored in a local drive
Objective: To learn how to build a dataset in TensorFlow from a file stored in a local drive.
Task: Load a dataset from a CSV file stored on the local drive and process it using TensorFlow
Activity: Load the file using TensorFlow's tf.data API and Process the dataset (e.g., convert it into tensors)

Lab 8: Loading Dataset from TensorFlow.dataset Library
Objective: To learn how to load a dataset from the tensorflow_datasets library and use it in machine learning models.
Task: Load a dataset from TensorFlow Datasets (tfds), preprocess it, and display sample data

Activity: Load a dataset (e.g., MNIST, CIFAR-10, IMDB Reviews) and Split the dataset into training and testing sets.

Lab 9: Build a Convolutional Neural Network
Objective: Create a CNN model.
Task: Build CNN architecture for Dog-Cat classification problem.
Activity: Implement a Convolution Neural Network (CNN) for dog/cat classification problem using keras.

Lab 10: **Build a Time-Series Model**
Objective: Create a RNN and LSTM Model
Task: Build RNN/LSTM Model for predicting time series data.
Activity Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes.

REFERENCE MATERIALS:

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

REFERENCES

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

JOURNALS/MAGAZINES
1. IEEE Transactions on Neural Networks and Learning Systems
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385   IEEE Transactions on Pattern Analysis and Machine Intelligence
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_papers/IT032.pdf International Journal of Intelligent Systems https://onlinelibrary.wiley.com/journal/1098111x

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

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Course Code: CAI3429	Course Title: Deep Learning Techniques for Computer Vision	L-T- P-C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	MAT2402					
Anti-requisites	NIL					
Course Description	This course covers the fundamentals and advanced concepts of deep learning for computer vision applications. Students will explore convolutional neural networks (CNNs), object detection, image segmentation, and generative models. Hands-on lab experiments will reinforce theoretical concepts using frameworks like TensorFlow and PyTorch.					
Course Out Comes	**On successful completion of the course the students shall be able to:** 1. Understand the Fundamentals of Deep Learning for Vision Explain the core concepts of neural networks and deep learning architectures for image processing. Implement and optimize convolutional neural networks (CNNs) for classification tasks. 2. Apply Object Detection and Image Segmentation Techniques Implement and analyze state-of-the-art object detection algorithms such as YOLO, Faster R-CNN, and SSD. Develop and evaluate image segmentation models like U-Net and Mask R-CNN. 3. Explore Advanced Deep Learning Techniques for Vision Utilize Vision Transformers (ViTs) and attention mechanisms for image classification. Generate and manipulate images using Generative Adversarial Networks (GANs). 4. **Deploy and Optimize Deep Learning Models for Real-World Applications**					
Course Content:						

Module 1	Fundamentals of Deep Learning for Vision	Assignment	Practical	No. of Classes:8
	Introduction to Deep Learning & Neural Networks, Convolutional Neural Networks (CNNs) Architecture Backpropagation & Optimization in CNNs, Transfer Learning & Pretrained Models.			

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dule 2	Object Detection & Image Segmentation	signment	actical	No. of Classes:14
Introduction to Object Detection (R-CNN, SSD, YOLO), Region Proposal Networks (Faster R-CNN) Semantic & Instance Segmentation (U-Net, Mask R-CNN), Real-time Object Detection Applications				
odule 3	vanced Topics in Vision	signment	actical	No. of Classes:8
Attention Mechanisms & Vision Transformers (ViTs), Generative Adversarial Networks (GANs) for Image Generation, Self-supervised Learning for Vision, Multi-modal Learning (CLIP, DALL·E)				
odule 4	plications & Deployment	signment	actical	No. of Classes:8
Edge AI & Mobile Deployment (TensorFlow Lite, ONNX), Adversarial Attacks & Robustness in Vision Models, Explainability & Interpretability of Vision Models, Case Studies & Industry Applications				

b Experiments are to be conducted on the following topics:-

Lab Sheet 1:

Keras Sequential API model

1. Read in the data and explore
2. Define a Sequential API model
3. Define the hyperparameters and optimizer
4. Train the model and visualize the history
5. Testing

Keras Functional API model:
1. Define a Functional API model
2. Train the model and visualize the history

Lab Sheet 2:
Softmax regression with Keras
1. Read in the data and prepare
2. Define a Sequential API model
3. Define the hyperparameters and optimizer
4. Train the model and visualize the history
5. Testing

Lab Sheet 3:
Convolutional Neural Network with Keras (grayscale images)
1. Read in the data:
2. Visualize the data:
3. Prepare the data:

4. Define a CNN model:
5. Define the hyperparameters and optimizer:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 4:

Convolutional Neural Network with Keras (color images):
1. Read in the data:
2. Visualize the data:
3. Prepare the data:
4. Define a CNN model:
5. Define the hyperparameters and optimizer:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 5:

Time series and prediction:
1. Read in the data and explore:
2. Apply the exponential smoothing method and predict

Recurrent neural network (RNN):
1. Pre-processing:
2. Do the necessary definitions: (Hyper parameters, Model,
3. Train the model:
4. Predict the future:

Lab Sheet 6:

Document classification with LSTM network:
1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:
5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 7:

Document classification with LSTM network (Binary):
1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:
5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 8:

Document classification with LSTM + CNN network (Binary):
1. Read in the data:
2. Explore the data:
3. Data preprocessing:

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4. Define the model:
5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 9:

Softmax regression to recognize the handswritten digits:
1. Download the MNIST data:
2. Take a look at the dataset:
3. Do the necessary definitions:
4. Training and Testing:

Multi-layer neural network to recognize the handswritten digits:
1. Download the MNIST data:
2. Take a look at the dataset:
3. Do the necessary definitions:

Training and Testing:

Lab Sheet 10:

Object Detection using YOLOv5

Lab Sheet 11:

Image Segmentation using U-Net
Custom Object Detection using Faster R-CNN

Lab Sheet 12:

Implementing Vision Transformers for Image Classification
Generating Images using GANs (DCGAN, StyleGAN)

(Group Project)

8. Object Detection and Recognition:
    a. Haar cascade object detection (e.g., face detection or object detection using pre-trained classifiers).
    b. Feature-based object detection using techniques like Speeded-Up Robust Features (SURF) or Scale-Invariant Feature Transform (SIFT).
    c. Deep learning-based object detection using Convolutional Neural Networks (CNNs) or You Only Look Once (YOLO) algorithm.
9. Optical Character Recognition (OCR):
    a. Preprocessing of text images (e.g., binarization, noise removal, or skew correction).
    b. Text localization using techniques like connected component analysis or Stroke Width Transform (SWT).
    c. Character recognition using machine learning algorithms like Support Vector Machines (SVM) or Convolutional Neural Networks (CNNs).
10. Gesture Recognition:
    a. Hand segmentation using techniques like background subtraction or skin color detection.
    b. Feature extraction from hand regions (e.g., finger counting, hand shape descriptors).
    c. Classification of gestures using machine learning algorithms (e.g., k-Nearest Neighbors or Support Vector Machines).

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Tools/Software Required :
1. OpenCV 4
2. Python 3.7
3. MATLAB

xt Books

1. "Deep Learning for Computer Vision Image Classification, Object Detection and Face Recognition in Python" **Jason Brownlee (2019)**

2. "Deep Learning for Computer Vision with python" **Adrian Rosebrock (2017)**

References

3. **Goodfellow, I., Bengio, Y., & Courville, A. (2016).** *Deep Learning.* MIT Press.

   A foundational book covering deep learning principles, including CNNs, optimization, and generative models.
4. **Raschka, S., & Mirjalili, V. (2022).** *Machine Learning with PyTorch and Scikit-Learn.* Packt Publishing.

   Covers practical deep learning techniques using PyTorch, including CNNs and transfer learning.
5. **Geron, A. (2022).** *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Edition).* O'Reilly Media.

   Provides hands-on implementations of deep learning for computer vision using TensorFlow and Keras.
6. **Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J. (2021).** *Dive into Deep Learning.* Available online (https://d2l.ai).

   Open-access book covering CNNs, object detection, and advanced vision techniques with PyTorch and TensorFlow.
7. **Chollet, F. (2021).** *Deep Learning with Python (2nd Edition).* Manning Publications.

   Explains deep learning fundamentals and applications with Keras, including image classification and segmentation.
8. **Ballé, J., Laparra, V., & Simoncelli, E. P. (2017).** *Deep Learning for Computer Vision: A Brief Introduction.*

   A concise introduction to CNNs, object detection, and generative models.