R23 ACADEMIC REGULATIONS

COURSE STRUCTURE AND SYLLABI

of

B.TECH. INFORMATION TECHNOLOGY

FOR

B.TECH. REGULAR FOUR YEAR DEGREE PROGRAM

(For the batches admitted from 2023-24)

&

B.TECH. LATERAL ENTRY PROGRAM

(For the batches admitted from 2024-25)

CHOICE BASED CREDIT SYSTEM

DEPARTMENT OF INFORMATION TECHNOLOGY

SRI VENKATESWARA COLLEGE OF ENGINEERING

(AUTONOMOUS)

(Affiliated to J.N.T. University Anantapur, Ananthapuramu, Accredited by NBA & NAAC "A")

Karakambadi Road, Tirupati - 517 507

VISION

To be a centre of excellence focusing on high quality technical education, research and technical services with global leadership competence to succeed in employment and higher education with ethical, social, entrepreneurial aspects updating to the real time requirements.

MISSION

M 1: To impart high quality technical education by providing the state-of-the art infrastructure, core instruction.

M 2: Advanced research and technical consultancy services with qualified and senior faculty.

M 3: To prepare the students professionally deft and intellectually adept possessing excellent skill, knowledge and behavior with global competence.

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To provide an excellent education in Information Technology through effective teaching and research environment in pursuit of academic proficiency, employment & higher education with social and ethical values.

MISSION

M 1: To provide high quality technical education in Information Technology by delivering the core instructions through world class infrastructure.

M 2: To prepare students with fine professional and intellectual skills to solve challenging tasks in the field of Information Technology.

M 3: To train students in design and implement novel systems based on education and research with the support of senior faculty. equip the graduate with necessary skills and leadership qualities along with strong ethical and moral values to serve the society and nation.

M 4: To inculcate students with leadership capabilities, integrity, ethical & social values.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Graduates will be technically competent and well trained as software engineers to attain National and International recognition.

PEO2: Graduates will be oriented to analyze, design & development of best engineering solutions for software products in contribution to industrial growth as well as societal wellbeing.

PEO3: Graduates are passionately involved in professional development, research and work effectively, progressively to become a successful entrepreneur with ethical & social values contribute to society.

PROGRAM OUTCOMES

PO1: **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PO4: **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO 1: Problem Solving Skills: Ability to design and develop computing tools with moderate complexity in the areas pertaining to database, data analytics, networking, web and app design, IoT and information security with integration.

PSO 2: Professional Skills: Ability to apply standard practices and methods in software project management and software development using suitable programming environments to deliver quality product to the industry.

ACADEMIC REGULATIONS

PRELIMINARY DEFINITIONS AND NOMENCLATURE

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (**Jawaharlal Nehru Technological University Anantapur**).

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs granted by UGC for promoting excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Branch: Means specialization in a program like B.Tech. degree program in Civil Engineering, B.Tech. degree program in Computer Science and Engineering etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade in that course.

Commission: Means University Grants Commission (UGC), New Delhi.

Certificate Course: It is a course that makes a student to have hands-on expertise and skills required for holistic development in a specific area/field.

Internal Examination: It is an examination conducted towards sessional assessment.

Core: The courses that are the essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value.

Credit Point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student overall the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials & resources.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

Detention in a Semester: Student who does not obtain minimum prescribed attendance in a Semester shall be detained in that particular Semester. A Student can also be detained for lack of required number of credits at the end of IV semester or VI semester respectively.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal examinations and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Represents Sri Venkateswara College of Engineering, Tirupati unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOCs inculcate the habit of self-learning. MOOCs would be additional choices in all the elective group courses.

Minor: Minor are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech. degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Denotes UG degree program: Bachelor of Technology (B.Tech.).

Project Work: It is a design or research-based work to be taken up by a student during his / her VIII semester to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Registration: Process of enrolling into a set of courses in a semester of a program.

Regulations: The regulations, common to all B.Tech. programs offered by Institute, are designated as “SVCE – R23” and are binding on all the stakeholders.

Semester: It is a period of study consisting of 90 working/instructional days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

University: Represents Jawaharlal Nehru Technological University Anantapur (JNTUA), Ananthapuramu.

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1. About the College

Sri Venkateswara College of Engineering (SVCE), Tirupati (Main Campus) is part of the SV Colleges group established in the year 2007 with a vision to become a leader in providing quality educational services. College is affiliated to JNTUA & Approved by AICTE, recognized under sections 2(f) & 12(B) of UGC act 1956, Accredited by NAAC with 'A' Grade. Six B.Tech. Programs CSE, ECE, EEE, IT, ME & CE are accredited by NBA, New Delhi. The College offers UG Programs [CE, CSE, CSE (AI & ML), CSE (CS), CSE (DS), ECE, EEE, IT & ME], PG Programs [M.Tech. (VLSI Design), M.Tech. (CSE), MCA & MBA]. The Institution conferred 'Autonomy' by UGC, New Delhi in the year 2020.

The Campus is equipped with state of art laboratories of centre of excellence through advanced tools and technologies. Learning at Sri Venkateswara College of Engineering has a pragmatic approach with a clear focus, valuing individual vision, intellectual discipline, and a sense of teamwork. We aim at developing our students to their full potential, preparing them to take the next step towards career success.

Sri Venkateswara College of Engineering is committed to its role in creating leaders through its innovative programs, outstanding faculty and thought leadership. Sri Venkateswara College of Engineering nurtures global leaders who can speak their minds and work well with others in a wide range of cultural contexts. It will develop their ability to manage a career successfully in the global economy.

Our teaching modes and methods of assessment vary between courses to ensure that you gain the most benefit from the interactive course content, faculty members, fellow students, and invited guests. Lectures comprise only a portion of course delivery, with the remaining taken up by discussions, seminars, case analysis, simulation, individual and group projects, and presentations.

From the academic year 2025–26, SV Colleges has also converted **Sri Venkateswara College of Engineering, Kadapa** as **Off Campus** to **Sri Venkateswara College of Engineering (SVCE), Tirupati (Main Campus)**. The College at off campus offers UG Programs [ECE, CSE, CSE (AI & ML)]. While **SVCE Tirupati continues to be the main campus**, both campuses adhere to the same academic framework, quality standards, and regulatory guidelines of JNTUA, AICTE, UGC, and other statutory bodies.

The academic programs of the College are governed by the rules and regulations approved by the Academic Council, which is the highest academic body of the College. These rules and regulations are effective from the academic year 2023–24 for students admitted into the four-year Undergraduate B.Tech. program offered at the SVCE Main Campus, and from the academic year 2025–26 for students admitted at the SVCE Off-Campus (SVCE Kadapa)

2. Applicability

All the rules specified herein, approved by the Academic Council, shall be in force and applicable to students admitted from the academic year 2023 – 24 onwards. Any reference to "College" in these rules and regulations stands for Sri Venkateswara College of Engineering.

3. Extent

All the rules and regulations, specified hereinafter shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. It shall be ratified by the Academic Council in the forthcoming meeting. As per the requirements of statutory bodies, Principal, **Sri Venkateswara College of Engineering** shall be the Chairman, Academic Council.

4. Vision and Mission:

Vision

To be a centre of excellence focusing on high quality technical education, research and technical services with global leadership competence to succeed in employment and higher education with ethical, social, entrepreneurial aspects updating to the real time requirements.

Mission

To impart high quality technical education by providing the state-of-the art infrastructure, core instruction. Advanced research and technical consultancy services are carried with qualified and senior faculty to prepare the students professionally deft and intellectually adept possessing excellent skill, knowledge and behaviour with global competence.

5. Programs Offered

Following programs are offered in various branches at **Sri Venkateswara College of Engineering** leading to the award of B.Tech. Degree

S. No.	Branch
1	Civil Engineering
2	Computer Science and Engineering
3	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
4	Computer Science and Engineering (Cyber Security)
5	Computer Science and Engineering (Data Science)
6	Electronics and Communication Engineering
7	Electrical and Electronics Engineering
8	Information Technology
9	Mechanical Engineering

6. Award of the Degree

a) Award of the B.Tech. Degree if he/she fulfils the following:
   - (i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
   - (ii) Registers for 163 credits and secures all 163 credits.

b) Award of B.Tech. degree with Minors/Honors if he/she fulfils the following:
   - (i) Student secures additional 18 credits fulfilling all the requisites of a B.Tech. program i.e., 163 credits.
   - (ii) Registering for Minors/Honors is optional.
   - (iii) Minors/Honors is to be completed simultaneously with B.Tech. program.

c) Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with **clause 6 a) i)**.

7. Admissions:

Admission to the B.Tech. Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

8. Program Related Terms

Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit Definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hr. Practical (P) per week	1 credit

***Academic Year*:** Two consecutive (one odd + one even) semesters constitute one academic year.

***Choice Based Credit System (CBCS)*:** The CBCS provides a choice for students to select from the prescribed courses. Choice Based Credit System (CBCS) is introduced in line with UGC guidelines in order to promote:

i. Student centered learning
ii. Students to learn courses of their choice
iii. Interdisciplinary learning

9. Semester/Credits:

i. A semester comprises 90 working/instructional days and an academic year is divided into two semesters.
ii. The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
iii. Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

10. Structure of the Undergraduate Program

All courses offered for the undergraduate program (B.Tech.) are broadly classified as follows:

S. No.	Category	Breakup of Credits (Total 163)	Percentage of Total Credits	AICTE Recommenda-tions
1	Humanities and Social Science including Management (HS)	13	8%	8-9%
2	Basic Sciences (BS)	20	12%	12-16%
3	Engineering Sciences (ES)	26.5	16%	10-18%
4	Professional Core (PC)	54.5	33%	30-36%
5	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SC)	33	20%	19-23%
6	Internships (IP), Community Service (CS) & Project Work (PW)	16	10%	8-11%
7	Mandatory Courses (MC) / Audit Courses (AC)	Non-Credit	Non-Credit	-

11. Course Classification

All subjects/ courses offered for the undergraduate program in Engineering & Technology (B.Tech. degree programs) are broadly Classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1	Foundation Course	Basic Science (BS) Courses	Includes Mathematics, Physics and Chemistry.
		Engineering Science (ES) Courses	Includes Fundamental Engineering courses
		Humanities and Science including Management (HS) Courses	Includes Humanities, Social Sciences and Management courses.
2	Core Courses	Professional Core Courses (PC)	Includes courses related to the parent discipline / department / branch of Engineering
3	Elective Courses	Professional Elective Courses (PE)	Includes elective courses related to the parent discipline / department / branch of Engineering
		Open Elective Courses	Elective courses which include

S. No.	Broad Course Classification	Course Category	Description
		(OE)	interdisciplinary courses or courses in an area outside the parent discipline / department / branch of Engineering
4	Domain Specific Skill Enhancement Courses	Skill Courses (SC)	Interdisciplinary / job-oriented / domain courses which are relevant to the industry
5	Projects and Internships	Project Work (PW)	B.Tech. Project or Major Project
		Community Service (CS)	Community Service Projects during summer vacation
		Internships (IP)	Summer Industry Internship Programs; Industry oriented Full Semester Internship Programs
6	Mandatory and Audit Courses	Mandatory Courses (MC) *(Non-credit Courses with Internal Examination)*	Covering courses of developing desired attitude and awareness among the learners
		Audit Courses (AC) *(Non-credit Courses without Internal Examination but with Formative Assessments)*	Covering value added courses

12. Program Pattern

i. Total duration of the of B.Tech. (Regular) Program is four academic years.
ii. Each academic year of study is divided into two semesters.
iii. Minimum number of instructional days in each semester is 90 days.
iv. There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
v. Health/wellness/yoga/sports and NSS / NSS / Scouts & Guides / Community service activities are made mandatory as credit courses for all the under graduate students.
vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
vii. Audit courses are offered as non-credit mandatory courses covering value added courses, without internal examination but with formative assessments.
viii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
ix. A mandatory one-week domain-specific workshop shall be organized during VI semester
x. It is mandatory for every student to undertake a minimum of one industrial visit during any semester between the V and VIII semesters
xi. Department should conduct one domain-specific expert lecture in every semester from the V semester to VII semester.
xii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
xiii. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
xiv. While choosing the electives, students shall ensure that they do not opt for the

courses with syllabus contents similar to courses already pursued.

xv. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be a minimum of 05 skill-oriented courses offered during III to VII semesters. Among them, one course shall be a soft skills course.

xvi. Students shall undergo mandatory summer internships, for a minimum of eight weeks' duration at the end of second and third year of the program. The internship at the end of second year shall be community oriented and industry internship at the end of third year.

xvii. There shall also be mandatory full internship in the final semester of the program along with the project work.

xviii. Undergraduate degree with Honors / Minors is introduced by the college for the students having good academic record.

xix. Each college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concepts through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xx. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

xxi. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

13. Evaluation Process

i. The performance of a student in each semester shall be evaluated course wise with a maximum of 100 marks for theory and 100 marks for practical course. Summer Internships shall be evaluated for 100 marks, Full Internship & Project Work in final semester shall be evaluated for 100 marks and 200 marks respectively, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

ii. A student has to secure not less than 35% of marks in the semester end examination and a minimum of 40% of marks in the sum total of the mid semester and semester end examination marks taken together for the theory, practical, design, drawing course or project etc. In case of a mandatory courses, he/she should secure 40% of the total marks. In case of audit courses, he/she should submit formative assessments only.

13.1 Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

i. For theory course, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the Semester End Examination.

ii. For practical course, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the Semester End Examination.

iii. If any course contains two different branch courses, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and semester end examination question paper shall be set with two parts each for 35 marks.

a) Continuous Internal Evaluation

i. For theory courses, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.

ii. Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations' questions.
- The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted on the day of subjective paper test itself.

iii. Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.

iv. The internal evaluation for the course on "Design Thinking and Innovation" shall be activity based, in the form of presentations / reports as per the curriculum and shall be evaluated for 15 marks by the concerned teacher and 15 marks for internal tests. There shall be two internal tests. The internal test shall be of 20 marks for subjective paper and 10 marks for objective paper, total shall be condensed to 15 marks.

v. If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.

vi. First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

vii. Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25
Marks obtained in second mid: 20
Final mid semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other.

For Example:

Marks obtained in first mid: Absent
Marks obtained in second mid: 25
Final mid semester Marks: (25x0.8) + (0x0.2) =20

b) Semester End Examination Evaluation

Semester End Examination of theory courses shall have the following pattern:

i. There shall be 6 questions and all questions are compulsory.

ii. Question 1 shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks.

iii. There shall be 2 short answer questions from each unit. In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

iv. The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

v. Semester end examination of theory courses consisting of two parts of different courses, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:

a. Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.

b. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.

c. In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

d. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

13.2 Practical Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

i. For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and semester end examination shall be for 70 marks.

ii. Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

iii. The semester end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the course from the same department.

- Procedure: 20 marks
- Experimental work & Results: 30 marks
- Viva voce: 20 marks.

In a practical course consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the semester end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

iv. For the course having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for semester end examination.

Day-to-day work shall be evaluated for 15 marks by the concerned course teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weight age of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day- to-day evaluation and the mid semester marks will be the final sessional marks for the course.

The semester end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the semester end examination. However, the semester end examination pattern for other courses related to design/drawing, multiple branches, etc is mentioned along with the syllabus.

v. The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the institution as per the institutional norms and shall be produced to the Statutory Committees as and when the same are asked for.

14. Health and Wellness, Yoga & Sports; and NSS/NCC/Scout & Guides/Community Service Courses

Courses like HEALTH AND WELLNESS, YOGA & SPORTS; AND NSS/NCC/SCOUT & GUIDES/ COMMUNITY SERVICE are evaluated as follows.

- Evaluated for a total of 100 marks.
- A Student can select 6 activities of his/her choice with a minimum of 1 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totally to 90 marks.
- The student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the course.

15. Mandatory Courses

There shall be no semester end examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examination. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in **item 6** of the regulations. The performance of the student shall be indicated in the grade sheet as **"Satisfactory"** or **"Not Satisfactory"**, as specified in **Clause 26** and this will not be counted for the computation of SGPA/CGPA/Percentage. The student shall pass all the mandatory courses, for the award of B.Tech. degree.

16. Audit Courses

Audit courses carry "zero" credits. There shall be no internal and semester end examinations. However, formative assessments shall be submitted, and attendance shall be considered while calculating the aggregate attendance. The student shall complete all the audit courses, and their performance shall be indicated in the GRADE Sheet as **"Satisfactory"** or **"Not Satisfactory"**, as specified in **Clause 26**.

17. Skill Oriented Courses

i. There shall be a minimum five skill-oriented courses offered during III to VII semesters.
ii. Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
iii. The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and semester end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The semester end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the course nominated by the principal.
iv. The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.
v. The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.
vi. The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the College at the beginning of the semester.
vii. If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the College.

18. Massive Open Online Courses (MOOCs)

In accordance with the University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulations, 2021, the college permits students to undertake up to 40% of the total courses offered in a specific program in a semester through SWAYAM / SWAYAM plus (www.swayam.gov.in) / Institution Approved MOOC Platforms for credit transfer.

Students may pursue any course (i.e., professional core, professional electives or open elective courses) of curriculum (excluding laboratory courses), as approved by the College, through SWAYAM / SWAYAM plus MOOCs / Institution Approved MOOC Platforms. **Completion of at least one MOOC (Massive Open Online Course) is mandatory for the award of the degree.**

At the beginning of each semester, the College shall notify the list of approved courses from SWAYAM/ SWAYAM plus / Institution Approved MOOC Platforms eligible for credit transfer.

Students must register for the courses offered through MOOC platform with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the students' progress in the MOOC.

A student must complete at least 75% of the assignments and quizzes on the SWAYAM / SWAYAM plus / Institution Approved MOOC Platforms to be eligible for the semester end examination. The semester end exam may be conducted by the National Testing Agency (NTA), the National Program on Technology Enhanced Learning (NPTEL), Institution Approved MOOC Service Provider or the College during the regular end-term exams. Evaluation shall comprise 70% weightage for the semester end examination and 30% for assignments and quizzes conducted by the SWAYAM / SWAYAM plus / Institution Approved MOOC Platforms course coordinator.

Students must earn a certificate by passing the SWAYAM/ SWAYAM plus/ Institution Approved MOOC Platforms examination and submit the same to the College to receive the credits as specified in the curriculum. Examination fees, if applicable, shall be borne by the student. Pass marks and grading will be as per the SVCE academic regulations. No relaxation is permitted. Credits will be awarded only after submission of the completion certificate.

Students who fail or are unable to appear in SWAYAM / SWAYAM plus / Institution Approved MOOC Platforms exams conducted by NTA / NPTEL / Intuitional Approved MOOC Service Provider may write the College-conducted exam during the next subsequent semesters. Students who qualify through NTA / NPTEL / Intuitional Approved MOOC Service Provider, but miss College registration for credit transfer may apply during the next supplementary notification.

Students who qualify in the proctored SWAYAM / SWAYAM plus exams are eligible for direct credit transfer and are exempted from both internal and external assessments for the equivalent College course.

In case of delays in result declaration by NTA / NPTEL, the College shall issue revised marks memos once results are available.

The College reserves the right to make amendments to these guidelines from time to time in alignment with UGC directives.

19. Credit Transfer Policy

Adoption of Massive Open Online Courses (MOOCs) is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the College shall allow up to a maximum of 40% of the total courses being offered in a particular program i.e., maximum of **64** credits through MOOCs platform (SWAYAM) / Institution Approved MOOC Platforms.

i. The College shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses, as detailed in Table 1.

Table 1: Duration of the MOOC and Number of Credits

S. No.	No. of Weeks	No. of Credits
1.	4	1
2.	8	2
3.	12	3
4.	16	4

ii. The Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.

iii. Credit transfer policy will be applicable to the theory courses only.

iv. The concerned department shall identify the courses permitted for credit transfer.

v. The College shall notify at the beginning of semester the list of online learning courses equivalent to the curriculum theory courses eligible for credit transfer.

vi. The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

vii. The College shall ensure no overlap of MOOC exams with that of the College examination schedule. In case of delay in results, the College will re-issue the marks sheet for such students.

viii. Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

ix. The departments shall submit the following to the examination section of the College:
   a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
   b) Undertaking form filled by the students for credit transfer.

x. If a student fails to attain credits through MOOCs, he shall have the option to attend the exam in conventional (pen & paper) mode at the end of the same semester along with Regular Examinations, or he can again re-register for the same MOOC course in the next academic year.

xi. The institute shall ensure that students who have completed the entire MOOC and submitted a minimum of 75% of the assignments and quizzes on MOOC Platform shall only be allowed to appear for the semester end examination conducted by the institute. The MOOC Coordinator / SWAYAM Nodal Officer shall verify this from the MOOC Platform Admin dashboard.

xii. Evaluation shall comprise 70% weightage for the semester end examination and 30% for assignments and quizzes conducted by the SWAYAM / SWAYAM plus / Institution Approved MOOC Platforms course coordinator.

Evaluation of MOOC in Conventional Mode:

- There shall be no internal evaluation
- The Semester End Examination of MOOCs shall have the following pattern:
  - ✓ There shall be 6 questions and all questions are compulsory, Part-A and Part-B, totaling 70 Marks.
  - ✓ ***Part-A:*** Question 1 shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks. There shall be 2 short answer questions from each unit.
  - ✓ ***Part-B:*** In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each, totaling 50 Marks. Student shall answer any one of them. The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.
  - ✓ The student will be considered to have passed only if he/she scores a minimum of 35% of marks in the semester end examination and a minimum of 40% of marks in the sum total of the mid semester and semester end examination marks taken together for theory courses. In case of a mandatory course, he/she should secure 40% of the total marks.

xiii. The College shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the College from time to time.

20. Academic Bank of Credits (ABC)

The College has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i. Provide option of mobility for learners across the universities of their choice.
ii. Provide option to gain the credits through MOOCs from approved digital platforms.
iii. Facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC.
iv. Execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

21. Mandatory Internships

21.1 Summer Internships

Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the

Undergraduate Program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / College shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A Certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 100 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the College.

21.2 Full Semester Internship and Project Work

In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

Full Semester Internship

The student shall undergo a Full Semester Internship in an Industry/National Laboratories/ Academic institutions relevant to the branch specific or interdisciplinary through offline / online / blended mode. The Internship shall be submitted in a report form, and a presentation of the same shall be made before an Internship Evaluation Committee (IEC) and it shall be evaluated for 100 marks. The report and the oral presentation shall carry 40% and 60% weightage respectively. The IEC shall consist the concerned Supervisor and a Senior Faculty Member of the Department nominated by Head of the Department with the approval of the Principal. If required, multiple IECs shall be constituted for multiple sections with prior approval.

Project Work

The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). The evaluation of remaining 30 marks shall be done by departmental Project Evaluation Committee (PEC) consisting of concerned supervisor, and 2 senior faculty members. At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner nominated by Head of the Department with the approval of the Principal and is evaluated for 140 marks.

22. Guidelines for offering a Minor

The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B.Tech. program. Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department and as defined by the respective department offering Minor program.

i. Minor is introduced in the curriculum of all B.Tech. programs offering a major degree and is applicable to all B.Tech. (Regular and Lateral Entry) students admitted in Engineering & Technology.
ii. Minor programs shall be offered in emerging technologies by the respective

departments or in collaboration with the relevant industries/agencies.

iii. A student shall earn additional 18 credits in the specified area to be eligible for the award of B.Tech. degree with Minor. This is in addition to the credits essential for obtaining the Undergraduate Degree in Major Discipline (i.e., 163 credits).

iv. A student shall study five theory courses each carrying three credits, along with either two laboratory courses of 1.5 credits each or a project course of three credits

v. A student is permitted to register for a Minor offered by a department other than the parent department and as defined by the respective department offering Minor program.

vi. Minor in Quantum Computing/Quantum Technologies/Internet of Things (IoT) can be studied by any branch of student.

vii. A student is permitted to register for Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two courses per semester pertaining to their Minor from V Semester onwards.

viii. The courses offered under Minor can have theory as well as laboratory component. If a course comes with a lab component, that component is to be cleared separately.

ix. The Concerned HODs shall arrange separate class work and timetable of the courses offered under various Minor programs.

x. Courses that are used to fulfil the student’s primary major may not be double counted towards the Minor. Courses with content substantially equivalent to courses in the student's primary major may not be counted towards the Minor.

xi. Students can complete the courses offered under Minor either in the college or in online platforms like SWAYAM/ SWAYAM plus with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria defined for credit mobility, as mentioned in **Clause 19**. If the courses under Minor are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B.Tech. courses.

xii. **Minor Capstone Project** Report shall be evaluated with an external examiner. The total marks for Minor Capstone Project Work shall be 100 marks and distribution shall be 50 marks for internal and 50 marks for external evaluation. The Project Review Committee consisting of supervisor, a senior faculty and HOD assesses the student for 50 marks (Report: 30 marks, Seminar: 20 marks). The external evaluation of Minor Capstone Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the College and is evaluated for 50 marks.

xiii. The attendance for the registered courses under Minor and regular courses offered for Major degree in a semester are to be considered separately.

xiv. A student shall maintain an attendance of 75% in all registered courses of Minor to be eligible for attending semester end examinations.

xv. A student registered for Minor in a discipline shall pass in all courses that constitute the requirement for the Minor degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Minor degree program.

xvi. If a student fails in any Minor course, he/she shall be permitted to appear for a supplementary examination. However, the student must successfully complete all Minor courses within the regular period of study. Failure to do so shall lead to automatic cancellation of the student’s registration in the Minor Program.

xvii. If a student drops or is terminated from the Minor program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xviii. The Minor in a discipline will be mentioned in the degree certificate as Bachelor of Technology in XXX with Minor in YYY. For example, Bachelor of Technology in Mechanical Engineering with Minor in Machine Learning.

Enrolment into a Minor:

i. Students without any backlog courses up to III semester will be permitted to register for a Minor.

ii. If a student is detained due to lack of attendance in either Major or Minor program, registration shall be cancelled

iii. Transfer of credits from a particular Minor to regular B.Tech. and vice-versa shall not be permitted

iv. Minor is to be completed simultaneously with Major degree program.

Registration for Minor:

i. The institution will announce specialization, eligibility and courses offered by the departments under Minor and seek registrations in IV Semester, after the results of III Semester are announced.

ii. The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Minor.

iii. The selected students shall submit their willingness to the principal through his/her parent department which shall be forwarded to the concerned departments offering Minor. Both parent department and department offering minor shall maintain the record of student pursuing the Minor.

iv. The students enrolled in the minor courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

23. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The program is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i. Honors is introduced in the curriculum of all B.Tech. programs offering a major degree and is applicable to all B.Tech. (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii. A student shall earn additional 18 credits for award of B.Tech. (Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 163 credits).

iii. A student shall study 05 theory courses each carrying 3 credits, along with either two practical courses of 1.5 credits each or a project course of 3 credits.

iv. A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two courses per semester pertaining to the Honors from V Semester onwards.

v. The concerned HOD shall arrange separate classwork and timetable of the courses offered under Honors program.

vi. Courses that are used to fulfil the student’s primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

vii. Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM/SWAYAM Plus with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B.Tech. courses.

viii. The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

ix. A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

x. A student registered for Honors shall pass in all courses that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree program.

xi. If a student fails in any Honors course, he/she shall be permitted to appear for a supplementary examination. However, the student must successfully complete all Honors courses within the regular period of study. Failure to do so shall lead to automatic cancellation of the student’s registration in the Honors Program.

xii. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii. The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering.

Enrolment into Honors

i. Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline.

ii. The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog courses will be permitted to register for Honors.

iii. If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iv. Transfer of credits from Honors to regular B.Tech. degree and vice-versa shall not be permitted.

v. Honors are to be completed simultaneously with a Major degree program.

Registration for Honors:

i. The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

ii. The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

iii. The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

24. Attendance Requirements:

i. A student shall be eligible to appear for the College semester end examinations if he/she acquires a minimum of 40% attendance in each course and 75% of attendance in aggregate of all the courses. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

ii. Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

iii. A stipulated fee shall be payable towards Condonation of shortage of attendance to the College.

iv. Students whose shortage of attendance is not condoned in any semester are not eligible to take their semester end examination of that class and their registration shall stand cancelled.

v. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

vi. If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

vii. If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

viii. For induction program attendance shall be maintained as per AICTE norms.

25. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in **section 24**.

i. A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per College norms.

ii. A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) up to in the courses that have been studied up to III semester

iii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any ***decimal*** fraction should be ***rounded***

off to ***lower*** digit) in the courses that have been studied up to V semester. And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

iv. When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

26. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the Marks in the Course fall	Grade	Grade Points Assigned
≥ 90	S (Superior)	10
≥ 80 - < 90	A (Excellent)	9
≥ 70 - < 80	B (Very Good)	8
≥ 60 - < 70	C (Good)	7
≥ 50 - < 60	D (Average)	6
≥ 40 - < 50	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0
Mandatory Courses		
≥ 12	Satisfactory (Y)	-
< 12	Not Satisfactory (N)	-
Audit Courses		
-	Satisfactory (Y)	-
-	Not Satisfactory (N)	-

i). A student obtaining Grade 'F' or Grade 'Ab' in a course shall be considered failed and will be required to reappear for that course when it is offered the next supplementary examination.

ii). For non-credit mandatory courses and audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

Semester Grade Point Average (SGPA)

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade point scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \sum_{i=1}^{n}(C_i \times G_i) \Bigg/ \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course, G_i is the grade point scored by the student in the i^{th} course and n is the no. of courses.

Cumulative Grade Point Average (CGPA)

The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \sum_{i=1}^{n}(C_i \times S_i) \Big/ \sum_{i=1}^{n} C_i$$

Where S_i is the SGPA of the i^{th} semester, C_i is the total number of credits in that semester and n is the no. of semesters.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts **(Annexure – I)**. While computing the SGPA the courses in which the student is awarded Zero grade points will also be included.

Grade Point

It is a numerical weight allotted to each letter grade on a 10- point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D, E and F.

27. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B.Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

CGPA to Percentage of Marks Conversion

There shall be no formula prescribed for the conversion of CGPA into percentage of marks. Both the CGPA and the percentage of marks obtained by the student shall be printed on the Consolidated Marks Memo (CMM) at the time of its issuance.

28. Recounting / Revaluation:

Students shall be permitted to apply for Recounting / Revaluation of the semester end examination answer scripts within a stipulated period after payment of the prescribed fee. After completion of the process of Recounting / Revaluation, the records are updated with changes if any, and the student shall be issued a revised grade sheet. If there are no changes, the student shall be intimated the same through a notice.

The Revaluation shall be carried out by an expert not less than Associate Professor cadre, as per the scheme of evaluation supplied by the examination branch in the presence of Principal/Controller of Examinations. Neither the students nor his parents shall be permitted to the present during the valuation.

29. Supplementary Examinations:

In addition to the regular semester end examinations conducted, the college may also schedule and conduct supplementary examinations for all the courses of other semesters when feasible for the benefit of students. Such candidates writing supplementary examinations may have to write more than one examination per day. For eighth semester advanced supplementary examinations will be conducted.

30. Withholding of Results:

If the candidate has any dues not paid to the college or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases, and he/she shall not be allowed/promoted to the next higher semester.

31. Re-Registration for Improvement of Internal Marks:

Following are the conditions to avail the benefit of improvement of internal marks.

i. The candidate should have completed the 4 years of B.Tech. course work and obtained examinations results from I semester to VIII semester.

ii. He/she should have passed all the courses for which the internal evaluation marks secured are more than 50%

iii. Out of the courses the candidate has failed in the examinations due to internal evaluation marks secured being less than 50%, the candidate shall be given a chance for Theory courses and for a maximum of **three** theory courses for improvement of internal evaluation marks.

iv. This provision is only for Theory courses. The candidate has to re-register for the chosen courses and fulfil the academic requirements (i.e., a student has to attend the classes regularly and appear for the mid-examinations and satisfy the attendance requirements to become eligible for appearing at the semester end examinations).

v. For each course, the candidate has to pay a prescribed fee. In the event of availing the provision of Improvement of Internal evaluation marks, the internal evaluation marks as well as the Semester End Examinations marks secured in the previous attempt(s) for the re-registered courses shall stand cancelled.

32. Multiple Entry / Exit Option:

a) Exit Policy:

The students can choose to exit the four-year program at the end of first/second/third year.

i). **UG Certificate in (Field of study/discipline)** - Program duration: First year (first two semesters) of the undergraduate program, 40 credits followed by an additional exit 10-credit bridge / Skill oriented course(s) lasting two months, including at least 6-credit job-specific internship / apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii). **UG Diploma (in Field of study/discipline)** - Program duration: First two years (first four semesters) of the undergraduate program, 80 credits followed by an additional exit 10-credit bridge / Project oriented course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii). **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in (Field of study/discipline)** - Program duration: First three years (first six semesters) of the undergraduate program, 120 credits.

b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. program will be provided in due course of time.

Note: The college shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

33. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship program/to establish start-ups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the College. An evaluation committee constituted by the College shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not.

34. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent courses as and when courses are offered, subject to **section 6. (c)** and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B.Tech. from the date of commencement of class work, subject to **section 6. (c)** and they will follow the academic regulations into which they are readmitted.

35. Minimum Instructional Days for a Semester:
The minimum instructional days including exams for each semester shall be 90 days.

36. Medium of Instruction:
The medium of instruction of the entire B.Tech. undergraduate program in Engineering & Technology (including examinations and project reports) will be in English only.

37. Student Transfers:
Student transfers across institutions shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

38. General Instructions:
The academic regulations should be read as a whole for purpose of any interpretation.

i. Malpractices **<u>rules-nature</u>** and punishments are appended.
ii. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
iii. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Head of the institution is final.
iv. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

39. Amendments to Regulations:
The Academic Council of **Sri Venkateswara College of Engineering (Autonomous)** reserves the right to revise, amend, or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., with the recommendations of the concerned Board(s) of Studies. The changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the College.

NOTE: FAILURE TO READ AND UNDERSTAND THE RULES & REGULATIONS IS NOT AN EXCUSE

40. Rules for Disciplinary Action for Malpractices / Improper Conduct in Examinations

S. No.	Nature of Malpractices/ Improper Conduct	Punishment
	If the candidate	
1. (a)	Possesses or keeps accessible in Examination Hall, any paper, note book, programmable calculators, Cell phones, Pager, Palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he/she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination).	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the Exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he/she will be handed over to the police and a case is registered against him/her.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the notice of Principal.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all Semester End Examinations. The continuation of the course by the candidate is subject to the Academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all semester end examinations, if his/her involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class

S. No.	Nature of Malpractices/ Improper Conduct	Punishment
		work and all Semester End Examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him/her.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester End Examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in Cancellation of the performance in that course only. The answer paper or in letters to the examiners or writes to the examiner requesting him/her to award pass marks.	Cancellation of the performance in that course only.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant- Superintendent / any Officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-In charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-In-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. If the candidate physically assaults the invigilator/ officer-In-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.

S. No.	Nature of Malpractices/ Improper Conduct	Punishment
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in **clause 6** to **8**.	Student of the college's expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year.
11.	Copying detected on the basis of internal evidence, such as during valuation or during special scrutiny.	Cancellation of the performance in that course only or in that course and all other courses the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee.

S. No.	Nature of Malpractices/ Improper Conduct	Punishment
12.	If any malpractice is detected which is not covered in the above **clauses 1** to **11** shall be reported to the Principal for further action and suitable punishment.	--

Note: Whenever the performance of a student is cancelled in any course/courses due to malpractice, he has to register for Semester End Examinations in that course/courses consequently and has to fulfill all the norms required for the award of Degree.

ACADEMIC REGULATIONS (R23)
FOR B.TECH. (LATERAL ENTRY SCHEME)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2024-25** onwards)

1. Award of the Degree

(a) Award of the B.Tech. Degree if he/she fulfils the following:

i. Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).

ii. Registers for 123 credits and secures all 123 credits.

(b) Award of B.Tech. Degree with Minors/Honors if he/she fulfils the following:

i. Student secures additional 18 credits fulfilling all the requisites of a B.Tech. program i.e., 123 credits.

ii. Registering for Minors/Honors optional.

iii. Minors/Honors is to be completed simultaneously with B.Tech. program.

2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat. in B.Tech. course and their admission stands cancelled. This clause shall be read along with **clause 1 a) i).**

3. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.**2**

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing course or project if he secures not less than 35% of marks in the semester end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and semester end examination taken together.

ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the courses that have been studied up to V semester.
And in case if student is already detained for want of credits for a particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern:

i. The entire course of study is three academic years on semester pattern.

ii. A student eligible to appear for the semester end examination in a course but absent at it or has failed in the semester end examination may appear for that course at the next supplementary examination offered.

iii. When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfillment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B.Tech. Four-year degree course (Regular) will hold good for B.Tech. (Lateral Entry Scheme).

NOTE: FAILURE TO READ AND UNDERSTAND THE RULES & REGULATIONS IS NOT AN EXCUSE

SGPA and CGPA Calculations: An Illustrative Example for One Academic Year - B.Tech. Program (SVCE R23 Regulations)

(a) SGPA Calculations: One Academic Year							
Semester (Odd :I, Even: II)	**Course Code**	**Credits** (C_i)	**Marks**	**Grade**	**Grade Points** (G_i)	**Credit Points** $(C_i \times G_i)$	**SGPA** (S_i)
I	BB23AES101	3	78	B	8	3 × 8 = 24	
I	BB23AHS101	2	90	S	10	2 × 10 = 20	
I	BB23ABS101	3	44	E	5	3 × 5 = 15	
I	BB23AES101	3	61	C	7	3 × 7 = 21	$SGPA = \sum_{i=1}^{n}(C_i \times G_i) \Big/ \sum_{i=1}^{n} C_i$
I	BB23ABS101	3	67	C	7	3 × 7 = 21	
I	BB23AHS102	1	95	S	10	1 × 10 = 10	
I	BB23AES102	1.5	89	A	9	1.5 × 9 = 13.5	
I	BB23ABS102	1	62	C	7	1 × 7 = 7	$S_1 = \frac{145}{19.5} = 7.44$
I	BB23AES103	1.5	58	D	6	1.5 × 6 = 9	
I	BB23ABS105	0.5	34	A	9	0.5 × 9 = 4.5	
	$\sum_{i=1}^{n} C_i$	**19.5 (19.5*)**	**678#**	**Total**		$\sum_{i=1}^{n}(C_i \times G_i) = 145$	
II	BB23AES101	3	92	S	10	3 × 10 = 30	
II	BB23ABS201	3	71	B	8	3 × 8 = 24	
II	BB23ABS201	3	42	E	5	3 × 5 = 15	
II	BB23AES102	3	84	A	9	3 × 9 = 27	
II	BB23APC201	3	64	C	7	3 × 7 = 21	
II	BB23ABS202	1	23	F	0	1 × 0 = 0	
II	BB23AES102	1.5	AB	F	0	1.5 × 0 = 0	$S_2 = \frac{136.5}{20.5} = 6.66$
II	BB23APC201	1.5	53	D	6	1.5 × 6 = 9	
II	BB23AES103	1	56	D	6	1 × 6 = 6	
II	BB23ABS106	0.5	35	A	9	0.5 × 9 = 4.5	
	$\sum_{i=1}^{n} C_i$	**20.5 (17*)**	**520#**	**Total**		$\sum_{i=1}^{n}(C_i \times G_i) = 136.5$	
*** Total credits obtained in the current semester (without backlog courses) # Total marks obtained without considering mandatory courses**							
AFTER CLEARING BACKLOG COURSES							
II	BB23ABS202	1	49	E	5	1 × 5 = 5	
II	BB23AES102	1.5	59	D	6	1.5 × 6 = 9	$S_2 = \frac{150.5}{20.5} = 7.34$
	$\sum_{i=1}^{n} C_i$	**20.5 (20.5*)**	**605$**	**Total**		**150.5**	
$ Total marks obtained after clearing all backlog courses							

(b) CGPA Calculation of the Program									
Semester	I	II	III	IV	V	VI	VII	VIII	TOTAL
Semester Credits (C_i)	19.5	20.5	20	21	23	26	21	12	163
Total Max. Marks	1000	1000	800	900	1000	1000	750	300	6750
Total Marks Obtained	678	605	755	735	678	628	638	187	4904
SGPA (S_i)	7.44	7.32	8.67	8.63	7.59	7.67	7.65	8.5	----
$\sum_{i=1}^{n}(C_i \times S_i)$	145	150.5	173	181	175	199	161	102	1286.50
For Regular Students	$CGPA = \sum_{i=1}^{n}(C_i \times S_i) \Big/ \sum_{i=1}^{n} C_i = \frac{\mathbf{1286.50}}{\mathbf{163}} = \mathbf{7.89}$						$Percentage\ of\ Marks = \frac{Total\ Marks\ Obtained}{Total\ Max. Marks} * 100 = \frac{\mathbf{4904}}{\mathbf{6750}} * \mathbf{100} = \mathbf{72.65}$		
For Lateral Entry Students	$CGPA = \sum_{i=1}^{n}(C_i \times S_i) \Big/ \sum_{i=1}^{n} C_i = \frac{\mathbf{991}}{\mathbf{123}} = \mathbf{8.06}$						$Percentage\ of\ Marks = \frac{Total\ Marks\ Obtained}{Total\ Max. Marks} * 100 = \frac{\mathbf{3621}}{\mathbf{4750}} * \mathbf{100} = \mathbf{76.23}$		

In Course Code:
For Example: BB23APC501
BB- Correspond to Branch

Branch	**Short Code (BB)**
Civil Engineering	CE
Electrical & Electronics Engineering	EE
Mechanical Engineering	ME
Electronics & Communication Engineering	EC
Computer Science and Engineering	CS
Information Technology	IT
CSE (Data Science)	DS
CSE (Artificial Intelligence & Machine Learning)	AM
CSE (Cyber Security)	CY
English	EG
Mathematics	MA
Physics	PH
Chemistry	CH
MBA	BA
MCA	CA

CURRICULUM

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COURSE STRUCTURE

B.Tech. – I Year I Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	ME23AES101	Basic Civil & Mechanical Engineering	ES	3	-	-	3	3	30	70	100
2	ME23AES102	Engineering Graphics	ES	1	-	4	5	3	30	70	100
3	PH23ABS101	Engineering Physics	BS	3	-	-	3	3	30	70	100
4	CS23AES101	Introduction to Programming	ES	3	-	-	3	3	30	70	100
5	MA23ABS101	Linear Algebra & Calculus	BS	3	-	-	3	3	30	70	100
6	CS23AES102	Computer Programming Lab	ES	-	-	3	3	1.5	30	70	100
7	PH23ABS102	Engineering Physics Lab	BS	-	-	2	2	1	30	70	100
8	ME23AES103	Engineering Workshop	ES	-	-	3	3	1.5	30	70	100
9	CS23AES103	IT Workshop	ES	-	-	2	2	1	30	70	100
10	CH23ABS105	Health and Wellness, Yoga and Sports	BS	-	-	1	1	0.5	100	--	100
Total				**13**	**-**	**15**	**28**	**20.5**	**370**	**630**	**1000**

B.Tech. – I Year II Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	EE23AES101	Basic Electrical & Electronics Engineering	ES	3	-	-	3	3	30	70	100
2	EG23AHS101	Communicative English	HS	2	-	-	2	2	30	70	100
3	CS23APC201	Data Structures	PC	3	-	-	3	3	30	70	100
4	MA23ABS201	Differential Equations & Vector Calculus	BS	3	-	-	3	3	30	70	100
5	CH23ABS101	Chemistry	BS	3	-	-	3	3	30	70	100
6	EG23AHS102	Communicative English Lab	HS	-	-	2	2	1	30	70	100
7	CS23APC202	Data Structures Lab	PC	-	-	3	3	1.5	30	70	100
8	CH23ABS102	Chemistry Lab	BS	-	-	2	2	1	30	70	100
9	EE23AES102	Electrical & Electronics Engineering Workshop	ES	-	-	3	3	1.5	30	70	100
10	CH23ABS106	NSS/NCC/Scouts & Guides/Community Service	BS	-	-	1	1	0.5	100	--	100
Total				**14**	**-**	**11**	**25**	**19.5**	**370**	**630**	**1000**

B.Tech. – II Year I Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	MA23ABS302	Discrete Mathematics and Graph Theory	BS	3	-	-	3	3	30	70	100
2	BA23AHS302	Universal Human Values	HS	3	-	-	3	3	30	70	100
3	CS23APC301	Advanced Data Structures and Algorithm Analysis	PC	3	-	-	3	3	30	70	100
4	CS23APC302	Object Oriented Programming Through Java	PC	3	-	-	3	3	30	70	100
5	EC23AES301	Digital Logic and Computer Organization	ES	3	-	-	3	3	30	70	100
6	CS23APC303	Advanced Data Structures and Algorithm Analysis Lab	PC	-	-	3	3	1.5	30	70	100
7	CS23APC304	Object Oriented Programming Through Java Lab	PC	-	-	3	3	1.5	30	70	100
8	IT23ASC301	Web Programming	SC	-	1	2	3	2	30	70	100
9	CH23AMC301	Environmental Science	MC	2	-	-	2	-	30	--	30
Total				**17**	**1**	**8**	**26**	**20**	**270**	**560**	**830**

B.Tech. – II Year II Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	MA23ABS403	Optimization Techniques	BS	2	-	-	2	2	30	70	100
2	MA23ABS306	Probability and Statistics	BS	3	-	-	3	3	30	70	100
3	CS23APC401	Database Management Systems	PC	3	-	-	3	3	30	70	100
4	CS23APC402	Operating Systems	PC	3	-	-	3	3	30	70	100
5	IT23APC401	Software Engineering	PC	3	-	-	3	3	30	70	100
6	CS23AES301	Design Thinking and Innovation	ES	1	-	2	3	2	30	70	100
7	CS23APC403	Database Management Systems Lab	PC	-	-	2	2	1	30	70	100
8	CS23APC404	Operating Systems Lab	PC	-	-	2	2	1	30	70	100
9	IT23APC402	Software Engineering Lab	PC	-	-	2	2	1	30	70	100
10	IT23ASC401	Linux Programming	SC	-	1	2	3	2	30	70	100
Total				**15**	**1**	**10**	**26**	**21**	**300**	**700**	**1000**
Mandatory Community Service Project Internship of 08 Weeks Duration During Summer Vacation											

B.Tech. – III Year I Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	AM23APC301	Artificial Intelligence	PC	3	-	-	3	3	30	70	100
2	CY23APC301	Computer Networks	PC	3	-	-	3	3	30	70	100
3	IT23APC502	Python Programming	PC	3	-	-	3	3	30	70	100
4	CS23APC501 CS23APC502 IT23APE502 AM23APE501	**Professional Elective-I** Automata Theory and Compiler Design Data Warehousing and Data Mining Object Oriented Analysis and Design Soft Computing	PE	3	-	-	3	3	30	70	100
5		**Open Elective-I**	OE	3	-	-	3	3	30	70	100
6	CY23APC302	Computer Networks Lab	PC	-	-	3	3	1.5	30	70	100
7	IT23APC504	Python Programming Lab	PC	-	-	3	3	1.5	30	70	100
8	CS23ASC401	Full Stack Development-I	SC	-	1	2	3	2	30	70	100
9	EG23ASC401	Soft Skills	SC	-	1	2	3	2	30	70	100
10	EC23AES501	Tinkering Lab	ES	-	-	2	2	1	30	70	100
11	BA23AMC501	Business Economics and Financial Management	MC	3	-	-	3	-	30	-	30
12	IT23ACS501	Community Service Project	CS	-	-	-	-	2	-	100	100
Total				**18**	**2**	**12**	**32**	**25**	**330**	**800**	**1130**

Note: One Domain Specific Expert Lecture during the Semester and One Industrial Visit between the V and VIII Semesters are mandatory requirements

B.Tech. – III Year II Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	CS23AES501	Introduction to Quantum Technology and Applications	ES	3	-	-	3	3	30	70	100
2	CY23APC501	Cyber Security	PC	3	-	-	3	3	30	70	100
3	IT23APC601	Cloud Computing and DevOps	PC	3	-	-	3	3	30	70	100
4	AM23APC401	Machine Learning	PC	3	-	-	3	3	30	70	100
5	CY23APE602 IT23APE601 IT23APE501 DS23APC301	**Professional Elective-II** Blockchain for AI Cloud Computing for AI Internet of Things Introduction to Data Science	PE	3	-	-	3	3	30	70	100
6	IT23APE602 IT23APE603 CY23APE604 CS23APE605	**Professional Elective-III** Mobile Application Development Software Testing Methodologies Mobile Adhoc Networks Software Project Management	PE	3	-	-	3	3	30	70	100
7		**Open Elective–II**	OE	3	-	-	3	3	30	70	100
8	AM23APC402	Machine Learning Lab	PC	-	-	2	2	1	30	70	100
9	IT23APC602	Cloud Computing and DevOps Lab	PC	-	-	3	3	1.5	30	70	100
10	CS23AMC601	Technical Paper Writing and IPR	MC	2	-	-	2	-	30	-	30
Total				**23**	**-**	**7**	**28**	**23.5**	**300**	**630**	**930**

Mandatory Industry Internship of 08 Weeks Duration During Summer Vacation

Note: One Domain Specific Expert Lecture and One Domain Specific Workshop are mandatory requirements for the Semester

B.Tech. – IV Year I Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	IT23APC701	IT Infrastructure Management	PC	2	1	-	3	3	30	70	100
2	 BA23AHS701 BA23AHS702 BA23AHS703	**Management Course** Business Ethics and Corporate Governance E-Business Management Science	HS	2	-	-	2	2	30	70	100
3	 AM23APE701 CS23APE602 AM23APC602 IT23APE701	**Professional Elective-IV** Augmented Reality and Virtual Reality Computer Vision Deep Learning Enterprise Systems	PE	3	-	-	3	3	30	70	100
4	 CS23APE702 DS23APC701 IT23APE702 IT23APE703	**Professional Elective-V** Agile Methodologies Big Data Analytics High Performance Computing Human Computer Interaction	PE	3	-	-	3	3	30	70	100
5		**Open Elective-III**	OE	3	-	-	3	3	30	70	100
6		**Open Elective-IV**	OE	3	-	-	3	3	30	70	100
7	CS23ASC701	Introduction to R Programming	SC	-	-	1	1	0.5	30	70	100
8	CS23ASC501	Full Stack Development-II	SC	-	1	2	3	2	30	70	100
9	BA23AAC701	Gender Sensitization	AC	2	-	-	2	-	-	-	-
10	IT23AIP701	Industry Internship	IP	-	-	-	-	2	--	100	100
Total				**18**	**2**	**3**	**23**	**21.5**	**240**	**660**	**900**
Note: One Domain Specific Expert Lecture is mandatory requirement for the Semester											

B.Tech. – IV Year II Semester

S. No.	Course Code	Course Name	Category	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	IT23AIP801	Internship	IP	-	-	-	-	4	--	100	100
2	IT23APW801	Project	PW	-	-	-	-	8	60	140	200
Total				**-**	**-**	**-**	**-**	**12**	**60**	**240**	**300**

LIST OF OPEN ELECTIVE COURSES

Open Elective-I

Course Code	Course Name	Offering Dept.
CE23AOE501	Construction Technology and Management	CE
CE23AOE502	Green Buildings	CE
CS23AOE501	Principles of Operating Systems	CSE
AM23AOE501	Artificial Intelligence Tools and Techniques	CSM
AM23AOE502	Introduction to Artificial Intelligence	CSM
CY23APC301	Computer Networks	CSC
DS23AOE501	Data Analysis with R Programming	CSD
IT23AOE501	Web Programming Concepts	IT
EC23AOE501	Electronic Circuits	ECE
EE23AOE501	Electrical Safety Practices and Standards	EEE
ME23AOE501	Sustainable Energy Technologies	ME
BA23AOE501	Entrepreneurship and Venture Creation	MBA
EG23AOE501	Academic Writing and Public Speaking	English
MA23AOE501	Mathematics for Machine Learning and AI	Mathematics
PH23AOE501	Materials Characterization Techniques	Physics
CH23AOE501	Chemistry of Energy Systems	Chemistry

Open Elective-II

Course Code	Course Name	Offering Dept.
CE23AOE601	Disaster Management	CE
CE23AOE602	Sustainability in Civil Engineering Practice	CE
CS23AOE601	Fundamentals of Object Oriented Analysis and Design	CSE
CS23AOE602	Java Programming	CSE
AM23AOE601	Machine Learning Concepts	CSM
CY23AOE601	Introduction to Cryptography and Network Security	CSC
DS23AOE601	Introduction to Social Media Mining	CSD
IT23APC401	Software Engineering	IT
EC23AOE601	Digital Electronics	ECE
EE23AOE601	Renewable Energy Sources	EEE
ME23AOE601	Drone Technology	ME
ME23AOE602	System Design for Sustainability	ME
BA23AOE601	Business Communication Skills	MBA
EG23AOE601	English for Competitive Examinations	English
MA23AOE601	Mathematical Foundation of Quantum Technologies	Mathematics
MA23AOE602	Optimization Techniques and Applications	Mathematics
PH23AOE601	Physics of Electronic Materials and Devices	Physics
CH23AOE601	Chemistry of Polymers and Applications	Chemistry

Open Elective-III and IV

Course Code	Course Name	Offering Dept.
CE23AOE701	Building Materials and Services	CE
CE23APE502	Environmental Impact Assessment	CE
CE23AOE702	Geospatial Technologies	CE
CE23AOE703	Smart Cities	CE
CE23AOE704	Solid Waste Management	CE
CS23AOE701	Introduction to Data Base Management Systems	CSE
CS23APE604	Quantum Computing	CSE
AM23AOE701	AI Prompt Engineering	CSM
AM23AOE702	Artificial Intelligence and Machine Learning	CSM
AM23AOE703	Introduction to Deep Learning	CSM
CY23AOE701	Fundamentals of Blockchain Technology	CSC
CY23AOE702	Fundamentals of Cyber Security	CSC
CY23AOE703	Fundamentals of Ethical Hacking	CSC
DS23AOE701	Data Analysis and Visualization	CSD
DS23AOE702	Fundamentals of Data Science	CSD
IT23APC501	Cloud Computing	IT
IT23APE501	Internet of Things	IT
EC23AOE701	Fundamentals of Digital Image Processing	ECE
EC23APC504	Microprocessors and Microcontrollers	ECE
EC23AOE702	Transducers and Sensors	ECE
EE23AOE701	Electric Vehicles	EEE
EE23AOE702	Energy Audit, Conservation and Management	EEE
EE23AOE703	Smart Grid Technologies	EEE
ME23AOE701	3D Printing Technologies	ME
ME23APE706	Automation and Robotics	ME
ME23APE710	Total Quality Management	ME
BA23AOE701	Business Development	MBA
BA23AOE702	Techno Marketing	MBA
EG23AOE701	Employability Skills	English
EG23AOE702	Life Skills	English
EG23AOE703	Literary Vibes	English
MA23AOE701	Financial Mathematics	Mathematics
MA23AOE702	Wavelet Transforms: Theory and Applications	Mathematics
PH23AOE701	Introduction to Quantum Mechanics	Physics
PH23AOE702	Sensors and Actuators for Engineering Applications	Physics
PH23AOE703	Smart Materials and Devices	Physics
CH23AOE701	Biology for Engineers	Chemistry
CH23AOE702	Chemistry of Nanomaterials and Applications	Chemistry
CH23AOE703	Green Chemistry and Catalysis for Sustainable Environment	Chemistry

Note: Students shall register only for Open Elective course(s) offered by other departments, not by their parent department. A student who has already studied a course(s) or its equivalent in the curriculum cannot register for the same under Open Electives.

HONORS DEGREE and MINOR DEGREE

In addition to the Major Degree, Students have an opportunity to pursue either Minor or Honors Degrees, subject to the eligibility criteria specified in Academic Regulations, Point No.: 22 & 23.

Honors Degree: An Honors degree is awarded to students who complete an additional 18 credits of coursework within the same discipline, reflecting extended learning and academic depth.

HONORS DEGREE IN INFORMATION TECHNOLOGY

S. No.	Year & Sem.	Course Code	Course Name	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
				L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	III-I (2 Theory)	IT23AHN501	Blockchain Technology	3	-	-	3	3	30	70	100
2		IT23AHN502	Multimedia Applications and Development	3	-	-	3	3	30	70	100
3		IT23AHN503	Natural Language Processing	3	-	-	3	3	30	70	100
4	III-II (2 Theory)	IT23AHN601	Computational Intelligence	3	-	-	3	3	30	70	100
5		IT23AHN602	Cryptography and Network Security	3	-	-	3	3	30	70	100
6		IT23AHN603	Predictive Analytics	3	-	-	3	3	30	70	100
7	IV-I (1 Theory)	IT23AHN701	Cyber Physical Systems	3	-	-	3	3	30	70	100
8		IT23AHN702	Generative AI	3	-	-	3	3	30	70	100
9	IV-I	IT23AHN703	Honors Capstone Project	-	-	-	-	3	50	50	100
Total				**15**	**-**	**-**	**15**	**18**	**200**	**400**	**600**

Minor Degree: A Minor degree is awarded to students who complete an additional 18 credits of coursework in a discipline other than their parent discipline, demonstrating interdisciplinary learning.

Award of Degree:
B.Tech. in [Major Discipline] with Minor in [Other than Major Discipline/Emerging Technology Area]

MINOR DEGREES OFFERED UNDER SVCE R23 REGULATIONS

S. No.	Host Department	Title of the Minor	Eligible Branches
1	CE	Civil Engineering	All branches except CE
2		Building Planning and Construction Technology	All branches except CE
3	CSE	Computer Science and Engineering	EEE, ECE, CE, ME
4		Programming and Computational Intelligence	All branches except CSE
5		Quantum Computing	All branches
6		Quantum Technologies	All branches
7	CSM	Artificial Intelligence and Machine Learning	All branches except CSM
8		AI Applications and Emerging Technologies	All branches except CSM
9	CSC	Cyber Security	All branches except CSC
10	CSD	Data Science	All branches except CSD
11		Data Analytics	All branches except CSD
12		Data Science and Analytics	All branches except CSD
13	ECE	Electronics and Communication Engineering	All branches except ECE
14		Embedded Systems and IoT	All branches except ECE
15		Electronic Systems	All branches except ECE
16	EEE	Electrical and Electronics Engineering	All branches except EEE
17		Energy Systems and Microgrid Technologies	All branches except EEE
18	IT	Information Technology	EEE, ECE, CE, ME
19		Internet of Things	All branches
20	ME	Mechanical Engineering	All branches except ME
21		3D Printing	All branches except ME
22		Industrial Engineering	All branches except ME
23	Management Studies	Business Administration	All branches

For complete information on course structures and syllabi, please refer to the Minor Degree Syllabi Book.

Note: Students who have already completed any course listed under the Minor Degree as part of their regular curriculum are not eligible to opt for the same course(s) again under the Minor Degree program. It is the student's responsibility to ensure that all necessary prerequisites are completed prior to registering for a course under the Minor Degree.

I Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(ME23AES101) BASIC CIVIL & MECHANICAL ENGINEERING

PART A: BASIC CIVIL ENGINEERING

COURSE OBJECTIVES:
The objectives of this course are to:

- Get familiarized with basic Construction Materials; the scope and importance of Civil Engineering specializations.
- Introduce the preliminary concepts of Structural and Geotechnical Engineering.
- Acquire preliminary knowledge on Surveying and Transportation Engineering.
- Get familiarized with the importance of Water Resources and Environmental Engineering.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society and the basic characteristics of Construction Materials.
CO 2: Gain knowledge regarding Structural and Geotechnical Engineering.
CO 3: Explain the concepts of surveying and Transportation Engineering, Water Resources and Environmental Engineering.

COURSE CONTENT

UNIT I: **(8 Periods)**
Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-Technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering- Scope of each discipline.
Construction Materials - Cement – Sand - Aggregate - Bricks- Cement concrete – Steel - Timber.

UNIT II: **(7 Periods)**
Structural Engineering: Importance- Types of Structures and structural Members- Building Components –Building Planning principles.
Geotechnical Engineering: Types of Foundations-Functions and Requirement of a good foundation.

UNIT III: **(8 Periods)**
Surveying & Transportation Engineering: Objectives and Principles of Surveying- Instruments used in Surveying-Importance of Transportation in Nation's economic development- Modes of Transportation- Types of Highway Pavements- Flexible Pavements and Rigid Pavements -Traffic signals and signs.
Water Resources and Environmental Engineering: Introduction to Hydrology– hydrological cycle- Sources of water- Quality of water- Specifications- Rainwater Harvesting- Water Storage and Conveyance Structures- Dams and Reservoirs-types and components.

TEXT BOOKS:
1. M.S. Palanichamy, Basic Civil Engineering, Tata McGraw Hill Education Pvt. Ltd., 4th Edition, 2011.
2. S.S. Bhavikatti, Introduction to Civil Engineering, New Age International Publishers, 1st Edition, 2022.

REFERENCES:
1. S.K. Duggal, Surveying, Vol I & Vol II, Tata McGraw Hill Publishers, 5th Edition, 2019.
2. Santosh Kumar Garg, Hydrology and Water Resources Engineering, Khanna

Publishers, Delhi, 1st Edition, 2016.
3. Santosh Kumar Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, Delhi, 38th Edition, 2023.
4. S.K. Khanna, C.E.G. Justo, Veeraraghavan, Highway Engineering, Nemchand & Brothers Publications, 10th Edition, 2019.
5. Bureau of Indian Standards (BIS), IS 10500:2012 - Indian Standard Drinking Water Specification, BIS, 1st Edition, 2012.
6. Satheesh Gopi, Basic Civil Engineering, Pearson Publications, 1st Edition, 2009.

PART B: BASIC MECHANICAL ENGINEERING

COURSE OBJECTIVES:
The objectives of this course are to:
- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Understand and familiarize the different engineering materials and different manufacturing processes.
- Get an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand the different manufacturing processes.
CO 2: Explain the basics of thermal engineering and its applications.
CO 3: Describe the working of different mechanical power transmission systems and power plants and describe the basics of robotics and its applications.

COURSE CONTENT

UNIT I: (7 Periods)
Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in Different Sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine Sectors.
Engineering Materials: Metals-Ferrous and Non-Ferrous, Ceramics, Composites, Smart Materials.

UNIT II: (8 Periods)
Manufacturing Processes: Principles of Casting, Forming, Joining Processes, Machining, Introduction to CNC Machines, 3D Printing, and Smart Manufacturing.
Thermal Engineering – Working Principle of Boilers, Otto Cycle, Diesel Cycle, Refrigeration and Air-Conditioning Cycles, IC Engines, 2-Stroke and 4-Stroke Engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III: (7 Periods)
Power Plants – Working Principle of Steam, Diesel, Hydro, Nuclear Power Plants.
Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.
Introduction to Robotics - Joints & Links, Configurations and Applications of Robotics.

Total Periods: 45

TEXT BOOKS:
1. V. Ganesan, Internal Combustion Engines, Tata McGraw-Hill Education Pvt. Ltd., 4th Edition, 2012.
2. S.S. Rattan, A Textbook of Theory of Machines, Tata McGraw Hill Publications (India) Pvt. Ltd., 4th Edition, 2017.

REFERENCES:

1. Appuu K.K., Robotics, I.K. International Publishing House Pvt. Ltd., 3rd Edition, 2007.
2. L. Jyothish Kumar, Pulak M. Pandey, David Ian Wimpenny, 3D Printing and Additive Manufacturing Technologies, Springer Singapore, 1st Edition, 2019.
3. Mahesh M. Rathore, Thermal Engineering, Tata McGraw-Hill Education, 1st Edition, 2010.
4. G. Shanmugam and M.S. Palanisamy, Basic Civil and Mechanical Engineering, Tata McGraw Hill Education (India) Pvt. Ltd., 4th Edition, 2018.

I Year B.Tech. – I Semester

L	T	P	C
1	-	4	3

(ME23AES102) ENGINEERING GRAPHICS

COURSE OBJECTIVES:
The objectives of this course are to:
- Enable with various concepts like dimensioning, conventions and standards related to engineering drawing.
- Impart knowledge on the projection of points, lines and plane surfaces.
- Improve the visualization skills for better understanding of projection of solids.
- Develop the imaginative skills required to understand section of solids and developments of surfaces.
- Draw the viewing perception of a solid object in isometric and orthographic projections.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Draw various engineering curves, scales.
CO 2: Draw and Interpret orthographic projections of points, lines, planes.
CO 3: Draw the projection of solids in various positions.
CO 4: Draw and Explore the sections of solids and development of surfaces.
CO 5: Draw an isometric and orthographic views of simple solids.

COURSE CONTENT

UNIT I: **(2 L and 8 P)**
Introduction to Engineering Drawing: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing Regular Polygons by General Methods.
Curves: Construction of Ellipse, Parabola and Hyperbola by General Method, Cycloids, Involutes, Normal and Tangent to Curves.
Scales: Plain Scales, Diagonal Scales and Vernier Scales.

UNIT II: **(3 L and 12 P)**
Orthographic Projections: Reference Plane, Importance of Reference Lines or Plane, Projections of a Point Situated in any One of the Four Quadrants.
Projections of Straight Lines: Projections of Straight Lines Parallel to both Reference Planes, Perpendicular to One Reference Plane and Parallel to other Reference Plane, Inclined to one Reference Plane and Parallel to the other Reference Plane. Projections of Straight Line Inclined to both the Reference Planes.
Projections of Planes: Regular Planes Perpendicular to both Reference Planes, Parallel to One Reference Plane and Inclined to the other Reference Plane; Plane Inclined to both the Reference Planes.

UNIT III: **(3 L and 12 P)**
Projections of Solids: Types of Solids: Polyhedra and Solids of Revolution. Projections of Solids in Simple Positions: Axis Perpendicular to Horizontal Plane, Axis Perpendicular to Vertical Plane and Axis Parallel to both the Reference Planes, Projection of Solids with Axis Inclined to One Reference Plane and Parallel to another Plane, Projection of Solids Inclined to both the Reference Planes.

UNIT IV: **(3 L and 12 P)**
Sections of Solids: Perpendicular and Inclined Section Planes, Sectional Views and True Shape of Section, Sections of Solids in Simple Position only.
Development of Surfaces: Methods of Development: Parallel Line Development and Radial Line Development. Development of a Cube, Prism, Cylinder, Pyramid and Cone.

UNIT V: **(4 L and 16 P)**
Conversion of Views: Conversion of Isometric Views to Orthographic Views of Simple Solids;

Conversion of Orthographic Views to Isometric views of Simple Solids.
Computer Graphics: Creating 2D&3D Drawings of Objects Including Domain Specific Engineering Applications using Auto CAD (Not for end examination).

Total Periods: 15 L and 60 P

TEXT BOOKS:

1. K.L. Narayana and P. Kannaiah, Engineering Drawing, Tata McGraw Hill, 1st Edition, 2013.
2. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 54th Edition, 2023.

REFERENCES:

1. M.B.Shah and B.C. Rana, Engineering Drawing, Pearson Education Inc, 1st Edition, 2009.
2. Dhananjay Jolhe, Engineering Drawing with an Introduction to AutoCAD, Tata McGraw-Hill, 3rd Edition, 2017.
3. K. Venugopal, Engineering Drawing and Graphics, New Age Publishers, 4th Edition, 2004.
4. Basant Agarwal, C.M. Agarwal, Engineering Drawing, Tata McGraw-Hill, 2nd Edition, 2013.

I Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(PH23ABS101) ENGINEERING PHYSICS

COURSE OBJECTIVES:
The objective of this course is to:

- Bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the intensity variation of light due to interference, diffraction and polarization.
CO 2: Apply the basic concepts of crystal structures and X-ray diffraction to study the behavior of materials for engineering applications.
CO 3: Summarize the fundamental properties of dielectric and magnetic materials for engineering applications.
CO 4: Analyze the properties of quantum particles to interpret the energy band formation and classification of solids
CO 5: Assess the current flow mechanism to understand the transport phenomenon of charge carriers in semiconductors.

COURSE CONTENT

UNIT I: **(10 Periods)**
Wave Optics Interference: Introduction - Principle of superposition –Interference of light Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index. Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).
Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II: **(8 Periods)**
Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.
X- ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

UNIT III: **(10 Periods)**
Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative)
- Lorentz internal field - Clausius- Mossotti equation – Frequency dependence of polarization – dielectric loss.
Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization- Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro &Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials- Applications of magnetic materials.

UNIT IV: (9 Periods)

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution
- Density of states - Fermi energy

UNIT V: (8 Periods)

Semiconductors: Formation of energy bands – classification of solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers (Qualitative) – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications - Direct and indirect bandgap semiconductors and its applications.

Total Periods: 45

TEXT BOOKS:

1. M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, A Text book of Engineering Physics, S. Chand Publications, 11th Edition 2019.
2. D.K. Bhattacharya, Poonam Tandon, Engineering Physics, Oxford University Press, 1st Edition, 2015.

REFERENCES:

1. B.K. Pandey, S. Chaturvedi, Engineering Physics, Cengage Learning, 1st Edition, 2021.
2. Shatendra Sharma, Jyotsna Sharma, Engineering Physics, Pearson Education, 1st Edition, 2018.
3. Sanjay D. Jain, D. Sahasrabudhe, Girish, Engineering Physics, University Press, 1st Edition, 2010
4. M.R. Srinivasan, Engineering Physics, New Age International Publishers, 1st Edition, 2009.

ONLINE RESOURCES:

1. https://www.loc.gov/rr/scitech/selected-ternet/physics.html

I Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CS23AES101) INTRODUCTION TO PROGRAMMING

COURSE OBJECTIVES:
The objectives of this course are to:

- Learn how to solve a given problem.
- Illustrate the basic concepts of C programming language.
- Discuss the concepts of Functions, Arrays, Pointers and Structures.
- Familiarize with dynamic memory allocation concepts.
- Apply concepts of structures and files to solve real word problems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Solve computational problems.
CO 2: Select the features of C language appropriate for solving a problem.
CO 3: Design computer programs for real world problems.
CO 4: Organize the data which is more appropriated for solving a problem.
CO 5: Understanding the basic concept of structures and file handling.

COURSE CONTENT

UNIT I: (10 Periods)
Introduction to Problem Solving: Problem Solving Aspect, Problem Identification, Problem Understanding, Algorithm Development, Solution Planning, characteristics of algorithm, Top-down approach, Bottom-up approach, Time and space complexities of algorithms, Flowchart. Overview of C: History of C, C Language Elements, Basic Structure of C Program, C Tokens-Variables and Data Types, Operators, Expressions and Type Conversions.

UNIT II: (8 Periods)
Control Statements: Selection Statements- if and switch statements.
Iterative Statements: for, while and do-while statements.
Jump Statements: break, continue, go to statements.

UNIT III: (8 Periods)
Arrays: Declaration, accessing array elements, Storing values, Operations on arrays, multi-dimensional arrays.
Functions: Introduction, Using Functions, Function declaration, Function definition and Function call, Parameter passing, Passing arrays to functions, Recursion, Storage classes.

UNIT IV: (10 Periods)
Pointers: Declaration and Initialization of pointer variables, Pointer arithmetic, Pointers and arrays, Pointer to pointer, Array of pointers, Pointers and functions, Dynamic Memory Allocation.
Strings: Introduction to Strings, String handling functions, Preprocessor Directives.

UNIT V: (9 Periods)
Structures: Introduction, Nested Structures, Array of Structures, Structures and Functions, Unions.
Files in C: Using Files in C, read data from Files, Writing data to Files, Random access to files, Command-line Arguments

Total Periods: 45

TEXT BOOKS:

1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, Cengage Learning, 3rd Edition, 2007.

2. M.T. Somashekara, D.S. Guru, K.S. Manjunatha, Problem Solving with C, PHI Learning Pvt. Ltd., 2nd Edition, 2018.

REFERENCES:

1. Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, Pearson, 5th Edition, 2011.
2. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall, 2nd Edition,1988.
3. Reema Thareja, Programming in C, Oxford University Press, AICTE Edition, 2018.
4. R. G. Dromey, How to Solve It by Computer, Pearson, 1st Edition, 2014.

I Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(MA23ABS101) LINEAR ALGEBRA & CALCULUS

COURSE OBJECTIVES:
The objectives of this course are to:

- Illuminate the students in the concepts of calculus and linear algebra.
- Equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understanding the concepts of matrix algebra techniques to solve the system of linear equations.
CO 2: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.
CO 3: Apply mean value theorems to solve real life problems in engineering.
CO 4: Make use of partial differentiation to solve optimization problems.
CO 5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

COURSE CONTENT

UNIT I: **(8 Periods)**
Matrices: Rank of a matrix by echelon form, normal form, Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II: **(10 Periods)**
Eigenvalues, Eigenvectors and Orthogonal Transformation: Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley- Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley- Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III: **(7 Periods)**
Calculus: Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV: **(10 Periods)**
Partial differentiation and Applications (Multi variable calculus): Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V: **(10 Periods)**
Multiple Integrals (Multi variable Calculus): Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Total Periods: 45

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2011.

REFERENCES:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd., 3rd Edition,2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, Pearson Publishers, 13th Edition, 2013.
3. GlynJames, Advanced Modern Engineering Mathematics, Pearson publishers, 4th Edition, 2011.
4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 11th Edition, 2010.
5. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand, 14th Edition, 2014.
6. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press, 1st Edition, 2007.

I Year B.Tech. – I Semester

L	T	P	C
-	-	3	1.5

(CS23AES102) COMPUTER PROGRAMMING LAB

COURSE OBJECTIVES:
The objectives of this course are to:
- Use basic data types, operators, expressions and expression evaluation mechanisms using C Programming Language.
- Implement control flows, construct in C Programming Language and understand the syntax, semantics and usability contexts of these different constructs.
- Develop composite data types in C and constructs available to develop their datatypes, utilize them to model things and dealing with data from and to external files.
- Design programs with different variations of the constructs available for practicing modular programming and understand the pros and cons of using different variants and apply optimization.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Read, understand and trace the execution of programs written in C language.
CO 2: Select the right control structure for solving the problem.
CO 3: Develop C programs which utilize the memory efficiently using programming constructs like pointers.
CO 4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

List of Exercises:
WEEK 1:
Objective: Getting familiar with the programming environment on the computer and writing the first program.
Activities:
Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment
- Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- Exposure to Turbo C, gcc.
- Writing simple programs using printf (), scanf ()

WEEK 2:
Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.
Activities:
Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code. Developing the algorithms/flowcharts for the following sample programs
- Sum and average of 3 numbers
- Conversion of Fahrenheit to Celsius and vice versa
- Simple interest calculation

WEEK 3:
Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.
Activities:
Tutorial 3: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions.
- Finding the square root of a given number
- Finding compound interest

- Area of a triangle using heron's formulae
- Distance travelled by an object

WEEK 4:
Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.
Activities:
Tutorial 4: Operators and the precedence and as associativity:
Lab 3: Simple computational problems using the operator precedence and associativity
i) Evaluate the following expressions.
   a. A+B*C+(D*E) + F*G
   b. A/B*C-B+A*D/3
   c. A+++B---A
   d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator.
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5:
Objective: Explore the full scope of different variants of "if construct" namely if- else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".
Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 4: Problems involving if-then-else structures.
i. Write a C program to find the max and min of four numbers using if-else.
ii. Write a C program to generate electricity bill.
iii. Find the roots of the quadratic equation.
iv. Write a C program to simulate a calculator using switch case.
v. Write a C program to find the given year is a leap year or not.

WEEK 6:
Objective: Explore the full scope of iterative constructs namely while loop, do- while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.
Activities:
Tutorial 6: Loops, while and for loops
Lab 5: Iterative problems e.g., the sum of series
i. Find the factorial of given number using any loop.
ii. Find the given numberis a prime or not.
iii. Compute sine and cos series.
iv. Checking a number palindrome.
v. Construct a pyramid of numbers.

WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.
Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 6:1D Array manipulation, linear search
i. Find the min and max of a 1-D integer array.
ii. Perform linear search on1Darray.
iii. The reverse of a 1D integer array
iv. Find 2's complement of the given binary number.
v. Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be

used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 7: Matrix problems, String operations, Bubble sort

i. Addition of twomatrices
ii. Multiplication two matrices
iii. Sort array elements using bubble sort
iv. Concatenate two strings without built-in functions
v. Reverse a string using built-in and without built-in string functions

WEEK 9:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Activities:

Tutorial 9: Functions, call by value, scope and extent,

Lab 8: Simple functions using call by value, solving differential equations using Eulers theorem

i. Write a C function to calculate NCR value
ii. Write a C function to find the length of a string
iii. Write a C function to transpose of a matrix
iv. Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 10:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Activities:

Tutorial 10: Recursion, the structure of recursive calls

Lab 9: Recursive functions

i. Write a recursive function to generate Fibonacci series
ii. Write a recursive function to find the lcm of two numbers
iii. Write arecursive function to find the factorial of a number
iv. Write a C Program to implement Ackermann function using recursion
v. Write a recursive function to find the sum of series.

WEEK 11:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Activities:

Tutorial 11: Call by reference, dangling pointers

Lab 10: Simple functions using Call by reference, Dangling pointers

i. Write a C program to swap two numbers using call by reference
ii. Demonstrate Dangling pointer problem using a C program
iii. Write a C program to copy one string into another using pointer
iv. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 12:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C.

Suggested Experiments/Activities:

Tutorial 12: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures, memory dereference.

i. Write a C program to find the sum of a 1D array using malloc()

ii. Write a C program to find the total, average of n students using structures
iii. Enter n students data using calloc() and display failed students list
iv. Read student name and marks from the command line and display the student details along with the total.
v. Write a C program to implement realloc()

WEEK 13:
Objective: Experiment with C Structures, Unions, bit fields and nested structures
Activities:
Tutorial 13: Bit fields, Self-Referential Structures, Linked lists
Lab 12: Bit fields, linked lists Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i. Demonstrate the differences between structures and unions using a C program
ii. Write a C program to shift/rotate using bitfields.
iii. Write a C program to copy one structure variable to another structure of the same type.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.
Activities:
Tutorial 14: File handling
Lab 13: File operations

i. Write a C program to write and read text into a file.
ii. Write a C program to write and read text into a binary file using fread() and fwrite().
iii. Copy the contents of one file to another file.
iv. Write a C program to merge two files into the third file using command-line arguments.
v. Find no. of lines, words and characters in a file
vi. Write a C program to print last n characters of a given file.

TEXT BOOKS:

1. Ajay Mittal, Programming in C: A Practical Approach, Pearson, 1st Edition, 2007.
2. Byron S. Gottfried, Schaum's Outline of Programming with C, McGraw Hill, 2nd Edition, 1996.

REFERENCES:

1. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India, 2nd Edition, 1988.
2. Behrouz A. Forouzan, Richard F. Gilberg, Anita Prasad, C Programming: A Problem-Solving Approach, Cengage Learning, 1st Edition, 2008.

I Year B.Tech. – I Semester

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(PH23ABS102) ENGINEERING PHYSICS LAB

COURSE OBJECTIVES:
The objective of this course is to:
- Study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity, Hall effect in semiconductors, study the parameters and applications of dielectric and magnetic materials by conducting experiments.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Compare the wavelengths of different colours using diffraction grating.
CO 2: Utilize optical instruments like travelling microscope and spectrometer.
CO 3: Analyze the intensity of the magnetic field of circular coil carrying current with distance.
CO 4: Evaluate dielectric constant for a dielectric material.
CO 5: Estimate the band gap of a given semiconductor and the type of semiconductor using Hall effect.

List of Experiments:
1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Determination of dielectric constant using charging and discharging method.
4. Study the variation of B versus H by magnetizing the magnetic material (B- H curve).
5. Determination of wavelength of Laser light using diffraction grating.
6. Estimation of Planck's constant using photoelectric effect.
7. Determination of the resistivity of semiconductors by four probe methods.
8. Determination of energy gap of a semiconductor using p-n junction diode.
9. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
10. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
11. Determination of temperature coefficients of a thermistor.
12. Sonometer: Verification of laws of stretched string.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

TEXT BOOKS:
1. S. Balasubramanian, M.N. Srinivasan, A Textbook of Practical Physics, S. Chand Publishers, 1st Edition, 2017.
2. D.K. Bhattacharya, Poonam Tandon, Engineering Physics, Oxford University Press, 1st Edition, 2015.

REFERENCES:
1. M.R. Srinivasan, Engineering Physics, New Age International Publishers, 1st Edition, 2009.
2. Sanjay D. Jain, D. Sahasrabudhe, Girish, Engineering Physics, University Press, 1st Edition, 2010.

ONLINE RESOURCES:
1. www.vlab.co.inhttps://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

I Year B.Tech. – I Semester

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(ME23AES103) ENGINEERING WORKSHOP

COURSE OBJECTIVES:
The objectives of this course are to:
- Identify and explain safety practices and precautions relevant to workshop activities.
- Recognize and differentiate various types of woods and tools used in woodwork.
- Demonstrate the ability to create different wood joints, including half-lap, mortise and tenon, and dovetail joints.
- Familiarize students with sheet metal working tools and techniques.
- Enable students to develop sheet metal projects such as tapered trays, conical funnels, elbow pipes and brazing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Fabricate sheet metal components manually.
CO 2: Construct wood joints such as half-lap, mortise, and tenon.
CO 3: Assemble the components to create joints like a V-fit.
CO 4: Demonstrate the plumbing, welding, foundry, and fitting jobs to form the components.
CO 5: Connect & Check the basic house wiring circuit connections for various applications.

List of Exercises:
1. **Demonstration**: Safety Practices and Precautions to be Observed in the Workshop.
2. **Wood Working:** Familiarity with Different Types of Woods and Tools used in Wood Working and Making Following Joints.
   a) Half – Lap Joint
   b) Mortise and Tenon Joint
   c) Corner Dovetail Joint or Bridle Joint
3. **Sheet Metal Working**: Familiarity with Different Types of Tools used in Sheet Metal Working, Developments of Following Sheet Metal Job from GI Sheets.
   a) Tapered Tray
   b) Conical Funnel
   c) Elbow Pipe
   d) Brazing
4. **Fitting:** Familiarity with Different Types of Tools used in Fitting and do the Following Fitting Exercises.
   a) V-Fit
   b) Dovetail Fit
   c) Semi-Circular Fit
   d) Bicycle Tire Puncture and Change of Two-Wheeler Tyre
5. **Electrical Wiring**: Familiarity with Different Types of Basic Electrical Circuits and make the Following Connections.
   a) Parallel and Series
   b) Two-Way Switch
   c) Godown Lighting
   d) Tube Light
   e) Three Phase Motor
   f) Soldering of Wires
6. **Foundry Trade:** Demonstration and Practice on Moulding Tools and Processes, Preparation of Green Sand Moulds for Given Patterns.
7. **Welding Shop:** Demonstration and Practice on Arc Welding and Gas Welding. Preparation of Lap Joint and Butt Joint.

8. **Plumbing:** Demonstration and Practice of Plumbing Tools, Preparation of Pipe Joints with Coupling for Same Diameter and with Reducer for Different Diameters.

TEXT BOOKS:

1. Felix W, Basic Workshop Technology: Manufacturing Process, Independently Published, 2019.
2. Bruce J. Black, Workshop Processes, Practices and Materials, Routledge Publishers, 5th Edition, 2015.

REFERENCES:

1. S. K. Hajra Choudhury, Elements of Workshop Technology, Vol. I, Media Promoters and Publishers, Mumbai, 2007, 14th Edition.
2. H. S. Bawa, Workshop Practice, Tata McGraw-Hill, 1st Edition, 2004.
3. P. M. Soni, P. A. Upadhyay, Wiring Estimating, Costing and Contracting, Atul Prakashan, 2021–22, 1st Edition, 2021.
4. B.S. Raghuwanshi, A Course in Workshop Technology Vol I. & II, Dhanpath Rai & Co., 2015 & 2017.

I Year B.Tech. – I Semester

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(CS23AES103) IT WORKSHOP

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce the internal parts of a computer, peripherals, I/O ports, connecting cables.
- Teach basic command line interface commands on Linux.
- Teach the usage of Internet for productivity and self-paced life-long learning
- Introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Perform Hardware troubleshooting.
CO 2: Understand Hardware components and inter dependencies.
CO 3: Safeguard computer systems from viruses/worms.
CO 4: Document/ Presentation preparation.
CO 5: Perform calculations using spreadsheets

List of Exercises:
Hardware:
Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheraland submit to your instructor.
Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.
Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.
Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web:
Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.
Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.
Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block activey downloads to avoid viruses and/or worms.

LaTeX and WORD:
Task 1: Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be

covered in each, Using La TeXand word
– Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.
Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel:
Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text
Task 2: Calculating GPA - Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,
LOOKUP/VLOOKUP
Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean andlogical operators, Conditional formatting

Power Point:
Task 1: Students will be working on basic power point utilities and toolswhich help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrowsin PowerPoint.
Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art,Audio, Video, Objects, Tables and Charts.
Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI Tools – ChatGPT:
Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences
to see how the model completes them.
Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"
Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this newreality."
Task 3: Code Generation: Test the model's ability to generate code by giving it partial code snippets and asking it to complete them. You can also ask the model to explain programming concepts or help you debug code.
Ex: Prompt: "Complete the following Python code to swap the values of two variables:\npython\na = 5\nb = 10\ntemp = a\na = b\nb = temp\n"
Task 4: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it intoanother language. Compare the output to see how accurate and fluent the translations are.
Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing

today?'"
Task 5: Summarization: Provide a long piece of text, such as an article or a blog post, and ask the model to summarize it. Compare the model's summary with the original text to assess its ability to condense information effectively.
Ex: Prompt: "Summarize the article titled 'Ramayanam' in 3-4 sentences."
Task 6: Futuristic Predictions: Have fun by asking the model to predict future technological advancements, societal changes, or even hypothetical scenarios. Compare its responses with your own ideas.
Ex: Prompt: "Predict how artificial intelligence will transform everyday life in the next 20 years."
Task 7: Technical Explanations: Challenge the model with technical questions from different domains. Ask it to explain scientific concepts, mathematical theorems, or complex algorithms in simple terms.
Ex: Prompt: "Explain the concept of neural networks in machine learning, including their layers and the process of backpropagation."

TEXT BOOKS:

1. Vikas Gupta, Comdex Information Technology Course Tool Kit, WILEY Dreamtech, 1st Edition, 2005.
2. Cheryl A. Schmidt, The Complete Computer Upgrade and Repair Text Book, Dreamtech Press, 3rd Edition, 2006.

REFERENCES:

1. ITL Education Solutions Limited, Introduction to Information Technology, Pearson Education, 2nd Edition, 2012.
2. Kate J. Chase, PC Hardware: A Handbook, Microsoft Press, 1st Edition, 2004.
3. Leslie Lamport, LaTeX: A Document Preparation System, Addison-Wesley, 2nd Edition, 1994.
4. David Anfinson, Ken Quamme, IT Essentials: PC Hardware and Software Companion Guide, Cisco Press, 3rd Edition, 2008.
5. Patrick Regan, IT Essentials: PC Hardware and Software Labs and Study Guide, Cisco Press, 3rd Edition, 2008.

I Year B.Tech. – I Semester

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(CH23ABS105) HEALTH AND WELLNESS, YOGA AND SPORTS

COURSE OBJECTIVES:
The objectives of this course are to:

- Make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the importance of yoga and sports for Physical fitness and sound health.
CO 2: Demonstrate an understanding of health-related fitness components.
CO 3: Compare and contrast various activities that help enhance their health.
CO 4: Assess current personal fitness levels.
CO 5: Develop Positive Personality.

COURSE CONTENT

UNIT I:
Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.
Activities:

ii) Organizing health awareness programmes in community.
iii) Preparation of health profile.
iv) Preparation of chart for balance diet for all age groups.

UNIT II:
Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas-Pranayama and meditation, stress management and yoga, Mental health and yoga practice.
Activities:
Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III:
Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.
Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho,Table tennis, Cricket etc. Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

TEXT BOOKS:

1. Gordon Edlin, Eric Golanty, Health and Wellness, Jones & Bartlett Learning, 14th Edition, 2022.
2. T.K.V. Desikachar, The Heart of Yoga: Developing a Personal Practice, Inner Traditions, 1st Edition, 1995.

REFERENCES:

1. Archie J. Bahm, Yoga Sutras of Patanjali, Jain Publishing Company, 1st Edition, 1993.
2. John Lofty Wiseman, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere, William Morrow Paperbacks, 3rd Edition, 2014.

Thomas Hanlon, The Sports Rules Book, Human Kinetics, Inc., 3rd Edition, 2014.

I Year B.Tech. – II Semester

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(EE23AES101) BASIC ELECTRICAL & ELECTRONICS ENGINEERING

PART A: BASIC ELECTRICAL ENGINEERING

COURSE OBJECTIVES:
The objectives of this course are to:
- Gain the knowledge about various laws, simplification techniques and principles associated with electrical circuits.
- Acquire basic knowledge about the Electric machines, their principle of operation and the concept of measuring instruments.
- Understand the concept of Power Generation, Electricity Bill and Safety Measures.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Apply the knowledge of theorems/laws to analyze the simple AC and DC circuits.
CO 2: Illustrate the operating principles of various electrical machines and electrical measuring equipment's.
CO 3: Understand the basic concepts of electrical power generation, Electricity Bill and Safety Measures.

COURSE CONTENT

UNIT I: **(8 Periods)**
DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.
AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II: **(7 Periods)**
Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.
Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone Bridge.

UNIT III: **(7 Periods)**
Energy Resources, Electricity Bill & Safety Measures Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.
Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

TEXT BOOKS:
1. D.C. Kulshreshtha, Basic Electrical Engineering, Tata McGraw Hill, 1st Edition, 2019.
2. P.V. Gupta, M.L. Soni, U.S. Bhatnagar, A. Chakrabarti, Power System Engineering, Dhanpat Rai & Co., 1st Edition, 2013.

REFERENCES:
1. D.P. Kothari, I.J. Nagrath, Basic Electrical Engineering, McGraw Hill, 4th Edition, 2019.
2. V.K. Mehta, Principles of Power Systems, S. Chand Technical Publishers, 1st Edition, 2020.

3. T.K. Nagsarkar, M.S. Sukhija, Basic Electrical Engineering, Oxford University Press, 1st Edition, 2017.
4. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Publications, 2nd Edition, 2018.

PART B: BASIC ELECTRONICS ENGINEERING

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the working principle of various electronic devices.
- Acquire knowledge on the operating conditions of a DC power supply system, amplifiers and general electronic instrumentation system.
- Learn basic techniques in the design of a logic circuit.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Apply the concept of science and mathematics to understand the working principles of electronic devices.
CO 2: Analyze the working principle of a DC power supply system and Amplifiers.
CO 3: Solve digital logic circuits and implement using different logic gates.

COURSE CONTENT

UNIT I: (7 Periods)
Semiconductor Devices: Introduction - Evolution of electronics - Characteristics of PN Junction Diode - Zener Effect- Zener Diode and its Characteristics. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics - Elementary Treatment of Small Signal CE Amplifier.

UNIT II: (8 Periods)
Basic Electronic Circuits and Instrumentation: Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III: (8 Periods)
Digital Electronics: Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only).

Total Periods: 45

TEXT BOOKS:
1. R.L. Boylestad, Louis Nashelsky, Electronic Devices & Circuit Theory, Pearson Education, 11th Edition, 2021.
2. R.P. Jain, Modern Digital Electronics, Tata McGraw Hill, 4th Edition, 2009.

REFERENCES:
1. R.S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co., 1st Edition, 2010.
2. Santiram Kal, Basic Electronics: Devices, Circuits and IT Fundamentals, Prentice Hall India, 1st Edition, 2002.

I Year B.Tech. – II Semester

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(EG23AHS101) COMMUNICATIVE ENGLISH

COURSE OBJECTIVES:
The objectives of this course are to:
- Facilitate effective listening, Reading, Speaking and Writing skills among the students.
- Enhance the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary.
- Make them effective in speaking and writing skills and to make them industry ready.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Understand the context, topic, and pieces of specific information from socialor Transactional dialogues.
- **CO 2:** Apply grammatical structures to formulate and correct word forms.
- **CO 3:** Analyze discourse markers to speak clearly on a specific topic in informal discussions.
- **CO 4:** Evaluate reading/listening texts and write summaries based on global comprehension of these texts.
- **CO 5:** Create a coherent paragraph, essay, and resume.

COURSE CONTENT

UNIT I: **(6 Periods)**
Lesson: HUMAN VALUES: The Gift of the Magi (Short Story)
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information. Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions.
Writing: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II: **(7 Periods)**
Lesson: NATURE: The Brook by Alfred Tennyson (Poem)
Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

UNIT III: **(6 Periods)**
Lesson: BIOGRAPHY: Elon Musk
Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed.
Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing.
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations.
Vocabulary: Compound words, Collocation.

UNIT IV: (5 Periods)
Lesson: INSPIRATION: The Toys of Peace by Saki
Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal trends / patterns / relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice.
Vocabulary: Words often confused, Jargons.

UNIT V: (6 Periods)
Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement).
Vocabulary: Technical Jargons

Total Periods: 30

TEXT BOOKS:

1. Pathfinder: Communicative English for Undergraduate Students, Orient Black Swan, 1st Edition, 2023.
2. Empowering Cengage Publications, Empowering with Language, Cengage Learning, 1st Edition, 2023.

REFERENCES:

1. Sham Ji Dubey, English for Engineers, Vikas Publishers, 1st Edition, 2020.
2. Stephen Bailey, Academic Writing: A Handbook for International Students, Routledge, 1st Edition, 2014.
3. Raymond Murphy, English Grammar in Use, Cambridge University Press, 4th Edition, 2019.
4. Norman Lewis, Word Power Made Easy: The Complete Handbook for Building a Superior Vocabulary, Anchor, 1st Edition, 2014.

ONLINE RESOURCES:
Grammar:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Vocabulary:

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

I Year B.Tech. – II Semester

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3	-	-	3

(CS23APC201) DATA STRUCTURES

COURSE OBJECTIVES:
The objective of this course is to:
- Familiarize with basic techniques of algorithm analysis.
- Familiarize Stacks, Queues using Arrays and Linked List.
- Understand Searching and Sorting techniques.
- Learn the concepts of different types of trees and its operations.
- Familiarize with graph algorithms.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Analyze the problems using asymptotic notations.
CO 2: Apply Stack, Queues and linked list to solve different applications.
CO 3: Demonstrate suitable sorting techniques for the real world problem.
CO 4: Implement tree structures in different patterns of representation of data.
CO 5: Analyze the given problem using graph traversal techniques.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures.
Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort, Merge Sort, Quick Sort.

UNIT II: **(9 Periods)**
Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT III: **(9 Periods)**
Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.
Queues: Introduction to queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc

UNIT IV: **(9 Periods)**
Deque: Introduction to deque (double-ended queues), Operations on deque and their applications.
Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal, AVL Trees, Heap Sort

UNIT V: **(9 Periods)**
Graph Theory: Graphs Terminology, Graph ADT, Data Structures for Graphs- Adjacency Matrix Structure, Graph Traversals, Shortest Paths, Minimum Spanning Trees- Prims' Algorithm, Kruskal's Algorithm.
Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Total Periods: 45

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson, 2nd Edition, 2002.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition, 2010.

REFERENCES:

1. Horowitz, Sahani, Anderson-Freed, Fundamental of Data Structures in C, Universities Press, 2nd Edition, 2008.
2. Debasis Samantha, Classic Data Structures, PHI, 2nd Edition, 2009.
3. Narasimha Karumanchi, Data Structures and Algorithms Made Easy, Career Monk Publications, 2020.

I Year B.Tech. – II Semester

L	T	P	C
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(MA23ABS201) DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

COURSE OBJECTIVES:
The objective of this course is to:

- Enlighten the learners in the concept of differential equations and multivariable calculus.
- Furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Familiarize to solve the first and higher order differential equations.
CO 2: Apply the knowledge of linear differential equations related to various engineering fields.
CO 3: Identify solution methods for partial differential equations that model physical processes.
CO 4: Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO 5: Evaluate the work done by force field, circulation and transformation between single, double and triple integrals using vector calculus.

COURSE CONTENT

UNIT I: **(8 Periods)**
Differential Equations: Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay, Electrical circuits.

UNIT II: **(10 Periods)**
Linear Differential Equations of Higher Order: Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III: **(10 Periods)**
Partial Differential Equations: Introduction, Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogenous linear Partial Differential equations with constant coefficients.

UNIT IV: **(8 Periods)**
Vector Differentiation: Scalar and vector point functions, vector operator Del, Del applies to scalar point functions, Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V: **(9 Periods)**
Vector Integration: Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Total Periods: 45

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons,10th Edition, 2011.

REFERENCES:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, Pearson, 2nd Edition, 2018.
3. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, Pearson Publishers, 13th Edition, 2013.
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd., 3rd Edition, 2002.
5. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.
6. H. K Dass, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
7. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

I Year B.Tech. – II Semester

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(CH23ABS101) CHEMISTRY

COURSE OBJECTIVES:
The objective of this course is to:
- Familiarize engineering chemistry and its applications.
- Train the students on the principles and applications of electrochemistry and polymers.
- Introduce instrumental methods.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand Schrodinger Wave equation, MOT, energy level diagrams.
CO 2: Apply the principle of Band diagrams in the application of conductors and semiconductors.
CO 3: Compare the materials for construction of a battery and electrochemical sensors.
CO 4: Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.
CO 5: Explain the principles of spectrometry and separation of solid and liquid mixtures by chromatography.

COURSE CONTENT

UNIT I: (8 Periods)
Structure and Bonding Models: Fundamentals of Quantum Mechanics-Plank's quantum theory, de-Broglie's hypothesis, Heisenberg uncertainty principle, Schrodinger Wave equation, significance of Ψ and Ψ2, molecular orbital theory – bonding in homo- and hetero nuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II: (12 Periods)
Modern Engineering Materials: Crystal field theory, d- orbital's splitting in tetra hedral and octa hedral complexes, Semiconductors – Introduction, doping concept, application, Super Conductors- Introduction basic concept, applications. Super capacitors-: Introduction, Basic Concept-Classification – applications. Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon Nano tubes and Graphenes.

UNIT III: (8 Periods)
Electrochemistry And Applications: Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples Primary cells – Zinc-air battery, Secondary cells –lithium- ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV: (9 Periods)
Polymer Chemistry: Introduction to polymers, functionality of monomers, Tactility, chain growth and step growth polymerization, co- polymerization, with specific examples and mechanisms of polymer formation.
Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6, 6.
Elastomers–Processing and vulcanization of natural rubber, Buna-S, Buna-N– preparation, properties and applications.
Conducting polymers – poly acetylene, poly aniline, – mechanism of conduction and applications. Bio-Degradable polymer - Poly Glycolic Acid (PGA).

UNIT V: **(8 Periods)**

Instrumental Methods and Applications: Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV- Visible Spectroscopy- electronic transition, Instrumentation and applications, IR spectroscopy- principle, Instrumentation and applications. Chromato graphy-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Total Periods: 45

TEXT BOOKS:

1. Jain and Jain, Engineering Chemistry, DhanpatRai, 16^{th} Edition, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins, Physical Chemistry, Oxford University Press, 10^{th} Edition, 2010.
3. Vogel's quantitative chemical analysis, 6^{th} Edition, 2009.

REFERENCES:

1. Skoog and West, Principles of Instrumental Analysis, Thomson, 6/e, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, Wiley Publications, 5^{th} Edition, Feb.2008.
3. Fred W. Billmayer Jr Textbook of Polymer Science, 3^{rd} Edition.
4. K.N. Jaya veera, G.V. Subba Reddy and C. Rama Chandraiah, Chemistry, Mc Graw Hill.

I Year B.Tech. – II Semester

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(EG23AHS102) COMMUNICATIVE ENGLISH LAB

COURSE OBJECTIVES:
The objective of this course is to:
- Expose the students to a variety of self-instructional, learner friendly modes of language learning.
- The students will get trained in basic communication skills and also make them ready to face job interviews.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand the different aspects of the English language proficiency with an emphasis on LSRW skills.
CO 2: Apply communication skills through various language learning activities.
CO 3: Analyze the English speech sounds, stress, rhythm, intonation, and syllable division for better listening and speaking comprehension.
CO 4: Evaluate and exhibit professionalism in participating in debates and group discussions.
CO 5: Create effective Course Objectives.

List of Topics:
1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:
- Walden InfoTech
- Young India Films

REFERENCES:
1. Raman Meenakshi, Sangeeta-Sharma, Technical Communication, Oxford Press, 2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India, 2016.
3. Hewing's, Martin. Cambridge Academic English(B2), CUP, 2012.
4. J. Sethi& P.V. Dhamija, A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013.

ONLINE RESOURCES:
Spoken English:
1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured

1. https://www.youtube.com/c/EnglishClass101/featured
2. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
3. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

VOICE AND ACCENT:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

I Year B.Tech. – II Semester

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(CS23APC202) DATA STRUCTURES LAB

COURSE OBJECTIVES:
The objective of this course is to:
- Strengthen the ability to identify and apply the suitable data structure for the given real-world problem.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Demonstrate the concept of Recursion for solving a problem.
CO 2: Choose and implement linear data structure to solve problems.
CO 3: Develop programs for searching and sorting algorithms.
CO 4: Select and implement suitable nonlinear data structure for solving a problem.

List of Exercises:

1. Implement basic operations on arrays: insertion, deletion, searching.
2. Create a program to find the maximum and minimum elements in an array.
3. Write a program to reverse an array.
4. Demonstrate recursive algorithms with examples.
5. Develop a program to perform operations of a Stack and Queue using arrays.
6. Implement and perform different operations on Single, Double and Circular Linked Lists.
7. Develop a program to perform operations of Stack and Queue using Linked Lists.
8. Develop a program to implement Stack applications.
9. Implement Circular Queues. 10.Implement various Searching techniques.
11. Develop programs for different Sorting techniques.
12. Develop a program to demonstrate operations on Binary Search Tree.

TEXT BOOKS:
1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson, 2nd Edition, 2002.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, PHI, 3rd Edition, 2010.
3. Narasimha Karumanchi, Data Structures and Algorithms Made Easy, Career Monk Publications, 2020.

I Year B.Tech. – II Semester

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(CH23ABS102) CHEMISTRY LAB

COURSE OBJECTIVES:
The objective of this course is to:
- Familiarize engineering chemistry and its applications.
- Train the students on the principles and applications of electrochemistry and polymers.
- Introduce instrumental methods.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Verify Beer Lambert's law.
CO 2: Analyze the IR and NMR spectra of some organic compounds.
CO 3: Apply electro analytical techniques foe sample analysis.
CO 4: Measure the strength of an acid present in the samples.
CO 5: Prepare advanced polymer materials.

List of Experiments:
1. Measurement of 10Dq by spectrophotometric method
2. Conduct metric titration of strong acid vs. strong base
3. Conduct metric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

REFERENCES:
1. Vogel's, Quantitative Chemical Analysis, Pearson, 6th Edition.

I Year B.Tech. – II Semester

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(EE23AES102) ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

PART A: ELECTRICAL ENGINEERING LAB

COURSE OBJECTIVES:
The objectives of this course are to:
- Gain the practical knowledge about various laws/theorems for the given circuit.
- Acquire knowledge about various electrical measuring instruments and safety measures.
- Obtain the performance characteristics of DC generator.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand the concept of KCL, KVL and Theorems practically for the given circuit.
CO 2: Evaluate the resistance, power and power factor of circuit elements by using measuring instruments.
CO 3: Obtain the Magnetization Characteristics of DC shunt Generator.

List of Experiments:
1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

TEXT BOOKS:
1. D.C. Kulshreshtha, Basic Electrical Engineering, Tata McGraw Hill, 1st Edition, 2019.
2. P.V. Gupta, M.L. Soni, U.S. Bhatnagar, A. Chakrabarti, Power System Engineering, Dhanpat Rai & Co., 1st Edition, 2013.

REFERENCES:
1. Rajendra Prasad, Fundamentals of Electrical Engineering, PHI Publishers, 3rd Edition, 2014.

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

COURSE OBJECTIVES:
The objectives of this course are to:
- Gain hands on experience in testing various electronic components.
- Acquire knowledge related to the use of electronic measuring instruments for different applications.
- Design and simulate a RC coupled amplifier.
- Verify the operating conditions of combinational and sequential circuits.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Identify & test various electronic components.
CO 2: Employ various electronic measuring instruments for different applications.
CO 3: Evaluate the biasing conditions of various diodes and BJTs.
CO 4: Examine the operating conditions of a digital circuit

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers.
4. Plot Input & Output characteristics of BJT in CE and CB configurations.
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied.
   i. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
7. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

TEXT BOOKS:

1. R.L. Boylestad, Louis Nashelsky, Electronic Devices & Circuit Theory, Pearson Education, 11th Edition, 2021.
2. R. P. Jain, Modern Digital Electronics, Tata Mc Graw Hill, 4th Edition, 2009.

REFERENCES:

1. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 1st Edition, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

I Year B.Tech. – II Semester

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(CH23ABS106) NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

COURSE OBJECTIVES:
The objective of this course is to:
- Impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand the importance of discipline, character and service motto.
CO 2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO 3: Explore human relationships by analyzing social problems.
CO 4: Determine to extend their help for the fellow beings and downtrodden people.
CO 5: Develop leadership skills and civic responsibilities

COURSE CONTENT
UNIT I:
Orientation: General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.
Activities:
i) Conducting –ice breaking sessions-expectations from the course- knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans- activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings-any other contribution.

UNIT II:
Nature & Care
Activities:
i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III:
Community Service
Activities:
i) Conducting One Day Special Camp in a village contacting village-area leaders-Survey in the village, identification of problems- helping them to solve via media-authorities experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

TEXT BOOKS:

1. Nirmalya Kumar Sinha, Surajit Majumder, A Text Book of National Service Scheme, Vol. I, Vidya Kutir Publication, 1st Edition, 2021.
2. Directorate General of NCC, Red Book - National Cadet Corps: Standing Instructions, Vol. I & II, Ministry of Defence, New Delhi, 1st Edition, 2010.

REFERENCES:

1. Davis M. L., Cornwell D. A., Introduction to Environmental Engineering, McGraw Hill, 4th Edition, 2008.
2. Masters G. M., Joseph K., Nagendran R., Introduction to Environmental Engineering and Science, Pearson Education, 2nd Edition, 2007.
3. Ram Ahuja, Social Problems in India, Rawat Publications, 4th Edition, 2021.

II Year B.Tech. – I Semester

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(MA23ABS302) DISCRETE MATHEMATICS AND GRAPH THEORY

COURSE OBJECTIVES:
The objectives of this course are to:
- Describe logical sentences in terms of predicates, quantifiers, and logical connectives in theory of inference for the statement calculus.
- Demonstrate the application of basic methods of discrete mathematics in Computer Science problem solving.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Apply mathematical concepts and logical reasoning to solve problems in different fields of Computer science and information technology.
CO 2: Categorize the properties of Algebraic Structures to find the given sets are Semi group, Monoid and Groups.
CO 3: Analyze the concepts of Combinations, permutations and Binomial theorems.
CO 4: Analyze the concepts of Generating and Recurrence relations for solving Homogeneous and In-Homogeneous equations.
CO 5: Apply Graph Theory in solving in computer science problems.

COURSE CONTENT

UNIT I: **(9 Periods)**
Mathematical Logic: Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

UNIT II: **(10 Periods)**
Set theory: The Principle of Inclusion- Exclusion, Pigeon hole principle and its application, Functions, Composition of functions, Inverse Functions, Recursive Functions.
Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, Homomorphism, Isomorphism.

UNIT III: **(9 Periods)**
Elementary Combinatorics: Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial theorems.

UNIT IV: **(9 Periods)**
Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of in homogeneous Recurrence Relations.

UNIT V: **(8 Periods)**
Graphs: Basic Concepts, Isomorphism and Sub-graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs.

Total Periods:45

TEXT BOOKS:
1. J.P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1st Edition, 2002.
2. Kenneth H. Rosen, Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, McGraw Hill Education (India) Private Limited, 7th Edition, 2012.

REFERENCES:

1. Joe L. Mott, Abraham Kandel, Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, Pearson Education, 2nd Edition, 2011.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1st Edition, 2003.

ONLINE RESOURCES:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

II Year B.Tech. – I Semester

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3	-	-	3

(BA23AHS302) UNIVERSAL HUMAN VALUES

COURSE OBJECTIVES:

The objective of this course is to:

- Help the students appreciate the essential complementary between 'VALUES' and' SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- Facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Define the terms like Natural Acceptance, Happiness and Prosperity.
CO 2: Identify one’s self, and one’s surroundings (family, society nature).
CO 3: Apply what they have learnt to their own self in different day-to-day settings in real life.
CO 4: Relate human values with human relationship and human society.
CO 5: Justify the need for universal human values and harmonious existence.

COURSE CONTENT

UNIT I: (7 Periods)

Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) – Understanding Value Education ;Practice Session - Sharing about Oneself ; Self-Exploration as the Process for Value Education - Continuous Happiness and Prosperity - the Basic Human Aspirations ; Practice Session - Exploring Human Consciousness ; Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations ; Practice Session - Exploring Natural Acceptance.

UNIT II: (6 Periods)

Harmony in the Human Being: Understanding Human Being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body ; Practice Session - Exploring the difference of Needs of self and body ; The Body as an Instrument of the Self - Understanding Harmony in the Self ; Practice Session - Exploring Sources of Imagination in the Self ; Harmony of the Self with the Body - Programme to ensure Self-regulation and Health ; Practice Session - Exploring Harmony of Self with the Body.

UNIT III: (6 Periods)

Harmony in the Family and Society: Harmony in the Family – The Basic Unit of Human Interaction - 'Trust' – The Foundational Value in Relationship; Practice Session - Exploring the Feeling of Trust ; 'Respect' – as the Right Evaluation ; Practice Session - Exploring the Feeling of Respect ; Other Feelings, Justice in Human-to-Human Relationship - Understanding Harmony in the Society - Vision for the Universal Human Order ; Practice Session ; Exploring Systems to fulfill Human Goal.

UNIT IV: (5 Periods)

Harmony in the Nature / Existence: Understanding Harmony in the Nature - Interconnectedness, Self-regulation and Mutual fulfillment among the Four Orders of Nature; Practice Session - Exploring the Four Orders of Nature; Realizing Existence as Co-existence at

All Levels - The Holistic Perception of Harmony in Existence; Practice Session - Exploring Co-existence in Existence**.**

UNIT V: (6 Periods)

Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct ; Practice Session -Exploring Ethical Human Conduct ; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics ; Practice Session - Exploring Humanistic Models in Education ; Holistic Technologies, Production Systems and Management Models-Typical Case Studies - Strategies for Transition towards Value-based Life and Profession ; Practice Session - Exploring Steps of Transition towards Universal Human Order.

Total Periods: 30

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2nd Revised Edition, 2019. ISBN 978-93-87034-47-1.
2. R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2nd Revised Edition, 2019. ISBN 978-93-87034-53-2.

REFERENCES:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathy, Human Values, The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi, New Age International Publishers, 2003.
3. E G Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.
4. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Prentice Hall of India Ltd, Eastern Economy Edition.
5. B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.

ONLINE RESOURCES:

1. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
2. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year B.Tech. – I Semester

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(CS23APC301) ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS

COURSE OBJECTIVES:
The objective of this course is to:
- Provide knowledge on advance data structures frequently used in Computer Science domain.
- Develop skills in algorithm design techniques popularly used.
- Understand the use of various data structures in the algorithm design.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Illustrate the working of the advanced tree data structures and their applications.
CO 2: Understand the Graph data structure, traversals and apply them in various contexts.
CO 3: Use various data structures in the design of algorithms.
CO 4: Recommend appropriate data structures based on the problem being solved.
CO 5: Analyze algorithms with respect to space and time complexities.

COURSE CONTENT

UNIT – I: **(9 periods)**
Introduction to Algorithm: Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion operations, and Applications. Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications.

UNIT – II: **(9 periods)**
Graphs: Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications.
Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's Matrix multiplication, Convex Hull Problem.

UNIT – III: **(9 periods)**
Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths.
Dynamic Programming: General Method, All pairs shortest paths.

UNIT – IV: **(9 periods)**
Dynamic Programming: 0/1 Knapsack, String Editing, Travelling Salesperson problem.
Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem.

UNIT – V: **(9 periods)**
Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem Introduction to NP Hard and NP Complete Problems: Basic Concepts.

Total Periods: 45

TEXT BOOKS:
1. Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, Fundamentals of Data Structures in C++, Universities Press, 2nd Edition.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar, Rajasekaran Computer Algorithms/C++, University Press, 2nd Edition.

REFERENCES:

1. Robert Kruse, Data Structures and program design in C, Pearson Education Asia.
2. Trembley & Sorenson, An introduction to Data Structures with applications, McGraw Hill.
3. DonaldE Knuth, Addison, The Art of Computer Programming, Vol.1: Fundamental Algorithms, -Wesley, 1997.
4. Langsam, Augenstein & Tanenbaum, Data Structures using C & C++, Pearson, 1995.
5. N. Wirth, Algorithms + Data Structures & Programs, PHI.
6. Horowitz Sahni & Mehta, Fundamentals of Data Structures in C++, Galgottia Pub.
7. Thomas Standish, Data structures in Java, Pearson Education Asia.

ONLINE LEARNING RESOURCES:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari,1. Introduction to Algorithms (youtube.com)

II Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CS23APC302) OBJECT ORIENTED PROGRAMMING THROUGH JAVA

COURSE OBJECTIVES:

The objectives of this course are to:

- Identify Java language components and how they work together in Applications.
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications.
- Understand how to design applications with threads in Java.
- Understand how to use Java apis for program development.

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COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO 2: Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects.
CO 3: Demonstrate an understanding of inheritance hierarchies & polymorphic behaviour, including method overriding and dynamic method dispatch.
CO 4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO 5: Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.

COURSE CONTENT

UNIT I: **(9 periods)**

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Fina.

Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: **(9 periods)**

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III: (9 periods)

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class- Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: (9 periods)

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto- unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2).

UNIT V: (9 periods)

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3).

Total Periods: 45

TEXT BOOKS:

1. Anitha Seth, B.L. Juneja, JAVA one step ahead, Oxford.
2. Debasis Samanta, Monalisa Sarma, Joy with JAVA, Fundamentals of Object-Oriented Programming, Cambridge, 2023.
3. Paul Deitel, Harvey Deitel, JAVA 9 for Programmers, Pearson, 4th Edition.

REFERENCES:

1. Y Daniel Liang, Introduction to Java programming, Pearson, 7th Edition.
2. Herbert Schildt, The complete Reference Java, TMH, 11th edition.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347shared/overview

II Year B.Tech. – I Semester

L	T	P	C
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(EC23AES301) DIGITAL LOGIC AND COMPUTER ORGANIZATION

COURSE OBJECTIVES:
The main objectives of the course are to:
- Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals.
- Describe memory hierarchy concepts.
- Explain input/output(I/O) systems and their interaction with the CPU, memory, and peripheral devices.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the properties of Boolean algebra, logic operations and design of Combinational Circuits.

CO 2: Analyze & Design sequential Circuits and demonstrate an understanding of the design of the functional units of a digital computer system.

CO 3: Understand the architecture of modern computer, and also understanding of how the computer performs arithmetic operations on positive and negative numbers.

CO 4: Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance & scalability.

CO 5: Understand of I/O devices communicating with Processing Unit and also knowing the characteristics of multiprocessors.

COURSE CONTENT

UNIT I: **(10 Periods)**

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes.

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers.

UNIT II: **(9 Periods)**

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters.

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture.

UNIT III: **(10 Periods)**

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hard wired Control and Multi programmed Control.

UNIT IV: **(9 Periods)**

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

UNIT V: **(8 Periods)**

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct

Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

Total Periods: 45

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, McGrawHill, 6th Edition, 2023.
2. M.Morris Mano, Digital Design, Pearson Education, 6th Edition, 2018.
3. William Stallings, Computer Organization and Architecture, Pearson, 11th Edition, 2022.

REFERENCES:

1. M.Moris Mano, Computer Systems Architecture, Pearson, 3rd Edition, 2017.
2. DavidA. Paterson, John L.Hennessy, Computer Organization and Design, Elsevier, 2004.
3. Roth, Fundamentals of Logic Design, Thomson, 5th Edition, 2003.

ONLINE LEARNING RESOURCES:

https://nptel.ac.in/courses/106/103/106103068/

II Year B.Tech. – I Semester

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(CS23APC303) ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS LAB

COURSE OBJECTIVES:

The objective of this course is to:

- Acquire practical skills in constructing and managing Data structures.
- Apply the popular algorithm design methods in problem-solving scenarios.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Design and develop programs to solve real world problems with the popular algorithm design methods.

CO 2: Demonstrate an understanding of Non-Linear data structures by developing implementing the operations on AVL Trees, B-Trees, Heaps and Graphs.

CO 3: Critically assess the design choices and implementation strategies of algorithms and data structures in complex applications.

CO 4: Utilize appropriate data structures and algorithms to optimize solutions for specific computational problems.

CO 5: Compare the performance of different of algorithm design strategies and design algorithms to new real world problems.

EXPERIMENTS COVERING THE TOPICS:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

SAMPLE PROGRAMS:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
3. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists
4. Write a program for finding the bi-connected components in a given graph.
5. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
6. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
7. Implement Job sequencing with deadlines using Greedy strategy.
8. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
9. Implement N-Queens Problem Using Backtracking.
10. Use Backtracking strategy to solve 0/1 Knapsack problem.
11. Implement Travelling Sales Person problem using Branch and Bound approach.

REFERENCES:

1. Horowitz Ellis, Sahni Sartaj, Mehta, Dinesh, Fundamentals of Data Structures in C++, Universities Press, 2nd Edition.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Computer Algorithms/C++, University Press, 2nd Edition.
3. Robert Kruse, Data Structures and program design in C, Pearson Education Asia.
4. Trembley & Sorenson, An introduction to Data Structures with applications, McGraw Hill.

ONLINE LEARNING RESOURCES:

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

II Year B.Tech. – I Semester

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(CS23APC304) OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Practice object-oriented programming in the Java programming language.
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism.
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity.
- Construct Threads, Event Handling, implement packages, Java FX GUI.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling.

CO 2: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.

CO 3: Familiar with commonly used Java libraries and APIs, including the CollectionsFramework, Java I/O, JDBC, and other utility classes.

CO 4: Develop problem-solving skills and algorithmic thinking, applying OOP concepts todesign efficient solutions to various programming challenges.

CO 5: Proficiently construct graphical user interface (GUI) applications using JavaFX.

EXPERIMENTS COVERING THE TOPICS:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

List of Exercises:

EXERCISE – 1:

a) Write a JAVA program to display default value of all primitive data type of JAVA.
b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

EXERCISE - 2

a) Write a JAVA program to search for an element in a given list of elements using binarysearch mechanism.
b) Write a JAVA program to sort for an element in a given list of elements using bubble sort.
c) Write a JAVA program using String Buffer to delete, remove character.

EXERCISE - 3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invokethem inside main method.
b) Write a JAVA program implement method overloading.
c) Write a JAVA program to implement constructor. Write a JAVA program to implement constructor overloading.

EXERCISE - 4

a) Write a JAVA program to implement Single Inheritance.
b) Write a JAVA program to implement multi level Inheritance.
c) Write a JAVA program for abstract class to find areas of different shapes.

EXERCISE - 5

a) Write a JAVA program give example for “super” keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
c) Write a JAVA program that implements Runtime polymorphism.

EXERCISE - 6

a) Write a JAVA program that describes exception handling mechanism.
b) Write a JAVA program Illustrating Multiple catch clauses.
c) Write a JAVA program for creation of Java Built-in Exceptions.
d) Write a JAVA program for creation of User Defined Exception.

EXERCISE - 7

a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable).
b) Write a program illustrating is Alive and join ().
c) Write a Program illustrating Daemon Threads.
d) Write a JAVA program Producer Consumer Problem.

EXERCISE – 8

a) Write a JAVA program that import and use the user defined packages.
b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX).
c) Build a Tip Calculator app using several JavaFX components and learn how torespond to user interactions with the GUI.

TEXT BOOKS:

1. Anitha Seth, B.L.Juneja, JAVA one step ahead, Oxford.
2. 2. Debasis Samanta, Monalisa Sarma, Joy with JAVA, Fundamentals of Object Oriented Programming, Cambridge, 2023.
3. Paul Deitel, Harvey Deitel, JAVA 9 for Programmers, Pearson, 4th Edition.

REFERENCES:

1. Herbert Schildt, The complete Reference Java, TMH, 11th Edition,
2. Y Daniel Liang, Introduction to Java programming, Pearson, 7th Edition.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0128804 64547

II Year B.Tech. – I Semester

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(IT23ASC301) WEB PROGRAMMING

COURSE OBJECTIVES:
The objectives of this course are to:
- Giving the students the insights of the Internet programming and how to design and implement complete applications over the web.
- It covers the notions of Design Methodologies with concentration on Object-Oriented concepts, Client-Side.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand basic HTML tags to design web pages.
CO 2: Apply Advanced features to your webpage including special effects**.**
CO 3: Apply The CSS Knowledge to add colors and text formatting.
CO 4: Apply Advanced CSS to style effective presentation of webpage.
CO 5: Create HTML and CSS Programs to create registration form.

COURSE CONTENT

UNIT I: (6 Periods)
Where Do I Start-What Does a Web Designer Do: What Languages Do I Need to Learn, What Do I Need to Buy, How the Web Works-The Internet Versus the Web, Serving Up Your Information, A Word About Browsers, Web Page Addresses (URLs), The Anatomy of a Web Page, Some Big Concepts You Need to Know-A Dizzying Multitude of Devices, Sticking with the Standards, Progressive Enhancement, Responsive Web Design, One Web for All (Accessibility), The Need for Speed (Site Performance).

UNIT II: (6 Periods)
HTML Markup for Structure I: Creating a Simple Page-A Web Page, Launch a Text Editor, Step 1: Start with Content, Step 2: Give the Document Structure, Step 3: Identify Text Elements, Step 4: Add an Image, Step 5: Change the Look with a Style Sheet, When Good Pages Go Bad, Validating Your Documents. Marking Up Text-Paragraphs, Headings, Lists, More Content Elements, Organizing Page Content, The Inline Element Roundup, Generic Elements (div and span), Some Special Characters.

UNIT III: (6 Periods)
HTML Markup for Structure II: Adding Links-The href Attribute, Linking to Pages on the Web, Linking Within Your Own Site, Targeting a New Browser Window, Mail Links, Telephone Links. Adding ImagesFirst, a Word on Image Formats, The img Element, A Window in a Window. Table Markup-How Tables Are Used, Minimal Table Structure, Spanning Cells, Table Accessibility, Wrapping Up Tables.
HTML Markup for Structure III: Forms-How Forms Work, The form Element, variables and Content, The Great Form Control Roundup, Form Accessibility Features, Form Layout and Design. What�begins Up, HTML5-A Funny Thing Happened on the Way to XHTML 2, In the Markup Department, Meet the APIs, Video and Audio, Canvas.

UNIT IV: (6 Periods)
CSS for Presentation I: Cascading Style Sheets Orientation-The Benefits of CSS, How Style Sheets Work, The Big Concepts, Moving Forward with CSS. Formatting Text-The Font Properties, Changing Text Color, A Few More Selector Types, Text Line Adjustments, Underlines and Other ―Decorations‖, Changing Capitalization, Spaced Out, Text Shadow, Changing List Bullets and Numbers. Colors and Backgrounds-Specifying Color Values, Foreground Color, Background Color, Playing with Opacity, Introducing…Pseudo-class Selectors, Pseudo-element Selectors, Attribute Selectors, Background Images.

The Shorthand background Property, Like a Rainbow (Gradients), External Style Sheets. Thinking Inside the Box-The Element Box, Specifying Box Dimensions, Padding, Borders, Margins, Assigning Display Roles, Adding Drop Shadows to Boxes.

UNIT V: (6 Periods)
CSS for Presentation II: Floating and Positioning- Normal Flow, Floating, positioning Basics, Relative Positioning, Absolute, Positioning, Fixed Positioning. Page Layout with CSS- Page Layout Strategies, page Layout Techniques, Multicolumn Layouts Using Floats, Positioned Layout, Top-to-Bottom Column Backgrounds. Transitions, Transforms, and Animation- Ease-y Does It (CSS Transitions), CSS Transforms, Keyframe Animation. CSS Techniques- A Clean Slate (CSS Reset), Image Replacement Techniques, CSS Sprites, Styling Forms, Styling Tables, Basic Responsive Web Design, Wrapping Up Style Sheets.

Total Periods: 30

TEXTBOOKS

1. Jennifer Niederst Robbins, Learning Web Design, OREILLY, 4th Edition.
2. Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.

REFERENCES:

1. Uttam K Roy—Web Technologies‖, Oxford University Press, 1st Edition, 2010.
2. Jon Duckett, HTML and CSS: Design and Build Websites, india price, 1st Edition.
3. Steven Holzner, —The Complete Reference PHP‖, Tata McGraw-Hill, 1st Edition, 2007.
4. HTML & CSS: The Complete Reference, (Complete Reference Series), 5th Edition.

e-RESOURCES:

1. http://www.scoopworld.in
2. http://www.sxecw.edu.in
3. http://www.technofest2u.blogspot.com
4. http://www.ptutorial.com/php-example/php-upload-image
5. http://www.ptutorial.com/php-example/php-change-case

II Year B.Tech. – I Semester

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(CH23AMC301) ENVIRONMENTAL SCIENCE

COURSE OBJECTIVES:

The objectives of this course are to:

- Make the students to get awareness on environment.
- Understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.
- Save earth from the inventions by the engineers.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Exploring different types of renewable and non-renewable energy sources.
CO 2: Students will learn about the structure and function of different ecosystems.
CO 3: Students will learn about different types of pollution and their sources, effects and control measures.
CO 4: Exploring the science behind climate change, its evidence, and its impacts on ecosystems and human societies.
CO 5: Understanding demographic factors and their environmental implications.

COURSE CONTENT

UNIT I: **(6 Periods)**

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Energy Resources**-** Renewable and Non-Renewable Resources – Natural Resources and Associated Problems – Forest Resources – Use and Over – Exploitation, Deforestation, Case Studies – Timber Extraction – Mining, Dams and other effects on Forest and Tribal People Water Resources – Use and Over Utilization of Surface and Ground Water – Floods, Drought, conflicts over Water, Dams – Benefits and Problems – Mineral Resources: Use and Exploitation, Environmental Effects of extracting and using Mineral Resources, Case Studies – Food Resources, World Food Problems, changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies.

UNIT II: **(7 Periods)**

Ecosystems: Concept of an Ecosystem. – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the following Ecosystems:

a) Forest Ecosystem.
b) Grassland Ecosystem
c) Desert Ecosystem.
d) Aquatic Ecosystems (Freshwater - Ponds, Streams, Lakes, Rivers, Marine Ecosystem- Oceans, Estuaries)

Biodiversity and its Conservation : Introduction, Definition: Genetic, Species and Ecosystem Diversity – Bio-Geographical Classification of India – Value of Biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – Endangered and Endemic Species of India – Conservation of Biodiversity: In-situ and Ex-situ Conservation of Biodiversity. Specific Case Studies.

UNIT III: **(6 Periods)**

Environmental Pollution: Definition, Cause, Effects, and Control measures of: Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards - Pollution Case Studies - Role of an Individual in the Prevention of Pollution - Solid Waste Management- Causes, Effects and Control Measures of Urban and Industrial Wastes -

Disaster Management-Floods, Earthquakes, Cyclones and Landslides.

UNIT IV: (5 Periods)

Social Issues and the Environment: Sustainable Development Goals, From Unsustainable to Sustainable Development–Urban Problems related to Energy – Water Conservation, Rainwater Harvesting, Watershed Management –Resettlement and Rehabilitation of People; Its Problems and Concerns. Case Studies – Environmental Ethics: Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust. Case Studies – Wasteland Reclamation. – Consumerism and Waste Products - Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in Enforcement of Environmental Legislation – Public Awareness.

UNIT V: (6 Periods)

Human Population and the Environment: Population Growth, Variation among Nations. Population Explosion – Family Welfare Programmes. – Environment and Human Health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

Field Work: Visit a Local Area to Document Environmental Assets River / Forest Grassland / Hill / Mountain – Polluted Site – Urban / Rural / Industrial / Agricultural - Study of Common Plants, Insects and Birds – River, Hill Slopes.

Total Periods: 30

TEXT BOOKS:

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, Universities Press, 3rd Edition, 2021.
2. K Raghavan Nambiar, Textbook of Environmental Studies for Undergraduate Courses (As per UGC Model Syllabus), Scitech Publications, 2nd Edition, 2008.

REFERENCES:

1. Deeksha Dave and E Sai Baba Reddy, Textbook of Environmental Science, Cengage Publications, 2nd Edition, 2012.
2. M Anji Reddy, Textbook of Environmental Sciences and Technology, BS Publications, 2nd Edition, 2023.
3. J P Sharma, Comprehensive Environmental Studies, Laxmi Publications, 3rd Edition, 2009.
4. J Glynn Henry and Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India, 2nd Edition, 2004.
5. G R Chatwal, A Textbook of Environmental Studies, Himalaya Publishing House, 4th Edition, 2014.
6. Gilbert M Masters and Wendell P Ela, Introduction to Environmental Engineering and Science, Prentice Hall of India, 3rd Edition, 2007.
7. Palaniswamy, Environmental Studies, Pearson Education, 2nd Edition, 2014.
8. S Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2012.
9. A Koushik and C P Koushik, Perspectives in Environmental Studies, New Age International, 4th Edition, 2006.

II Year B.Tech. – II Semester

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(MA23ABS403) OPTIMIZATION TECHNIQUES

COURSE OBJECTIVES:

The objective of this course are to:

- To provide the basic knowledge about optimization, importance, application areas of in Industry, Linear programming.
- To impart different optimization models under typical situations in the business organization like transportation, assignment.
- To understand the process of sequencing in typical industry, different game strategies and develop networks of activities of projects.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understanding Optimization and Formulation of Linear Programming Models.
CO 2: Formulate and Solve Transportation & Assignment Models.
CO 3: Apply simple problems of Sequencing and implement practical cases of decision making under different business environments.
CO 4: Discuss the game theory and strategies.
CO 5: Developing networks of activities and finding optimal mode of projects evaluation.

COURSE CONTENT

UNIT I: **(8 Periods)**

Introduction: Meaning, Nature, Scope & Significance of Optimization - Typical applications. The Linear Programming Problem – Introduction, Formulation of Linear Programming problem, Limitations of L.P.P, Graphical Method, Simplex Method: Maximization and Minimization model (exclude Duality problems), Big-M method and Two Phase method.

UNIT II: **(9 Periods)**

Transportation Problem: Introduction, Transportation Model, Finding initial basic feasible solutions, moving towards optimality, Unbalanced Transportation problems, Transportation problems with maximization, Degeneracy.

Assignment Problem: Introduction, Mathematical formulation of the problem, Solution of an Assignment problem, Hungarian Algorithm, Multiple Solution, Unbalanced Assignment problems, Maximization in Assignment Model.

UNIT III: **(10 Periods)**

Sequencing- Job sequencing, Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, n jobs through m machines, two jobs and m Machines Problems.

UNIT IV: **(10 Periods)**

Game Theory: Concepts, Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principal of Dominance, Mixed Strategy Games (Game without Saddle Point), Significance of Game Theory in Managerial Application.

UNIT V: **(8 Periods)**

Project Management: Network Analysis- Definition- objectives - Rules for constructing network diagram – Determining Critical Path –Earliest & Latest Times – Floats - Application of CPM and PERT techniques in Project Planning and Control – PERT Vs CPM (exclude Project Crashing).

Total Periods: 45

TEXT BOOKS:

1. R. Pannerselvam, Operations Research, PHI Publications.
2. S.D.Sharma-Kedarnath, Operations Research.
3. A.M.Natarajan,P. Balasubramani, A. Tamilarasi, Operations Research, Pearson Education.
4. S.S.Rao, Engineering Optimization: Theory and practice, New Age International (P) Limited.

REFERENCES:

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.
2. Hiller & Libermann, Introduction to O.R, TMH.
3. Maurice Saseini, Arhur Yaspan & Lawrence Friedman, Operations Research: Methods & Problems, Pearson.
4. Barry Render, Ralph M. Stair, Jr and Michael E. Hanna, Quantitative Analysis for Management.
5. Wagner, Operations Research, PHI Publications.

ONLINE LEARNING SOURCES:

1. https://onlinecourses.swayam2.ac.in/cec20_ma10/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
3. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

II Year B.Tech. – II Semester

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(MA23ABS306) PROBABILITY AND STATISTICS

COURSE OBJECTIVES:

The objective of this course are to:

- This course will illuminate the students in the concepts of probability and statistical methods.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

COURSE OUTCOMES:

CO 1: Acquire knowledge in finding the analysis of the data quantitatively or categorically and various statistical elementary tools Understand the concepts of Probability, Random Variables and their characteristics.

CO 2: Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.

CO 3: Apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant application areas.

CO 4: Analyze to test various hypotheses included in theory and types of errors for large samples.

CO 5: Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real life problems.

COURSE CONTENT

UNIT I: **(10 Periods)**

Descriptive statistics: Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines.

UNIT II: **(9 Periods)**

Probability: Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT III: **(8 Periods)**

Probability distributions: Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshev's inequality). Approximation the binomial distribution to normal distribution.

UNIT IV: **(10 Periods)**

Estimation and Testing of hypothesis, large sample tests: Estimation-parameters, statistics, Point estimation, Confidence interval, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means.

UNIT V: **(8 Periods)**

Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Total Periods: 45

TEXT BOOKS:

1. Millerand, Freund's, Probability and Statistics for Engineers, Pearson, 7th Edition, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons Publications, 11th Edition, 2012.

REFERENCES:

1. S. Ross, a First Coursein Probability, Pearson Education India, 2002.
2. W.Feller, An Introduction to Probability Theory and its Applications, Wiley, 1st Edition, 1968.
3. B.V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

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(CS23APC401) DATABASE MANAGEMENT SYSTEMS

COURSE OBJECTIVES:

The objective of this course are to:

- Introduce database management systems and to give a good formal foundation on therelational model of data and usage of Relational Algebra.
- Introduce the concepts of basic SQL as a universal Database language.
- Demonstrate the principles behind systematic database design approaches by coveringconceptual design, logical design through normalization.
- Provide an overview of physical design of a database system, by discussing Databaseindexing techniques and storage techniques.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the basic concepts of database management systems.
CO 2: Analyze a given database application scenario to use ER model for conceptual design of the database.
CO 3: Utilize SQL proficiently to address diverse query challenges.
CO 4: Employ normalization methods to enhance database structure.
CO 5: Assess and implement transaction processing, concurrency control and databaserecovery protocols in databases.

COURSE CONTENT

UNIT I: **(9 periods)**

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT II: **(9 periods)**

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: **(9 periods)**

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non- updatable), relational set operations.

UNIT IV: **(9 periods)**

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3
NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: **(9 periods)**

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Storage and File Structure: Overview of Physical Storage Media, RAID, File Organization.

Introduction to Indexing Techniques: B+ Trees, operations on B+ Trees, Hash Based Indexing.

Total Periods: 45

TEXT BOOKS:

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, TMH, 3rd Edition. (For Chapters 2, 3, 4)
2. Silberschatz, Korth, Sudarsan, Database System Concepts, TMH, 5th Edition, (ForChapter 1 and Chapter 5)

REFERENCES:

1. C J Date, Introduction to Database Systems, Pearson, 8th Edition.
2. RamezElmasri, Shamkant B. Navathe, Database Management System, Pearson, 6th Edition.
3. Corlos Coronel, Steven Morris, Peter Robb, Principles Fundamentals of Design Implementation and Management, Cengage Learning Database.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275 806667282022456_shared/overview

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(CS23APC402) OPERATING SYSTEMS

COURSE OBJECTIVES:

The objective of this course are to:

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.
CO 2: Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
CO 3: Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
CO 4: Illustrate different conditions for deadlock and their possible solutions.
CO 5: Analyze the memory management and its allocation policies.

COURSE CONTENT

UNIT - I **(9 periods)**

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems **System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging.

UNIT - II **(9 periods)**

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. **Threads and Concurrency:** Multithreading models, Thread libraries, Threading issues. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III **(9 periods)**

Synchronization Tools: The Critical Section Problem, Peterson’s Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV **(9 periods)**

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. **Virtual Memory Management:** Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing. **Storage Management:** Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V **(9 periods)**

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File- System Mounting, Partitions and Mounting, File Sharing. **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Total Periods: 45

TEXT BOOKS:

1. Silberschatz A, Galvin P B, Gagne G, Operating System Concepts, Wiley, 10th Edition, 2018.
2. Tanenbaum A S, Modern Operating Systems, Pearson, 4th Edition, 2016.

REFERENCES:

1. Stallings W, Operating Systems -Internals and Design Principles, Pearson, 9th Edition, 2018.
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach, McGraw- Hill, 3rd Edition, 2013.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

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(IT23APC401) SOFTWARE ENGINEERING

COURSE OBJECTIVES:
The objectives of this course are to:

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Perform various life cycle activities like Analysis, Design, Implementation, Testing.
CO 2: Analyze various software engineering models and apply methods for design.
CO 3: Develop system designs using appropriate techniques.
CO 4: Understand various testing techniques for a software project.
CO 5: Apply standards, CASE tools and techniques for engineering S/W projects.

COURSE CONTENT

UNIT I: (10 Periods)
Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.
Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT II: (9 Periods)
Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.
Requirements Analysis And Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III: (8 Periods)
Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.
Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process. (Text Book 2)
User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV: (9 Periods)
Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing.
Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT V: (9 Periods)
Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.
Software Maintenance: Characteristics of software maintenance, Software reverse

engineering, Software maintenance process models and Estimation of maintenance cost.
Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program and A reuse approach.

Total Periods: 45

TEXT BOOKS

1. Rajib Mall, Fundamentals of Software Engineering, PHI, 5th Edition.
2. Roger S. Pressman, Software Engineering A practitioner's Approach, Mc- Graw Hill International Edition, 9th Edition.

REFERENCES:

1. Ian Sommerville, Software Engineering, Pearson, 10th Edition,
2. Deepak Jain, Software Engineering, Principles and Practices, Oxford University Press.

e-RESOURCES:

- https://nptel.ac.in/courses/106/105/106105182/
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012605895063871 48827_shared/overview
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003 904735_shared/overview

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(CS23AES301) DESIGN THINKING AND INNOVATION

COURSE OBJECTIVES:

The objectives of this course are to:

- Familiarize students with design thinking process as a tool for breakthrough innovation.
- Equip students with design thinking skills and ignite their minds to create innovative ideas, develop solutions for real-time problems.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Define the concepts related to design thinking.
CO 2: Explain the fundamentals of Design Thinking and innovation.
CO 3: Apply the design thinking techniques for solving problems in various sectors.
CO 4: Analyze to work in a multidisciplinary environment.
CO 5: Evaluate the value of creativity.
CO 6: Formulate specific problem statements of real-time issues.

COURSE CONTENT

UNIT I: **(2 Periods)**

Introduction to Design Thinking Introduction to elements and principles of Design, basics of design - dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, new materials in Industry.

UNIT II: **(2 Periods)**

Design Thinking Process Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development.
Activity: Every student presents their idea in three minutes. Every student can present the design process in the form of a flow diagram or flow chart, etc. Every student should explain about product development.

UNIT III: **(4 Periods)**

Innovation Art of innovation, difference between innovation and creativity, role of creativity and innovation in organizations - Creativity to Innovation - Teams for innovation - Measuring the impact and value of creativity.
Activity: Debate on innovation and creativity, flow and planning from idea to innovation, debate on value-based innovation.

UNIT IV: **(3 Periods)**

Product Design Problem formation, introduction to product design, product strategies, product value, product planning, product specifications - Innovation towards product design - Case studies.
Activity: Importance of modeling, how to set specifications, explaining their own product design.

UNIT V: **(4 Periods)**

Design Thinking in Business Processes Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business - Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs - Design thinking for Startups - Defining and testing Business Models and Business Cases - Developing & testing prototypes.
Activity: How to market our own product, about maintenance, reliability and plan for startup.

Total Periods: 15

TEXT BOOKS:

1. Tim Brown, Change by Design, HarperCollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, John Wiley & Sons, 2013.

REFERENCES:

1. David Lee, Design Thinking in the Classroom, Ulysses Press, 2020.
2. Shrutin N Shetty, Design the Future, Norton Press, 2021.
3. William Lidwell, Kritina Holden and Jill Butler, Universal Principles of Design, Rockport Publishers, 2010.
4. Henry Chesbrough, The Era of Open Innovation, Harvard Business Review Press, 2013.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

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(CS23APC403) DATABASE MANAGEMENT SYSTEMS LAB

COURSE OBJECTIVES:

The objective of this course is to:

- Populate and query a database using SQL DDL/DML Commands.
- Declare and enforce integrity constraints on a database.
- Writing Queries using advanced concepts of SQL.
- Programming PL/SQL including procedures, functions, cursors and triggers.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment.

CO 2: Constructing and execute queries to manipulate and retrieve data from databases.

CO 3: Develop application programs using PL/SQL.

CO 4: Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality.

CO 5: Establish database connectivity through JDBC (Java Database Connectivity).

EXPERIMENTS COVERING THE TOPICS:

- DDL, DML, DCL commands,
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures,
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC.

SAMPLE EXPERIMENTS:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraintswhile creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between,least, greatest, trunc, round, to_char, to_date).
5. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found).
6. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
7. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
8. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.
9. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

10. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
11. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
12. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers.
13. Create a table and perform the search operation on table using indexing and non-indexing techniques.
14. Write a Java program that connects to a database using JDBC.
15. Case Study: Database Design
Given the following requirements for the e-commerce system: products catalog, customer accounts, order management, and reviews. Design a normalized relational database schema. Include tables, primary keys, foreign keys, and relationships. Explain your design decisions and how normalization principles are applied.

TEXT BOOKS:

1. Oracle: The Complete Reference by Oracle Press.
2. Nilesh Shah, Database Systems Using Oracle, PHI, 2007.
3. Rick F Vander Lans, Introduction to SQL, Pearson Education, 4th Education, 2007.

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(CS23APC404) OPERATING SYSTEMS LAB

COURSE OBJECTIVES:
The objectives of this course are to:
- Provide insights into system calls, file systems, semaphores.
- Develop and debug CPU Scheduling algorithms, page replacement algorithms, thread implementation.
- Implement Bankers Algorithms to Avoid the Dead Lock.
- Acquire the generic software development skill through various stages of software life cycle.
- Generate test cases for software testing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Trace different CPU Scheduling algorithms.
CO 2: Implement Bankers Algorithms to Avoid the Dead Lock.
CO 3: Evaluate Page replacement algorithms.
CO 4: Understand the functional & non-functional requirements of software model.
CO 5: Analyze the knowledge in project managements and its principles.

EXPERIMENTS COVERING THE TOPICS:
- UNIX fundamentals, commands & system calls
- CPU Scheduling algorithms, thread processing
- IPC, semaphores, monitors, deadlocks
- Page replacement algorithms, file allocation strategies
- Memory allocation strategies

List of Exercises:
1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir.
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms
   a) FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with
   a) Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library.
7. Write a program to solve producer-consumer problem using Semaphores.
8. Implement the following memory allocation methods for fixed partition
   a) First fit
   b) Worst fit
   c) Best fit
9. Simulate the following page replacement algorithms
   a) FIFO
   b) LRU
   c) LFU
10. Simulate Paging Technique of memory management.
11. Implement Bankers Algorithm for Dead Lock avoidance and prevention
12. Simulate the following file allocation strategies
    a) Sequential
    b) Indexed
    c) Linked

REFERENCES:

1. Silberschatz A, Galvin P B, Gagne G, Operating System Concepts, Wiley, 10th Edition, 2018.
2. Tanenbaum A S, Modern Operating Systems, Pearson, 4th Edition, 2016.
3. Stallings W, Operating Systems -Internals and Design Principles, Pearson, 9th Edition, 2018.
4. D.M Dhamdhere, Operating Systems: A Concept Based Approach, McGraw- Hill, 3rd Edition, 2013.

ONLINE LEARNING RESOURCES:

1. https://www.cse.iitb.ac.in/~mythili/os/
2. http://peterindia.net/OperatingSystems.html

II Year B.Tech. – II Semester

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(IT23APC402) SOFTWARE ENGINEERING LAB

COURSE OBJECTIVES:
The objectives of this course are to:
- To understand the software engineering methodologies involved in the phases for project development.
- To gain knowledge about open source tools used for implementing software engineering methods.
- To exercise developing product-startups implementing software engineering methods. Acquire the generic software development skill through various stages of software life cycle.
- Generate test cases for software testing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Ability to translate end-user requirements into system and software requirements.
CO 2: Ability to generate a high-level design of the system from the software Requirements.
CO 3: Able to develop a simple testing report.
CO 4: Understand the functional and non-functional requirements of software model.
CO 5: Analyze the knowledge in project managements and its principles.

Experiments covering the Topics:
- UNIX fundamentals, commands & system calls
- CPU Scheduling algorithms, thread processing
- IPC, semaphores, monitors, deadlocks
- Page replacement algorithms, file allocation strategies
- Memory allocation strategies

List of Exercises:
1. Perform the following, for the following experiments:
2. Do the Requirement Analysis and Prepare SRS
   a) Draw E-R diagrams, DFD, CFD and structured charts for the project.
   b) Course Registration System
   c) Students Marks Analyzing System
   d) Online Ticket Reservation System
   e) Stock Maintenance
3. Consider any application, using COCOMO model, estimate the effort.
4. Consider any application, Calculate effort using FP oriented estimation model.
5. Draw the UML Diagrams for the problem a, b, c, d.
6. Design the test cases for e-Commerce application (Flipcart, Amazon).
7. Design the test cases for a Mobile Application (Consider any example from Appstore).
8. Design and Implement ATM system through UML Diagrams.

REFERENCES:
1. Software Engineering, Ian Sommerville, Pearson, 10th Edition.
2. Deepak Jain, Software Engineering-Principles and Practices, Oxford University Press.

E-RESOURCES:
1. https://nptel.ac.in/courses/106/105/106105182/

II Year B.Tech. – II Semester

L	T	P	C
-	1	2	2

(IT23ASC401) LINUX PROGRAMMING

COURSE OBJECTIVES:
The objectives of this course are to:
- Familiarize basic concepts of shell programming.
- Learn shell programming.
- Practice basic administration skills.
- Demonstrate use of system calls.
- Demonstrate Inter process communication.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand shell script to create files and handle text documents.
CO 2: Analyze various methodologies in Linux administration.
CO 3: Implementation of IPC through shell programming in the Linux environment.
CO 4: Create child processes and background processes.
CO 5: Handle files and access permissions as well as system security.

List of Exercises:
1. Practice session: Practice use of some basic Linux commands. Document the syntax and semantics of the commands like man, passwd, tty, script, clear, date, cal, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who.
2. Study and Practice on various commands like cat, tail, head , sort, nl, uniq, grep, egrep,fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, tar, cpio.
3. Write a shell script that accepts a name from user and displays whether it is a file, directory or something else.
4. Write a shell script that creates users.
5. Write a shell script that searches for a given string in a file.
6. Write a shell script that compiles all C files in your home directory and creates executable files.
7. Write a shell script that given a filename as argument, deletes all even lines in a file.
8. Implement the grep command in C language.
9. Write a shell script that removes duplicate lines from a file.
10. Write a shell script that enhances find command by adding error messages that explain why the command failed.
11. Write a shell script to backup files in a specified directory.
12. Write a shell script that finds all links to a file.
13. Write an awk script to count the number of lines in a file that do not contain vowels.
14. Write an awk script to find the number of characters, words and lines in a file.

REFERENCES:

1. B.A.Forouzan and R.F.Gilberg, Unix and Shell programming, Cengage Learning.
2. N.Matthew, R.Stones,Wrox, Beginning Linux Programming, Wiley, 4th Edition.
3. N.B.Venkateswarulu, Advanced Unix Programming, BS Publications.
4. M.G. Venkatesh Murthy, Unix and Shell Programming, Pearson Education.
5. Elllie Quigley, Unix Shells by Example, Pearson Education, 4th Edition.
6. Sed and Awk, O.Dougherty & A.Robbins, SPD, 2nd Edition.
7. S.G.Kochan and P.Wood, Unix shell Programming, Pearson Education, 3rd Edition.

III Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(AM23APC301) ARTIFICIAL INTELLIGENCE
(Common to IT and CSC)

COURSE OBJECTIVES:
The objective of this course are to:
- The students should be made to study the concepts of Artificial Intelligence.
- The students should be made to learn the methods of solving problems using Artificial Intelligence.
- The students should be made to introduce the concepts of Expert Systems.
- Understand the applications of AI, namely game playing, theorem proving, and machine learning.
- Learn different knowledge representation techniques.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the AI, Intelligent agents and environment.
CO 2: Apply the search strategies and concept of problem reduction.
CO 3: Understand the fundamentals of knowledge representation and reasoning.
CO 4: Apply the concepts of learning from observation.
CO 5: Analyze architecture of expert systems and language models.

COURSE CONTENT

UNIT I: **(9 Periods)**

Introduction: AI problems, foundation of AI and history of AI.
Intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem-solving agents, problem formulation, Strong AI and Weak AI.

UNIT II: **(9 Periods)**

Searching: Searching for solutions, uninformed search strategies – Breadth-first search, Depth-first search.
Search with partial information (Heuristic search): Hill climbing, A*, AO* Algorithms.
Problem reduction.
Game Playing: Adversarial search, Games, Mini-max algorithm, Optimal decisions in multiplayer games, Problems in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT III: **(9 Periods)**

Representation of Knowledge: Knowledge representation issues, predicate logic - logic programming, semantic nets - frames and inheritance, constraint propagation, representing knowledge using rules, rules-based deduction systems.
Reasoning under uncertainty: Review of probability, Bayes' probabilistic inferences, and Dempster-Shafer theory.

UNIT IV: **(10 Periods)**

Logic concepts: First-order logic, Inference in first-order logic, Propositional vs. first-order inference, Unification & lifts, Forward chaining, Backward chaining, Resolution.
Learning from observation: Inductive learning, Decision trees, Explanation-based learning, Statistical learning methods, Reinforcement learning.

UNIT V: **(8 Periods)**

Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition, Meta knowledge, Heuristics. **Natural Language Processing:** Language Models, Phrase Structure grammar, Speech Recognition, Machine Translation.
Case Study: Chatbot, Voice Assistants.

Total Periods: 45

TEXT BOOKS

1. S. Russell and P. Norvig, Artificial Intelligence – A Modern Approach, Pearson Education, 3rd Edition.
2. Kevin Night and Elaine Rich, Nair B., Artificial Intelligence (SIE), McGraw Hill.

REFERENCES:

1. David Poole, Alan Mackworth, Randy Goebel, Computational Intelligence: A Logical Approach, Oxford University Press.
2. G. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 4th Edition.

III Year B.Tech. – I Semester

L	T	P	C
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(CY23APC301) COMPUTER NETWORKS

COURSE OBJECTIVES:

The objectives of the course are:

- To understand the different types of networks.
- To discuss the software and hardware components of a network.
- To develop an understanding the principles of computer networks.
- To familiarize with OSI model and the functions of layered structure.
- To explain networking protocols, algorithms and design perspectives.

COURSE OUTCOMES:

After successful completion of this course students will be able to:

CO 1: Identify the software and hardware components of a computer network.
CO 2: Explain the functionality of each layer of a computer network.
CO 3: Identify and analyze flow control, congestion control, and routing issues.
CO 4: Analyze & interpret the functionality& effectiveness of the routing protocols.
CO 5: Choose the appropriate transport protocol based on the application requirements.

COURSE CONTENT

UNIT I: (8 Periods)

Introduction: Types of Computer Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT II: (10 Periods)

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Half duplex, Full-Duplex.

Sliding Window Protocols: The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet.

UNIT III: (9 Periods)

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, unicast Routing,

Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6.

UNIT IV: **(8 Periods)**

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, , Error Control And Flow Control, Multiplexing, Congestion Control, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols.

The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT V: **(10 Periods)**

The Application Layer: Electronic Mail, Architecture and Services, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Total Periods: 45

TEXT BOOKS:

1. Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6^{th} Edition, Global Edition.

REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill Publication, 5^{th} Edition, 2017.
2. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 6^{th} Edition, 2019.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106105183/25
2. http://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

III Year B.Tech. – I Semester

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(IT23APC502) PYTHON PROGRAMMING

COURSE OBJECTIVES:

The objectives of this course are to:

- Learn the fundamentals of Python and problem-solving using Python.
- Introduce a function-oriented programming paradigm through python.
- Get training in the development of solutions using modular concepts.

COURSE OUTCOMES:

After successful completion of this course students will be able to:

CO 1: Apply the features of Python language in various real applications.
CO 2: Select appropriate core data structure of Python for solving a problem.
CO 3: Design object-oriented programs using Python for solving real-world problems.
CO 4: Apply modularity to programs.
CO 5: Design graphics using turtle module.

COURSE CONTENT

UNIT I: (9 Periods)

Introduction to Python Programming: Overview of Programming Languages,History of Python, Installing Python, Executing Python Programs, Commenting in Python, Internal Working of Python.

Basics of Python Programming: Python Character Set, Token, Python Core DataType, I/O functions, Assigning Value to a Variable, Multiple Assignments, Writing Simple Programs inPython, Formatting Number and Strings, Python Inbuilt Functions.

Operators and Expressions: Operators and Expressions, Arithmetic Operators, Operator Precedence and Associativity, Changing Precedence and Associativity of Arithmetic Operators, Translating Mathematical Formulae into Equivalent Python Expressions, Bitwise Operators, The Compound Assignment Operator.

UNIT II: (9 Periods)

Decision Statements: Boolean Type, Boolean Operators, Using Numbers with Boolean Operators, Using String with Boolean Operators, Boolean Expressions and Relational Operators, Decision Making Statements, Conditional Expressions.

Loop Control Statements: The while Loop, The range() Function, The for Loop, Nested Loops, The break Statement, The continue Statement. Functions: Syntax and Basics of a Function, Use of a Function, Parameters and Arguments in a Function, The Local and Global Scope of a Variable, The return Statement, Recursive Functions, The Lambda Function**.**

UNIT III: (9 Periods)

Strings: The str class, Basic Inbuilt Python Functions for String, The index[]Operator, Traversing String with for and while Loop, Immutable Strings, The String Operators, String Operations. Lists: Creating Lists, Accessing the Elements of a List, Negative List Indices, List Slicing [Start: end], List Slicing with Step Size, Python Inbuilt Functions for Lists, TheList Operator, List Comprehensions, List Methods, List and Strings, Splitting a Stringin List, Passing List to a Function, Returning List from a Function. Tuples, Sets and Dictionaries: Introduction to Tuples, Sets, Dictionaries.

UNIT IV: (9 Periods)

Exceptions: When Something Goes Wrong, Classes of Exceptions, A Final Note on Pythonic Exception Handling. File Handling: Need of File Handling, Text Input and Output, The seek() Function, Binary Files, Accessing and Manipulating Files and Directories on a Disk.

Modules: Reusing Code with Modules and Packages, Understanding Python Modules, Everyday Module Usage, Advanced Module Behavior, Combining Modules into Packages**.**

UNIT V: (9 Periods)
Object-Oriented Programming: Class, Objects and Inheritance: Defining Classes,The Self parameter and Adding Methods to a Class, Display Class Attributes and Methods, Special Class Attributes, Accessibility, The_init_Method (Constructor), Passing an Object as Parameter to a Method,__del__() (Destructor Method), Class Membership Tests, Method Overloading, Operator Overloading, Inheritance, The Object Class.
Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring.

Total Periods: 45

TEXT BOOKS:

1. Ashok Namdev Kamthane, Amit Kamthane, Programming and problem solving with Python, McGraw Hill Education (India) Private Limited, 2018.
2. Allen B. Downey, Think Python, SPD/O'Reilly, 2^{nd} Edition, 2016.

REFERENCES:

1. R. Nageswara Rao, Core Python Programming, Dreamtech Press, 2^{nd} Edition, 2016.
2. Mark Lutz, Python Pocket Reference: Python in Your Pocket, 5^{th} Edition, 2014.

III Year B.Tech. – I Semester

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(CS23APC501) AUTOMATA THEORY AND COMPILER DESIGN

COURSE OBJECTIVES:
The objectives of this course are to:

- Introduce the fundamentals of formal languages, automata theory & computation models.
- Develop an understanding of regular expressions, context-free grammars, and their role in language recognition.
- Explore the design and behavior of Pushdown Automata and Turing Machines as language acceptors.
- Explain the different phases of a compiler with a focus on lexical and syntax analysis using tools like LEX and YACC.
- Illustrate syntax-directed translation schemes and intermediate code generation for real time language processing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand and apply formal language concepts, including finite automata and regular languages, to language recognition.
CO 2: Design and analyze context-free grammars, derivations, and normal forms, and use Pushdown Automata for parsing.
CO 3: Compare different computation models including Turing Machines and understand their capabilities.
CO 4: Analyze and implement lexical and syntax analysis phases of a compiler using formal methods and tools like LEX/YACC.
CO 5: Apply syntax-directed translation techniques and generate intermediate representations for language translation.

COURSE CONTENT

UNIT I: **(9 Periods)**
Fundamentals: Formal Languages, Strings, Alphabets, Languages, Chomsky Hierarchy of languages.
Finite Automata: Introduction to Finite State machine, Acceptance of strings and languages, Deterministic finite automaton (DFA) and Non-deterministic finite automaton (NFA), Equivalence of NFA and DFA– Equivalence of NDFAs with and without €-moves, Minimization of finite automata, Equivalence between two DFA's, Finite automata with output– Moore and Mealy machines, conversion of Moore to Mealy and Mealy to Moore.

UNIT II: **(9 Periods)**
Regular Languages: Regular expressions, Identity rules, Conversion of a given regular expression into a finite automaton, Conversion of finite automata into a regular expression, pumping lemma for regular sets, Closure properties of regular sets (proofs not required).
Context Free Grammars: Context free grammars and languages, Derivation trees, Leftmost and rightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring in context free grammar, Minimization of context free grammar, Normal forms for context free grammars, Chomsky normal form, Greibach normal form, Pumping Lemma for Context free Languages, Closure and decision properties of context free languages.

UNIT III: **(9 Periods)**
Pushdown Automata: Introduction to Pushdown automata, Acceptance of context free languages, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of context free grammar and pushdown automata, Inter-conversion (Proofs not required).
Turing Machine: Introduction to Turing Machine, Design of Turing machines, Types of Turing machines.

UNIT IV: (9 Periods)

Introduction to Compiling: Overview of Compilers, Phases of a Compiler.
Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, A language for specifying Lexical Analyzers (LEX).
Syntax Analysis: The role of the Parser, First and Follow, Predictive Parsing, LR Parsers-SLR, Canonical LR, LALR, Parser Generator (YACC).

UNIT V: (9 Periods)

Syntax-Directed Translation: Syntax-Directed Definition, S-Attributed SDD, L-Attributed SDD, Translation Schemes.
Intermediate Code Generation: Intermediate Languages- Graphical Representations, Three address code, Implementations.

Total Periods: 45

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, Pearson Education, 3rd Edition, 2011.
2. Alfred Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers- Principles Techniques and Tool, Pearson Education India, 2nd Edition, 2013.

REFERENCES:

1. Peter Linz, An introduction to Formal Languages and Automata, Jones &Bartlett, 6th Edition, 2016.
2. V.Raghavan, Principles of Compiler Design,1st Edition, Mc Graw Hill Education, 2017.
3. Mishra and Chandrashekaran, Theory of Computer Science– Automata Languages and Computation, PHI, 3rd Edition, 2009.
4. K.V.N.Sunitha, N.Kalyani, Formal Languages and Automata Theory, TMH, 1st Edition, 2010.
5. Michel Sip ser, Introduction to Theory of Computation, Thomson, 2nd Edition, 2012.

ONILNE RESOURSES:

1. https://swayam.gov.in/nd1_noc19_cs79/preview

III Year B.Tech. – I Semester

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(CS23APC502) DATA WAREHOUSING AND DATA MINING

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the concepts of data warehousing, OLAP, and data preprocessing techniques.
- Explore various data mining processes, tasks, and methodologies to extract patterns and knowledge from large datasets.
- Gain knowledge of classification, clustering, association rule mining, and outlier detection techniques.
- Evaluate various models using statistical and machine learning methods for improved data analysis.
- Apply data mining algorithms using tools such as WEKA and R programming for real-world datasets and case studies.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Explain data warehousing architecture, OLAP concepts, and data warehouse schemas.
CO 2: Apply data preprocessing techniques and summarize data using statistical methods.
CO 3: Perform frequent pattern mining and derive association rules using different mining algorithms.
CO 4: Develop classification and clustering models using machine learning techniques and evaluate their performance.
CO 5: Use WEKA and R programming tools for implementing data mining algorithms and analyzing datasets.

COURSE CONTENT

UNIT I: **(9 Periods)**
Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II: **(9 Periods)**
Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III: **(9 Periods)**
Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT IV: **(9 Periods)**
Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines –– Lazy Learners – Model Evaluation and Selection Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT V: (9 Periods)

Weka Tool: Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

Total Periods: 45

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, -Data Mining Concepts and Techniques, Elsevier, 3rd Edition, 2012.
2. Roger D. Peng, R Programming for Data Science.

REFERENCES:

1. Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, 2nd Edition.

III Year B.Tech. – I Semester

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(IT23APE502) OBJECT ORIENTED ANALYSIS AND DESIGN

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the basic concepts of object-oriented techniques.
- Build the Model of the software system using UML diagrams Elucidate design patterns as templates for good design.
- Learn the object-oriented methodology in software design and explore testing techniques.

COURSE OUTCOMES:

After successful completion of this course students will be able to:

CO 1: Analyze the problem from object-oriented perspective.
CO 2: Model complex systems using UML Diagrams.
CO 3: Choose the suitable design patterns in software design.
CO 4: Adapt Object-Oriented Design Principles.
CO 5: Identify the challenges in testing object-oriented software.

COURSE CONTENT

UNIT I: **(9 Periods)**

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. Case Study: System Architecture: Satellite-Based Navigation.

UNIT II: **(9 Periods)**

Introduction to UML: Importance of modelling, principles of modelling, object oriented modelling, conceptual model of the UML, Architecture, and Software Development Life Cycle. Basic Structural Modelling: Classes, Relationships, common Mechanisms, and diagrams. Case Study: Control System: Traffic Management.

UNIT III: **(9 Periods)**

Class & Object Diagrams: Terms, concepts, Modelling techniques for Class & Object Diagrams. Advanced Structural Modelling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. Case Study: AI: Cryptanalysis.

UNIT IV **(9 Periods)**

Basic Behavioural Modelling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study**: Web Application: Vacation Tracking System.

UNIT V **(9 Periods)**

Advanced Behavioural Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. Architectural Modelling: Component, Deployment, Component diagrams and Deployment diagrams Case Study: Weather Forecasting.

Total Periods: 45

TEXT BOOKS:

1. Rajib Mall, Fundamentals of Software Engineering, PHI, 5th Edition, 2018.
2. Grady Booch, James Rumbaugh, Ivar Jacobson. The Unified Modeling Language User guide, Pearson Education, 2nd edition, New Delhi, India, 2005.

REFERENCES:

1. Rumbaugh and Blaha, Object oriented Modeling and design with UML, Pearson, 2007.
2. Bernd Bruegge and, Allen H. Dutoit, Object Oriented Software Engineering Using UML, Patterns, and Java, Pearson, 2009.

III Year B.Tech. – I Semester

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(AM23APE501) SOFT COMPUTING

COURSE OBJECTIVES:
The objectives of this course are to:

- Understand the concepts of soft computing techniques and how they differ from traditional AI techniques.
- Introduce the fundamentals of fuzzy logic and fuzzy systems.
- Familiarize with artificial neural networks and their architectures.
- Learn genetic algorithms and their role in optimization.
- Explore hybrid systems integrating fuzzy logic, neural networks, and genetic algorithms.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the components and applications of soft computing.
CO 2: Apply fuzzy logic concepts to real-world problems.
CO 3: Build and train various neural network models.
CO 4: Implement genetic algorithms for problem-solving and optimization.
CO 5: Design hybrid systems using soft computing techniques.

COURSE CONTENT
UNIT I: **(8 Periods)**
Introduction to Soft Computing and Fuzzy Logic
Artificial Neural Networks – I
Introduction to Soft Computing: Definition, Components, Differences with Hard Computing, Applications of Soft Computing.
Fuzzy Logic: Crisp Sets vs Fuzzy Sets, Membership Functions, Fuzzy Set Operations, Fuzzy Rules and Fuzzy Reasoning.
Fuzzy Inference Systems: Mamdani and Sugeno Models, Defuzzification Techniques

UNIT II: **(9 Periods)**
Artificial Neural Networks – I
Introduction to Neural Networks: Biological Neurons vs Artificial Neurons, Architecture of Neural Networks: Feedforward, Feedback Learning Rules: Hebbian, Delta, Perceptron Learning Rule, Single Layer Perceptron and its Limitations, Multi-Layer Perceptron: Backpropagation Algorithm, Applications of Neural Networks

UNIT III: **(10 Periods)**
Artificial Neural Networks – II
Hopfield Networks and Associative Memories, Radial Basis Function Networks, Self-Organizing Maps (SOM), Recurrent Neural Networks (RNNs) – Basic Concepts, Convolutional Neural Networks (CNNs) – Overview and Applications, and Practical Use Cases in Image and Pattern Recognition.

UNIT IV: **(10 Periods)**
Genetic Algorithms and Optimization
Introduction to Genetic Algorithms, GA Operators: Selection, Crossover, Mutation, Fitness Function and Evaluation, Schema Theorem, Elitism, Applications in Function Optimization, Scheduling, and Robotics, Introduction to Particle Swarm Optimization (PSO).

UNIT V: **(8 Periods)**
Hybrid Systems and Advanced Topics
Hybrid Systems: Neuro-Fuzzy Systems, Fuzzy-GA, GA-ANN, ANFIS: Architecture and Learning, Case Studies on Hybrid Systems, Introduction to Deep Learning in Soft Computing,

Real-World Applications: Forecasting, Control Systems, Medical Diagnosis, Image Processing.

Total Periods: 45

TEXT BOOKS:

1. S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley India, 3rd Edition.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley, 4th Edition.
3. S. Rajasekaran and G. A. Vijayalakshmi Pai,"Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI.

REFERENCES:

1. Laurene Fausett, Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Pearson.
2. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson.
3. Simon Haykin,Neural Networks and Learning Machines, Pearson, 3rd Edition.
4. Bart Kosko,Neural Networks and Fuzzy Systems, Prentice Hall.

ONLINE RESOURCES:

1. NPTEL – Soft Computing by Prof. S. Sengupta (IIT Kharagpur)
2. Coursera – Neural Networks and Deep Learning (Andrew Ng)

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(CY23APC302) COMPUTER NETWORKS LAB

COURSE OBJECTIVES:

The objectives of this course are to:

- To understand the different types of networks.
- To discuss the software and hardware components of a network.
- To enlighten the working of networking commands supported by operating system.
- Impart knowledge of Network simulator 2/3.
- To familiarize the use of networking functionality supported by JAVA.
- To familiarize with computer networking tools.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand working of wired and wireless networks.

CO 2: Develop scripts for Simulating Wired and wireless Networks.

CO 3: Analyze the data traffic using tools.

CO 4: Develop JAVA programs for client-server communication.

CO 5: Utilize networking commands proficiently to diagnose and troubleshoot the network issues.

List of Experiments:

1. Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect Two or more systems. Use crimping tool to connect jacks. Use LAN tester to connect the cables.
   - Install and configure Network Devices: HUB, Switch and Routers. Consider both manageable and non-manageable switches. Do the logical configuration of the system. Set the bandwidth of different ports.
   - Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both adhoc and infrastructure mode of operation.
2. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, net diag, and Ns lookup.
3. Find all the IP addresses on your network. Unicast, Multicast, and Broadcast on your network.
4. Use Packet tracer software to build network topology and configure using Distance vector routing protocol.
5. Use Packet tracer software to build network topology and configure using Link State routing protocol.
6. Using JAVA RMI Write a program to implement Basic Calculator.
7. Implement a Chatting application using JAVA TCP and UDP sockets.
8. Hello command is used to know whether the machine at the other end is working or not. Echo command is used to measure the round-trip time to the neighbor. Implement Hello and Echo commands using JAVA.
9. Using Wireshark perform the following operations:
   - Inspect HTTP Traffic,
   - Inspect HTTP Traffic from a Given IP Address,
   - Inspect HTTP Traffic to a Given IP Address,
   - Reject Packets to Given IP Address,
   - Monitor Apache and MySQL Network Traffic.

10. Install Network Simulator 2/3. Create a wired network using dumbbell topology. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metrics throughput, delay, jitter and packet loss.
11. Create a static wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.
12. Create a mobile wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.

REFERENCES:

1. Shivendra S.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, TCP/IP Essentials: A Lab-Based Approach, Cambridge University Press, 2004.
2. Cisco Networking Academy, CCNA1 and CCNA2 Companion Guide, Cisco Networking Academy Program, 3rd Edition, 2003.
3. Elloitte Rusty Harold, "Java Network Programming", O'REILLY, 3rd Edition, 2011.

ONLINE LEARNING RESOURCES:

1. https://www.netacad.com/courses/packet-tracer - Cisco Packet Tracer.
   Ns Manual, Available at: https://www.isi.edu/nsnam/ns/ns-documentation.html, 2011.
2. https://www.wireshark.org/docs/wsug_html_chunked/ -Wireshark.
3. https://nptel.ac.in/courses/106105183/25
4. http://www.nptelvideos.in/2012/11/computer-networks.html
5. https://nptel.ac.in/courses/106105183/3
6. http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php

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(IT23APC504) PYTHON PROGRAMMING LAB

COURSE OBJECTIVES:

The objectives of this course are to:

- Train students in solving computational and mathematical problems using the Python programming language.
- Understand the fundamentals of Python programming concepts & its applications.
- Understand the object-oriented concepts using Python in problem solving.

COURSE OUTCOMES:

After successful completion of this course students will be able to

CO 1: Design solutions to mathematical problems.
CO 2: Organize the data for solving the problem.
CO 3: Develop Python programs for numerical and text-based problems.
CO 4: Select appropriate programming construct for solving the problem.
CO 5: Illustrate object-oriented concepts.

List of Exercises:

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all the operations present in a Scientific Calculator.
2. Using turtles concept draw a wheel of your choice.
3. Write a program that evaluates Ackermann function.
4. Write a program which counts number of vowels, consonants and special characters.
5. Given a word which is a string of characters. Given an integer say 'n', Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.
6. Given rows of text, write it in the form of columns.
7. Given a page of text. Count the number of occurrences of each letter (don't consider special characters). Draw a histogram torepresent the same.
8. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.
9. Consider all the files on your PC. Write a program which checks for duplicate filesin your PC and displays their location.
10. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circleand sphere. Use object-oriented approach.
11. Write a program illustrating the object-oriented features supported by Python.
12. Design a Python script using the Turtle graphics library to construct a turtle barchart representing the grades obtained by N students read from a file categorizing them into distinction,first class, second class, third class and failed.
13. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format (0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
14. Design a Python Script to determine the time difference between two given timesin HH:MM: SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59).

REFERENCES:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, How to Think Like a Computer Scientist: Learning with Python 3, 3rd Edition, 2024.
2. Paul Barry, Head First Python a Brain Friendly Guide, O'Reilly, 2nd Edition,2016.

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(CS23ASC401) FULL STACK DEVELOPMENT-1

COURSE OBJECTIVES:
The main objectives of the course are to:

- Make use of HTML elements and their attributes for designing static web pages.
- Build a web page by applying appropriate CSS styles to HTML elements.
- Experiment with JavaScript to develop dynamic web pages and validate forms.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Design Websites.
CO 2: Apply Styling to web pages.
CO 3: Make Web pages interactive
CO 4: Design Forms for applications.
CO 5: Choose Control Structure based on the logic to be implemented.

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events

Sample Exercises:

1. Lists, Links and Images

a. Write a HTML program, to explain the working of lists.
Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique.

2. HTML Tables, Forms and Frames

a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan).
b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no

frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>,<footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.
b. Write a HTML program, to embed audio and video into HTML web page.
c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms
✓ Simple selector (element, id, class, group, universal)
✓ Combinator selector (descendant, child, adjacent sibling, general sibling)
✓ Pseudo-class selector
✓ Pseudo-element selector
✓ Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

a. Write a program to demonstrate the various ways you can reference a color in CSS.
b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
c. Write a program using the following terms related to CSS font and text:
   i. font-size
   ii. font-weight
   iii. font-style
   iv. text-decoration
   v. text-transformation
   vi. text-alignment
d. Write a program, to explain the importance of CSS Box model using
   i. Content
   ii. Border
   iii. Margin
   iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion

a. Write a program to embed internal and external JavaScript in a web page.
b. Write a program to explain the different ways for displaying output.
c. Write a program to explain the different ways for taking input.
d. Create a webpage which uses prompt dialogue box to ask a voter for hisname and age. Display the information in table format along with either the voter can vote or not.

7. JavaScript Pre-defined and User-defined Objects

a. Write a program using document object properties and methods.
b. Write a program using window object properties and methods.
c. Write a program using array object properties and methods.
d. Write a program using math object properties and methods.
e. Write a program using string object properties and methods.
f. Write a program using regex object properties and methods.
g. Write a program using date object properties and methods.
h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
b. Write a program to display week days using switch case.
c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
d. Write a program to print data in object using for-in, for-each and for-of loops
e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153].
f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's.(Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's).

9. Java script Functions and Events

a. Design a appropriate function should be called to display
   - ✓ Factorial of that number
   - ✓ Fibonacci series up to that number
   - ✓ Prime numbers up to that number
   - ✓ Is it palindrome or not
b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
   - ✓ Factorial of that number
   - ✓ Fibonacci series up to that number
   - ✓ Prime numbers up to that number
   - ✓ Is it palindrome or not
c. Write a program to validate the following fields in a registration page
   i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
   ii. Mobile (only numbers and length 10 digits)
   iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

TEXT BOOKS:

1. Robet W Sebesta, Pearson, Programming the World Wide Web, 7th Edition, 2013.
2. John Dean, Web Programming with HTML5, CSS, and JavaScript, Jones & Bartlett Learning, 2nd Edition, 2019.

REFERENCES:

1. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Apress, 2nd Edition, 2019.

ONLINE RESOURCES:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css

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(EG23ASC401) SOFT SKILLS

COURSE OBJECTIVES:
The objectives of this course are to:
- Encourage all round development of the students by focusing on soft skills.
- Make the students aware of critical thinking and problem-solving skills.
- Enhance healthy relationship and understanding within and outside an organization.
- Function effectively with heterogeneous teams.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: List out various elements of soft skills.
CO 2: Describe methods for building professional image.
CO 3: Apply critical thinking skills in problem solving.
CO 4: Analyze the needs of an individual and team for well-being.
CO 5: Assess the situation and take necessary decisions.

COURSE CONTENT
UNIT I:
Soft Skills & Communication Skills: Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

Activities:
Intrapersonal Skills - Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.
(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources).
Interpersonal Skills - Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.
Verbal Communication-Oral Presentations – Extempore - brief addresses and speeches – Convincing - Negotiating- Agreeing and disagreeing with professional grace.

Non - verbal communication - Public speaking - Mock interviews - presentations with an objective to identify non - verbal clues and remedy the lapses on observation.

UNIT II:
Critical Thinking: Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open- mindedness – Creative Thinking - Positive thinking – Reflection.
Activities:
Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis.

UNIT III:
Problem Solving & Decision Making: Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles.
Activities:
Placing a problem which involves conflict of interests, choice and views - formulating the problem - exploring solutions by proper reasoning - Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion.

UNIT IV:

Emotional Intelligence & Stress Management: Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of writtenand oral presentation, Organizing Debates.

UNIT V:

Corporate Etiquette: Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips - Overcoming challenges.

Activities

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games.

NOTE:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

TEXT BOOKS:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, Paper/Cdr Edition, 2012.
2. Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018.

REFERENCES:

1. Prashant Sharma, Soft Skills: Personality Development for Life Success, BPB Publications, 2018.
2. Alex K., Soft Skills, S. Chand & Co., Revised Edition, 2012.
3. Gajendra Singh Chauhan and Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality, Wiley, 2013.
4. Sabina Pillai and Agna Fernandez, Soft Skills and Employability Skills, Cambridge University Press, 2018.
5. Renu Shorey, Soft Skills for a Big Impact, Notion Press, 2016.

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(EC23AES501) TINKERING LAB

COURSE OBJECTIVES:
The objectives of the course are to:

- Encourage Innovation and Creativity
- Provide Hands-on Learning and Impart Skill Development
- Foster Collaboration and Teamwork
- Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
- Impart Problem-Solving mind-set

COURSE OUTCOMES:
After Successful completion of the course, students will be able to:

CO 1: Demonstrate creativity and innovation by designing and developing working prototypes for real-world applications.
CO 2: Apply interdisciplinary knowledge of electronics, programming, mechanical design, and data science/AI in problem-solving.
CO 3: Use modern engineering tools such as microcontrollers, sensors, 3D printing, and CAD software for prototype development.
CO 4: Work collaboratively in teams to plan, design, and execute projects, demonstrating leadership, communication, and teamwork skills.
CO 5: Analyze, test, and evaluate prototype performance to validate solutions against given requirements.

LIST OF EXPERIMENTS:

1. Make your own parallel and series circuits using breadboard for any application of your choice.
2. Design and 3D print a Walking Robot
3. Design and 3D Print a Rocket.
4. Temperature & Humidity Monitoring System (DHT11 + LCD)
5. Water Level Detection and Alert System
6. Automatic Plant Watering System
7. Bluetooth-Based Door Lock System
8. Smart Dustbin Using Ultrasonic Sensor
9. Fire Detection and Alarm System
10. RFID-Based Attendance System
11. Voice-Controlled Devices via Google Assistant
12. Heart Rate Monitoring Using Pulse Sensor
13. Soil Moisture-Based Irrigation
14. Smart Helmet for Accident Detection
15. Milk Adulteration Detection System
16. Water Purification via Activated Carbon
17. Solar Dehydrator for Food Drying
18. Temperature-Controlled Chemical Reactor
19. Ethanol Mini-Plant Using Biomass
20. Smart Fluid Flow Control (Solenoid + pH Sensor)
21. Portable Water Quality Tester
22. AI Crop Disease Detection
23. AI-based Smart Irrigation
24. ECG Signal Acquisition and Plotting
25. AI-Powered Traffic Flow Prediction
26. Smart Grid Simulation with Load Monitoring
27. Smart Campus Indoor Navigator
28. Weather Station Prototype
29. Firefighting Robot with Sensor Guidance
30. Facial Recognition Dustbin
31. Barcode-Based Lab Inventory System

32. Growth Chamber for Plants
33. Biomedical Waste Alert System
34. Soil Classification with AI
35. Smart Railway Gate
36. Smart Bin Locator via GPS and Load Sensors
37. Algae-Based Water Purifier
38. Contactless Attendance via Face Recognition

Note: The students can also design and implement their own ideas, apart from the list of experiments mentioned above.

Note: A minimum of **8** to **10** experiments must be completed by the students.

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(BA23AMC501) BUSINESS ECONOMICS AND FINANCIAL MANAGEMENT

COURSE OBJECTIVES:

The objective of this course is to:

- To introduce fundamental economic concepts and tools relevant to business decision-making.
- To provide insights into production functions, cost behaviors, and break-even analysis for efficient resource utilization.
- To examine market structures and understand the impact of liberalization, privatization, and globalization.
- To introduce the core concepts, objectives, and functions of financial management.
- To explore capital structure, working capital, and investment decision-making through capital budgeting techniques.

COURSE OUTCOMES:

On completion of this course students will be able to:

CO 1: Able to analyze demand, measure elasticity, and apply forecasting techniques for business planning.
CO 2: Understand cost structures and apply break-even analysis for managerial decisions.
CO 3: Able to differentiate market types and evaluate economic reforms like GST and demonetization.
CO 4: Understand the goals of financial management and its importance in business strategy.
CO 5: Able to evaluate capital budgeting proposals using various appraisal methods.

COURSE CONTENT

UNIT I: **(7 Periods)**

Business Economics: Definition, Nature, Scope, and Contemporary importance of Business Economics. Demand Analysis: Concept of Demand, Demand Function, Law of Demand. Elasticity of Demand: Significance, Types of Elasticity, Measurement of elasticity of demand. Demand Forecasting: Factors governing demand forecasting-Methods of demand forecasting**.**

UNIT II: **(10 Periods)**

Theory of Production and Cost Analysis: Production Function-Least cost combination-Short-run and Long-run production function- Iso quants and Is costs, MRTS Cobb-Douglas production function, Laws of returns - Internal and External economies of scale - Cost Analysis: Cost concepts and cost behavior-Break-Even Analysis (BEA)-Determination of Break Even Point (Simple Problems)-Managerial significance and Limitations of Break- Even Point.

UNIT III: **(9 Periods)**

Markets and New Economic Environment: Market structures: Types of Markets-Perfect and Imperfect Competition-Features of perfect Competition-Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination. Pricing Methods and Strategies - New Economic Environment-Economic Liberalization-privatization-Globalization. GST and Demonetization.

UNIT IV: **(8 Periods)**

Financial Management: Nature, Scope and objectives of financial management. Importance of Finance function– Goals of Finance function; Profit Vs Wealth maximization– The role in the contemporary scenario.

UNIT V: **(11 Periods)**

Capital and Capital Budgeting: Concept of Capital-Over and Under capitalization-Remedial Measures-Sources of Shot term and Long term Capital-Estimating Working Capital

Requirements, Capital Budgeting Features of Capital Budgeting Proposals -Methods and Evaluation of Capital Budgeting Projects - Pay Back Method -Accounting Rate of Return (ARR)- Net Present Value (NPV) - Internal Rate Return(IRR) Method (simple problems).

Total Periods: 45

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 4^{th} Edition, 2009.
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.

REFERENCES:

1. Premchand Babu, Madan Mohan: Financial Accounting and Analysis, Himalaya, 2009.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2009.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2^{nd} Edition, New Delhi.

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(IT23ACS501) COMMUNITY SERVICE PROJECT

COURSE DESCRIPTION:

The Community Service Project (CSP) is an experiential learning strategy that integrates meaningful community service with academic instruction, active participation, and real-life problem-solving. It provides students with opportunities to engage in community development activities, apply their classroom knowledge in real-world contexts, and reflect on their learning for both personal and academic growth.

The initiative is designed to foster a strong linkage between the college and the community for mutual benefit. While communities benefit from the focused contributions of students toward local/village development, colleges gain the opportunity to instill in students a sense of social sensitivity, responsibility, and accountability—thus positioning themselves as socially responsible institutions.

CSP also serves as an effective alternative to summer internships, apprenticeships, or on-the-job training in situations where students cannot pursue those options. By immersing students in societal realities, the project enhances their holistic development, cultivates leadership qualities, and strengthens their commitment to inclusive growth and sustainable development.

COURSE OBJECTIVES:
The objectives of this course are to:

- Develop understanding of societal structures, cultural practices, traditions, habits, lifestyles, resource utilization, wastage management, social problems, public administration system and the roles and responsibilities of different persons across different social systems, enabling students to analyze the living conditions, challenges, and aspirations of communities.
- Enhance students' abilities in analyzing societal problems, designing and implementing innovative solutions, applying problem-solving techniques, using appropriate tools and technologies, managing projects and resources effectively, communicating professionally, and working efficiently both individually and in teams while engaging in community development activities in coordination with local communities, public agencies, and government authorities.
- Cultivate social responsibility, empathy, ethical awareness, societal consciousness, and accountability, fostering holistic perspectives and empowering students to address societal challenges responsibly and creatively.

COURSE OUTCOMES:
On successful completion of the course, the students will be able to:

CO 1: Create engineering solutions or processes to address complex societal problems by applying modern tools, relevant codes, standards, policies, and emerging developments.

CO 2: Evaluate environmental, sustainability, ethical, and economic aspects with project management principles to formulate impactful community interventions.

CO 3: Demonstrate teamwork, leadership, and effective communication (written, oral, graphical) while executing and reflecting on community service projects.

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(CS23AES501) INTRODUCTION TO QUANTUM TECHNOLOGY AND APPLICATIONS

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce fundamental quantum concepts like superposition and entanglement.
- Understand theoretical structure of qubits and quantum information.
- Explore conceptual challenges in building quantum computers.
- Explain principles of quantum communication and computing.
- Examine real-world applications and the future of quantum technologies.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Explain core quantum principles in a non-mathematical manner.
CO 2: Compare classical and quantum information systems.
CO 3: Identify theoretical issues in building quantum computers.
CO 4: Discuss quantum communication and computing concepts.
CO 5: Recognize applications, industry trends, and career paths in quantum technology.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Quantum Theory and Technologies: The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, Why quantum? Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: India's Quantum Mission, EU, USA, China.

UNIT II: **(9 Periods)**
Theoretical Structure of Quantum Information Systems: Qubit, Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role.

UNIT III: **(9 Periods)**
Building a Quantum Computer – Theoretical Challenges and Requirements: Building a Quantum Computer, Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability.

Theoretical Barriers: Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities.

UNIT IV: (9 Periods)

Quantum Communication and Computing: Theoretical Perspective: Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD), Role of Entanglement in Communication, The Idea of the Quantum Internet – Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once), Classical vs Quantum Gates, Challenges: Decoherence and Error Correction, Real-World Importance and Future Potential.

UNIT V: (9 Periods)

Applications, Use Cases, and the Quantum Future: Real-world application domains: Healthcare (drug discovery), Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways, Educational and research landscape – India's opportunity in the global quantum race.

Total Periods: 45

TEXT BOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

REFERENCES:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.
4. Alastair I.M. Rae, Quantum Physics: A Beginner's Guide, Oneworld Publications, Revised Edition, 2005.
5. Eleanor G. Rieffel, Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
7. Bruce Rosenblum, Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press, 2nd Edition, 2011.
8. Giuliano Benenti, Giulio Casati, Giuliano Strini, Principles of Quantum Computation and Information, Volume I: Basic Concepts, World Scientific Publishing, 2004.

ONLINE RESOURCES:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

III Year B.Tech. – II Semester

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(CY23APC501) CYBER SECURITY

COURSE OBJECTIVES:
The objective of this course is to:

- Provide awareness on different cybercrimes, cyber offenses, tools and methods used in cybercrime.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Classify the cybercrimes and understand the Indian ITA 2000.
CO 2: Analyze the vulnerabilities in any computing system and find the solutions.
CO 3: Predict the security threats of the future.
CO 4: Investigate the protection mechanisms.
CO 5: Design security solutions for organizations.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Cybercrime Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT II: **(9 Periods)**
Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT III: **(9 Periods)**
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones,
Mobile Devices:
Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies a Measures in Mobile Computing Era, Laptops.

UNIT IV: **(9 Periods)**
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIIT V: **(9 Periods)**
Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Total Periods: 45

TEXT BOOKS:

1. Godbole, N., & Belapure, S. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India, 1st Edition, 2011.
2. Graham, J., Olson, R., & Howard, R. Cyber Security Essentials CRC Press/Auerbach, 1st Edition, 2013.

REFERENCES:

1. Wu, C.-H. John, & Irwin, J. D. Introduction to Computer Networks and Cybersecurity Taylor & Francis/CRC Press, 1st Edition, 2017.

ONLINE RESOURCES:

1. http://nptel.ac.in/courses/106105031/40
2. http://nptel.ac.in/courses/106105031/39
3. http://nptel.ac.in/courses/106105031/38

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(IT23APC601) CLOUD COMPUTING AND DEVOPS

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand collaboration and productivity by automating infrastructure and workflows.
- Familiarize with continuous measuring applications performance.
- Automate workflows in multi-cloud environments using tools like Terraform, Kubernetes.

COURSE OUTCOMES:

After successful completion of this course students will be able to

CO 1: Explain the basic concepts models, and technologies of cloud computing.

CO 2: Demonstrate knowledge of cloud platforms and services, Hadoop architecture, and Python programming.

CO 3: To describe the principles of continuous development and deployment.

CO 4: Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models.

CO 5: Set up complete private infrastructure using version control systems and CI/CD tools.

COURSE CONTENT

UNIT I: **(9 Periods)**

Basics of Cloud computing

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications.
Cloud concept and Technologies: Virtualization ,Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce , Identity and Access Management, services level Agreements, Billing.
Cloud Services and Plat forms: Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

UNIT II: **(9 Periods)**

Hadoop

Hadoop Map Reduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup. **Cloud Application Design**: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

UNIT III: **(9 Periods)**

Introduction to DevOps and Business Foundations

DevOps Fundamentals: Overview, Origins, Roots, Practices, and Culture.
Adopting DevOps: Developing the Playbook and Business Case.
Business Model Canvas: Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structures.

UNIT IV: **(9 Periods)**

DevOps Strategies for Delivery and Innovation

Optimizing the Delivery Pipeline: DevOps as an Optimization Exercise, Core Themes, The DevOps Plays, Specializing Core Plays. **Driving Innovation with DevOps**: Optimize to Innovate, The Uber Syndrome, Role of Technology in Innovation. **Strategic Plays for Innovation**: Building a DevOps Platform, Delivering Microservices Architectures, DevOps and the API Economy, Organizing for Innovation.

UNIT V: **(9 Periods)**

Scaling and Leading DevOps in the Enterprise

Scaling DevOps: DevOps Center of Competency, Innovation Culture at Scale, Continuous Improvement Culture, Team Models, Tool & Process Standardization, Security Considerations, Outsourcing. **Leading Enterprise Adoption**: DevOps as a Transformation Exercise, Culture of Collaboration & Trust, Line-of-Business Alignment, Pilot Projects, Metaphor: "Rearing Unicorns on an Aircraft Carrier". **Kubernetes**: Architecture, Pods and Workloads, Services and Networking.

Total Periods: 45

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Marinetti, Cloud computing A hands- on Approach Universities Press, 2016.
2. Raj Kumar Buyya, James Bromberg, and razes Goscinski, Cloud Computing Principles and Paradigms, Wiley, 2016.

REFERENCES:

1. Nicole Forsgren, Jez Humble, Gene Kim Accelerate: The Science of Lean Software and DevOps by 1st Edition 2018.
2. Mikael Krief, Learning DevOps: Continuously Deliver Better Software 1st Edition 2021.

III Year B.Tech. – II Semester

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(AM23APC401) MACHINE LEARNING

COURSE OBJECTIVES:

The objectives of this course are to:

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbors (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

COURSE OUTCOMES:

After successful completion of this course students will be able to:

CO1: Identify machine learning techniques suitable for a given problem.
CO2: Solve real-world problems using various machine learning techniques.
CO3: Apply dimensionality reduction techniques for data preprocessing.
CO4: Analyze what is learning and why it is essential in the design of intelligent machines.
CO5: Evaluate advanced learning models for language, vision, speech, decision making.

COURSE CONTENT

UNIT I: (8 Periods)

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Stages in Machine Learning.
CRISP-Model: CRISP-DM framework.

UNIT II: (12 Periods)

Dimensionality Reduction: Principal Component Analysis, Singular Value Decomposition.
Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers.

UNIT III: (8 Periods)

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.
The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality.

UNIT IV: (10 Periods)

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Performance of Regression Algorithms.
Artificial Neural Networks: Characteristics, Neural Network Representation in Machine Learning, Multi-Layer Perceptrons (MLPs), Back propagation for Training an MLP.

UNIT V: (7 Periods)

Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Fuzzy C-Means Clustering, K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Total Periods: 45

TEXT BOOKS:

1. M N Murthy, V S Ananthanarayana, Machine Learning Theory and Practice, Universities Press (India), 2024.
2. Tom M. Mitchell, Machine Learning, McGraw-Hill Publication, 2017.

REFERENCES:

1. Peter Harrington, Machine Learning in Action, DreamTech.
2. Pang-Ning Tan, Michel Stenbach, Vipin Kumar, Introduction to Data Mining, 7th Edition, 2019.

III Year B.Tech. – II Semester

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(CY23APE602) BLOCKCHAIN FOR AI
(Professional Elective)

COURSE OBJECTIVES:
The objectives of this course are to:
- To understand the foundational concepts of blockchain technology and its architecture.
- To explore smart contracts, consensus algorithms, and distributed ledger technology.
- To investigate the integration of AI with blockchain for secure, decentralized applications.
- To develop blockchain-enabled AI solutions for real-world use cases.
- To understand the ethical, security, and scalability challenges in Blockchain-AI ecosystems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO1: Explain the fundamentals of blockchain and its components.
CO2: Analyze the role of consensus mechanisms in maintaining trust and decentralization.
CO3: Apply blockchain for secure data sharing in AI systems.
CO4: Develop and deploy smart contracts using Ethereum/Solidity.
CO5: Evaluate blockchain-based AI applications in healthcare, finance & supply chains.

COURSE CONTENT
UNIT I: (9 periods)
Blockchain Fundamentals and Architecture: Introduction to Blockchain Technology, Components: Blocks, Hashing, Merkle Trees, Types of Blockchains: Public, Private, Consortium, Distributed Ledger Technology (DLT) and P2P Networks, Blockchain Structure and Mining, Use Cases and Evolution of Blockchain.

UNIT II: (9 periods)
Smart Contracts and Consensus Mechanisms: Smart Contracts: Definition, Features, Use Cases, Ethereum and Solidity Basics, Consensus Algorithms: PoW, PoS, DPoS, PBFT, Gas, Transactions, and Events in Ethereum, Hyperledger Fabric: Architecture and Chaincode, Deployment and Testing of Smart Contracts.

UNIT III: (9 periods)
Integration of Blockchain and AI: Motivation for Integrating Blockchain with AI, Decentralized AI Models and Federated Learning, Secure Model Sharing and Provenance, Blockchain for Data Integrity in AI Systems, AI for Blockchain (e.g., optimizing consensus), Case Study: Decentralized AI Marketplace.

UNIT IV: Applications of Blockchain in AI Systems (9 periods)
Blockchain for Explainable and Trusted AI, Applications in Healthcare and Genomics, Blockchain for Autonomous Vehicles and IoT, Financial AI Systems with Smart Contracts, Supply Chain and Logistics Intelligence, NFT-based AI Applications (Digital Identity, IP).

UNIT V: Security, Privacy and Challenges in Blockchain-AI (9 periods)
Security Challenges: Sybil Attacks, 51% Attacks, Privacy Preservation and Zero Knowledge Proofs, Scalability and Energy Concerns in Blockchain-AI, Ethical and Legal Concerns in AI

with Blockchain, Interoperability of Blockchain Platforms, Future Trends: Quantum-Resistant Blockchain- AI.

Total Periods: 45

TEXT BOOKS:

1. Imran Bashir, Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, Packt, 3rd Edition, 2020.
2. Melanie Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, 1st Edition, 2015.
3. Joseph Holbrook, Architecting AI Solutions on Blockchain, Packt Publishing, 1st Edition, 2020.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach, VPT, 1st Edition, 2017.
2. Karamjit Singh, Blockchain for AI: Use Cases and Implementation, Springer, 1st Edition, 2023.
3. Roger Wattenhofer, The Science of the Blockchain, 1st Edition, 2016.

ONLINE RESOURCES:

1. Coursera: Blockchain Specialization – University at Buffalo
2. edX: Blockchain Fundamentals – UC Berkeley
3. Coursera: AI and Blockchain – IBM

III Year B.Tech. – II Semester

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(IT23APE601) CLOUD COMPUTING FOR AI

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce the concepts, models, & services of cloud computing and its role in AI.
- Explore the architecture and deployment of AI applications on cloud platforms.
- Equip students with skills in using cloud-based tools and services for AI/ML workload.

COURSE OUTCOMES:

After successful completion of this course students will be able to

CO 1: Explain cloud computing architecture, services, and deployment models.
CO 2: Utilize cloud platforms (AWS, GCP, Azure) for training and deploying.
CO 3: Handle large-scale data storage and processing in the cloud environment.
CO 4: Integrate AI workflows using server less and container-based architectures.
CO 5: Analyze challenges in security, cost, scalability, and performance of cloud-based AI systems.

COURSE CONTENT

UNIT I: **(9 Periods)**

Introduction to Cloud Computing and AI Integration

Basics of Cloud Computing: Characteristics, Models and Services, Cloud Service Models: IaaS, PaaS, SaaS

Deployment Models: Public, Private, Hybrid, Community

AI and Cloud Convergence: Benefits and Challenges

Use Cases of AI in Cloud: NLP, Vision, Analytics

Overview of Cloud Providers for AI: AWS, Azure, GCP

UNIT II: **(9 Periods)**

Storage, Computing, and Data Processing in the Cloud

Cloud Storage Services: S3, Blob, BigQuery, Virtualization and Elastic Computing, Distributed Computing with Hadoop and Spark, Data Ingestion and Processing Pipelines, Data Lakes and Warehousing in the Cloud, Cost Optimization for Storage and Compute Resources.

UNIT III: **(9 Periods)**

Cloud-based Machine Learning and Deep Learning ML Services on AWS (SageMaker), Azure ML, GCP Vertex AI, Training and Deploying Models on Cloud, AutoML and Custom ML Model Workflows, GPUs/TPUs for Model Training, Experiment Tracking and Model Evaluation, Integration of Notebooks (Jupyter, Colab) with Cloud Storage.

UNIT IV: **(9 Periods)**

Advanced Cloud Concepts for AI Applications Containers and Docker for AI Applications, Kubernetes and Cloud-native AI Workflows, Serverless Computing: AWS Lambda, Azure Functions, CI/CD Pipelines for AI Models in Cloud, Scaling AI Applications using Load Balancers and Auto-Scaling. Monitoring and Logging in Cloud for AI Workflow.

UNIT V: **(9 Periods)**

Security, Ethics, and Case Studies in Cloud AI Security and Privacy in Cloud-based AI, Identity and Access Management (IAM) in Cloud, Cost Management and Billing for AI Services, Ethical Issues and Fairness in Cloud AI, Case Study: AI in Healthcare Cloud Solutions, Case Study: Real-Time Analytics in Financial Cloud Services.

Total Periods: 45

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, McGraw-Hill, 2013.
2. Judith Hurwitz et al., Cloud Computing for Dummies, Wiley, 2020.

REFERENCES:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Distributed & Cloud Computing, Morgan Kaufmann, 2011.
2. Tomasz Kajdanowicz et al., Practical Cloud AI, Springer.

ONLINE LEARNING RESOURCES:

1. AWS Cloud Practitioner & Machine Learning Path – AWS Training.
2. Google Cloud AI and ML Specialization – Coursera.

III Year B.Tech. – II Semester

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(IT23APE501) INTERNET OF THINGS

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology.
- Introduce some of the application areas where IoT can be applied.

COURSE OUTCOMES:

After successful completion of this course students will be able to:

CO 1: Understand general concepts of Internet of Things.
CO 2: Apply design concept to IoT solutions.
CO 3: Analyze various M2M and IoT architectures.
CO 4: Evaluate design issues in IoT applications.
CO 5: Create IoT solutions using sensors, actuators and Devices.

COURSE CONTENT

UNIT I: **(9 Periods)**

Introduction to IoT

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates.

UNIT II: **(9 Periods)**

Prototyping IoT Objects using Microprocessor/Microcontroller

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III: **(9 Periods)**

IoT Architecture and Protocols

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV: **(9 Periods)**

Device Discovery and Cloud Services for IoT

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT V: **(9 Periods)**

UAV IoT

Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defence, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Total Periods: 45

TEXT BOOKS:

1. Vijay Madisetti and Arshdeep Bahga, — Internet of Things (A Hands-on-Approach), VPT, 1st Edition, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

REFERENCES:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, — From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, Academic Press, 1st Edition, 2014.
2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.

III Year B.Tech. – II Semester

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(DS23APC301) INTRODUCTION TO DATA SCIENCE

COURSE OBJECTIVES:
The objective of this course are to:
- Knowledge and expertise to become a data scientist.
- Essential concepts of statistics and machine learning that are vital for data science;
- Significance of exploratory data analysis (EDA)in data science.
- Critically evaluate data visualizations presented on the dash boards.
- Suitability and limitations of tools and techniques related to data science process.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand significance of Data Science.
CO 2: Analyze large data.
CO 3: Understand the fundamentals of Data Science Process Methods.
CO 4: Apply machine learning in Data Science.
CO 5: Perform Data reduction and apply visualization techniques.

COURSE CONTENT

UNIT I: **(8 Periods)**

Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science.
Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them.

UNIT II: **(10 Periods)**
Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning.
Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems.

UNIT III: **(9 Periods)**
NoSQL movement for handling Big data: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling.

UNIT IV: **(8 Periods)**
Tools and Applications of Data Science: Introducing Neo4jfor dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts.

UNIT V: **(10 Periods)**
Data Visualization and Prototype Application Development: Data Visualization options, Cross filter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools. Applying the Data Science process for real-world problem-solving scenarios as a detailed case study.

Total Periods: 45

TEXT BOOKS

1. Davy Cielen, Arno D.B. Meysman, and Mohamed Ali, Introducing to Data Science using Python tools, Manning Publications Co, Dream tech press, 2016.
2. Prateek Gupta, Data Science with Jupyter, for basics, BPB publishers, 2019.

REFERENCES:

1. Joel Grus, Data Science from Scratch, OReilly, 2019.
2. Doing Data Science: Straight Talk from TheFrontline,1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013.

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(IT23APE602) MOBILE APPLICATION DEVELOPMENT

COURSE OBJECTIVES:
The objectives of this course are to:

- Facilitate students to understand android SDK.
- Help students to gain a basic understanding of Android application development.
- Inculcate working knowledge of Android Studio development tool.

COURSE OUTCOMES:
After successful completion of this course students will be able to

CO 1: Identify various concepts of mobile programming.
CO 2: Evaluate mobile applications on their design pros and cons.
CO 3: Utilize rapid prototyping techniques to design and develop mobile interfaces.
CO 4: Develop mobile applications for the Android operating system.
CO 5: Demonstrate the deployment of applications to the Android marketplace.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Android
The Android Platform, Android SDK, Eclipse and Android Installation, Building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT II: **(9 Periods)**
Android Application Design Essentials
Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Using Intent Filter, Permissions.

UNIT III: **(9 Periods)**
Android User Interface Design Essentials
User Interface Screen elements,Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT IV: **(9 Periods)**
Testing Android applications
Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT V: **(9 Periods)**
Using Common Android APIs
Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, and Deploying Android Application to the World.

Total Periods: 45

TEXT BOOKS:

1. Lauren Darcey and Shane Conder, Android Wireless Application Development, PearsonEducation, 2nd Edition, 2011.
2. Android Application Development All in one for Dummies by Barry Burd,2021.

REFERENCES:

1. Reto Meier, Professional Android 2 Application Development, Wiley India, 2018.
2. Mark L Murphy, Beginning Android, Wiley India Pvt Ltd.

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(IT23APE603) SOFTWARE TESTING METHODOLOGIES

COURSE OBJECTIVES:
The objectives of this course are to:
- Study the fundamental concepts of software testing which includes objectives, process, criteria, strategies, and methods.
- Discuss various software testing types and levels of testing like black and white box testing along with levels unit test, integration, regression, and system testing.
- Learn the types of bugs, testing levels with which the student can very well identify a bug and correct as when it happens.

COURSE OUTCOMES:
After successful completion of this course students will be able to

CO 1: Know the basic concepts of software testing and its essentials.
CO 2: Able to identify the various bugs and correcting them.
CO 3: Use of program control flow as a structural model.
CO 4: Performing functional testing using control flow and transaction flow graphs.
CO 5: Evaluate software quality using metrics and apply defect tracking techniques.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction: -Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.
Flow graphs and Path Testing: - Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT II: (9 Periods)
Transaction Flow Testing: -Transaction flows, transaction flow testing techniques.
Dataflow Testing: - Basics of dataflow testing, strategies in dataflow testing, application of data flow testing.

UNIT III: (9 Periods)
Domain Testing: -domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT IV: (9 Periods)
Paths, Path products and Regular expressions: - path products & paths expression, reduction procedure, applications, regular expressions & flow anomaly detection.
Logic Based Testing: -over view, decision tables, path expressions, kv charts, specifications.

UNIT V: (9 Periods)
State, State Graphs and Transition testing: - state graphs, good & bad state graphs, state testing, Testability tips.
Graph Matrices and Application: -Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools.

Total Periods: 45

TEXT BOOKS:

1. Boris Beizer, Software Testing techniques, Dreamtech, 2nd Edition, 2002.
2. Dr. K.V.K.K. Prasad, Software Testing Tools, Dreamtech, 2004.

REFERENCES:

1. Edward Kit, Software Testing in the Real World, Pearson, 2001.
2. Perry, Effective methods of Software Testing, John Wiley, 2006.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106101163

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(CY23APE604) MOBILE ADHOC NETWORKS

(Professional Elective-III)

COURSE OBJECTIVES:

The objectives of this course are to:

- Knowledge of mobile adhoc networks, design and implementation issues, and available solutions.
- Knowledge of routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid.
- Knowledge of clustering mechanisms and the different schemes that have been employed, e.g., hierarchical, flat, and leaderless.
- Knowledge of the 802.11 Wireless Lane (Wi-Fi) and Bluetooth standards.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Describe the unique issues in ad-hoc/sensor networks.
CO 2: Describe current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.
CO 3: Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
CO 4: Discuss the challenges in designing routing and transport protocols for wireless Adhoc/sensor networks.
CO 5: Comprehend the various sensor network Platforms, tools and applications.

COURSE CONTENT

UNIT I: **(9 Periods)**

Introduction to Ad Hoc Networks: Characteristics of MANETs, Applications of MANETs and challenges of MANETs -Routing in MANETs: Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms, Position based routing algorithms, other routing algorithms.

UNIT II: **(9 Periods)**

Data Transmission: Broad cast storm problem, Broadcasting, Multicasting and Recasting - TC Plover Ad Hoc: TCP protocol overview, TCP and MANETs, Solutions for TCP over Adhoc.

UNIT III: **(9 Periods)**

Basics of Wireless, Sensors and Applications: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

UNIT IV: **(9 Periods)**

Data Retrieval in Sensor Networks: Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots-Security: Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

UNIT V: **(9 Periods)**

Sensor Network Plat forms and Tools: Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms -Operating System: T annoys -Imperative Language: knees C, Dataflow style language: Tiny GALS, Node Level Simulators, ns-2 and its sensor network extension.

Total Periods: 45

TEXT BOOKS:

1. Cordeiro, C. de M., & Agrawal, D. P. Ad Hoc and Sensor Networks: Theory and Applications World Scientific Publishing, 2nd Edition, 2011.
2. Zhao, F., &Guibas, L. J. Wireless Sensor Networks: An Information Processing Approach Morgan Kaufmann/Elsevier Science, 1st Edition, 2004.

REFERENCES:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, Ad Hoc and Sensor Networks: Theory and Applications, World Scientific, 1st Edition, 2011.
2. Kazem Sohraby, Daniel Minoli, and TaiebZnati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley-Inter science, 1st Edition, 2007.

ONLINE RESOURCES:

1. https://onlinecourses.swayam2.ac.in/ntr25_ed126/preview?

III Year B.Tech. – II Semester

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(CS23APE605) SOFTWARE PROJECT MANAGEMENT

(Professional Elective-III)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the limitations of conventional software management and explore the evolution of software economics.
- Familiarize students with modern software engineering principles and lifecycle models including iterative processes.
- Introduce work breakdown structures, milestone-based tracking, and planning methodologies for software project workflows.
- Emphasize process automation, project metrics, and team management strategies for successful project execution.
- Examine organizational structures and analyze real-world case studies in the context of modern software project management.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Describe traditional and modern software management practices and Understand software economics and cost estimation.

CO 2: Analyze and apply iterative software development models and understand the role of lifecycle phases and process artifacts.

CO 3: Plan project iterations effectively using WBS, scheduling techniques, milestones, and assessments.

CO 4: Utilize automation tools, interpret key software metrics, and tailor processes based on project-specific factors.

CO 5: Evaluate organizational project structures and apply best practices through real-world case studies like CCPDS-R.

COURSE CONTENT

UNIT I: **(9 Periods)**

Conventional Software Management: The water fall model, conventional software Management performance Evolution of Software Economics: software Economics. Pragmatic Software Cost Estimation Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections.

UNIT II: **(9 Periods)**

The old way and the new: The principles of convention al software Engineering, principles of modern software management, transitioning to an iterative process. Lifecycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT III: **(9 Periods)**

Work Flows of the process: Software process work flows, Inter Trans work flows. Check points of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: work break down structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT IV: **(9 Periods)**

Process Automation: Automation Building Blocks, The Project Environment. Project Control and Process instrumentation: The sevencore Metrics, Management indicators, quality indicators Tailoring the Process: Process discriminants. Managing people and organizing teams.

UNIT V: (9 Periods)

Project Organizations and Responsibilities: Line - of-Business Organizations, Project Organizations, evolution of Organizations.

Future Software Project Management: modern Project Profiles, Next generation Software economics, modern process stransitions.

Case Study: The Command Center Processing and Display System-Replacement (CCPDS-R).

Total Periods: 45

TEXT BOOKS:

1. Software Project Management, Walker Royce, Pearson Education, 2012.
2. Bob Hughes, Mike Cotterell and Rajib Mall—Software Project Management, 6th Edition, Mc Graw Hill Edition, 2017.

REFERENCES:

1. Pankaj Jalote,—Software Project Management in practice, 5th Edition, Pearson Education, 2017.
2. Murali K. Chemuturi, Thomas M. Cagley Jr. Mastering Software Project Management: Best Practices, Tools and Techniques‖, J.Ross Publishing, 2010.
3. Sanjay Mohapatra,—Software Project Management, Cengage Learning, 2011.

ONLINE RESOURCES:

http://nptel.ac.in/courses/106101061/29

III Year B.Tech. – II Semester

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-	-	2	1

(AM23APC402) MACHINE LEARNING LAB

COURSE OBJECTIVES:
The objective of this course are to:
- To learn about computing central tendency measures and data preprocessing techniques.
- To learn about classification and regression algorithms.
- To apply different clustering algorithms for a problem**.**

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO1: To apply preprocessing techniques.
CO2: To perform regression techniques.
CO3: To solve clustering algorithms.

List of Exercises:
1. Compute Central Tendency Measures: Mean, Median, Mode. Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset: a. Attribute selection b. Handling Missing Values c. Discretization d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression.
4. Demonstrate decision tree algorithm for classification and regression problem.
5. Demonstrate Naïve Bayes Classification algorithm.
6. Apply Support Vector algorithm for classification.
7. Demonstrate simple linear regression algorithm for a regression problem.
8. Apply Logistic regression algorithm for a classification problem.
9. Demonstrate Multi-layer Perceptron algorithm for a classification problem.
10. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters.
11. Demonstrate the use of Fuzzy C-Means Clustering.
12. Demonstrate the use of Expectation Maximization-based clustering algorithm.

TEXT BOOKS:
1. M N Murthy, V S Ananthanarayana, Machine Learning Theory and Practice, Universities Press (India), 2024.

REFERENCES:
1. Tom M. Mitchell, Machine Learning, McGraw-Hill Publication, 2017.
2. Peter Harrington, Machine Learning in Action, DreamTech.

III Year B.Tech. – II Semester

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(IT23APC602) CLOUD COMPUTING AND DEVOPS LAB

COURSE OBJECTIVES:

The objectives of this course are to:

- Demonstrate application development using Cloud.
- Explain features of Hadoop.

COURSE OUTCOMES:

After successful completion of this course students will be able to

CO 1: Configure various virtualization tools such as Virtual Box.
CO 2: Design and deploy a web application in a Peas environment.
CO 3: Learn how to simulate a cloud environment to implement new schedulers.
CO 4: Install and use a generic cloud environment.
CO 5: Manipulate large data sets in a parallel environment.

List of Exercises:

S.NO	NAME OF THE EXERCISE
	CLOUD PROGRAMS
1.	Install Virtual Box/ VMware Workstation with different flavors of Linux or windows OS on top of windows operating systems.
2.	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3.	Install Google App Engine. Create hello world app and other simple web applications using python/java.
4.	Install Hadoop single node cluster and run simple applications like word count.
5.	Design a Cloud based smart traffic management system.
6.	Design Cloud based attendance management system.
	DEVOPS PROGRAMS
7.	Exploring Git Commands through Collaborative Coding.
8.	Implement GitHub, GitLab Operations & BitBucket Operations.
9.	Applying CI/CD Principles to Web Development Using Jenkins, Git, and Local HTTP Server and using Docker Containers.
10.	Exploring Containerization and Application Deployment with Docker.
11.	Demonstrate Maven Build Life Cycle.
12.	Demonstrate Container Orchestration using Kubernetes.
13.	Create the GitHub Account to demonstrate CI/CD pipeline using Cloud Platform.

REFERENCES:

1. https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html
2. http://code.google.com/appengine/downloads.html

ONLINE LEARNING RESOURCES/VIRTUAL LABS:

1. Google Cloud Computing Foundations Course - Course (nptel.ac.in)

III Year B.Tech. – II Semester

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2	-	-	-

(CS23AMC601) TECHNICAL REPORT WRITING AND IPR

COURSE OBJECTIVES:
The objectives of this course are to:
- To enable the students to practice the basic skills of research paper writing.
- To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
- To practice the basic skills of performing quality literature review.
- To help them in knowing the significance of real-life practice and procedure of Patents.
- To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Identify key secondary literature related to their proposed technical pap writing.
CO 2: Explain various principles and styles in technical writing.
CO 3: Use the acquired knowledge in writing a research/technical paper.
CO 4: Analyse rights and responsibilities of holder of Patent, Copyright, trademark, International Trademark etc.
CO 5: Evaluate different forms of IPR available at national & international level.

COURSE CONTENT

UNIT I: **(9 Periods)**
Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language - highlighting your findings- discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

UNIT II: **(9 Periods)**
Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature Problems and Framing Research Questions- Synopsis.

UNIT III: **(9 Periods)**
Process of Research: publication mechanism: types of journals- indexing-seminars-conferences proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion results- citation rules.

UNIT IV: **(9 Periods)**
Introduction to Intellectual Property: Introduction, types of intellectual property, International organizations, agencies and ties, importance of intellectual property rights Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and updating trade mark, trade mark registration processes.

UNIT V: **(9 Periods)**
Law of Copy Rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Total Periods: 45

TEXT BOOKS:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013.
2. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and practices, Oxford.

REFERENCES:

1. R.Myneni, Law of Intellectual Property, Asia law House, 9th Edition, 2019.
2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001.
3. P.Naryan, Property Law, Eastern Law House, 3rd Edition, 2007.
4. Adrian Wallwork. English for Writing Research Papers, Springer Cham Heidelberg New York , 2nd Edition, 2016.
5. Dan Jones, Sam Dragga, Technical Writing Style.

ONLINE RESOURCES:

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper- journal/
5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/

IV Year B.Tech. – I Semester

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(IT23APC701) IT INFRASTRUCTURE MANAGEMENT

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the components and architecture of IT infrastructure.
- Explore data center operations and virtualization techniques.
- Study IT service management frameworks such as ITIL and examine the security, disaster recovery, and business continuity aspects of IT infrastructure.

COURSE OUTCOMES:
After successful completion of this course students will be able to

CO 1: Describe the components and operations of IT infrastructure.
CO 2: Analyze enterprise network and communication systems.
CO 3: Manage hardware, software, and data center resources effectively.
CO 4: Apply ITIL-based practices for IT service delivery.
CO 5: Evaluate virtualization and cloud strategies for infrastructure scaling.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to IT Infrastructure
Overview of IT Infrastructure: Definition, Components, Evolution of IT Infrastructure, Infrastructure Management Activities, Trends in IT Infrastructure: Cloud, Edge, IoT, Role of IT in Business Transformation.

UNIT II: **(9 Periods)**
Hardware and Software Management
Data Center Facilities: Servers, Storage, Power & Cooling, Software Platforms and **Applications Enterprise Software**: ERP, CRM, SCM, Software License Management, Patch and Configuration Management.

UNIT III: **(9 Periods)**
Network and Communication Infrastructure
LAN, WAN, and Wireless Technologies, Network Devices and Protocols, Internet, Intranet, VPN, Bandwidth and Performance Management, Network Monitoring Tools (e.g., Wireshark, Solar Winds).

UNIT IV: **(9 Periods)**
IT Service Management (ITSM)
Introduction to ITIL Framework, Service Lifecycle: Strategy, Design, Transition, Operation, Improvement, Service Desk Operations, Change, Incident, and Problem Management, SLA (Service Level Agreement) and Performance Metrics.

UNIT V: **(9 Periods)**
Virtualization, Cloud and Security
Virtualization Technologies: VMware, Hyper-V, KVM, **Cloud Providers**: AWS, Azure, GCPIT Infrastructure Security: Threats and Solutions Business Continuity and Disaster Recovery Planning (BCP & DR).

Total Periods: 45

TEXT BOOKS:
1. Arif Mohamed, IT Infrastructure Management, Tata McGraw-Hill, 2011.
2. Kumar Saurabh, Cloud Computing: Insights into New-Era Infrastructure, Wiley,2011.

REFERENCES:

1. Curt Aubley et al., IT Infrastructure Architecture – Infrastructure Building Blocks and Concepts, 3rd Edition, 2023.
2. Sjaak Laan, IT Infrastructure Architecture Explained, 2nd Edition, 2023.

IV Year B.Tech. – I Semester

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2	-	-	2

(BA23AHS701) BUSINESS ETHICS AND CORPORATE GOVERNANCE

COURSE OBJECTIVES:

The objective of this course is to:

- To make the student understand the principles of business ethics.
- To enable the min knowing about the ethics in management.
- To facilitate the student role in corporate culture.
- To impart knowledge about the fair-trade practices.
- To encourage the student in knowing about the corporate governance.

COURSEOUTCOMES:

On completion of this course students will be able to:

CO 1: Understand the meaning of loyalty and ethical Behavior.
CO 2: Develop ethical values in self and organization.
CO 3: Understand the key elements of corporate culture.
CO 4: Make use of Environmental Protection and Fair-Trade Practices.
CO 5: Analyze role of auditors, board of directors and shareholders in corporate governance.

COURSE CONTENT

UNIT I: **(5 Periods)**

Ethics: Introduction–Meaning–Nature, Scope, significance, Loyalty, and ethical behavior. Value systems – Business Ethics-Types, Characteristics, Factors, Contradictions and Ethical Practices in Management-Corporate Social Responsibility–Issues of Management–Crisis Management. Ethics in the Digital Age: AI Ethics, Data Privacy, Cybersecurity Ethics.

UNIT II: **(6 Periods)**

Ethics In Management: Introduction-Ethics in production, finance, Human resource management and Marketing Management –The Ethical Value System–Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics–Ethical Values in different Cultures -Culture and Individual Ethics – professional ethics and technical ethics. Ethical Challenges in Startups & Gig Economy.

UNIT III: **(7 Periods)**

Corporate Culture: Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change**.** Toxic Workplaces: Recognizing and Managing Ethical Culture Failures.

UNIT IV: **(5 Periods)**

Legal Frame Work: Law and Ethics -Agencies enforcing Ethical Business Behavior -Legal Impact –Environmental Protection, ESG (Environmental, Social, Governance) Regulations, Fair Trade Practices, legal Compliances, Safeguarding Health and well being of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

UNIT V: **(7 Periods)**

Corporate Governance: Introduction - Meaning–Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams-Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees- Reports –Benefits and Limitations. Emerging Global Trends in Corporate Governance (OECD Guidelines).

Total Periods: 30

TEXT BOOKS:

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July, 2017.
2. Bholananth Dutta, S.K.Podder–Corporation Governance, VB, June, 2010.

REFERENCES:

1. Dr.K. Nirmala, Karunakara Readdy. Business Ethics and Corporate Governance, HPH.
2. H.R. Machiraju: Corporate Governance, HPH, 2013.
3. K. Venkataramana, Corporate Governance, SHBP.
4. N.M. Khandelwal. Indian Ethos and Values for Managers.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. https://archive.nptel.ac.in/courses/109/106/109106117/

IV Year B.Tech. – I Semester

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(BA23AHS702) E-BUSINESS

COURSE OBJECTIVES:

The objective of this course is to:

- To provide knowledge on emerging concept on E-Business related aspect.
- To understand various electronic markets & business models.
- To impart the information about electronic payment systems &banking.
- To create awareness on security risks and challenges in E-commerce.
- To the students aware on different e-marketing channels &strategies.

COURSE OUTCOMES:

On completion of this course students will be able to:

CO 1: Remember E-Business & its nature, scope and functions.
CO 2: Understand the concept of business models.
CO 3: Understand the Electronic payment system.
CO 4: Understand E-Security, Contrast & compare security protocols & public network.
CO 5: Understand the concept of on-line marketing.

COURSE CONTENT

UNIT I: **(6 Periods)**

Electronic Business: Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)- Advantages & Disadvantages of E-Commerce – E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries. Green E-Business & Sustainable Digital Practices.

UNIT II: **(7 Periods)**

Electronic Markets and Business Models: Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models-Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India. Platform-Based Business Models (e.g., Uber, Amazon, Airbnb), Subscription-Based E-Business Models (SaaS, DaaS).

UNIT III: **(5 Periods)**

Electronic Payment Systems: Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments. Cross-Border E-Commerce and Global Payment Gateways(PayPal, Stripe, Razorpay).

UNIT IV: **(7 Periods)**

E-Security: Security risks and challenges in electronic commerce - Cyber threats -Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms. Data Privacy Laws and Compliance (GDPR, PDP Bill - India).

UNIT V: **(5 Periods)**

E-Marketing: Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research–E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM).AI in Personalized Marketing (Chatbots, Product Recommendations).

Total Periods: 30

TEXT BOOKS:

1. Arati Oturkar &Sunil Khilari, E-Business. Everest Publishing House, 2022.
2. P.T.SJoseph. E-Commerce, Fourth Edition, Prentice Hall of India, 2011.

REFERENCES:

1. Debjani, Kamalesh K Bajaj.E-Commerce, Second Edition Tata Mc Graw-Hill's, 2005.
2. Dave Chaffey. E-Commerce E-Management, Second Edition, Pearson, 2012.
3. Henry Chan.E-Commerce Fundamentals and Application, Raymond Leatham Wiley India, 2007.
4. S.Jaiswal. E-Commerce Galgotia Publication Pvt Ltd., 2003.

ONLINE RESOURCES:

1. https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771
2. https://www.slideshare.net/VikramNani/e-commerce-business-models
3. https://www.slideshare.net/RiteshGoyal/electronic-payment-system
4. https://www.slideshare.net/WelingkarDLP/electronic-security
5. https://www.slideshare.net/Ankitha2404/emarketing-ppt

IV Year B.Tech. – I Semester

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(BA23AHS703) MANAGEMENT SCIENCE

COURSE OBJECTIVES:

The objective of this course is to:

- Provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production.
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts.
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management.
- To make the students aware of the contemporary issues in modern management.

COURSE OUTCOMES:

On completion of this course students will be able to:

CO 1: Remember the concepts & principles of management and designs of organization in a practical world.

CO 2: Understand the knowledge of Work-study principles & Quality Control techniques in industry.

CO 3: Apply the process of Recruitment & Selection in organization.

CO 4: Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.

CO 5: Create awareness on contemporary issues in modern management &technology.

COURSE CONTENT

UNIT I: **(5 Periods)**

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations -Organizational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management. Global Management Practices – cross-cultural management insights.

UNIT II: **(7 Periods)**

Operations Management: Principles and Types of Plant Layout -Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Material Management - Objectives - Inventory- Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Marketing Management - Concept-Meaning-Nature-Functions of Marketing- Marketing Mix- Channels of Distribution-Advertisement and Sales Promotion-Marketing Strategies based on Product Life Cycle. Smart Manufacturing / Industry 4.0 **–** IoT, automation, robotics in production.

UNIT III: **(6 Periods)**

Human Resources Management (HRM):HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection -Process -Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration. Remote Work & Hybrid Workforce Management.

UNIT IV: **(5 Periods)**

Strategic& Project Management: Definition & Meaning - Setting of Vision - Mission - Goals -Corporate Planning Process – EnvironmentalScanning-StepsinStrategyFormulationandImplementation –SWOT Analysis- Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path

Method (CPM)Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems). Risk Management in Projects – identification and mitigation.

UNIT V: (7 Periods)

Contemporary Issues in Management: Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re- engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility. Corporate Social Innovation (CSI).

Total Periods: 30

TEXT BOOKS:

1. FrederickS. Hillier, MarkS. Hillier. Introduction to Management Science, 2023.
2. A.RAryasri, Management Science, TMH, 2019.

REFERENCES:

1. Stoner, Freeman, Gilbert. Management, Pearson Education, New Delhi, 2019.
2. Koontz &Weihrich, Essentials of Management, TMH, 6th Edition, TMH, 2005.
3. Thomas N.Duening &JohnM. Ivancevich, Management Principles and Guidelines, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Samuel C.Certo, Modern Management, PHI, 9th Edition, 2005.

ONLINE RESOURCES:

1. https://www.slideshare.net/slideshow/introduction-to-management-and-organization-231308043/231308043
2. https://nptel.ac.in/courses/112107238
3. https://archive.nptel.ac.in/courses/110/104/110104068/
4. https://archive.nptel.ac.in/courses/110/105/110105069/

IV Year B.Tech. – I Semester

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(AM23APE701) AUGMENTED REALITY AND VIRTUAL REALITY

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce students to the fundamental concepts, principles, and technologies of Virtual Reality (VR) and Augmented Reality (AR).
- Provide knowledge of VR/AR hardware and software architectures, including display devices, sensors, tracking systems, and development platforms.
- Develop understanding of human perception and interaction mechanisms that influence immersive experience design.
- Train students in 3D modeling, rendering, and audio techniques essential for creating realistic virtual environments.
- Expose students to interaction design principles for natural and intuitive user experiences in VR/AR systems.

COURSE OUTCOMES:
After successful completion, students will be able to:

CO 1: Understand the core concepts of Virtual Reality and Augmented Reality and their differences.
CO 2: Learn about the hardware and software components required for VR and AR systems.
CO 3: Gain knowledge of input devices (trackers, navigation, and gesture interfaces) and output devices (graphics, sound displays, and haptic feedback).
CO 4: Develop skills in modeling techniques and behavior modeling for VR and AR environments.
CO 5: Explore the technologies and methodologies used to create Augmented Reality systems.

COURSE CONTENT

UNIT I : (8 Periods)
Introduction to Virtual Reality (VR)
Defining Virtual Reality, Key elements of virtual reality experience, Virtual Reality, Telepresence, Augmented Reality and Cyberspace, Bird's-Eye View: Hardware, Software, Human Physiology and Perception.

UNIT II : (9 Periods)
Input and Output Devices
Input Devices: Trackers, Navigation, and Gesture Interfaces, Three-dimensional position trackers, Navigation and manipulation interfaces, Gesture interfaces
Output Devices: Graphics displays, sound displays & haptic feedback.

UNIT III: (10 Periods)
Modeling
Geometric modeling, Kinematics modeling, Physical modeling, Behavior modeling, Model management.

UNIT IV : (10 Periods)
Augmented Reality (AR)
Taxonomy, Technology and Features of Augmented Reality, AR vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods and Visualization Techniques, Enhancing interactivity in AR Environments, Evaluating AR systems, AR software development: Camera parameters, calibration, marker-based AR, AR Toolkit.

UNIT V: (8 Periods)
Interaction & Audio
Interaction: Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction.

Audio: The Physics of Sound, Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Total Periods: 45

TEXT BOOKS:

1. Gregory C. Burdea & Philippe Coiffet, John , Virtual Reality Technology, Wiley & Sons,2nd Edition, 2017.
2. Steven M. LaValle ,Virtual Reality, Cambridge University Press, 2016.

REFERENCES:

1. Rajesh K. Maurya, Computer Graphics with Virtual Reality System, Wiley Publication, 3rd Edition, 2018.
2. William R. Sherman and Alan B. Craig, Understanding Virtual Reality Interface, Application, and Design, Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2019.
3. Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, Wiley, 2nd Edition, 2017.
4. K.S. Hale and K. M. Stanney, Handbook on Virtual Environments, CRC Press, 2nd Edition, 2015.

ONLINE RESOURCES:

1. http://vr.cs.uiuc.edu/vrbook.pdf
2. https://nptel.ac.in/courses/106/106/106106138/

IV Year B.Tech. – I Semester

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(CS23APE602) COMPUTER VISION

(Professional Elective-V)

COURSE OBJECTIVES:
The objectives of this course are to:

- Introduce the basic concepts and mathematical foundations of computer vision and enable students to understand how digital images can be processed for feature extraction.
- Study linear filters, convolution, and frequency-based analysis for understanding image structure and transformation.
- Explore edge detection techniques, including noise handling and smoothing, for accurate object boundary identification in images.
- Examine texture representation methods using filter banks, pyramids, and spatial domain transformations to extract patterns and structural information.
- Provide an understanding of image segmentation techniques, including clustering and graph-theoretic methods, for dividing images into meaningful regions. Enable students to apply recognition techniques using template relations, classifiers, and probabilistic models like Hidden Markov Models for real-world object detection and interpretation.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the fundamentals of computer vision and apply linear filters and convolution operations.
CO 2: Analyze the impact of noise and smoothing in edge detection and implement techniques like Gaussian filters.
CO 3: Represent and synthesize texture using filter banks, pyramids, and spatial frequency analysis.
CO 4: Apply clustering and graph-based methods for image segmentation and detect shapes using the Hough Transform.
CO 5: Use relational and probabilistic models such as HMMs for object recognition and person detection.

COURSE CONTENT

UNIT I: **(9 Periods)**
Linear Filters: Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT II: **(9 Periods)**
Edge Detection: Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Lap lacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT III: **(9 Periods)**
Texture: Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Lap lacian Pyramid, Filters in the Spatial Frequency Domain,
Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes.

UNIT IV: **(9 Periods)**
Segmentation by Clustering: What is Segmentation, Human Vision: Grouping and Gestalt,

Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph- Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves.

UNIT V: **(9 Periods)**
Recognition by Relations Between Templates: Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

Total Periods: 45

TEXT BOOKS:

1. David A. Forsyth, Jean Ponce, Computer Vision – A modern Approach, PHI, 2003.
2. Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics, Springer;1st Edition,2001 by Sommer.

REFERENCES:

1. Digital Image Processing and Computer Vision,1/e, by Sonka.
2. Computer Vision and Applications: Concise Edition (With CD) by Jack Academy Press, 2000.

ONLINE RESOURCES:

https://nptel.ac.in/courses/106105216https://nptel.ac.in/courses/108103174

IV Year B.Tech. – I Semester

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(AM23APC602) DEEP LEARNING

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce the fundamental concepts and mathematical foundations of deep learning.
- Explore different neural network architectures including CNNs, RNNs, LSTMs and Transformers.
- Enable students to implement, train, and optimize deep neural networks.
- Analyze the performance and limitations of various architectures in different AI tasks.
- Develop the ability to apply deep learning models to real-world applications such as image recognition, language modeling, and autonomous systems.

COURSE OUTCOMES:

After successful completion of this lab, students will be able to:

CO 1: Understand the theoretical foundations of neural networks and deep learning.

CO 2: Implement and train multilayer perceptrons, CNNs, RNNs, and the architectures.

CO 3: Analyze and optimize deep learning models using advanced regularization and tuning techniques.

CO 4: Evaluate the applicability of different neural network architectures for various AI problems.

CO 5: Apply state-of-the-art models such as Transformers and GANs in real-world domains.

COURSE CONTENT

UNIT I: (8 Periods)

Foundations of Neural Networks

Introduction to Artificial Neural Networks, Biological Neuron vs. Artificial Neuron, Perceptron, Multilayer Perceptron (MLP), Activation Functions: ReLU, Sigmoid, Tanh, Softmax, Backpropagation and Gradient Descent, Loss Functions: MSE, Cross Entropy, Overfitting, Regularization (L1/L2), Dropout.

UNIT II: (9 Periods)

Convolutional Neural Networks (CNNs)

Convolution Operation and Feature Maps, Pooling Layers: Max and Average Pooling, CNN Architectures: LeNet, AlexNet, VGG, ResNet, Transfer Learning and Fine-tuning, Image Classification, Object Detection Basics, Implementation with TensorFlow/PyTorch.

UNIT III: (10 Periods)

Recurrent Neural Networks (RNNs) and Variants

Sequential Data and Time Series, RNN Basics and Back propagation Through Time (BPTT), Vanishing and Exploding Gradients, LSTM and GRU Architectures, Applications in Text, Speech, and Music, Sequence-to-Sequence Models.

UNIT IV: (10 Periods)

Advanced Architectures & Optimization

Autoencoders and Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs), Deep Reinforcement Learning Overview, Batch Normalization, Early Stopping, Hyperparameter Tuning and Optimization, Performance Metrics and Evaluation.

UNIT V: (8 Periods)

Transformer Models & Applications

Attention Mechanism and Self-Attention, Transformers and BERT Architecture, Positional

Encoding, Multi-head Attention, Pre-trained Language Models and Fine-Tuning, Applications in NLP: Text Classification, Translation, Large Language Models and Transfer Learning.

Total Periods: 45

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.
2. Michael Nielsen, Neural Networks and Deep Learning (Online Book).

REFERENCES:

1. Rajalingappaa Shanmugamani, Deep Learning for Computer Vision.
2. Lewis Tunstall, Leandro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly.
3. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction.
4. Christopher M. Bishop, Pattern Recognition and Machine Learning.

ONLINE RESOURCES:

1. Deep Learning Specialization – Andrew Ng (Coursera)
2. CS231n: Convolutional Neural Networks for Visual Recognition Stanford
3. Practical Deep Learning for Coders – Fast.ai
4. Deep Learning with PyTorch – Udacity
5. Transformers by Hugging Face – Free Course

IV Year B.Tech. – I Semester

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(IT23APE701) ENTERPRISE SYSTEMS

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce the concept and architecture of Enterprise Systems.
- Understand the integration of business processes across functional units.
- Explore ERP, SCM, and CRM systems and their implementations.

COURSE OUTCOMES:
After successful completion of this course students will be able to
- **CO 1:** Explain the fundamental concepts and scope of enterprise systems.
- **CO 2:** Analyze various ERP modules and their role in business integration.
- **CO 3:** Evaluate CRM and SCM strategies for improving organizational efficiency.
- **CO 4:** Apply enterprise integration techniques using modern technologies.
- **CO 5:** Identify emerging trends and technologies shaping future enterprise systems.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Enterprise Systems: Definition and Scope of Enterprise Systems, Evolution of Enterprise Applications, Components and Architecture of Enterprise Systems, Business Process Reengineering (BPR) Role of Enterprise Systems in Organizations.

UNIT II: **(9 Periods)**
Enterprise Resource Planning (ERP)
Overview of ERP, ERP Modules- Finance, HR, Manufacturing, Supply Chain, etc., ERP Life Cycle-Planning, Selection, Implementation, and Post-Implementation, Case Studies: SAP, Oracle ERP, Microsoft Dynamics, Benefits and Challenges of ERP Implementation.

UNIT III: **(9 Periods)**
Customer Relationship Management (CRM) and Supply Chain Management (SCM)
Overview and Features of CRM Systems, CRM Life Cycle and Tools, Overview of SCM and its Components, Integration of SCM with ERP, CRM and SCM, Case Studies (e.g., Salesforce, Zoho CRM, SAP SCM).

UNIT IV: **(9 Periods)**
Enterprise Application Integration
Need for Integration, Middleware and Enterprise Service Bus (ESB), Web Services and APIs, Service-Oriented Architecture (SOA)Data Synchronization and Master Data Management (MDM).

UNIT V: **(9 Periods)**
Trends and Future Directions
Cloud-based Enterprise Systems (SaaS ERP), Mobile and Social ERPAI and Analytics in Enterprise Systems, Security and Compliance in Enterprise Systems, Case Studies of Modern Enterprises using Digital Transformation.

Total Periods: 45

TEXT BOOKS:
1. Alexis Leon, Enterprise Resource Planning, McGraw Hill, 4th Edition, 2020.
2. Mary Sumner, Enterprise Resource Planning, Pearson Education. 1st Edition, 2013.

REFERENCES:
1. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill. 1st Edition, 2008.
2. S. Sadagopan, Enterprise Resource Planning, PHI Learning. 1st Edition, 1999.

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(CS23APE702) AGILE METHODOLOGIES

(Professional Elective-V)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the fundamental theories, values, and principles of Agile methodology and contrast it with traditional software development models.
- Explore various Agile frameworks and processes such as Scrum, XP, Crystal, and FDD. Recognize the role of agility in knowledge management and decision-making within software projects.
- Apply Agile practices in requirements engineering, focusing on handling dynamic and evolving requirements.
- Evaluate Agile techniques for software quality assurance, including metrics and test-driven development in a global context.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Explain the core principles of Agile methodology and differentiate it from traditional models.

CO 2: Apply various Agile processes and frameworks in managing software development lifecycle.

CO 3: Analyze the integration of Agile approaches in knowledge management within software teams.

CO 4: Develop and prioritize agile-based requirements using abstraction and modeling techniques.

CO 5: Evaluate Agile quality assurance practices such as TDD and use metrics for performance tracking.

COURSE CONTENT

UNIT I: **(9 Periods)**

Agile Methodology: Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values.

UNIT II: **(9 Periods)**

Agile Processes: Lean Production - SCRUM, Crystal, Feature Driven Development Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III: **(9 Periods)**

Agility and Knowledge Management: Agile Information Systems – Agile Decision Making - Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story- Cards – Story-Card Maturity Model (SMM).

UNIT IV: **(9 Periods)**

Agility and Requirements Engineering: Impact of Agile Processes in RE– Current Agile Practices – Variance – Overview of RE Using Agile Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements-Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V: (9 Periods)

Agility and Quality Assurance: Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

Total Periods: 45

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results‖, Prentice Hall, 2003.
2. Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science‖, Springer, 2009.

REFERENCES:

1. Craig Larman, ―Agile and Iterative Development: A Manager‗s Guide‖, Addison-Wesley, 2004.
2. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and Management‖, Butterworth-Heinemann, 2007.

ONLINE RESOURCES:

https://www.nptelvideos.com/video.php?id=904

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(DS23APC701) BIG DATA ANALYTICS

COURSE OBJECTIVES:

The objective of this course are to:

- Provide an overview of an exciting growing field of big data analytics.
- Introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- Optimize business decisions and create competitive advantage with Big Data analytics.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Illustrate on big data and its use cases from selected business domain.
CO 2: Interpret and summarize on NoSQL, Cassandra.
CO 3: Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore Big Data applications Using Hive.
CO 4: Make use of Apache Spark, RDDs etc. to work with datasets.
CO 5: Assess real time processing with Spark Streaming.

COURSE CONTENT

UNIT I: **(10 Periods)**

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II: **(8 Periods)**

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra, Table creation, loading and reading data.

UNIT III: **(8 Periods)**

Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance, with data replication, High availability, Data locality, Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV: **(10 Periods)**

Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server.

UNIT V: **(9 Periods)**

Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Total Periods: 45

TEXT BOOKS:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj.
2. SPARK: The Definitive Guide, Bill Chambers &MateiZaharia, O'Reilley, 2018Edition 3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional,2012.
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012.

REFERENCES:

1. Eric Sammer, Hadoop Operations, O'Reilley, 2012.
2. E. Capriolo, D. Wampler, and J. Rutherglen, Programming Hive", O'Reilley, 2012.
3. Lars George, HBase: The Definitive Guide, O'Reilley, 2011.
4. Eben Hewitt, Cassandra: The Definitive Guide, O'Reilley ,2010.
5. Alan Gates, Programming Pig, O'Reilley, 2011.

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(IT23APE702) HIGH PERFORMANCE COMPUTING

COURSE OBJECTIVES:

The objectives of this course are to:

- Improve the system performance.
- Learn various distributed and parallel computing architecture.
- Learn different computing technologies.

COURSE OUTCOMES:

After successful completion of this course students will be able to

CO 1: Understanding the concepts in grid computing.
CO 2: Ability to set up cluster and run parallel applications.
CO 3: Ability to understand the cluster projects and cluster OS.
CO 4: Understanding the concepts of pervasive computing.
CO 5: Understanding the concepts of quantum gates and circuits.

COURSE CONTENT

UNIT I: (9 Periods)

Grid Computing: Data & Computational Grids, Grid Architectures and Its Relations to Various Distributed Technologies. Autonomic Computing, Examples of The Grid Computing Efforts (Ibm).

UNIT II: (9 Periods)

Cluster Setup & Its Advantages, Performance Models & Simulations: Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O.

UNIT III: (9 Periods)

Example Cluster System – Beowulf; Cluster Operating System: Compass And Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface.

UNIT IV: (9 Periods)

Device Connectivity: Java for Pervasive Devices; Application Examples.

UNIT V: (9 Periods)

Classical Vs Quantum Logic Gates: One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms.

Total Periods: 45

TEXT BOOKS:

1. Dr. P. Padmanabham and Dr.M.B. Srinivas, Selected Topics in Advanced Computing, Pearson Education, 2005.
2. Marivesar: Approaching quantum computing, Pearson Education,2004.

REFERENCES:

1. J. Joseph & C. Fellenstien: Grid Computing, Pearson Education, 2003.
2. J. Burkhardt et.al: pervasive computing Pearson Education, 2002.

IV Year B.Tech. – I Semester

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(IT23APE703) HUMAN COMPUTER INTERACTION

COURSE OBJECTIVES:
The objective of this course is to:
- Gain an overview of Human-Computer Interaction (HCI).
- Become familiar with the vocabulary associated with sensory and cognitive systems as relevant to task performance by humans.
- Be able to apply models from cognitive psychology to predicting user performance in various human computer interaction.

COURSE OUTCOMES:
After successful completion of this course students will be able to:
CO 1: Understand the principles and practices of software project management.
CO 2: Apply project estimation techniques, scheduling tools.
CO 3: Analyze and manage software project risks, quality assurance processes.
CO 4: Demonstrate the ability to use project management tools.
CO 5: Develop skills to work in teams, communicate effectively with stakeholders.
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COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction: Importance of user Interface – definition, importance of good design,Benefits of good design, A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation,graphical system, Characteristics of Web user Interface - popularity, characteristics- Principles of user interface**.**

UNIT II: **(9 Periods)**
Design process – Understanding how people interact with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business functions. Screen Designing: Design goals – Screen meaning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design**.**

UNIT III: **(9 Periods)**
System menus: Structures of Menus, Functions of Menus, Content of Menus, Kinds of Graphical menus, Windows: Window characteristics, Components of a window, Window presentation styles, Types of windows, Windom management**.**

UNIT IV: **(9 Periods)**
Controls: Characteristics of device-based controls, Selecting the proper device-based controls, Operable controls, Text Entry/Read-only controls, Selection controls, Combination Entry/selection controls, Selecting the proper controls.

UNIT V: **(9 Periods)**
Graphics: Icons, Multimedia, Color-what is it, Color uses, Color and Human vision, Choosing colors, Testing: The purpose and importance of usability testing, Scope of testing,Prototypes, Kinds of Tests, Developing and conducting the test.

Total Periods: 45

TEXT BOOKS:

1. Wilbert O Galitz, The essential guide to user interface design, Wiley, 2nd Edition, 2013.
2. I.Scott Mackenzie, Human – Computer Interaction, Elsevier Publishers, 2024.

REFERENCES:

1. Ben Shneidermann, Designing the user interface, Pearson Education Asia, 3rd Edition, 1997.
2. D.R.Olsen, Human –Computer Interaction, Cengage Learning, 2009.

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(CS23ASC701) INTRODUCTION TO R PROGRAMMING

COURSE OBJECTIVES:
The objectives of this course are to:

- Introduce the R programming environment and familiarize students with installation, basic setup, and package management.
- Provide foundational understanding of R programming concepts, including data types, variables, operators, and control structures.
- Develop the ability to work with different data structures in R, such as vectors, lists, matrices, and data frames.
- Enable students to write functions and use R packages for implementing programming logic and solving problems.
- Train students in data manipulation, analysis, and visualization using built-in functions and graphical tools in R.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Setup R Programming Environment.
CO 2: Understand and use R – Data types.
CO 3: Understand and use R – Data Structures.
CO 4: Develop programming logic using R – Packages.
CO 5: Analyze data sets using R – programming capabilities.

List of Exercises:

1. Download and install R-Programming environment and install basic packages using install.packages() command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)
3. Write a program to find list of even numbers from 1 to n using R-Loops.
4. Create a function to print squares of numbers in sequence.
5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write a program to read a csv file and analyze the data in the file in R.
9. Create pie chart and bar chart using R.
10. Create a data set and do statistical analysis on the data using R.

TEXT BOOKS:

1. Norman Matloff, The Art of R Programming, UC Davis, 2009.

REFERENCES:

1. Garrett Grolemund, Hands-On Programming with R: Write Your Own Functions and Simulations, O'Reilly Media, 2014. ISBN: 978-1-4493-7272-0
2. Hadley Wickham & Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media, 2017. Available freely at: https://r4ds.had.co.nz
3. W. N. Venables and B. D. Ripley, Modern Applied Statistics with S, Springer, 4th Edition, 2002. ISBN: 978-0387954578

ONLINE RESOURCES:

1. https://www.r-project.org/

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(CS23ASC501) FULL STACK DEVELOPMENT – II

COURSE OBJECTIVES:
The objectives of this course are to:

- Enable the use of Modern JavaScript (ES6) for building dynamic, interactive, and modular front-end applications.
- Develop fast, scalable, and responsive user interfaces using React.js, a widely-used JavaScript library.
- Design and implement backend APIs using Express.js, a Node.js framework.
- Establish seamless full-stack connectivity between the frontend (React), backend (Express), and database (MySQL).
- Provide hands-on experience in building a complete web application with real- time interactions and persistent storage.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Build fast, dynamic, and interactive user interfaces using React.js.
CO 2: Use declarative programming paradigms to develop scalable web applications.
CO 3: Leverage ES6 JavaScript features for writing modern, cleaner, and efficient code.
CO 4: Design and implement backend services and RESTful APIs using Express.js.
CO 5: Integrate frontend, backend, and MySQL database to build a complete full stack solution.

Experiments covering the Topics:

- Introduction to DOM (Document Object Model), Ecma Script (ES6) standards and features like Arrow functions, Spread operator, Rest operator, Type coercion, Type hoisting, String literals, Array and Object Destructuring.
- Basics of React. js like React Components, JSX, Conditional rendering Differences between Real DOM and Virtual DOM.
- Important React.js concepts like React hooks, Props, React forms, Fetch API, Iterative rendering using JavaScript map() function.
- JavaScript runtime environment node. js and its uses, Express. js and Routing, Micro- Services architecture and MVC architecture, database connectivity using (My SQL).
- Introduction to My SQL, setting up MySQL and configuring, Databases, My SQL queries, subqueries, creating My SQL driver for database connectivity to Express. js server.

Sample Experiments:

1. Introduction to Modern JavaScript and DOM
   a. Write a JavaScript program to link JavaScript file with the HTML page
   b. Write a JavaScript program to select the elements in HTML page using selectors
   c. Write a JavaScript program to implement the event listeners
   d. Write a JavaScript program to handle the click events for the HTML button elements
   e. Write a JavaScript program to With three types of functions
      i. Function declaration
      ii. Function definition
      iii. Arrow functions

2. Basics of React. js
   a. Write a React program to implement a counter button using react class components
   b. Write a React program to implement a counter button using react functional

components
c. Write a React program to handle the button click events in functional component
d. Write a React program to conditionally render a component in the browser
e. Write a React program to display text using String literals

3. Important concepts of React. js
    a. Write a React program to implement a counter button using React use State hook
    b. Write a React program to fetch the data from an API using React use Effect hook
    c. Write a React program with two react components sharing data using Props.
    d. Write a React program to implement the forms in react
    e. Write a React program to implement the iterative rendering using map() function.

4. Introduction to Node. js and Express. js
    a. Write a program to implement the ‗hello world‛ message in the route through the browser using Express
    b. Write a program to develop a small website with multiple routes using Express. js
    c. Write a program to print the ‗hello world‛ in the browser console using Express. js
    d. Write a program to implement the CRUD operations using Express. js
    e. Write a program to establish the connection between API and Database using Express – My SQL driver

5. Introduction to My SQL
    a. Write a program to create a Database and table inside that database using My SQL Command line client
    b. Write a My SQL queries to create table, and insert the data, update the data in the table
    c. Write a My SQL queries to implement the subqueries in the My SQL command line client
    d. Write a My SQL program to create the script files in the My SQL workbench
    e. Write a My SQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API.

TEXT BOOKS:

1. Web Design with HTML, CSS, JavaScript and Journey Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas.
2. John Dean, Web Programming with HTML5, CSS and JavaScript, Jones & Bartlett Learning, 2019.
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React
4. Vasan Subramanian, 2nd Edition, A Press, O‛Reilly.
5. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating
6. AZAT MARDAN, Full Stack Java Script: Learn Back bone. js Node. Js and Mongo DB.2015

REFERENCES:

1. Full-Stack JavaScript Development by Eric Bush.
2. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
3. Tomasz Dyl , Kamil Przeorski, Maciej Czarnecki, Mastering Full Stack React Web Development 2017.

ONLINE RESOURCES:

1. https://ict.iitk.ac.in/product/full-stack-developer-html5-css3-js-bootstrap-php-4/
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs

IV Year B.Tech. – I Semester

L	T	P	C
2	-	-	-

(BA23AAC701) GENDER SENSITIZATION

COURSE OBJECTIVES:
The objectives of this course are to:

- Enable students to understand the gender related issues, vulnerability of women and men
- Familiarize them about constitutional safeguard for gender equality
- Expose the students to debates on the politics and economics of work
- Help students reflect critically on gender violence
- Make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the basic concepts of gender and its related terminology.
CO 2: Identify the biological, sociological, psychological and legal aspects of gender.
CO 3: Use the knowledge in understanding how gender discrimination works in our society and how to counter it.
CO 4: Able to critically analyze the concept, types, and consequences of gender-based violence.
CO 5: able to evaluate gender representations in media, literature, and language.

COURSE CONTENT

UNIT I: (7 Periods)
Understanding Gender: Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT II: (5 Periods)
Gender Roles and Relations: Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum

UNIT III: (7 Periods)
Gender and Labour: Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction-Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT IV: (5 Periods)
Gender-Based Violence: The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

UNIT V: (6 Periods)
Gender and Culture: Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships.

Total Periods: 30

TEXT BOOKS:

1. A. Suneetha, Uma Bhrugubanda, Towards a World of Equals: A Bilingual Textbook on Gender, Telugu Akademi, Telangana, 2015.
2. Butler, Judith, Gender Trouble: Feminism and the Subversion of Identity, UK Paperback Edn., March 1990

REFERENCES:

1. Wtatt, Robin and Massood, Nazia, Broken Mirrors: The Dowry Problems in India, London: Sage Publications, 2011
2. Datt, R. and Kornberg, J., Women in Developing Countries, Assessing Strategies for Empowerment, London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., Gender and Governance, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, Women and Politics World Wide, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, Gender Sensitization: Issues and Challenges (English, Hardcover), Raj Publications, 2019
6. A. Revathy & Murali, Nandini, A Life in Trans Activism (Lakshmi Narayan Tripathi). The University of Chicago Press, 2016.

ONLINE RESOURCES:

1. https://onlinecourses.swayam2.ac.in/nou24_hs53/preview
2. https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes
3. https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408
4. https://onlinecourses.swayam2.ac.in/cec23_hs29/preview
5. https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed
6. https://onlinecourses.nptel.ac.in/noc23_mg67/preview
7. https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en
8. https://onlinecourses.swayam2.ac.in/nou25_ge38/preview
9. https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/
10. https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/
11. https://archive.nptel.ac.in/courses/109/106/109106136/
12. https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls

IV Year B.Tech. – I Semester

L	T	P	C
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(IT23AIP701) INDUSTRY INTERNSHIP

COURSE DESCRIPTION: This course is designed to expose students to the industrial environment and prepare them as competent professionals for the industry. It sharpens real-time technical and managerial skills required on the job, while providing valuable professional experience and an understanding of engineers' responsibilities and ethics. Students will gain familiarity with the latest equipment, materials, and technologies, develop proficiency in technical report writing, and acquire first-hand exposure to corporate working culture.

COURSE OBJECTIVES:
The objectives of this course are to:

- **Equip** students with an understanding of industrial processes, organizational structures, professional practices, and emerging technologies relevant to engineering domains.
- Enhance technical competence, analytical ability, problem-solving, leadership, team spirit, finance, project management, and communication skills through hands-on engagement in real-time industrial projects.
- Cultivate professional ethics, social responsibility, adaptability to corporate culture, environmental and sustainability awareness, and a lifelong learning mindset for industry readiness.

COURSE OUTCOMES:
On successful completion of the course, the students will be able to:

CO 1: **Evaluate** industrial processes, latest equipment, materials, and technologies to solve complex engineering problems in compliance with relevant standards, codes, policies, and regulations.

CO 2: Evaluate safety, health, societal, environmental, sustainability, ethical, economic, and managerial considerations in industrial problem-solving and decision-making.

CO 3: Analyze individual and team performance, leadership, and professional communication effectiveness in written, oral, and graphical forms while practicing engineering in real-time industrial settings.

IV Year B.Tech. – II Semester

L	T	P	C
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(IT23AIP801) INTERNSHIP

COURSE DESCRIPTION: This semester-long course provides students with comprehensive, hands-on exposure to industry, national laboratories, or academic institutions, relevant to their branch-specific or interdisciplinary interests, through offline, online, or blended modes. It is designed to prepare students as competent professionals by sharpening real-time technical, managerial, and problem-solving skills, while fostering an understanding of professional responsibilities, ethics, and workplace culture.

Students will analyze, design, and develop innovative solutions to real-world engineering problems, gain familiarity with latest equipment, materials, and technologies, and enhance proficiency in technical report writing, documentation, and professional communication. They will also acquire first-hand exposure to organizational processes and corporate working culture, preparing them to function effectively in diverse professional settings.

COURSE OBJECTIVES:
The objectives of this course are to:

- **Equip** students with an understanding of industrial processes, organizational structures, professional practices, and emerging technologies relevant to engineering domains.
- Enhance technical competence, analytical ability, design, problem-solving, leadership, team spirit, finance, project management, and communication skills through hands-on engagement in real-time industrial projects.
- Cultivate professional ethics, social responsibility, adaptability to corporate culture, environmental and sustainability awareness, and a lifelong learning mindset for industry readiness.

COURSE OUTCOMES:
On successful completion of the course, the students will be able to:

CO 1: Create real-world engineering solutions using industrial processes, latest equipment, materials, and technologies in compliance with relevant standards, codes, policies, and regulations.

CO 2: Evaluate safety, health, societal, environmental, sustainability, ethical, economic, and managerial considerations in industrial problem-solving and decision-making.

CO 3: Analyze individual and team performance, leadership, and professional communication effectiveness in written, oral, and graphical forms while practicing engineering in real-time industrial settings.

IV Year B.Tech. – II Semester

L	T	P	C
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(IT23APW801) PROJECT

COURSE DESCRIPTION: This capstone course provides students with the opportunity to conceptualize, design, and execute a comprehensive project, either research-oriented or application-oriented, relevant to their discipline or interdisciplinary areas. Students will identify a project topic, perform a critical literature survey, and gather preliminary data. They will evaluate feasibility through time, cost, and resource analysis, select suitable tools and methodologies, and carry out detailed design, analysis, and implementation. The project emphasizes creating solutions to real-world problems, supported by ethical, sustainable, and professional considerations. The outcomes are documented in a thesis and defended through a formal presentation before an evaluation committee.

COURSE OBJECTIVES:

The objectives of this course are to:

- Develop a thorough understanding of project identification, planning, and execution by integrating domain knowledge, research insights, and emerging trends in engineering practice.
- Equip students with the ability to design, develop, and implement project-based engineering solutions through systematic analysis, application of modern tools and techniques, project and financial management, leadership, and effective individual and team participation.
- Foster professional ethics, societal and environmental responsibility, and a lifelong learning mindset by engaging students in real-world project work that addresses contemporary challenges and community needs.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to:

CO 1: Create engineering systems or processes to solve complex problems by applying appropriate tools, techniques, standards, codes, policies, regulations, and the latest developments.

CO 2: Evaluate societal, health, safety, environmental, sustainability, economic, and project management considerations in developing engineering solutions.

CO 3: Demonstrate effective individual or teamwork, leadership, and professional communication in written, oral, and graphical forms while executing engineering projects.

OPEN ELECTIVES

III Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CE23AOE501) CONSTRUCTION TECHNOLOGY AND MANAGEMENT

(Open Elective-I)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand project management fundamentals, organizational structures, and leadership principles in construction.
- Analyse manpower planning, equipment management, and cost estimation in civil engineering projects.
- Apply planning, scheduling, and project management techniques such as CPM and PERT.
- Evaluate various contract types, contract formation, and legal aspects in construction management.
- Assess safety management practices, accident prevention strategies, and quality management systems in construction.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand project management fundamentals, organizational structures, and leadership principles in construction.
CO 2: Analyse manpower planning, equipment management, and cost estimation in civil engineering projects.
CO 3: Apply planning, scheduling, and project management techniques such as CPM and PERT.
CO 4: Evaluate various contract types, contract formation, and legal aspects in construction management.
CO 5: Assess safety management practices, accident prevention strategies, and quality management systems in construction.

COURSE CONTENT

UNIT I: (9 Periods)

Introduction: Project forms, Management Objectives and Functions; Organizational Chart of a Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability.

UNIT II: (10 Periods)

Man and Machine: Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering, Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.

UNIT III: (9 Periods)

Planning, Scheduling and Project Management: Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network- formulation and Time Computation.

UNIT IV: (9 Periods)

Contracts: Types of Contracts, formation of Contract – Contract Conditions – Contract for Labour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.

UNIT V: (8 Periods)

Safety Management: Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall

Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.

Total Periods: 45

TEXT BOOKS:

1. SK. Sears, GA. Sears, RH. Clough, Construction Project Management, John Wiley and Sons, 6th Edition, 2016.
2. Saleh Mubarak, Construction Project Scheduling and Control, 4th Edition, 2019.

REFERENCES:

1. Brien, J.O. and Plotnick, F.L., CPM in Construction Management, McGraw Hill, 2010.
2. Punmia, B.C., and Khandelwal, K.K., Project Planning and Control with PERT and CPM, Laxmi Publications, 2002.
3. Stephens Nunnally, Construction Methods and Management: Pearson New International Edition, 8th Edition.
4. Rhoden, M and Cato B, Construction Management and Organisational Behaviour, Wiley-Blackwell, 2016.
5. T.R. Jagadish and M.A. Jayaram, Design of Bridges Structure, Prentice Hall of India Pvt., Delhi.
6. Pandey, I.M, Financial Management, Pearson India Education Services Pvt. Ltd, 12th Edition, 2021.

III Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CE23AOE502) GREEN BUILDINGS

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the fundamental concepts of green buildings, their necessity, and sustainable features.
- Analyze green building concepts, rating systems, and their benefits in India.
- Apply green building design principles, energy efficiency measures, and renewable energy sources.
- Evaluate air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.
- Assess material conservation strategies, waste management, and indoor environmental quality in green buildings.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the importance of green buildings, their necessity, and sustainable features.

CO 2: Analyze various green building practices, rating systems, and their impact on environmental sustainability.

CO 3: Apply principles of green building design to enhance energy efficiency and incorporate renewable energy sources.

CO 4: Evaluate HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.

CO 5: Assess material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Green Building: Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing a Green Building, Important Sustainable Features for Green Buildings.

UNIT II: **(10 Periods)**
Green Building Concepts and Practices: Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.

UNIT III: **(9 Periods)**
Green Building Design: Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT IV: **(9 Periods)**
Air Conditioning: Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT V: (8 Periods)

Material Conservation– Handling of Non-Process Waste, Waste Reduction During Construction, Materials with Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.

Total Periods: 45

TEXT BOOKS:

1. Handbook on Green Practices, Indian Society of Heating Refrigerating and Air Conditioning Engineers, 2009.
2. Tom Woolley and Sam Kimings, Green Building Hand Book, 2009.

REFERENCES:

1. T.R. Jagadish and M.A. Jayaram, Design of Bridges Structure, Prentice Hall of India Pvt., Delhi.
2. Trish Riley, Complete Guide to Green Buildings
3. Kent Peterson, Standard for the Design for High Performance Green Buildings, 2009
4. Energy Conservation Building Code –ECBC-2020, Published by BEE

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/105/102/105102195/

III Year B.Tech. – I Semester

L	T	P	C
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(CS23AOE501) PRINCIPLES OF OPERATING SYSTEMS

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:

- Understand the fundamental components and design principles of operating systems.
- Explore the concepts of processes, threads, interprocess communication, and synchronization.
- Analyze problems related to concurrency, deadlocks, and CPU scheduling.
- Study memory management strategies including paging and virtual memory.
- Understand file systems and their management in modern operating systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Explain the roles and responsibilities of operating systems in resource management.
CO 2: Design and evaluate algorithms for process scheduling and memory management.
CO 3: Apply synchronization mechanisms to solve concurrency problems.
CO 4: Analyze and prevent deadlock scenarios in multitasking environments.
CO 5: Describe file system structures and their role in storage management.

COURSE CONTENT

UNIT I: (9 Periods)
Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems **System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT II: (10 Periods)
Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multithreading models, Thread libraries, Threading issues.
CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT III: (9 Periods)
Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.
Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT IV: (9 Periods)
Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing. Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT V: (8 Periods)
File System: File System Interface: File concept, Access methods, Directory Structure;
File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method,Free space management; File-System Internals: File-

System Mounting, Partitions and Mounting, File Sharing. Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Total Periods: 45

TEXT BOOKS:

1. Silberschatz A, Galvin P B, Gagne G, Operating System Concepts Wiley, 10th Edition, 2018
2. Tanenbaum A S, Modern Operating Systems, Pearson, 4th Edition, 2016

REFERENCES:

1. Stallings W Operating Systems -Internals and Design Principles, Pearson, 9th Edition, 2018
2. D.M. Dhamdhere, Operating Systems: A Concept Based Approach, McGraw- Hill, 3rd Edition, 2013.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/106/106106144/
2. https://peterindia.net/OperatingSystems.html/

III Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(AM23AOE501) ARTIFICIAL INTELLIGENCE TOOLS AND TECHNIQUES

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce the fundamental concepts and real-world applications of Artificial Intelligence.
- Explore AI tools and platforms with minimal mathematical complexity.
- Provide practical experience in building intelligent systems using Python-based libraries.
- Develop AI thinking through hands-on use cases from multiple domains.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the key areas and applications of Artificial Intelligence.
CO 2: Apply search and logic-based reasoning techniques for simple problem solving.
CO 3: Use standard AI libraries to implement basic ML and NLP applications.
CO 4: Analyze real-life problems and apply suitable AI tools to solve them.
CO 5: Demonstrate the ability to use AI ethically and responsibly.

COURSE CONTENT

UNIT I: **(8 Periods)**
What is AI? Scope and Applications,Intelligent Agents and Simple AI Systems Search Techniques: Breadth-First Search, Depth-First Search,Problem-solving with heuristics (A* algorithm),Tools Introduction: Google Colab, Jupyter Notebook

UNIT II: **(9 Periods)**
Basics of Logic and Inference, Knowledge Representation: Facts and Rules,Simple Rule-Based Systems,Constraint Satisfaction Problems (CSP),Tools: Prolog demo or Scikit-learn Rule-based models·

UNIT III: **(10 Periods)**
What is Machine Learning? Types of ML, Basic Algorithms: Decision Trees, k-NN, Clustering, Train/Test Split, Accuracy, Confusion Matrix,Using Scikit-learn for classification tasks, Hands-on: Predicting student performance, loan default detection.

UNIT IV: **(10 Periods)**
Natural Language Processing (NLP) Basics: Tokenization, Stopwords, Sentiment Analysis using NLTK/spaCy, Basics of Image Processing: OpenCV introduction, Simple CNN for image classification (using pre-trained models),Mini-project: Text-based chatbot or object recognition system.

UNIT V: **(8 Periods)**
Overview of AI Platforms: Google AI, AWS AI, Azure AI, Streamlit for AI web app deployment, OpenAI GPT & Chatbot APIs (Intro Only), AI in Healthcare, Education, Finance, and Agriculture, Ethics in AI: Data Bias, Responsible AI, Future of Work.

Total Periods: 45

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 3rd Edition.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 2022.

REFERENCES:

1. E. Rich and K. Knight, Artificial Intelligence, 3rd Edition.
2. Patrick Henny Winston, Artificial Intelligence, Pearson Education, 3rd Edition.

III Year B.Tech. – I Semester

L	T	P	C
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(AM23AOE502) INTRODUCTION TO ARTIFICIAL INTELLIGENCE

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:

- Learn the distinction between optimal reasoning Vs. human like reasoning.
- Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- Learn different knowledge representation techniques.
- Understand the applications of AI, namely game playing, theorem proving, and machine learning.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
CO 2: Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
CO 3: Learn different knowledge representation techniques.
CO 4: Understand the concepts of state space representation, exhaustive Search, heuristic search together with the time and space complexities.
CO 5: Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.

COURSE CONTENT

UNIT I: **(8 Periods)**
Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT II: **(9 Periods)**
Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic-Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT III: **(10 Periods)**
First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

UNIT IV: **(10 Periods)**
Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

UNIT V: **(8 Periods)**
Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes�-Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions,

Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

Total Periods: 45

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 3rd Edition.
2. E. Rich and K. Knight, Artificial Intelligence, TMH, 3rd Edition.

REFERENCES:

1. Patrick Henny Winston, Artificial Intelligence, Pearson Education, 3rd Edition.
2. Shivani Goel, Artificial Intelligence, Pearson Education.

III Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CY23APC301) COMPUTER NETWORKS

(Open Elective-I)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the different types of networks
- Discuss the software and hardware components of a network
- Develop an understanding the principles of computer networks.
- Familiarize with OSI model and the functions of layered structure.
- Explain networking protocols, algorithms and design perspectives

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Identify the software and hardware components of a Computer network.
CO 2: Explain the functionality of each layer of a computer network.
CO 3: Identify and analyze flow control, congestion control, and routing issues.
CO 4: Analyze and interpret the functionality and effectiveness of the routing protocols.
CO 5: Choose the appropriate transport protocol based on the application requirements.

COURSE CONTENT

UNIT I: (8 Periods)

Introduction: Types of Computer Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols ,Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT II: (10 Periods)

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided to The Network Layer, Framing Error Control, Flow Control, Error Detectiona and Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission and Receipt, Simplex Link-Layer Protocols, Half duplex, Full-Duplex.

Sliding Window Protocols: The Channel Allocation Problem, Static Channel Allocation, Assumptions for Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet.

UNIT III: (9 Periods)

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, unicast Routing, Internetworking, **Internetworks:** An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6.

UNIT IV: (8 Periods)

The Transport Layer: The Transport Service, Services Provided to The Upper Layers, Transport Service Primitives, Error Control and Flow Control, Multiplexing, Congestion Control,

Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction to UDP, Remote Procedure Call, Real-Time Transport Protocols,
The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT V: (10 Periods)
The Application Layer: Electronic Mail, Architecture and Services, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Total Periods: 45

TEXT BOOKS

3. Andrew Tanenbaum, Feamster, Wetherall, Computer Networks (Global Edition), Pearson, 6th Edition, 2021.
4. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill, 5th Edition, 2017.

REFERENCES:

1. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 6th Edition, 2019.
2. Youlu Zheng, Shakil Akthar, Networks for Computer Scientists and Engineers, Oxford Publishers, 1st Edition, 2016.

ONLINE RESOURCES:

4. https://nptel.ac.in/courses/106105183/25
5. http://www.nptelvideos.in/2012/11/computer-networks.html
6. https://nptel.ac.in/courses/106105183/3

III Year B.Tech. – I Semester

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(DS23AOE501) DATA ANALYSIS WITH R PROGRAMMING

(Open Elective-I)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the fundamental concepts of computing and data analysis using the R programming language.
- Learn statistical concepts such as measures of central tendency, variability, and correlation, and apply them using real-world datasets.
- Develop the ability to perform hypothesis testing and interpret the results in the context of statistical inference.
- Explore advanced R programming constructs and statistical modeling techniques for applied data analysis.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Use R to perform basic data operations, handle datasets, and create simple visualizations.

CO 2: Analyze data patterns and relationships using visualizations and probability distributions in R.

CO 3: Perform exploratory data analysis, hypothesis testing, and linear regression modeling using R.

CO 4: Calculate and interpret correlation and perform hypothesis tests on means using R.

CO 5: Apply advanced R programming and statistical modeling techniques, including linear regression, loops, and hypothesis testing.

COURSE CONTENT

UNIT I: (8 Periods)

Introduction to Computing: Installation of R, The basics of R syntax, workspace, Matrices and lists, Sub setting, System-defined functions; the help system, Errors and warnings; coherence of the workspace.

Getting Used to R: Describing Data**:** Viewing and manipulating Data, Plotting data, Reading the data from console, file (.csv) local disk and web, Working with larger datasets.

UNIT II: (10 Periods)

Shape of Data and Describing Relationships: Tables, charts and plots, Univariate data, measures of central tendency, frequency distributions, variation, and Shape, Multivariate data, relationships between a categorical and a continuous variable, Relationship between two continuous variables – covariance, correlation coefficients, comparing multiple correlations, Visualization methods – categorical and continuous variables, two categorical variables, two continuous variables.

Probability Distributions: Sampling from distributions – Binomial distribution, normal distribution, tTest, zTest, Chi Square test 194, Density functions, Data Visualization using ggplot – Box plot, histograms, scatter plotter, line chart, bar chart, heat maps.

UNIT III: (9 Periods)

Exploratory Data Analysis: Demonstrate the range, summary, mean, variance, median, standard deviation, histogram, box plot, scatter plot using population dataset.

Testing Hypothesis: Null hypothesis significance testing, Testing the mean of one sample, Testing two means.

Predicting Continuous Variables: Linear models, Simple linear regression, Multiple regression, Bias-variance trade-off – cross-validation.

UNIT IV: (9 Periods)

Correlation: How to calculate the correlation between two variables, How to make scatter

plots, Use the scatter plot to investigate the relationship between two variables.
Tests of Hypotheses: Perform tests of hypotheses about the mean when the variance is known, Compute the p-value, Explore the connection between the critical region, the test statistic, and the p-value.

UNIT V: (9 Periods)
Estimating A Linear Relationship: Demonstration on a Statistical Model for, Linear Relationship, Least Squares Estimates, The R Function lm, Scrutinizing the Residuals.
Apply-Type Functions: Defining user defined classes and operations, Models and methods in R, Customizing the user&# 39; s environment, Conditional statements, Loops and iterations.
Statistical Functions in R: Write Demonstrate Statistical functions in R, Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modeling methods.

Total Periods: 45

TEXT BOOKS:

1. Sandip Rakshit, Statistics with R Programming, 1^{st} Edition, 2018.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer Texts in Statistics, 2017.

REFERENCES:

1. Joseph Schmuller, Statistical Analysis with R for Dummies, Wiley, 2017.
2. K G Srinivasa, G M Siddesh, ChetanShetty, Sowmya B J, Statistical Programming in R, Oxford Higher Education, 2017.

III Year B.Tech. – I Semester

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(IT23AOE501) WEB PROGRAMMING CONCEPTS

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:

- Provide students with insights into Internet programming and the skills to design and implement complete web-based applications.
- Equip students with the knowledge of web servers and web application servers, and to develop their ability to apply design methodologies.
- Provide students with insights on programming Common Gateway Interfaces (CGI), and developing user interfaces for web applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Analyze a web page and identify its elements and attributes.
CO 2: Create web pages using XHTML and Cascading Styles sheets.
CO 3: Installation and usage of Server software`s.
CO 4: Database Connectivity to web applications
CO 5: Build web applications using Servlet and JSP

COURSE CONTENT

UNIT I: **(9 Periods)**
Web Basics and Overview: Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Tool box.
HTML Common tags: List, Tables, images, forms, frames, Cascading Style Sheets(CSS) & its Types. Introduction to Java Script, Declaring variables, functions, Event handlers (onclick, on submit, etc.,) and Form Validation

UNIT II: **(9 Periods)**
Introduction to XML: Document type definition, XML Schemas, Presenting XML, Introduction to XHTML, Using XML Processors: DOM and SAX.
PHP: Declaring Variables, Data types, Operators, Control structures, Functions.

UNIT III: **(9 Periods)**
Web Servers and Servlets: Introduction to Servlets, Lifecycle of a Servlet, JSDK, Deploying Servlet, The Servlet API, The javax. Servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax. servlet HTTP package, Handling Http Request& Responses, Cookies and Session Tracking

UNIT IV: **(9 Periods)**
Database Access: Database Programming using JDBC, JDBC drivers, Studying Javax.sql.* package, Connecting to database in PHP, Execute Simple Queries, Accessing a Database from a Servlet. Introduction to struts frameworks.

UNIT V: **(9 Periods)**
JSP Application Development: The Anatomy of a JSP Page, JSP Processing. JSP Application Design and JSP Environment, JSP Declarations, Directives, Expressions, Scripting Elements, implicit objects. Java Beans: Introduction to Beans, Deploying java Beans in a JSP page.

Total Periods: 45

TEXT BOOKS:

1. Chris Bates, Web Programming, Building Internet Applications, Wiley Dream Tech, 2nd Edition, 2006.
2. Marty Hall and Larry Brown, Core Servlets and Java Server Pages, Volume 1: Core

Technologies, Pearson, 2003.

REFERENCES:

1. Sebesta, Programming world wide web, Pearson Education, 2007.
2. Dietel and Nieto, Internet and World Wide Web, 2018.

III Year B.Tech. – I Semester

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(EC23AOE501) ELECTRONIC CIRCUITS

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:

- Understand semiconductor diodes, their characteristics and applications.
- Explore the operation, configurations, and biasing of BJTs.
- Study the operation, analysis, and coupling techniques of BJT amplifiers.
- Learn the operation, applications and uses of feedback amplifiers and oscillators.
- Analyze the characteristics, configurations, and applications of operational amplifiers

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand semiconductor diodes, their characteristics and applications.
CO 2: Explore the operation, configurations, and biasing of BJTs.
CO 3: Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
CO 4: Learn the operation, applications and uses of feedback amplifiers and oscillators.
CO 5: Analyze the characteristics, configurations, and applications of operational amplifiers.

COURSE CONTENT

UNIT I: **(9 Periods)**
Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).
Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode.

UNIT II: **(9 Periods)**
Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, SelfBias, Bias Stability, Bias Compensation using Diodes.
Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

UNIT III: **(9 Periods)**
Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT IV: **(9 Periods)**
Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).
Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT V: **(9 Periods)**
Op-amp: Classification of IC‛S, basic information of Op-amp, ideal and practical Op-amp, 741

op-amp and its features, modes of operation-inverting, non-inverting, differential.
Applications of op-amp: Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

Total Periods:45

TEXT BOOKS:

1. J. Millman and Christos. C. Halkias, Electronics Devices and Circuits, Tata McGraw Hill, 3rd Edition, 2006.
2. David A. Bell, Electronics Devices and Circuits Theory, Oxford University press, 5th Edition, 2008.

REFERENCES:

1 . Electronics Devices and Circuits Theory, R.L.Boylestad, Lousis Nashelsky and K.Lal Kishore, 12th Edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N. Salivahanan, and N.Suresh Kumar, TMH, 3rd Edition, 2012.
3. S. Sedra and K.C. Smith, Microelectronic Circuits, Oxford University Press, 5th Edition.

III Year B.Tech. – I Semester

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(EE23AOE501) ELECTRICAL SAFETY PRACTICES AND STANDARDS

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand fundamentals of electrical safety and causes of electrical hazards.
- Learn safety components and protection against overvoltages and static electricity.
- Study grounding principles and determine safe working conditions.
- Apply electrical safety practices in various environments.
- Familiarize with electrical safety standards and statutory regulations.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understanding the Fundamentals of Electrical Safety.
CO 2: Identifying and Applying Safety Components.
CO 3: Analyzing Grounding Practices and Electrical Bonding.
CO 4: Applying Safety Practices in Electrical Installations and Environments.
CO 5: Evaluating Electrical Safety Standards and Regulatory Compliance.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Electrical Safety: Fundamentals of Electrical safety-Electric Shock-physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

UNIT II: **(10 Periods)**
Safety Components: Introduction to conductors and insulators- voltage classification - safety against over voltages- safety against static electricity-Electrical safety equipment's - Fire extinguishers for electrical safety.

UNIT III: **(9 Periods)**
Grounding: General requirements for grounding and bonding- Definitions- System grounding- Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.

UNIT IV: **(9 Periods)**
Safety Practices: General first aid- Safety in handling hand held electrical appliances tools-Electrical safety in train stations-swimming pools, external lighting installations, medical locations- Case studies.

UNIT V: **(8 Periods)**
Standards for Electrical Safety: Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate.

Total Periods: 45

TEXT BOOKS:
1. Massimo A.G.Mitolo, Electrical Safety of Low-Voltage Systems, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi, Electric Safety - Practice and Standards, CRC Press, USA, 2014.

REFERENCES:

1. Kenneth G.Mastrullo, Ray A. Jones, The Electrical Safety Program Book, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, Electrical Safety-Related Work Practices, Jones & Bartlett Publishers, London, 2009
3. Fordham Cooper, W., Electrical Safety Engineering, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, Electrical Safety Hand Book, McGraw-Hill, New York, USA, 4th Edition, 2012.

III Year B.Tech. – I Semester

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(ME23AOE501) SUSTAINABLE ENERGY TECHNOLOGIES

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the fundamentals of energy systems and assess the current global energy scenario.
- Analyze the impact of fossil fuels on climate and the need for sustainable alternatives.
- Study the working principles and applications of various renewable energy technologies.
- Explore energy storage systems and their integration with renewable sources.
- Examine future energy solutions including hydrogen energy and carbon capture techniques.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Describe energy fundamentals, global energy demand, and the need for transition to renewables.
CO 2: Compare and evaluate different renewable energy sources like solar, wind, hydro, and biomass.
CO 3: Design and analyze basic solar photovoltaic and wind energy systems. Classify and explain various energy storage technologies and their applications.
CO 4: Evaluate advanced energy technologies such as hydrogen fuel cells and CCS for sustainable energy systems.
CO 5: Assess advanced energy technologies such as hydrogen fuel cells and CCS for sustainable energy systems

COURSE CONTENT

UNIT I: (9 Periods)
Fundamentals of Energy and Renewable Sources: Introduction and Fundamental Concepts, Energy Scenario in Modern World, Fossil Fuels, Climate Change Impacts, and Overview of Renewable Energy Technology

UNIT II: (9 Periods)
Renewable Energy Technologies: Hydropower, Wind Energy, Solar Energy, Solar Photovoltaic Systems.

UNIT III: (9 Periods)
Biomass and Emerging Renewable Sources: Bioenergy and Biofuels, Geothermal Energy, Introduction to Energy Storage Systems.

UNIT IV: (9 Periods)
Energy Storage Technologies: Introduction, Mechanical Energy Storage Technologies, Energy Storage System through Capacitor, Electrochemical Energy Storage Systems, Thermal Energy Storage Systems

UNIT V: (9 Periods)
Energy Storage – Advanced Concepts and Future Technologies: Trends in Energy Storage Types and their Characteristics, Fuel Cells and Hydrogen Energy, Carbon Capture and Storage (CCS).

Total Periods: 45

TEXT BOOKS

1. S. P. Sukhatme & J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, McGraw-Hill Education, 3rd Editio.
2. D. Y. Goswami, F. Kreith & J. F. Kreider, Principles of Solar Engineering, CRC Press.

REFERENCES:

1. B. K. Hodge, Alternative Energy Systems and Applications, Wiley.
2. Ibrahim Dincer & Mark A. Rosen, Thermal Energy Storage: Systems and Applications, Wiley.

ONLINE RESOURCES:

1. Energy Resources, Economics and Environment, NPTEL, IIT Bombay. https://nptel.ac.in/courses/109101171
2. https://www.youtube.com/watch?v=E76q-9q7ZDg

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(BA23AOE501) ENTREPRENEURSHIP AND VENTURE CREATION

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:
- Foster anentrepreneurialmind-setforventurecreationandintrapreneurialleadership
- Encourage creativity and innovation
- Enable them to learn pitching and presentation skills
- Make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept
- Enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship.
CO 2: Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution
CO 3: Understand and apply customer-centric innovation by designing solutions aligned with Jobs-to-be-Done, developing MVP prototypes, assessing competitive positioning, and evaluating market size and opportunity potential.
CO 4: Develop and apply comprehensive business and financial models, go-to-market strategies, and funding plans by leveraging lean methodologies, financial planning, marketing, and sales fundamentals tailored to startup growth.
CO 5: Prepare and deliver an investible pitch deck of the impractical venture to attract stakeholders

COURSE CONTENT

UNIT I: **(8 Periods)**
Entrepreneurship Fundamentals and Context: Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

UNIT I: **(8 Periods)**
Problem & Customer Identification: Understanding and analyzing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion-identifying and defining problem using Design thinking principles –Analyzing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

UNIT III: **(1O Periods)**
Solution Design, Prototyping & Opportunity Assessment and Sizing: Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer‵s needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

UNIT IV: **(10 Periods)**
Business & Financial Model, Go-to-Market Plan: Introduction to Business model and types, Lean approach,9 block lean canvas model, riskiest assumptions to Business models.

Importance of Build - Measure – Lean approach.
Business Planning: components of Business plan- Sales plan, People plan and financial plan.
Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance.
Introduction to Marketing and Sales: Selecting the Right Channel, creating digital presence, building customer acquisition strategy.
Choosing a form of business organization specific to your venture, identifying sources of funds: Debt& Equity, Map the Start-up Life-cycle to Funding Options.

UNIT V: (9 Periods)
Scale Outlook and Venture Pitch Readiness: Understand and identify potential and aspiration for scale is-a-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Total Periods: 45

TEXT BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship, Mcgraw Hill Education, 11th Edition, 2016
2. Peter F. Drucker, Innovation and Entrepreneurship, Harper Business, 1st Edition,1985

REFERENCES:

1. Simon Sinek, Start with Why, Penguin Books limited, 2011.
2. Brown Tim, Changeby Design Revised & Updated: How Design Thinking
3. Transforms Organizations and Inspires Innovation, Harper Business, 2019.
4. Namita Thapar, The Dolphin and the Shark: Storieson Entrepreneurship, Penguin Books Limited, 2022.
5. Saras D. Sarasvathy, Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd., 2008.

ONLINE RESOURCES:

1. https://www.ediindia.org
2. https://www.wfnen.org
3. https://www.coursera.org/browse/business/entrepreneurship

III Year B.Tech. – I Semester

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(EG23AOE501) ACADEMIC WRITING AND PUBLIC SPEAKING

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:

- Encourage all round development of the students by focusing on writing skills
- Make the students aware of non-verbal skills
- Develop analytical skills
- Deliver effective public speeches

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand various elements of Academic Writing
CO 2: Identify sources and avoid plagiarism
CO 3: Demonstrate the knowledge in writing a Research paper
CO 4: Analyze different types of essays
CO 5: Build confidence in giving an impactful presentation to the audience and Assess the speeches of others to know the positive strengths of speakers

COURSE CONTENT

UNIT I: **(09 Periods)**
Introduction to Academic Writing: Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing.

UNIT II: **(09 Periods)**
Academic Journal Article: Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading – Plagiarism.

UNIT III: **(09 Periods)**
Essay & Writing Reviews: Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP.

UNIT IV: **(09 Periods)**
Public Speaking: Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events.

UNIT V: **(09 Periods)**
Public Speaking and Non-Verbal Delivery: Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics - Paralanguage – Signs.

Total Periods: 45

TEXT BOOKS:

1. Marilyn Anderson, Critical Thinking, Academic Writing and Presentation Skills: MG University Edition Paperback – 1 January 2010 Pearson Education; 1st Edition Pease, Allan & Barbara. The Definitive Book Ff Body Language RHUS Publishers, 2016.

REFERENCES:

1. Alice Savage, Masoud Shafiei, Effective Academic Writing, 2nd Edition. 2014.
2. Shalini Verma, Body Language, S Chand Publications 2011.

3. Sanjay Kumar and Pushpalata, Communication Skills 2nd Edition, Oxford, 2015.
4. Sharon Gerson, Steven Gerson, Technical Communication Process and Product, Pearson, New Delhi, 2014
5. Elbow, Peter. Writing with Power. OUP USA, 1998.

ONLINE RESOURCES:

1. https://youtu.be/NNhTIT81nH8
2. phttps://www.youtube.com/watch?v=478ccrWKY-A
3. https://www.youtube.com/watch?v=nzGo5ZC1gMw
4. https://www.youtube.com/watch?v=Qve0ZBmJMh4
5. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/
6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7. https://archive.nptel.ac.in/courses/109/107/109107172/#
8. https://archive.nptel.ac.in/courses/109/104/109104107/

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(MA23AOE501) MATHEMATICS FOR MACHINE LEARNING AND AI

(Open Elective-I)

COURSE OBJECTIVES:
The objectives of this course are to:
- Provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
- Enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
- Equip students with optimization techniques and graph-based methods used in AI applications.
- Develop critical problem-solving skills for analyzing mathematical formulations in AI/ML.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 6: Apply linear algebra concepts to ML techniques like PCA and regression.
CO 7: Analyze probabilistic models and statistical methods for AI applications.
CO 8: Implement optimization techniques for machine learning algorithms.
CO 9: Utilize vector calculus and transformations in AI-based models.
CO 10: Develop graph-based AI models using mathematical representations

COURSE CONTENT

UNIT I: (9 Periods)
Linear Algebra for Machine: Learning Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT II: (8 Periods)
Probability and Statistics for AI: Probability distributions: Gaussian, Binomial, Poisson. Baye’s Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP). Entropy and Kullback -Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT III: (10 Periods)
Optimization Techniques for ML: Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions. Gradient Descent and its variants (Momentum, Adam) Newton ‘s method, BFGS method.

UNIT IV: (10 Periods)
Vector Calculus &Transformations: Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT V: (8 Periods)
Graph Theory for AI: Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Total Periods: 45

TEXT BOOKS:
1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
2. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.

REFERENCES:

1. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer.

ONLINE RESOURCES:

1. MIT– Mathematics for Machine Learning https://ocw.mit.edu
2. Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/
3. Deep AI – Mathematical Foundations for AI https://deepai.org

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(PH23AOE501) MATERIALS CHARACTERIZATION TECHNIQUES

(Open Elective-I)

COURSE OBJECTIVES:

The objectives of this course are to:

- Provide exposure to different characterization techniques.
- Explain the basic principles and analysis of different spectroscopic techniques.
- Elucidate the working of Scanning electron microscope - Principle, limitations and applications.
- Illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
- Educate the uses of advanced electric and magnetic instruments for characterization.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Analyze the crystal structure and crystallite size by various methods

CO 2: Analyze the morphology of the sample by using a Scanning Electron Microscope

CO 3: Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope

CO 4: Explain the principle and experimental arrangement of various spectroscopic techniques

CO 5: Identify the construction and working principle of various Electrical & Magnetic Characterization technique

COURSE CONTENT

UNIT I: **(9 Periods)**

Structure Analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT II: **(9 Periods)**

Microscopy Technique -1 –Scanning Electron Microscopy (SEM): Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT III: **(9 Periods)**

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT IV: **(9 Periods)**

Spectroscopy Techniques: Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT V: **(9 Periods)**

Electrical & Magnetic Characterization Techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Total Periods: 45

TEXT BOOKS:

1. Yang Leng, Material Characterization: Introduction to Microscopic and Spectroscopic Methods, John Wiley & Sons (Asia) Pvt. Ltd., 2013.
2. David Brandon, Wayne D Kalpan, John, Microstructural Characterization of Materials, Wiley & Sons Ltd., 2008.

REFERENCES:

1. Colin Neville Banwell, Elaine M. McCash, Fundamentals of Molecular Spectroscopy, Tata McGraw-Hill, 4^{th} Edition, 2008.
2. Bernard Dennis Cullity, Stuart R Stocks, Elements of X-ray diffraction, Prentice Hall, 2001.
3. Khalid Sultan, Practical Guide to Materials Characterization: Techniques and Applications, Wiley, 2021.
4. Sam Zhang, Lin Li, Ashok Kumar, Materials Characterization Techniques, CRC Press, 2008.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/115/103/115103030/
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

III Year B.Tech. – I Semester

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(CH23AOE501) CHEMISTRY OF ENERGY SYSTEMS

(Open Elective-I)

COURSE OBJECTIVES:

The objectives of this course are to:

- Make the student understand basic Electrochemical principles such as standard electrode potentials, emf and applications of Electrochemical principles in the design of batteries.
- Understand the basic concepts of processing and limitations of Fuel cells & their applications.
- Impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications.
- Necessity of harnessing alternate energy resources such as solar energy and its basic concepts.
- Impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquefaction method.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Apply the principles of electrochemistry to construct and analyze electrochemical cells and use the Nernst equation to calculate cell potentials.

CO 2: Analyze the efficiency and practical applications of fuel cells in energy conversion systems.

CO 3: Illustrate the design and functioning of photochemical cells

CO 4: Demonstrate understanding of the design, efficiency, and installation of solar panels, and evaluate the working and applications of various types of solar inverters.

CO 5: Use the knowledge of hydrogen storage technologies to analyze and compare chemical and physical methods of hydrogen storage, including compressed gas, liquid hydrogen, and advanced materials.

COURSE CONTENT

UNIT I: **(9 Periods)**

Electrochemical Systems: Electrochemical cell, Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries-Introduction, Zinc-Air battery, Lead-acid, Nickel- cadmium batteries and their applications**.**

UNIT II: **(9 Periods)**

Fuel Cells: Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Methanol fuel cell, Fuel cell efficiency and applications.

UNIT III: **(9 Periods)**

Photo and Photo-Electrochemical Conversions: Photochemical Cells-Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT IV: **(9 Periods)**

Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications. Solar Panels– Design, efficiency, installation, Solar Inverters **–** String, micro inverters, hybrid.

UNIT V **(9 Periods)**

Hydrogen Storage: Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel, and Organic hydrogen carriers.

Total Periods: 45

TEXT BOOKS:

1. Ira N. Levine, Physical Chemistry, 6th Edition, 2008.
2. Bahl and Bahl and Tuli, Essentials of Physical Chemistry, 28th Edition, 2024.

REFERENCES:

1. Fuel Cell Hand Book, by US Department of Energy, 7th Edition, (EG&G technical services and corporation).
2. Arvind Tiwari and Shyam, Hand Book of Solar Energy and Applications.
3. Klaus Jagar, Solar Energy Fundamental, Technology and Systems.
4. Levine Klebonoff, Hydrogen Storage.
5. Silver and Atkin, Inorganic Chemistry, 6th Edition, 2025.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/104106137
2. https://onlinecourses.nptel.ac.in/noc24_ee109/preview
3. https://onlinecourses.nptel.ac.in/noc22_ch66/preview

III Year B.Tech. – II Semester

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(CE23AOE601) DISASTER MANAGEMENT

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
- Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
- Apply wind engineering principles and computational techniques in designing wind-resistant structures.
- Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
- Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
CO 2: Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
CO 3: Apply wind engineering principles and computational techniques in designing wind resistant structures.
CO 4: Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
CO 5: Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Natural Disasters: Types of Natural Disasters, Geographical and Climatic Distribution of Natural Disasters, Hazard Maps (Earthquake and Cyclone) of The World and India, Regulations and guidelines for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socioeconomic Consequences).

UNIT II: **(10 Periods)**
Cyclones and their Impact: Climate Change and Its Impact on Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structures in Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures and Emergency Infrastructure: Temporary and Permanent Cyclone Shelters

UNIT III: **(9 Periods)**
Wind Engineering and Structural Response: Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Lab: Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects on Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.

UNIT IV: **(9 Periods)**
Seismology and Earthquake Effects: Causes of Earthquakes, Plate Tectonics, types of Faults,

Seismic Waves, Earthquake parameters: Magnitude, Intensity, Epicenter, hypocenter, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening.

UNIT V: (8 Periods)

Planning and Design Considerations for Seismic Safety: General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.

Total Periods: 45

TEXT BOOKS:

1. David Alexander, Natural Disasters, CRC Press, 1st Edition, 2017.
2. Edward A. Keller and Duane E. DeVecchio, Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes, Routledge, 5th Edition, 2019.

REFERENCES:

1. Ben Wisner, J.C. Gaillard, and Ilan Kelman (Editors), Handbook of Hazards and Disaster Risk Reduction and Management, Routledge, 2nd Edition, 2012.
2. Damon P. Coppola, Introduction to International Disaster Management, Butterworth-Heinemann, 4th Edition, 2020.
3. Bimal Kanti Paul, Environmental Hazards and Disasters: Contexts, Perspectives and Management, Wiley-Blackwell, 2nd Edition, 2020

III Year B.Tech. – II Semester

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(CE23AOE602) SUSTAINABILITY IN CIVIL ENGINEERING PRACTICE

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
- Analyze sustainable construction materials, their durability, and life cycle assessment.
- Apply energy calculations in construction materials and assess their embodied energy.
- Evaluate green building standards, energy codes, and performance ratings.
- Assess the environmental effects of energy use, climate change, and global warming.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
CO 2: Analyze sustainable construction materials, their durability, and life cycle assessment.
CO 3: Apply energy calculations in construction materials and assess their embodied energy.
CO 4: Evaluate green building standards, energy codes, and performance ratings.
CO 5: Assess the environmental effects of energy use, climate change, and global warming.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO_2 Contribution from Cement and Other Construction Materials.

UNIT II: **(10 Periods)**
Materials Used in Sustainable Construction: Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT III: **(9 Periods)**
Energy Calculations: Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

UNIT IV: **(9 Periods)**
Green Buildings: Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings – Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

UNIT V: **(8 Periods)**
Environmental Effects: Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

Total Periods: 45

TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, Wiley Publishers, 4th Edition, 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK, 2016.

REFERENCES:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques, Yesdee Publication Pvt. Ltd, 3rd Edition, 2012.

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(CS23AOE601) FUNDAMENTALS OF OBJECT ORIENTED ANALYSIS AND DESIGN

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Describe the activities in the different phases of the object-oriented development lifecycle.
- Understand the concepts of object-oriented model with the E-R and EER models.
- Model a real-world application by using UML diagram.
- Design architectural modelling.
- Describing an application of UML.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: The importance of modelling in UML.
CO 2: Compare and contrast the object-oriented model with the E-R and EER models.
CO 3: Design use case diagram. Design an application using deployment diagram.
CO 4: Apply UML diagrams to build library application.
CO 5: Design an application of UML.

COURSE CONTENT

UNIT I: (9 Periods)

Introduction to UML: Importance of modelling, principles of modelling, object-oriented modelling, conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT II: (10 Periods)

Basic Structural Modelling: Classes, Relationships, common Mechanisms, and diagrams. Advanced Structural Modelling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams.

UNIT III: (9 Periods)

Basic Behavioural Modelling-I: Interactions, Interaction diagrams.
Basic Behavioural Modelling-II: Use cases, Use case Diagrams, Activity Diagrams.

UNIT IV: (9 Periods)

Advanced Behavioral Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

UNIT V: (8 Periods)

Architectural Modelling: Component, Deployment, Component diagrams and Deployment diagrams, Patterns and Frameworks, Artifact Diagrams.
Case Study: The Unified Library application.

Total Periods: 45

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, and Ivar Jacobson, The Unified Modeling Language User Guide, Pearson Education, 2nd Edition, 2005
2. John W. Satzinger, Robert B. Jackson, and Stephen D. Burd, Object-Oriented Analysis and Design with the Unified Process, Cengage Learning, 2004.

REFERENCES:

1. Fundamentals of Object-Oriented Design in UML, Meilir Page-Jones: Pearson Education.
2. Modelling Software Systems Using UML2, Pascal Roques, WILEY-Dreamtech India Pvt.Ltd.
3. Atul Kahate, Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Practical Object-Oriented Design with UML, Mark Priestley TMH.
5. Craig Larman Appling UML and Patterns: An introduction to Object Oriented Analysis and Design and Unified Process, Pearson Education.

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(CS23AOE602) JAVA PROGRAMMING

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.

CO 2: Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects

CO 3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.

CO 4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.

CO 5: Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.

COURSE CONTENT

UNIT I: **(9 Periods)**

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: **(10 Periods)**

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III: **(9 Periods)**

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to

Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two- dimensional Arrays, Arrays of Varying Lengths, Three- dimensional Arrays, Arrays as Vectors. Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: (9 Periods)

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java. lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto- boxing and Auto un boxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java..Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class. Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throw able, Unchecked Exceptions, Checked Exceptions.Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java.

UNIT V: (8 Periods)

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.
Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter thread Communication - Suspending, Resuming, and Stopping of Threads. Java Database Connectivity: Introduction, JDBC Architecture, Installing My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface
Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events

Total Periods: 45

TEXT BOOKS:

1. Debasis Samanta, Monalisa Sarma, Joy with JAVA, Fundamentals of Object Oriented Programming, Cambridge, 2023.
2. Paul Deitel, Harvey Deitel, JAVA 9 for Programmers, Pearson, 4^{th} Edition.

REFERENCES:

1. Herbert Schildt, *Java: The Complete Reference*, Tata McGraw-Hill, 11^{th} Edition, 2019.
2. Kathy Sierra and Bert Bates, *Head First Java*, O'Reilly Media, 2^{nd} Edition, 2005.
3. Cay S. Horstmann, *Core Java Volume I – Fundamentals*, Pearson, 12^{th} Edition, 2022.
4. Cay S. Horstmann, *Core Java Volume II – Advanced Features*, Pearson, 12th Edition, 2022

III Year B.Tech. – II Semester

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(AM23AOE601) MACHINE LEARNING CONCEPTS

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the fundamental concepts of machine learning, its types, applications, and data preprocessing techniques.
- Learn to select, train, evaluate, and improve machine learning models while applying feature engineering techniques.
- Explore Bayesian methods for concept learning and understand various classification algorithms.
- Understand regression techniques for predictive modeling and methods to enhance model accuracy.
- Learn unsupervised learning techniques such as clustering and association rule mining for pattern discovery.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Explain the significance of machine learning types, applications, and data quality in model building.

CO 2: Apply feature engineering methods to improve model performance and interpretability. Implement classification models such as k-NN, Decision Trees, and Random Forest for predictive tasks.

CO 3: Implement classification algorithms such as k-NN, Decision Trees, and Random Forests.

CO 4: Analyze regression algorithms and improve model accuracy using optimization techniques.

CO 5: Design clustering models using partitioning and density-based techniques for pattern recognition.

COURSE CONTENT

UNIT I: (8 Periods)

Introduction to Machine Learning & Preparing to Model: Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning. Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing.

UNIT II: (9 Periods)

Modelling and Evaluation & Basics of Feature Engineering: Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model. Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection.

UNIT III: (10 Periods)

Bayesian Concept Learning & Supervised Learning: Classification: Introduction, Why Bayesian Methods are Important? Bayes�much Theorem, Bayes‘ Theorem and Concept Learning, Bayesian Belief Network. Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-k-Nearest Neighbour (kNN), Decision tree, Random forest model, Support vector machines.

UNIT IV: (10 Periods)

Supervised Learning: Regression: Introduction, Example of Regression, Common

Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT V: (8 Periods)
Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN. Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules.

Total Periods: 45

TEXT BOOKS:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson, 2019.
2. Ethern Alpaydin, Introduction to Machine Learning, MIT Press, 2004.

REFERENCES:

1. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Edition.
2. Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists, O'Reilly.

ONLINE RESOURCES:

1. https://www.deeplearning.ai/machine-learning- B.Techning/
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

III Year B.Tech. – II Semester

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(CY23AOE601) INTRODUCTION TO CRYPTOGRAPHY AND NETWORK SECURITY

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce the basic principles of cryptography and network security.
- Familiarize students with classical encryption methods and number theory fundamentals.
- Provide an overview of modern cryptographic algorithms such as AES, RSA, and ECC.
- Explain hash functions, digital signatures, and their applications in message authentication.
- Introduce network security protocols like TLS, IPSec, PGP, and the use of firewalls.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Explain basic security concepts, goals, threats, and mechanisms in cryptography and network security.

CO 2: Apply number theory concepts to design and analyze public key cryptography algorithms.

CO 3: Use hash functions and digital signatures to ensure data integrity and authentication.

CO 4: Implement authentication methods and network security protocols for secure communication.

CO 5: Apply web security standards and firewall techniques to protect systems and networks.

COURSE CONTENT

UNIT I: **(9 Periods)**

Classical Encryption & Block Ciphers: Security Goals, Attacks, and Services, Security Architecture and Network Security Model, Classical Encryption Techniques: Substitution and Transposition, Steganography, Block Ciphers: DES Overview, AES Structure and Transformations

UNIT II: **(9 Periods)**

Number Theory & Public Key Cryptography: Basics of Number Theory: GCD, Euclidean Algorithm, Modular Arithmetic, Fermat's & Euler's Theorems, Discrete Logarithms, Public Key Concepts and Algorithms: RSA, Diffie-Hellman, Elliptic Curve Cryptography.

UNIT III: **(9 Periods)**

Hash Functions & Digital Signatures: Cryptographic Hash Functions and Requirements, Secure Hash Algorithm (SHA), HMAC, CMAC, Digital Signature Concepts, DSA, X.509 Certificates, Public Key Infrastructure (PKI)

UNIT IV: **(9 Periods)**

Authentication & Network Security Protocols: User Authentication Principles, Kerberos Authentication Protocol, Email Security: PGP, S/MIME, IP Security: Overview, ESP, Internet Key Exchange (IKE)

UNIT V: **(9 Periods)**

Web Security & Firewalls: Web Security Requirements, Transport Layer Security (TLS), HTTPS, SSH, Firewalls: Characteristics, Types, and Configurations.

Total Periods: 45

TEXT BOOKS:

1. William Stallings, Cryptography and Net Work Security, Pearson Education, 8th Edition, 2020.
2. Bernard Menezes, Cryptography, Network Security and Cyber Laws, Engage Learning, 1st Edition, 2010.

REFERENCES:

1. Beerhouse Frozen, Debden Mukhopadhyaya, Cryptography and Network Security, McGrow Hill, 3rd Edition, 2015.
2. Jason Albanese, Wes Sonnenreich, Network Security Illustrated, McGraw-Hill Professional, 1st Edition, 2003.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105031/lecture
2. https://nptel.ac.in/courses/106/105/106105162/lecturebyDr.SouravMukhopadhya IITKharagpur
3. https://www.mitel.com/articles/web-communication-cryptography-and-network-security web articles by Mitel Power Connections

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(DS23AOE601) INTRODUCTION TO SOCIAL MEDIA MINING

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the nature and structure of social media data
- Learn techniques to collect, clean, and analyze social media content
- Apply machine learning and network analysis to social media data
- Explore real-world applications such as sentiment analysis, influence detection, and misinformation tracking
- Address ethical and privacy issues in social media mining

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand Social Media Ecosystems.
CO 2: Collect and Manage Social Media Data.
CO 3: Pre-process and Clean Social Media Data.
CO 4: Apply Text Mining and NLP Techniques.
CO 5: Analyze Social Networks and Influencers.

COURSE CONTENT

UNIT I: **(10 Periods)**
Introduction to Social Media and Data Mining: Overview of social media platforms, Differences between social media data and traditional data, Case studies and applications.
Data Collection Techniques APIs: Twitter, Reddit, YouTube, Facebook (limitations), Web scraping basics (Beautiful Soup, Selenium), Handling rate limits and authentication, Legal and ethical considerations.
Pre-processing Social Media Data: Data cleaning (removing spam, duplicates), Tokenization, stop words, stemming, lemmatization, Handling emoji's, hashtags, mentions

UNIT II: **(8 Periods)**
Text Mining and Natural Language Processing (NLP): Bag-of-words and TF-IDF, Named Entity Recognition (NER), Language detection and normalization.
Sentiment Analysis: Lexicon-based vs. machine learning-based approaches, Tools: VADER, TextBlob, transformers, Visualizing sentiment over time.

UNIT III: **(9 Periods)**
Topic Modeling: Latent Dirichlet Allocation (LDA), Non-negative Matrix Factorization (NMF), Topic trends and interpretation.
Social Network Analysis (SNA): Graph theory basics, Centrality measures (degree, betweenness, closeness), Detecting communities (modularity, Louvain method).

UNIT IV: **(10 Periods)**
Influence and Virality: Information diffusion models, Identifying influencers and key nodes, Modeling trends and virality (SIR, IC models).
Misinformation and Fake News Detection: Misinformation vs. disinformation, Detecting fake news and bots, NLP techniques for credibility analysis.
Visualizing Social Media Data: Word clouds, trend graphs, network graphs, Tools: Gephi, NetworkX, Plotly, Tableau.

UNIT V: **(8 Periods)**
Case Studies and Real-World Applications: Social media in marketing, politics, disaster response, and public health, Guest speaker / project presentation (optional).
Ethics, Privacy, and Regulation: GDPR, data ownership, and consent, Algorithmic bias and

discrimination, Platform policies and responsibilities.

Total Periods:45

TEXT BOOKS:

1. Matthew Russell and Mikhail Klassen, Mining the Social Web, 3rd Edition.
2. Huan Liu, Mohammad Ali Abbasi, and Reza Zafarani, Social Media Mining: An Introduction

REFERENCES:

1. Julia Silge, David Robinson, Text Mining with R: A Tidy Approach.

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(IT23APC401) SOFTWARE ENGINEERING

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the Evolution of Software Development, Gain Insight into Software Development Life Cycle Models.
- Develop Project Management Skills, Learn Requirements Engineering Techniques.
- Design Reliable Software Architectures, Explore User Interface Design Principles.
- Master the Practices of Coding and Testing, Understand Software Quality and Reliability.
- Introduce CASE Tools and Automation in SE, Understand Software Maintenance and Reuse

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.

CO 2: Analyze various software engineering models and apply methods for design and development of software projects.

CO 3: Develop system designs using appropriate techniques.

CO 4: Understand various testing techniques for a software project.

CO 5: Apply standards, CASE tools and techniques for engineering S/W projects

COURSE CONTENT

UNIT I: (10 Periods)

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model

UNIT II: (9 Periods)

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

Requirements Analysis and Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III: (8 Periods)

Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.

Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV: (9 Periods)

Coding and Testing: Coding, Code review, Software documentation, Testing, Black box testing, White-Box testing, Debugging, Program analysis tools, Integration testing

Software Reliability and Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT V: (9 Periods)
Computer-Aided Software Engineering (CASE): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.
Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost. **Software Reuse:** reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program and A reuse approach.

Total Periods: 45

TEXT BOOKS:

1. Rajib Mall, Fundamentals of Software Engineering, PHI, 5th Edition.
2. Roger S. Pressman, Software Engineering A practitioner's Approach, Mc- Graw Hill International Edition, 9th Edition.

REFERENCES:

1. Software Engineering, Ian Sommerville, Pearson, 10th Edition.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105182/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126058950638 71 48827_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0133826904110 03 904735_shared/overview

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(EC23AOE601) DIGITAL ELECTRONICS

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:

- Learn Boolean algebra, logic simplification techniques, and combinational
- circuit design.
- Analyze combinational circuits like adders, subtractors, and code converters.
- Explore combinational logic circuits and their applications in digital design.
- Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
- Gain knowledge about programmable logic devices.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
CO 2: Analyze combinational circuits like adders, subtractors, and code converters.
CO 3: Explore combinational logic circuits and their applications in digital design.
CO 4: Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
CO 5: Gain knowledge about programmable logic devices.

COURSE CONTENT

UNIT I: (9 Periods)
Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De-Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT II: (9 Periods)
Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT III: (9 Periods)
Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers

UNIT IV (9 Periods)
Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT V: (9 Periods)
Semiconductor Memories and Programmable Logic Devices: Read only Memory (ROM), Read and Write Memory (RAM), ROM as a PLD, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Introduction to Complex Programmable Logic Devices (CPLD's).

Total Periods:45

TEXT BOOKS:

1. M.Morris Mano & Michel D. Ciletti, Digital Design, Pearson Education, 5th Edition, 1999.

2. R. P. Jain, Modern Digital Electronics, McGraw Hill Education, 2009.

REFERENCES:

1. Charles H Roth Jr., Fundamentals of Logic Design, Brooks/Cole Cengage Learning, 5th Edition, 2004.
2. ZviKohavi and NirahK.Jha, Switching theory and Finite Automata Theory, Tata McGraw Hill, 2nd Edition,2005.

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(EE23AOE601) RENEWABLE ENERGY SOURCES

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand solar radiation principles, collectors, and thermal storage methods.
- Explore photovoltaic (PV) principles, module construction, and system configurations.
- Study wind energy conversion systems and evaluate their design parameters.
- Identify geothermal resources and examine their utilization and potential.
- Analyze ocean, biomass, and fuel cell technologies for energy generation.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Explain solar energy fundamentals, radiation measurement, and thermal storage systems.
- **CO 2:** Illustrate the working of solar PV cells, modules, and system configurations.
- **CO 3:** Analyze the design and aerodynamic aspects of horizontal and vertical axis wind turbines.
- **CO 4:** Describe geothermal resources and evaluate their applications and limitations.
- **CO 5:** Compare various emerging energy technologies like ocean, biomass, and fuel cells based on principles and performance.

COURSE CONTENT

UNIT I: **(9 Periods)**
Renewable Energy Overview: Introduction to global and national renewable energy scenarios.
Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT II: **(9 Periods)**
PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT III: **(9 Periods)**
Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations

UNIT IV: **(9 Periods)**
Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo- pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT V: Miscellaneous Energy Technologies: **(9 Periods)**
Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.
Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification,

advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Total Periods: 45

TEXT BOOKS:

1. G. D. Rai, Non-Conventional Energy Source, Khanna Publishers, 4th Edition, 2000.
2. Chetan Singh Solanki, Solar Photovoltaics Fundamentals, Technologies and Applications, PHI Learning Private Limited, 2nd Edition 2012.

REFERENCES:

1. Stephen Peake, Renewable Energy Power for a Sustainable Future, Oxford International, 4th Edition, 2018.
2. S. P. Sukhatme, Solar Energy, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
3. B H Khan, Non-Conventional Energy Resources, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
4. S. Hasan Saeed and D.K.Sharma, Non-Conventional Energy Resources, S.K.Kataria & Sons, 3rd Edition, 2012.
5. G. N. Tiwari and M.K.Ghosal, Renewable Energy Resource: Basic Principles and Applications, Narosa Publishing House, 2004.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

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(ME23AOE601) DRONE TECHNOLOGY

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:

- Understand the basics of drone concepts
- Learn and understand the fundaments of design, fabrication and programming of drone
- Impart the knowledge of an flying and operation of drone
- Understand about the various applications of drone
- Understand the safety risks and guidelines of fly safely.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Know about a various type of drone technology, drone fabrication and programming.
CO 2: Execute the suitable operating procedures for functioning a drone
CO 3: Select appropriate sensors and actuators for Drones
CO 4: Develop a drone mechanism for specific applications
CO 5: Create the programs for various drones

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to Drone Technology: Drone Concept, Vocabulary Terminology, History of drone, Types of current generation of drones based on their method of propulsion, Drone technology impact on the businesses- Drone business through entrepreneurship, Opportunities/applications for entrepreneurship and employability

UNIT II: (9 Periods)
Drone Design, Fabrication and Programming: Classifications of the UAV, Overview of the main drone parts, Technical characteristics of the parts, Function of the component parts, Assembling a drone, The energy sources, Level of autonomy, Drones configurations, Methods of programming drone, Download program - Install program on computer, Running Programs, Multi rotor stabilization, Flight modes, Wi-Fi connection.

UNIT III: (9 Periods)
Drone Flying and Operation: Concept of operation for drone, Flight modes, Operate a small drone in a controlled environment, Drone controls Flight operations, management tool, Sensors, Onboard storage capacity, Removable storage devices, Linked mobile devices and applications.

UNIT IV: (9 Periods)
Drone Commercial Applications: Choosing a drone based on the application, Drones in the insurance sector, Drones in delivering mail, parcels and other cargo, Drones in agriculture, Drones in inspection of transmission lines and power distribution, Drones in filming and panoramic picturing

UNIT V: (9 Periods)
Future Drones and Safety: Safety risks, Guidelines to fly safely, Specific aviation regulation and standardization- Drone license Miniaturization of drones, Increasing autonomy of drones, Use of drones in swarms.

Total Periods: 45

TEXT BOOKS

1. Daniel Tal & John Altschuld, Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation, John Wiley & Sons, Inc., 2021.
2. Terry Kilby & Belinda Kilby, Make: Getting Started with Drones, Maker Media, Inc., 2016.

REFERENCES:

1. John Baichtal, Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, Que Publishing, 2016.
2. Zavrsnik, Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance, Springer, 2018.

ONLINE RESOURCES:

1. Flight Dynamics and Control, NPTEL, IIT Bombay.
   https://nptel.ac.in/courses/101106042
2. Drone Systems and Control, NPTEL, IISc Bangalore
   https://nptel.ac.in/courses/101108661

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(ME23AOE602) SYSTEM DESIGN FOR SUSTAINABILITY

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:

- Introduce the fundamental concepts of sustainability and its relevance to engineering and design.
- Equip students with knowledge of life cycle thinking and sustainable design methodologies.
- Expose students to sustainable materials, product-service systems, and circular economy principles.
- Provide tools and strategies for designing products and systems that minimize environmental impact.
- Enable students to apply sustainable thinking through case studies and real-world examples.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Describe the fundamentals of sustainability and system design principles.
CO 2: Apply life cycle assessment (LCA) methods to evaluate environmental impact.
CO 3: Design products/services using sustainable materials and eco-design strategies.
CO 4: Analyze circular economy concepts and product-service systems for sustainability.
CO 5: Solve real-world sustainability challenges using industry case studies and teamwork.

COURSE CONTENT

UNIT I: **(9 Periods)**
Fundamentals of Sustainability and System Design: Introduction to sustainability: principles and dimensions, Sustainable development goals (SDGs), Systems thinking in design, Evolution of sustainability in engineering.

UNIT II: **(9 Periods)**
Life Cycle Thinking and Assessment: Life Cycle Thinking (LCT) and product life cycle stages, Life Cycle Assessment (LCA) – goal, scope, inventory, impact, ISO 14040/44 standards, LCA tools and software (overview)

UNIT III: **(9 Periods)**
Sustainable Product and Process Design: Eco-design principles and strategies, Design for Environment (DfE), design for disassembly, Sustainable materials selection, Resource and energy-efficient manufacturing

UNIT IV: **(9 Periods)**
Circular Economy and Product-Service Systems: Circular economy: definition, principles, and strategies, Closed-loop design and industrial symbiosis, Product-Service System (PSS): types, examples, and implementation challenges.

UNIT V: **(9 Periods)**
Case Studies and Practical Applications: Industrial examples of sustainable products and systems, Policy and behavioral change for sustainability, Group project: Sustainable design proposal and presentation, Assessment and peer review.

Total Periods: 45

TEXT BOOKS:

1. Michael Z. Hauschild, Ralph K. Rosenbaum, Stig I. Olsen, Life Cycle Assessment: Theory and Practice, Springer, 2018.
2. Thomas E. Graedel, Braden R. Allenby, Industrial Ecology and Sustainable Engineering, Pearson Education, 2010.

REFERENCE:

1. Marc A. Rosen, Engineering Sustainability: Fundamentals and Applications, CRC Press, 2020.
2. Carolynne Sherwin, Tracy Bhamra, Design for Sustainability: A Practical Approach, Gower Publishing, 2010.
3. Martin Charter, Ursula Tischner, Sustainable Solutions: Developing Products and Services for the Future, Greenleaf Publishing, 2001.
4. Arnold Tukker, Ursula Tischner, New Business for Old Europe, Greenleaf Publishing, 2006.
5. Josef Fresner, Helmut Schnitzer, Eco-Innovation Tools for Sustainable Product Development, Springer, 2012.

ONLINE RESOURCES:

1. System Design for Sustainability, NPTEL, IIT Guwahati. https://nptel.ac.in/courses/107103081
2. Sustainable Engineering Concepts and Life Cycle Analysis, NPTEL, IIT Kharagpur. https://nptel.ac.in/courses/105105157
3. Introduction to Sustainability, Coursera, University of Illinois. https://www.coursera.org/learn/sustainability

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(BA23AOE601) BUSINESS COMMUNICATION SKILLS

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Familiarize students with the foundational principles and process of effective business communication.
- Develop proficiency in professional writing, including business correspondence, email etiquette, and documentation.
- Enhance oral and interpersonal communication skills essential for group discussions, presentations, and public speaking.
- Improve understanding and application of non-verbal cues, workplace etiquette, and professional conduct.
- Prepare students for effective cross-cultural communication and collaboration in both physical and virtual business environments.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the fundamentals and process of effective business communication.

CO 2: Demonstrate writing skills in various business formats such as emails, reports, and proposals

CO 3: Exhibit professional speaking skills in presentations, group discussions, and interviews.

CO 4: Apply non-verbal communication and business etiquette in real-life contexts.

CO 5: Collaborate effectively in a team and communicate in cross-cultural settings.

COURSE CONTENT

UNIT I: **(8 Periods)**

Fundamentals of Business Communication: Nature, purpose, and scope of communication, Communication process and elements, Types of communication: Verbal & Non-verbal, Barriers to effective communication, and 7Cs of effective communication.

UNIT II: **(8 Periods)**

Business Writing Skills: Principles of business writing, Email etiquette & writing professional emails, Business letters (inquiry, complaint, cover letter, thank you note), Memo, notice, and circular, Resume and CV writing.

UNIT III: **(10 Periods)**

Oral & Interpersonal Communication: Group discussion techniques, Presentation skills: structure, design, and delivery, Public speaking: body language, voice modulation, and handling questions, Business meetings: agenda, minutes, and participation.

UNIT IV: **(9 Periods)**

Report Writing & Documentation: Types of business reports: informal, formal, progress, analytical, Structure: Title, TOC, Executive Summary, Findings, Conclusion, Proposals and technical documentation basics, Visual communication: charts, graphs, tables.

UNIT V: **(10 Periods)**

Cross-Cultural Communication & Etiquette: Communication in global and multicultural teams, Workplace etiquette and ethics, Virtual communication & remote collaboration, Social media communication and professionalism.

Total Periods: 45

TEXT BOOKS:

1. Meenakshi Raman, Prakash Singh, Business Communication, Oxford University Press, 2nd Edition, 2012
2. Lesikar R. V., Pettit J. D., Flately M. E., Basic Business Communication, Mcgraw Hill Education, 11th Edition, 2009

REFERENCES:

1. Courtland L. Bovee, John V. Thill, Business Communication Today
2. M. Ashraf Rizvi, Effective Technical Communication
3. Simon Sweeney, English for Business Communication
4. Sunita Mishra & C. Muralikrishna, Communication Skills for Engineers

ONLINE RESOURCES:

1. https://owl.purdue.edu
2. https://www.coursera.org/courses?query=business%20communication

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(EG23AOE601) ENGLISH FOR COMPETITIVE EXAMINATIONS

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Enable the students to learn about the structure of competitive English
- Understand the grammatical aspects and identify the errors
- Enhance verbal ability and identify the errors
- Improve word power to answer competitive challenges
- Make them ready to crack competitive exams

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Identify the basics of English grammar and its structures.

CO 2: Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams

CO 3: Analyze an unknown passage and reach conclusions about it.

CO 4: Choose the appropriate form of verbs in framing sentences

CO 5: Develop speed reading and comprehending ability thereby perform better in competitive exams

COURSE CONTENT

UNIT I: (9 Periods)

Grammar 1: Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees of Comparison-Adverbs-types- errors-Conjunctions-usage. Prepositions-usage-Tag Questions, types-identifying errors- Practice.

UNIT II: (9 Periods)

Grammar 2: Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-active voice and passive voice- reported Speech-Agreement-subject and verb-Modals-Spotting Errors-Practices.

UNIT III: (9 Periods)

Verbal Ability: Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbled Sentences -Selecting the proper statement by reading a given paragraph.

UNIT IV: (9 Periods)

Reading Comprehension and Vocabulary: Competitive Vocabulary: Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix & Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones-Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods-Competitive based Reading comprehension (Exercise).

UNIT V: (9 Periods)

Writing for Competitive Examinations: Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs- Essay writing-types.

Total Periods: 45

TEXT BOOKS:

1. Wren & Martin, English for Competitive Examinations, S. Chand & Co, 2021

2. Hari Mohan Prasad, Uma Rani Sinha, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.

REFERENCES:

1. Hari Mohan Prasad, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.
2. Philip Sunil Solomon, English for Success in Competitive Exams, Oxford 2016
3. Shalini Verma, Word Power Made Handy, S Chand Publications
4. Neira, Anjana Dev & Co. Creative Writing: A Beginner's Manual. Pearson Education India, 2008.
5. Abhishek Jain, Vocabulary Learning Techniques Vol. I & II, RR Global Publishers 2013.
6. Michel Swan, Practical English Usage, Oxford, 2006.

ONLINE RESOURCES:

1. https://www.grammar.cl/english/parts-of-speech.htm
2. https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech
3. https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice
4. https://languagetool.org/insights/post/verb-tenses/
5. https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council
6. https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx

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(MA23AOE601) MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Develop critical problem-solving skills for analyzing mathematical formulations in AI/ML. To provide students with essential linear algebra foundations, including vector spaces, inner products, and operators for quantum mechanical applications.
- Develop an understanding of the transition from finite-dimensional systems to infinite-dimensional function spaces and Hilbert space concepts.
- Establish quantum mechanical formalism, including measurement theory, uncertainty relations, and time evolution principles.
- Enable students to apply quantum mechanical principles to solve problems in simple quantum systems and understand statistical interpretation.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite-dimensional systems.

CO 2: Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.

CO 3: Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations.

CO 4: Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory.

CO 5: Apply conceptual understanding of these topics to emerging technologies in quantum computation and quantum information science.

COURSE CONTENT

UNIT I: **(8 Periods)**

Linear Algebra Foundation for Quantum Mechanics: Vector spaces definition and examples (R^2, R^3, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigenvalues, eigenvectors), Finite-dimensional examples (2×2 matrices, spin-1/2 systems), Dirac notation introduction ($|\psi\rangle$, $\langle\varphi|$, $\langle\varphi|\psi\rangle$), Change of basis (transformations, unitary matrices).

UNIT II: **(9 Periods)**

From Finite to Infinite Dimensions: Function spaces (L^2 space, square-integrable functions), Inner products for functions ($\int\psi^*\varphi\, dx$), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx, multiplication by x).

UNIT III: **(10 Periods)**

Quantum Mechanical Formalism: Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

UNIT IV: **(8 Periods)**

Applications and Statistical Interpretation: Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

UNIT V: (10 Periods)

Advanced Topics in Quantum Technologies: Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

Total Periods: 45

TEXT BOOKS:

1. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press, 1996.
2. Srinivas, M. D., Measurements and Quantum Probabilities, University Press, Hyderabad, 2001.

REFERENCES:

1. Leonard Schiff, Quantum Mechanics, Mc, Graw Hill (Education), 2010.
2. Parthasarathy. K. R., Mathematical Foundations of Quantum, Hindustan Book Agency, New Delhi.
3. Gerad Tesch, Mathematical Methods in Quantum Mechanics with application to Schrodinger operators, Graduate Studies in Mathematics, 99, AMS, Providence, 2009.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_cy31/preview
2. https://qosf.org/learn_quantum/
3. https://www.nqcc.ac.uk/a-guide-to-online-resources-for-learning-quantum-computing/
4. https://mitpress.mit.edu/9780262539531/quantum-computing-for-everyone/

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(MA23AOE602) OPTIMIZATION TECHNIQUES AND APPLICATIONS

(Open Elective-II)

COURSE OBJECTIVES:
The objectives of this course are to:

- Provide a comprehensive understanding of the fundamental principles and formulations of linear and non-linear optimization problems.
- Impart knowledge of various optimization techniques and algorithms, including the simplex method, duality concepts, and feasible direction methods, for effective problem solving.
- Enable students to apply optimization methodologies, such as geometric programming, to analyze and solve practical problems in engineering and applied sciences.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Apply the Simplex, Big-M, and Two-Phase methods to solve optimization models in resource allocation and production scheduling

CO 2: Analyze Dual Simplex method, Transportation, and Assignment models for solving real-world optimization and manufacturing design problems.

CO 3: Apply unconstrained optimization techniques to optimize machine learning models and neural network training problems.

CO 4: Examine constrained optimization techniques including Sequential Linear Programming and apply them to solve Support Vector Machine.

CO 5: Apply geometric programming formulations for both unconstrained and Constrained problems in engineering design, cost minimization, and resource optimization.

COURSE CONTENT

UNIT I: **(9 Periods)**

Linear Programming I: Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two-phase Simplex Method, Big-M method and Applications to resource allocation and production scheduling problems

UNIT II: **(8 Periods)**

Linear Programming II: Duality in Linear Programming: Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and Assignment problem, Application of LPP models in design manufacturing and Complementary slackness Theorem

UNIT III: Non-linear Programming **(10 Periods)**

Unconstrained Optimization Techniques: Classification of Unconstrained minimization methods,
Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method and Applications Machine Learning Model Optimization and Neural Network Training, Applications of unconstrained optimization techniques in machine learning model optimization.

UNIT IV: Non-linear Programming **(9 Periods)**

Constrained Optimization Techniques: Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria and Applications of Support Vector Machine (SVM) Optimization

UNIT V: Geometric Programming **(9 Periods)**
Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.
Constrained Minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints, Applications of geometric programming in engineering design optimization, and cost minimization.

Total Periods: 45

TEXT BOOKS:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi 2009.
2. J. C. Panth, Introduction to Optimization Techniques, 7th Edition, Jain Brothers, New Delhi 2015.

REFERENCES:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi 1978.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag 1988.

ONLINE RESOURCES:

4. https://nptel.ac.in/courses/111102012
5. https://nptel.ac.in/courses/106104356
6. https://kcl.digimat.in/nptel/courses/video/111107104/lec13.pdf
7. https://nptel.ac.in/courses/112106134

III Year B.Tech. – II Semester

L	T	P	C
3	-	-	3

(PH23AOE601) PHYSICS OF ELECTRONIC MATERIALS AND DEVICES

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Make the students to understand the concept of crystal growth, defects in crystals and thin films.
- Provide insight into various semiconducting materials and their properties.
- Develop a strong foundation in semiconductor physics and device engineering.
- Elucidate excitonic and luminescent processes in solid-state materials.
- Understand the principles, technologies, and applications of modern display systems.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand crystal growth and thin film preparation
CO 2: Summarize the basic concepts of semiconductors
CO 3: Illustrate the working of various semiconductor devices
CO 4: Analyze various luminescent phenomena and the devices based on these concepts
CO 5: Explain the working of different display devices

COURSE CONTENT

UNIT I: **(9 Periods)**

Fundamentals of Materials Science: Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT II: **(9 Periods)**

Semiconductors: Introduction, quantum confinement in semiconductors (qualitative), charge carriers in semiconductors, effective mass, Electron and Hole in quantum well, Diffusion and recombination, Diffusion length. Change of electron-hole concentration-Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects, optical absorption.

UNIT III: **(9 Periods)**

Physics of Semiconductor Devices: Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions and its applications in high speed devices, Transistors, MOSFETs.

UNIT IV: **(9 Periods)**

Excitons and Luminescence: Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials.

Photoluminescence: General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot.

Electro-luminescence: General Principles of electroluminescence, light emitting diode, diode laser.

UNIT V: **(9 Periods)**

Display Devices: LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Total Periods: 45

TEXT BOOKS:

1. S. O. Kasap, Principles of Electronic Materials and Devices, McGraw-Hill Education, 4th Edition, 2021.
2. Donald A. Neamen, Semiconductor Physics and Devices: Basic principles, 4th Edition, McGraw Hill, 2012.

REFERENCES:

1. B. G. Streetman, S. Banerjee, Solid State Electronic Devices, PHI Learning, 6th Edition, 2005.
2. Eugene A. Irene, Electronic Materials Science, Wiley, 2005.
3. Grover and Jamwal, Electronic Components and Materials, Dhanpat Rai And Co., New Delhi, 2012.
4. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineers, World Scientific Publishing Co. Pvt. Ltd., 2nd Edition, 2011.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/113/106/113106062/
2. https://onlinecourses.nptel.ac.in/noc20_ph24/preview

III Year B.Tech. – II Semester

L	T	P	C
3	-	-	3

(CH23AOE601) CHEMISTRY OF POLYMERS AND APPLICATIONS

(Open Elective-II)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the basic principles of polymers.
- Understand natural polymers and their applications.
- Understand natural polymers and their applications.
- Enumerate the applications of hydro-gel polymers.
- Enumerate applications of conducting and degradable polymers in engineering.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Classify the polymers, explain polymerization mechanism, differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer.

CO 2: Summarize the physical and chemical properties of natural polymers and Modified cellulosic.

CO 3: Illustrate Bulk, solution, Suspension and emulsion polymerization, describe fibers and elastomers, Identify the thermosetting and thermos polymers.

CO 4: Identify types of polymer networks, describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery.

CO 5: Explain classification and mechanism of conducting and degradable polymers.

COURSE CONTENT

UNIT I: **(9 Periods)**

Polymers-Basics and Characterization: Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, co-polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, poly dispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT II: **(9 Periods)**

Natural Polymers and Modified Cellulosic: Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as natural rubber, cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified Cellulosic: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetyls, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

UNIT III: **(9 Periods)**

Synthetic Polymers: Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers (PE, PAN), Butadiene polymers (Buna-S, Buna-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

UNIT IV: **(9 Periods)**

Hydrogels of Polymer Networks: Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

UNIT V: **(9 Periods)**

Conducting and Degradable Polymers: Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable Polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications, De polymerization.

Total Periods: 45

TEXT BOOKS:

1. Billmayer, A Text book of Polymer Science, 3rd Edition, 2025.
2. G.S. Mishra, Polymer Chemistry, 4th Edition, 2025.

REFERENCES:

1. K.J. Saunders, Organic Polymer Chemistry, Chapman and Hall
2. B.Miller, Advanced Organic Chemistry, Prentice Hall
3. Premamoy Ghosh, Polymer Science and Technology, McGraw- Hill, 3rd Edition, 2010.

ONLINE RESOURCES:

1. http://acl.digimat.in/nptel/courses/video/104105039/L31.html
2. https://archive.nptel.ac.in/content/syllabus_pdf/104105039

IV Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CE23AOE701) BUILDING MATERIALS AND SERVICES

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
- Analyze the composition, manufacturing process, and properties of cement and admixtures.
- Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
- Evaluate masonry, mortars, finishing techniques, and formwork systems.
- Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
CO 2: Analyze the composition, manufacturing process, and properties of cement and admixtures.
CO 3: Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
CO 4: Evaluate masonry, mortars, finishing techniques, and formwork systems.
CO 5: Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

COURSE CONTENT

UNIT I: **(9 Periods)**
Stones and Bricks, Tiles: Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – Composition of Brick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, Paints and Plastics: Wood - Structure – Types and Properties – Seasoning – Defects; Alternate Materials for Timber – GI / Fibre – Reinforced Glass Bricks, Steel &Aluminum, Plastics

UNIT II: **(10 Periods)**
Cement & Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency – Initial &Final Setting – Soundness. Admixtures – Mineral & Chemical Admixtures – Uses

UNIT III: **(9 Periods)**
Building Components: Lintels, Arches, Walls, Vaults – Stair Cases – Types of Floors, Types of Roofs – Flat, Curved, Trussed; Foundations – Types; Damp Proof Course; Joinery – Doors – Windows – Materials – Types

UNIT IV: **(9 Periods)**
Mortars, Masonry and Finishing's Mortars: Lime and Cement Mortars Brick Masonry – Types – Bonds; Stone Masonry – Types; Composite Masonry – Brick-Stone Composite; Concrete, Reinforced Brick. Finishers: Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP. form Work: Types: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning.

UNIT V: **(8 Periods)**
Building Services: Plumbing Services: Water Distribution, Sanitary – Lines & Fittings; Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning - Essentials and Types; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire

Hazards – Classification of Fire-Resistant Materials and Constructions.

Total Periods: 45

TEXT BOOKS:

1. Arora and Bindra, Building Materials and Construction, Dhanpat Roy Publications.
2. G C Sahu, Joygopal Jena, Building Materials and Construction, McGraw Hill Pvt Ltd., 2015.

REFERENCES:

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd., New Delhi
2. P. C. Varghese, Building Materials, Prentice Hall of India, 2015.
3. N. Subramanian, Building Materials Testing and Sustainability, Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

IV Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CE23APE502) ENVIRONMENTAL IMPACT ASSESSMENT

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
- Analyze the impact of developmental activities on land use, soil, and water resources.
- Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
- Develop environmental audit procedures and assess compliance with environmental regulations.
- Understand and apply environmental acts, notifications, and legal frame works in EIA studies.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Apply various methodologies for conducting Environmental Impact Assessments.
CO 2: Analyze the impact of land-use changes on soil, water, and air quality.
CO 3: Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
CO 4: Develop environmental audit reports and assess compliance with environmental policies.
CO 5: Interpret and apply environmental acts and regulations related to EIA.

COURSE CONTENT

UNIT I: **(9 Periods)**
Concepts and methodologies of EIA: Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, EIA Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT II: **(10 Periods)**
Impact of Developmental Activities and Land Use: Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I Ain Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts on Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT III: **(9 Periods)**
Assessment of Impact on Vegetation, Wildlife and Risk Assessment: Introduction - Assessment of Impact of Development Activities on Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing an Environmental Risk Assessment-Advantages of Environmental Risk Assessment.

UNIT IV: **(9 Periods)**
Environmental Audit: Introduction - Environmental Audit &Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT V: **(8 Periods)**
Environmental Acts and Notifications: The Environmental Protection Act, The Water Preservation Act, The Air (Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

Total Periods: 45

TEXT BOOKS:

1. Y. Anjaneyulu, Environmental Impact Assessment Methodologies, B S Publication-Hyderabad, 2nd Edition, 2011.
2. W Canter Larry, Environmental Impact Assessment, McGraw-Hill Education, Edition, 1996.

REFERENCES:

1. Peavy, H S Rowe, D. R, G Tchobanoglous, Environmental Engineering, Mc-Graw Hill International Editions, New York 1985.
2. Suresh K Dhaneja, Environmental Science and Engineering, S K Katania & Sons Publication, New Delhi.
3. J Glynn and Gary W Hein Ke, Environmental Science and Engineering, Prentice Hall Publishers.
4. H S Bhatia, Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ar07/preview

IV Year B.Tech. – I Semester

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(CE23AOE702) GEOSPATIAL TECHNOLOGIES

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
- Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
- Apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
- Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
- Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
CO 2: Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
CO 3: Apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
CO 4: Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
CO 5: Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

COURSE CONTENT

UNIT I: **(9 Periods)**
Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering – Extended Neighborhood-Operations- Zonal Operations - Statistical Analysis – Cost-Distance Analysis-Least Cost Path.

UNIT II: **(10 Periods)**
Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance – topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line-In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

UNIT III: **(9 Periods)**
Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path in A Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis

UNIT IV: **(9 Periods)**
Surface Data – Sources of X, Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram.

UNIT V: (8 Periods)

Customization of GIS: Need, Uses, Scripting Languages –Embedded Scripts – Use of Python Script - Web GIS: Web GIS Architecture, Advantages of Web GIS, Web Applications- Location Based Services: Emergency and Business Solutions - Big Data Analytics.

Total Periods: 45

TEXT BOOKS:

1. Kang Tsung Chang, Introduction to Geographical Information System, Tata McGraw Hill, 4th Edition, 2008.
2. Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

REFERENCES:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub., 2008

IV Year B.Tech. – I Semester

L	T	P	C
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(CE23AOE703) SMART CITIES

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the fundamental concepts, scope, and global benchmarks of smart cities and sustainable urban development.
- Gain knowledge of urban planning principles relevant to the development of smart cities and the integration of infrastructure services.
- Analyze infrastructure development processes, policies, and financial models applicable to smart cities, including PPP frameworks.
- Explore modern transportation systems and sustainable mobility solutions for urban areas using intelligent transport systems (ITS).
- Evaluate the applications of Artificial Intelligence in smart city management across urban planning, transportation, energy, and public service domains.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Define the concept of smart cities and explain their importance, global standards, and performance indicators.
CO 2: Demonstrate an understanding of urban infrastructure planning and the role of planners in delivering sustainable services.
CO 3: Evaluate major infrastructure projects in smart cities with reference to policy frameworks, PPP models, and governance practices.
CO 4: Analyze urban transportation systems and propose intelligent and sustainable solutions for enhancing urban mobility.
CO 5: Apply AI-based approaches to address challenges in urban management including planning, transportation, energy, and public services.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to Smart Cities: Introduction to smart cities - Definition, Scope - Importance – Global Standards and Performance Benchmarks - Practice Code - Principal stakeholders - key trends in smart cities developments - Concept of Sustainable cities

UNIT II: (10 Periods)
Smart Cities Planning and Development: Planning for Urban Infrastructure - Introduction to city planning, key trends in smart cities developments, Sustainable features for smart cities - Role of Planner in the provision of urban networks for different services, Case Study.

UNIT III: (9 Periods)
Infrastructure Planning and Development for smart Cities: Feasibility studies for infrastructure projects - planning for major infrastructure projects - Various Infrastructure Program and policies by MOUD, PPP (DBOOT, BOOT, etc.) in infrastructure projects - Dimension of smart cities, Financing smart cities development - Governance of smart cities - Smart Cities Regulations & Smart Techniques - Case Study.

UNIT IV: (9 Periods)
Transportation System for Smart Cities: Urbanization and urban mobility - urban land use and transport - Concepts of sustainable mobility - public transportation - pedestrians and bicyclists and parking - fundamentals of the intelligent transportation systems (ITS) - Case Study.

UNIT V: (8 Periods)
AI in Smart City Management: Introduction - Applications in Urban Planning -

Transportation Management - Energy Management - Public Services - Case studies - Challenges and Future Directions.

Total Periods: 45

TEXT BOOKS:

1. Jo Beall, A City for all: Valuing Differences and Working with Diversity, Zed Books Limited, London, 1997, ISBN: 1 85649-477-2.
2. UN-Habitat, Inclusive and Sustainable Urban Planning: A Guide for Municipalities, Volume 3, Urban Development Planning, United Nations Human Settlements Programme, 2007, ISBN: 978- 92-1-132024-4.

REFERENCES:

1. Arup Mitra, Insights into Inclusive Growth, Employment and Wellbeing in India, Springer, New Delhi, 2013, ISBN: 978 81-322-0655-2.
2. Mission Statement & Guidelines on Smart City Scheme, Government of India, Ministry of Urban Development.
3. Anthony M. Townsend, Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia.
4. Stephen Lucci and Danny Kopec, Artificial Intelligence in the 21st Century.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/124107007
2. https://nptel.ac.in/courses/109105185
3. http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf

IV Year B.Tech. – I Semester

L	T	P	C
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(CE23AOE704) SOLID WASTE MANAGEMENT

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
- Analyze engineering systems for solid waste collection, storage, and transportation.
- Apply resource and energy recovery techniques for sustainable solid waste management.
- Evaluate landfill design, construction, and environmental impact mitigation strategies.
- Assess hazardous waste management techniques, including biomedical and e-waste disposal.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
- **CO 2:** Analyze engineering systems for solid waste collection, storage, and transportation.
- **CO 3:** Apply resource and energy recovery techniques for sustainable solid waste management.
- **CO 4:** Evaluate landfill design, construction, and environmental impact mitigation strategies.
- **CO 5:** Assess hazardous waste management techniques, including biomedical and e-waste

COURSE CONTENT

UNIT I: **(9 Periods)**
Solid waste – Definition, Classification, Types, Sources, Composition, Characteristics; Integrated Solid Waste Management (ISWM); SWM Rules (2016).

UNIT II: **(10 Periods)**
Engineering Systems for Solid Waste Management: Solid Waste Generation and Estimation; On-Site Handling and Storage; Collection of Solid Wastes; Stationary and Hauled Container Systems – Route Planning - Transfer and Transport

UNIT III: **(9 Periods)**
Engineering Systems for Resource and Energy Recovery: Overview of Processing Techniques; Materials Recovery Facilities; Energy recovery from biological and thermal processes; Biological Conversion – Composting, Problems with Composing, Anaerobic Digestion; Thermal Conversion- Pyrolisis, Gasification, incineration, Refuse Derived Fuel (RDF)

UNIT IV: **(9 Periods)**
Landfills: Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills – Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.

UNIT V: **(8 Periods)**
Hazardous Waste Management: – Sources and Characteristics, Environmental and health impacts, Risk Assessment – Treatment and disposal methods – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management.

Total Periods: 45

TEXT BOOKS:

1. Tchobanoglous G, Theisen H and Vigil SA, Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, Solid Waste Engineering, Brooks/Cole Thomson Learning Inc., 2002.

REFERENCES:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, Environmental Engineering, McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, Geotechnical Aspects of Landfill Design and Construction, Prentice Hall, 2002.

IV Year B.Tech. – I Semester

L	T	P	C
3	-	-	3

(CS23AOE701) INTRODUCTION TO DATA BASE MANAGEMENT SYSTEMS

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques
- Provide an overview of Schema refinement and Transaction processing

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the basic concepts of database management systems

CO 2: Analyze a given database application scenario to use ER model for conceptual design of the database

CO 3: Utilize SQL proficiently to address diverse query challenges

CO 4: Employ normalization methods to enhance database structure

CO 5: Assess and implement transaction processing, concurrency control and database recovery protocols in databases

COURSE CONTENT

UNIT I: (9 Periods)

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT II: (10 Periods)

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT III: (9 Periods)

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT IV: (9 Periods)

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non- updatable), relational set operations

UNIT V: (8 Periods)

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate

key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).
Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability

Total Periods: 45

TEXT BOOKS:

1. Raghurama Krishnan and Johannes Gehrke, Database Management Systems, Tata McGraw-Hill, 3rd Edition, 2003.
2. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, Tata McGraw-Hill, 5th Edition, 2006.

REFERENCES:

1. C. J. Date, *Introduction to Database Systems*, Pearson, 8th Edition, 2004.
2. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson, 6th Edition, 2011.
3. Carlos Coronel, Steven Morris, and Peter Rob, *Database Principles: Fundamentals of Design, Implementation, and Management*, Cengage Learning, 2013.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672 82 022456_shared/overview

IV Year B.Tech. – I Semester

L	T	P	C
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(CS23APE604) QUANTUM COMPUTING

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Introduce the fundamental concepts of quantum mechanics and linear algebra as they apply to quantum computing.
- Explain quantum gates, circuits, and key algorithms that leverage quantum principles for computation.
- Familiarize students with quantum algorithmic strategies and computational complexity classes.
- Enable hands-on experience with quantum programming using tools like Qiskit and IBM Quantum Experience.
- Explore real-world applications, challenges, and the future landscape of quantum computing, including ethics and societal impact.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand and apply foundational concepts from quantum mechanics and linear algebra to model quantum computation.
CO 2: Analyze and construct quantum circuits using basic quantum logic gates and simulate quantum operations.
CO 3: Explain and implement fundamental quantum algorithms like Grover's and Shor's, and interpret their computational benefits.
CO 4: Develop and execute quantum programs using Qiskit and IBM Quantum platforms and interpret results from quantum hardware.
CO 5: Evaluate applications of quantum computing in cryptography, AI, and optimization, and discuss ethical and future challenges.

COURSE CONTENT

UNIT I: **(9 Periods)**
Fundamentals of Quantum Mechanics and Linear Algebra: Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems

UNIT II: **(10 Periods)**
Quantum Gates and Circuits: Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits

UNIT III: **(9 Periods)**
Quantum Algorithms and Complexity: Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA

UNIT IV: **(9 Periods)**
Quantum Programming and Simulation Platforms: Introduction to Qiskit and IBM Quantum Experience,Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT V: **(8 Periods)**
Applications and Future of Quantum Computing: Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum, Key Distribution, Quantum Algorithms in AI and Optimization,

Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Total Periods: 45

TEXT BOOKS:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

REFERENCES:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

IV Year B.Tech. – I Semester

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(AM23AOE701) AI PROMPT ENGINEERING

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the principles and techniques of prompt engineering, including the designs of effective prompts.
- Explore the capabilities of large language models for text and image generations and to leverage the creation of engaging content.
- Gain practical experience in crafting prompts and generating text and images using AI tools and platforms.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Design clear, concise, and relevant prompts following the standard principles of prompt engineering.
- **CO 2:** Utilize LLMs to generate text and image for designing more effective content and design.
- **CO 3:** Analyze existing prompts and make strategic combinations for enhanced prompts.
- **CO 4:** Demonstrate proficiency in generative AI techniques for text data generation.
- **CO 5:** Develop skills in designing prompts for AI-driven image generation using diffusion models

COURSE CONTENT

UNIT I: (8 Periods)
Introduction to LLM and Prompting: Introduction to Large Language Models (LLMs),Text Generation Models: Evolution and Importance, Architecture and Capabilities of LLMs, Market Landscape of LLMs: OpenAI, Anthropic, Cohere, etc.

UNIT II: (9 Periods)
Prompt Engineering Fundamentals: Understanding Prompting and Prompt Techniques, Five Principles of Effective Prompting, Components of a Prompt: Instructions, Context, Input, and Output, Types of Prompts: Zero-shot, Few-shot, Chain-of-thought, Designing Prompt Personas and Personalities, Mix-and-Match Techniques for Strategic Prompt Combination.

UNIT III: (10 Periods)
Case Studies and Prompt Design Practices: Case Studies: Successful Prompt Implementations in Industry, Challenges and Limitations of Prompting, Prompt Rewriting and Refinement, Tools for Prompt Experimentation and Testing, Ethical Use and Bias Mitigation in Prompt Design

UNIT IV: (10 Periods)
Text Data Generation with Generative AI: Standard Practices for Text Generation, Generating Lists, Simplification Techniques, Text Translation and Rephrasing, Extractive and Generative Techniques, Role-Based Prompting and Context Awareness, Using AI for Content Creation: Copywriting, Social Media, Video Scripts, Personalized Messaging and Survey Generation, Hands-on Exercises in Prompt Design and Analysis.

UNIT V: (8 Periods)
Image Generation and AI Application Development: Introduction to Image Generation with Diffusion Models, Overview of DALL·E, Mid Journey, Stable Diffusion, etc. Designing Prompts for Visual Outputs, Negative Prompting, Rewriting, and Prompt Chaining, Reverse Engineering Image Prompts, Building AI-powered Applications: Blog Writing, UI/UX Tools,

Text-Image Synthesis, Ethical Considerations in AI-Generated Media.

Total Periods: 45

TEXT BOOKS:

1. James Phoenix, Mike Taylor, Prompt Engineering for Generative AI, O'Reilly, 2024
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, 1st Edition, 1998.

REFERENCES:

1. Gilbert Mizrahi, Unlocking the Secrets of Prompt Engineering, 2024.
2. Michael Ferguson, Prompt Engineering: The Future of Language Generation, 2023.

ONLINE RESOURCES:

1. https://www.promptingguide.ai/
2. https://developers.google.com/machine-learning/resources/prompt-eng
3. https://platform.openai.com/docs/guides/

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(AM23AOE702) ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Gain knowledge of Artificial Intelligence, focusing on intelligent agents, problem-solving techniques, and state-space search approaches.
- Understand and apply various problem-solving and search techniques, including uniform and heuristic search strategies in artificial intelligence.
- Explore and apply local search techniques for solving Constraint Satisfaction Problems (CSPs) and adversarial search strategies to make optimal decisions.
- Apply various statistical reasoning techniques for knowledge representation and reasoning in AI, as well as logic programming and reasoning methods.
- Become familiar with fundamental concepts of Machine Learning techniques, including classification, regression, clustering problems, and an introduction to neural networks and deep learning.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Design intelligent agents, define problems using state-space models, and apply AI techniques.

CO 2: Implement and compare different search algorithms (both uniform and heuristic), and apply appropriate strategies for solving AI problems.

CO 3: Solve CSPs using local search methods and implement adversarial search algorithms for optimal decisions in competitive game scenarios.

CO 4: Utilize statistical and logical reasoning methods to represent knowledge and perform forward/backward reasoning in AI applications.

CO 5: Understand and apply various machine learning techniques, including an introduction to neural networks and deep learning.

COURSE CONTENT

UNIT I: (8 Periods)

Introduction to Artificial Intelligence and Problem-Solving Agent: Problems of AI, AI technique, Tic–Tac–Toe problem. Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

UNIT II: (9 Periods)

Search Techniques: Problem solving agents, searching for solutions. **Uniform search strategies:** breadth-first search, depth-first search, depth-limited search, bidirectional search, comparing strategies.
Heuristic search strategies: Greedy best-first search, A* search, AO* search. **Memory bounded heuristic search:** Local search algorithms & optimization problems: hill climbing, simulated annealing, local beam search.

UNIT III: (8 Periods)

Constraint Satisfaction Problems and Game Theory: Local search for CSPs. Adversarial search, games, optimal decisions & strategies, minimax search, alpha-beta pruning, additional refinements, iterative deepening.

UNIT IV: (10 Periods)

Knowledge & Reasoning: Statistical Reasoning: Probability, Bayes’ Theorem, Certainty Factors, Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. Knowledge representation: rule-based, procedural & declarative knowledge.Logic programming: forward and backward reasoning.

UNIT V: (10 Periods)

Introduction to Machine Learning: Exploring ML as a sub-discipline of AI. Supervised learning, Unsupervised learning, Reinforcement learning. Classification, regression, clustering problems. Introduction to neural networks and deep learning.

Total Periods: 45

TEXT BOOKS:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 3rd Edition, 2015.
2. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, 1st Edition, 1998.

REFERENCES:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGrawHill, 3rd Edition, 2017.
2. Patterson, Introduction to Artificial Intelligence & Expert System, Pearson, 1st Edition, 2015.

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(AM23AOE703) INTRODUCTION TO DEEP LEARNING

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce the fundamental concepts, algorithms, and mathematical foundations of machine learning and deep learning.
- Train students in building, evaluating, and deploying ML/DL models using Python-based libraries and frameworks.
- Enable students to solve real-world problems across domains using supervised, unsupervised, and neural network-based models.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand and apply core machine learning algorithms for classification, regression, and clustering tasks.
CO 2: Design and train deep neural networks including CNNs, RNNs, and transfer learning models.
CO 3: Evaluate and improve ML/DL models using proper metrics and validation strategies.
CO 4: Develop practical solutions using ML/DL libraries such as Scikit-learn, TensorFlow, and Keras.
CO 5: Identify ethical considerations and limitations of AI systems.

COURSE CONTENT

UNIT I: (8 Periods)
Introduction to Machine Learning: What is ML? Types of ML: Supervised, Unsupervised, Reinforcement, Basic concepts: hypothesis space, loss functions, over fitting, underfitting, Data preprocessing and feature engineering.

UNIT II: (9 Periods)
Supervised and Unsupervised Learning Algorithms: Regression: Linear, Polynomial, Ridge, Lasso, Classification: k-NN, Decision Trees, Random Forest, Naive Bayes, SVM, Clustering: K-Means, Hierarchical, DBSCAN, Dimensionality reduction: PCA, t-SNE, Evaluation metrics: accuracy, precision, recall, F1-score, ROC-AUC.

UNIT III: (10 Periods)
Neural Networks and Deep Learning Foundations: Basics of Artificial Neural Networks (ANN), Perceptron, activation functions, forward/backward propagation, Gradient descent and variants (SGD, Adam), Model optimization: loss functions, weight initialization, batch normalization, Frameworks: TensorFlow, Keras, PyTorch basics.

UNIT IV: (10 Periods)
Convolutional and Recurrent Neural Networks: Convolutional Neural Networks (CNN): architecture, filters, pooling, Applications: Image classification, object detection, Recurrent Neural Networks (RNN), LSTM, GRU, Applications: Text classification, sequence prediction, Introduction to Attention and Transformers

UNIT V: (8 Periods)
Advanced Topics and Model Deployment: Transfer learning with pretrained models (VGG, ResNet, BERT), Generative models: Autoencoders, GANs, Model deployment with Flask/Streamlit, Introduction to MLOps and model versioning, Ethics in ML/DL: fairness, bias, explainability

Total Periods: 45

TEXT BOOKS:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press.

REFERENCES:

1. Tom M. Mitchell, Machine Learning, McGraw Hill.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer.
3. François Chollet, Deep Learning with Python, Manning Publications.

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(CY23AOE701) FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the fundamental concepts of Blockchain and its core components.
- Explore Blockchain architecture, consensus mechanisms, and data structures such as Merkle trees and hashing.
- Design and deploy simple smart contracts and decentralized applications.
- Gain hands-on knowledge of Ethereum and Hyperledger platforms.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Explain the principles, features, and evolution of Blockchain technology.
CO 2: Describe the technical components like blocks, consensus algorithms, tokens, and wallets.
CO 3: Analyze blockchain architectures, tokens, and deployment models to design.
CO 4: Analyze use cases and implement solutions using Ethereum and Hyperledger Fabric.
CO 5: Evaluate emerging block chain technologies and their integration with IoT, AI/ML, and cloud platforms.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to Blockchain: Blockchain definition, characteristics, and real-world challenges; Centralized vs. Decentralized systems; History and evolution of blockchain; Types of Blockchain: public, private, consortium; Key stakeholders in the blockchain ecosystem.

UNIT II: (9 Periods)
Core Concepts of Blockchain: Blocks and transactions, hashing and Merkle trees, consensus mechanisms (Proof of Work, Proof of Stake), mining, tokens and cryptocurrencies, wallets, Blockchain transaction lifecycle, peer-to-peer networks, types of nodes, risks in Blockchain systems.

UNIT III: (9 Periods)
Blockchain Architecture & Design: Blockchain application types, enterprise Blockchain architecture, evaluation framework for Blockchain solutions, cryptographic tokens, design considerations for blockchain systems, typical architecture and deployment models.

UNIT IV: (9 Periods)
Ethereum Platform and Smart Contracts: Ethereum basics, smart contracts and Solidity programming, Ethereum Virtual Machine (EVM), Truffle development framework, MetaMask, Ether wallets, decentralized applications, case study: Tuna Fish Tracking on Ethereum.

UNIT V: (9 Periods)
Hyperledger and Emerging Trends: Hyperledger Fabric architecture and transaction flow, chain code development, use case: Car ownership tracking, advanced blockchain topics: IPFS, Oracles, Zero-Knowledge Proofs, Blockchain with IoT and AI, Initial Coin Offerings, Blockchain Cloud Platforms, Future trends.

Total Periods: 45

TEXT BOOKS:
1. Armadas, Arched Surfers A Riff, Sham, Block Chain for Enterprise Application Developers‖, Wiley, 1st edition, 2020.

2. Andreas M. Antonopoulos, Mastering Bit coin: Programming the Open Block Chain, O'Reilly, 1st edition, 2017.

REFERENCES:

1. Joseph Barbara, Paul R. Allen, Block chain: A Practical Guide to Developing Business, Law, and Technology Solutions, Mc Grow Hill, 1st Edition, 2018.
2. Melanie Swan, Block chain: Blueprint for a New Economy, O'Reilly, 1st Edition, 2017.

ONLINE RESOURCES:

1. https://github.com/blockchainedindia/resources
2. https://onlinecourses.nptel.ac.in/noc22_cs44/preview

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(CY23AOE702) FUNDAMENTALS OF CYBER SECURITY

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Develop a foundational comprehension of cyber security concepts, encompassing threats, vulnerabilities, and protective strategies.
- Identify and categorize common cyber threats, understand their propagation, and implement effective countermeasures.
- Explore techniques for ensuring data integrity, authentication, and data availability, while comprehending cryptographic controls.
- Develop skills to respond to cyber security incidents, execute disaster recovery plans, and enhance system availability.
- Analyze the ethical dimensions of cyber security, understand professional responsibilities, and uphold ethical standards in the field.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Demonstrate various cyber threats and vulnerabilities, understanding their potential impact on digital assets.
CO 2: Implement proactive measures to mitigate cyber threats and protect against common attack vectors.
CO 3: Apply cryptographic techniques to ensure data integrity, authenticity, and confidentiality.
CO 4: Develop incident response plans and disaster recovery strategies to minimize the impact of cyber security incidents.
CO 5: Understand to ethical principles and professional responsibilities while making informed decisions in the realm of cyber security

COURSE CONTENT

UNIT I: **(9 Periods)**
Cyber security Essentials and Cube: The Cyber security World, Cyber Criminals versus Cyber security Specialists, Common Threats, Spreading Cyber security Threats, The Three Dimensions of the Cyber security Cube, CIA Triad, States of Data, Cyber security Countermeasures, IT Security Management Framework, Cybercrime, and Information Security

UNIT II: **(9 Periods)**
Cyber security Threats, Vulnerabilities, Attacks and Protecting Secrets: Introduction, Governance, Managing Cloud Security Risk, Compliance, Legal Issues in Cloud, Audit, CSA Tools. Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT III: **(9 Periods)**
Data Integrity: Types of Data Integrity Controls, Digital Signatures, Certificates, Database Integrity Enforcement.

UNIT IV: **(9 Periods)**
Tools and Methods Used in Cyber Crime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT-V: **(9 Periods)**
Protecting a Cyber security Domain: Defending Systems and Devices, Server Hardening,

Network Hardening, Physical and Environmental Security, Cyber security Domains, Ethics of Working in Cyber security.

Total Periods: 45

TEXT BOOKS:

1. Dr. ErdalOzkaya, Cyber security: The Beginner's Guide, Packt Publishing Limited, 1st Edition, 2019.
2. Mike Chappell, James Michael Stewart, Darrel Gibson, CISSP (ISC)² Certified Information Systems Security Professional Official Study Guide, 9th Edition, 2021.

REFERENCES:

1. Charles J. Brooks, Christopher Grow, Philip Craig and Donald Short, Cyber security Essentials, Say box, 1st Edition, 2018.
2. William Stallings, Network Security Essentials, Pearson Education, 6th Edition, 2018.
3. Nina Godbole and Sunil Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India, 1st Edition, 2011.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_cs116/preview

IV Year B.Tech. – I Semester

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(CY23AOE703) FUNDAMENTALS OF ETHICAL HACKING

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objective of this course is to:

- Ethical hacking, Network and computer attacks, Foot printing, Social engineering, Port scanning, System hacking, Sniffers, Denial of service, Hacking web servers, Wireless hacking, Cryptography, Network Protection System.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Demonstrate knowledge on the computer security, social engineering and the intent of ethical hacking.
CO 2: Learn TCP/IP basics and social engineering attacks.
CO 3: Select and apply foot printing and port scanning tools to discover vulnerabilities of the computer system.
CO 4: Investigate hacking techniques and tools to maintain computer security.
CO 5: Analyze cryptosystems and network protection systems for information security and intrusion prevention.

COURSE CONTENT

UNIT I: (9 Periods)
Ethical Hacking, Network and Computer Attacks: The role of security and penetration testers, Penetration-Testing methodologies, what you can and cannot do legally. Network and Computer Attacks: Malicious software, Trojans, Backdoors, Viruses, and Worms, Protection against malware attacks, Intruder attacks on networks and computers, Addressing physical security.

UNIT II: (9 Periods)
TCP/IP Concepts and Social Engineering: Overview of TCP/IP – Application layer, Transport layer, Internet layer; IP addressing – Planning IP address assignments, IPv6 addressing. Social Engineering: What is social engineering, what are the common types of attacks, understand insider attacks, understand identity theft, describe phishing attacks, understand online scams, Understand URL obfuscation, Social engineering countermeasures.

UNIT III: (9 Periods)
Footprinting and Port Scanning: Foot printing: Using web tools for foot printing, conducting competitive intelligence, Using domain name system zone transfers. Port Scanning: Port scanning, using port scanning tools, conducting ping sweeps, Understanding scripting.

UNIT IV: (9 Periods)
System Hacking: System hacking -Password cracking techniques, Types of passwords, Key loggers and other spyware technologies, Escalating privileges, Root kits, How to hide files, Steganography technologies, How to cover your tracks and evidences; Sniffers – Protocols susceptible to sniffing, Active and passive sniffing, ARP poisoning, Ethereal capture and display filters, MAC flooding, DNS spoofing techniques, Sniffing countermeasures; Denial of Service - Types of DoS attacks, How DDoS attacks work, How BOTs/BOTNETs work, Smurf attack, SYN flooding, DoS/DDoS counter measures; Session hijacking – Spoofing vs. hijacking, Types of session hijacking, Sequence prediction, Steps in performing session hijacking, Preventing session hijacking.

UNIT V: (9 Periods)
Cryptography, Network Protection Systems: Cryptography: Understanding Cryptography basics, Symmetric and asymmetric algorithms, Public key infrastructure, Cryptography

attacks. Network Protection Systems: Understanding routers, Firewalls, Honeypots.

Total Periods: 45

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, James E. Corley, Hands-On Ethical Hacking and Network Defense, Cengage Learning, 3rd Edition, 2017.
2. Kimberly Graves, CEH: Official Certified Ethical Hacker Review Guide, Wiley, 1st Edition, 2007.

REFERENCES:

1. Michael Gregg, Certified Ethical Hacker (CEH) Cert Guide, Pearson, 3rd Edition, 2019.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_cs94/preview

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(DS23AOE701) DATA ANALYSIS AND VISUALIZATION

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce the principles and practices of Exploratory Data Analysis (EDA) using Python.
- Teach techniques for data cleaning, preprocessing, transformation, and visualization.
- Apply statistical techniques and visual methods to discover patterns and relationships.
- Gain experience using popular Python libraries such as NumPy, Pandas, Matplotlib.
- Prepare datasets for further machine learning and predictive modeling. Provide an overview of an exciting growing field of big data analytics.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand and apply key concepts of EDA and data pre-processing.
CO 2: Perform exploratory analysis using Python libraries and interpret results.
CO 3: Handle missing data, outliers, and categorical features effectively.
CO 4: Create meaningful visualizations to support data-driven insights.
CO 5: Use EDA as a foundation for data science workflows.

COURSE CONTENT

UNIT I: **(10 Periods)**

Introduction to Data Science and EDA, Importance of EDA in Data Science Life Cycle, Setting up Python Environment: Jupyter, Anaconda, VS Code, Introduction to NumPy and Pandas: Arrays, Series, DataFrames, Data loading, viewing, basic operations (info, describe, shape).

UNIT II: **(8 Periods)**

Handling Missing Data (mean, median, drop, interpolation), Dealing with Duplicates, Outliers, and Anomalies, Encoding Categorical Variables (Label, One-hot), Data Transformation: Scaling, Normalization, Binning, Data Types Conversion and Data Type Casting.

UNIT III: **(8 Periods)**

Measures of Central Tendency and Dispersion, Distribution Plots: Histograms, Boxplots, KDE, Bar Charts, Count Plots, Pie Charts, Bivariate Analysis: Scatter Plots, Pair Plots, Heatmaps, Correlation and Covariance Analysis.

UNIT IV: **(10 Periods)**

Visualization with Matplotlib and Seaborn, Customizing Plots: Titles, Legends, Labels, Themes, Advanced Visuals: Violin Plots, Strip Plots, Swarm Plots, Multivariate Visualization and Subplots, Plotly and Interactive Visualizations (basic overview).

UNIT V: **(9 Periods)**

Step-by-step EDA on Sample Datasets (Titanic, Iris, Sales, etc.), Outlier Detection Techniques, Feature Engineering Techniques in EDA, EDA Report Generation using Python Notebooks, Preparing Data for Machine Learning Models

Total Periods: 45

TEXT BOOKS:

1. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly, 2016.
2. Wes McKinney, Python for Data Analysis, O'Reilly, 2nd Edition, 2018

REFERENCES:
1. Joel Grus, Data Science from Scratch, O'Reilly, 2019.
2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow, O'Reilly, 2nd Edition, 2019.
3. Allen B. Downey, Think Stats: Probability and Statistics for Programmers, O'Reilly, 2014.

ONLINE RESOURCES:
1. https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2. https://www.coursera.org/specializations/data-science-python

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(DS23AOE702) FUNDAMENTALS OF DATA SCIENCE

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the basics of data science.
- Summarize testable predictions for real-time data.
- Understand Data Scientist's Role in the analysis Process.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Describe the significance of data science and understand the Data Science process.
- **CO 2:** Explain how data is collected, managed and stored for data science.
- **CO 3:** Build, and prepare data for use with a variety of statistical methods and models
- **CO 4:** Analyze Data using various Visualization techniques
- **CO 5:** Choose contemporary models, such as machine learning, AI, techniques to solve practical problems

COURSE CONTENT

UNIT I: (10 Periods)
Introduction to Data Science: Definition, Big Data and Data Science Hype, Datafication, Data Science Profile, Meta-Definition, Data Scientist, Statistical Inference, Populations and Samples, Populations and Samples of Big Data, Big Data Can Mean Big Assumptions, Modeling, Philosophy of Exploratory Data Analysis, The Data Science Process, A Data Scientist's Role in this Process.

UNIT II: (9 Periods)
Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA.

UNIT III: (10 Periods)
Spam Filter, Linear Regression and Spam Filter, K-NN and spam Filter, Naïve Bayes Algorithm, Spam Filter using Naïve Bayes, Laplace Smoothing, Comparing Naïve Bayes to K-NN, Scraping the Web, introduction to Logical Regression and M6D case study.

UNIT IV: (8 Periods)
Visualizing Data: Exploratory Data Analysis, Developing a Visualization Aesthetic, Chart Types, Great Visualizations.

UNIT V: (8 Periods)
Data Engineering, Map reduce, Word Frequency Problem, Map Reduce Solution, Other Examples of Map Reduce, Pregel-An Introduction.

Total Periods: 45

TEXT BOOKS:
1. Cole Nussbaumer Knaflic, A Data Visualization Guide for Business Professionals, Wiley.
2. Ben Jones, Communicating Data with Tableau, O'Reilly.

REFERENCES:

1. Steven S. Skiena, The Data Science Design Manual, Springer 2017.
2. Rachel Schutt & O'neil, "Doing Data Science", Straight Talk from The Frontline O'Reilly.

ONLINE RESOURCES:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/

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(IT23APC501) CLOUD COMPUTING

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Explain the evolving computer model called cloud computing.
- Introduce the various selves of services that can be achieved by cloud.
- Describe the security aspects in cloud.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Create cloud computing environment
CO 2: Design applications for cloud environment
CO 3: Design and develop back up strategies for cloud data based on features
CO 4: Use and examine different cloud computing services
CO 5: Learn about applications and issues in cloud

COURSE CONTENT

UNIT I: **(9 Periods)**
Basics of Cloud computing
Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications.
Cloud concept and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.
Cloud Services and Plat forms: Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

UNIT II: Hadoop and Python **(9 Periods)**
Hadoop Map Reduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.
Cloud Application Design: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.
Python Basics: Introduction, Installing Python, Python data Types & Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes

UNIT III: Python for Cloud computing **(9 Periods)**
Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for Map Reduce, Python package self-interest, Python web Application Frame work, Designing a Restful web API.
Cloud Application Development in Python: Design Approaches, Image Processing APP, Document Storage App, Map Reduce App, Social Media Analytics App.

UNIT IV: **(9 Periods)**
Big data, multimedia and Tuning Big Data Analytics: Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.
Multimedia Cloud: Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transco ding App.
Cloud Application Benchmarking and Tuning: Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hardtop benchmarking case Study.

UNIT V: (9 Periods)

Applications and Issues in Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Healthcare & Education: Cloud Computing for Health care, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.

Migrating into a Cloud: Introduction, Broad Approach est. migrating into the cloud, the seven–step model of migration into a cloud.

Organization area dines and Change Management in The Cloud Age: Introduction, Basic concepts of Organizational Readiness.

Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturate models, Organization area dines self–assessment.

Legal Issues Cloud Computing: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and data location, commercial and business considerations, Special Topics.

Total Periods: 45

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Marinetti, Cloud Computing a Hands on Approach, Universities Press, 2016.
2. Raj Kumar Buyya, James Bromberg, and razes Goscinski, Cloud Computing Principles and Paradigms, Wiley, 2016

REFERENCES:

1. Raj kumar Buyya, Christian Vecchiola, S Thamarai Selvi, Mastering Cloud Computing.
2. Arsh deep Bahga and Vijay Madi setti, Cloud computing A Hands On Approach.
3. Anthony Svelte, J.Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw Hill, 2011.

ONLINE RESOURCES:

1. Cloud computing – Course (nptel.ac.in)

IV Year B.Tech. – I Semester

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(IT23APE501) INTERNET OF THINGS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology.
- Introduce some of the application areas where IoT can be applied.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Understand general concepts of Internet of Things.
CO 2: Apply design concept to IoT solutions.
CO 3: Analyze various M2M and IoT architectures.
CO 4: Evaluate design issues in IoT applications.
CO 5: Create IoT solutions using sensors, actuators and Devices.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to IoT: Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II: (9 Periods)
Prototyping IoT Objects using Microprocessor/Microcontroller: Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III: (9 Periods)
IoT Architecture and Protocols: Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV: (9 Periods)
Device Discovery and Cloud Services for IoT: Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT V: (9 Periods)
UAV IoT: Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defence, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Total Periods: 45

TEXT BOOKS:
1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), VPT, 1st Edition, 2014.
2. K Valavanis; George J Vachtsevanos, Handbook of Unmanned Aerial Vehicles, New York, Springer, Boston, Massachusetts: Credo Reference, 2016.

REFERENCES:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, Academic Press, 1st Edition, 2014.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2014.

ONLINE RESOURCES:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/
3. https://nptel.ac.in/courses/106105166/5
4. https://nptel.ac.in/courses/108108098/4

IV Year B.Tech. – I Semester

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(EC23AOE701) FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Introduce fundamentals of Image Processing.
- Expose various relationships between pixels.
- Descript various intensity transformations in spatial domains.
- Descript various spatial and frequency domains filters.
- Dissimilate various segmentation and compression techniques for image processing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand fundamentals of digital image processing and apply engineering mathematics in processing of digital image.
CO 2: Compute the relationship between the pixels in image processing.
CO 3: Analyze different image enhancement techniques in spatial domain.
CO 4: Describe various image spatial filters and Analyze different image enhancement techniques in frequency domain.
CO 5: Analyze various techniques in image segmentation and apply various algorithms to perform image compression.

COURSE CONTENT

UNIT I: **(9 Periods)**
Fundamentals of Image Processing – I: Introduction, A simple image model, Components of image processing system, Fundamental Steps in digital image processing, image sensing and acquisition, Applications of image processing.

UNIT II: **(9 Periods)**
Fundamentals of Image Processing – II: Image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures, mathematical operations in image processing.

UNIT III: **(9 Periods)**
Image Enhancement in Spatial Domain: Introduction to gray level transformations, Point processing - Image negative, contrast stretching, intensity slicing, Bit plane slicing and grey level slicing, Histogram Processing, Histogram equalization and Specifications.

UNIT IV: **(9 Periods)**
Image Enhancement in Frequency Domain: Spatial Filtering, smoothing filters, sharpening filters, Enhancement in Frequency domain –image smoothing, image sharpening and Homomorphic filtering.

UNIT V: **(9 Periods)**
Image Segmentation and Compression: Point, Line and Edge Detection, Fundamentals of Compression, Image compression model, Types of Redundancy – Coding, Inter pixel and Psycho visual, Lossless compression – Huffman coding, Shannon-Fano coding.

Total Periods:45

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Digital Image processing using MATLAB, Tata McGraw Hill, 2010.

2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, Digital Image processing, Tata McGraw Hill.

REFERENCES:

1. Milan Sonka, Vaclav Hlavac, Roger Boule, Image Processing, Analysis, and Machine Vision, Cengage Learning, 3rd Edition, 2016.
2. William K. Pratt, Digital Image Processing, John Wiley, 3rd Edition, 2004.

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(EC23APC504) MICROPROCESSORS AND MICROCONTROLLERS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Learn the fundamental architectural concepts of microprocessors.
- Gain knowledge about assembly language programming concepts.
- Get familiar about 8086 interfacing.
- Understand the fundamentals of the 8051 Microcontroller.
- Learn interfacing with the 8051 Microcontroller.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Learn the fundamental architectural concepts of microprocessors.
CO 2: Gain knowledge about assembly language programming concepts.
CO 3: Understand the concepts of 8086 interfacing.
CO 4: Learn the fundamentals of the 8051 Microcontroller.
CO 5: Know the interfacing with the 8051 Microcontroller.

COURSE CONTENT

UNIT I: (9 Periods)
8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II: (9 Periods)
8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III: (9 Periods)
8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT IV: (9 Periods)
Microcontroller: Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V: (9 Periods)
Interfacing Microcontroller: - Programming 8051 Timers - Serial Port Programming Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors**.**

Total Periods: 45

TEXT BOOKS:

1. Douglas V Hall, SSSP Rao, Microprocessors and Interfacing – Programming and Hardware, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, McGraw Hill Education, 3rd Edition, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System

Design, Pearson, 2nd Edition, 2012.

REFERENCES:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, Penram International Publishing, 6th Edition, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, Cengage Learning, 3rd Edition, 2004.

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(EC23AOE702) TRANSDUCERS AND SENSORS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand characteristics of Instrumentation System and the operating principle of motion transducers.
- Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
- Provide knowledge on flow transducers and their applications.
- Study the working principles of pressure transducers.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand characteristics of Instrumentation System and the operating principle of motion transducers.
CO 2: Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
CO 3: Gain knowledge on flow transducers and their applications.
CO 4: Learn the working principles of pressure transducers.
CO 5: Understand the working principle and applications of force and sound transducers.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.
Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

UNIT II: (9 Periods)
Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics. Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

UNIT III: (9 Periods)
Flow Transducers: Bernoulli 's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT IV: (9 periods)
Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high- and low-pressure measurement.

UNIT V: (9 Periods)
Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Total Periods:45

TEXT BOOKS:

1. A.K. Sawhney, A Course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai & Co. 3rd Edition, Delhi, 2010.

2. Rangan C.S, Sarma G.R and Mani V S V, Instrumentation Devices and Systems, TATA McGraw Hill Publications, 2007.

REFERENCES:

1. Doebelin. E. O, Measurement Systems Application and Design, McGraw-Hill International, New York, 2004.
2. Nakra B.C and Chaudhary K.K, Instrumentation Measurement and Analysis, Tata McGraw-Hill Publication Ltd., 2nd Edition, 2006.

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(EE23AOE701) ELECTRIC VEHICLES

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Understand the fundamentals, components, and environmental aspects of electric vehicle systems.
- Learn the propulsion system configurations and motor selection for electric vehicles.
- Study the operation and characteristics of fuel cells and hybrid electric systems.
- Explore battery charging methods and control strategies for electric vehicles.
- Understand various energy storage technologies and their integration in power systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Explain the configuration, parameters, and environmental impact of electric vehicle systems.
CO 2: Analyze propulsion architectures and motor choices used in electric vehicle applications.
CO 3: Evaluate fuel cell models, characteristics, and hybrid system configurations in EVs.
CO 4: Design control strategies for battery charging and electric vehicle performance optimization.
CO 5: Assess energy storage technologies and their application in smart grid and EV integration.

COURSE CONTENT

UNIT I: (10 Periods)
Introduction to EV Systems and Energy Sources: Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT II: (9 Periods)
EV Propulsion and Dynamics: Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi- motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT III: (8 Periods)
Fuel Cells: Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

UNIT IV: (9 Periods)
Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction.
Control: Introduction- Modelling of electro mechanical system- Feedback controller design approach- PI controller‘s designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

UNIT V: (9 Periods)
Energy Storage Technologies: Role of Energy Storage Systems**-** Thermal- Mechanical-

Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super Capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SOH -fuel cells - G2V-V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems.

Total Periods: 45

TEXT BOOKS:

1. C.C Chan, K.T Chau, Modern Electric Vehicle Technology, Oxford University Press Inc., New York, 1st Edition, 2001
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 1st Edition, 2017.

REFERENCES:

1. Iqbal Husain, Electric and Hybrid Vehicles Design Fundamentals, CRC Press, 3rd Edition, 2021.
2. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt, Energy Storage in Power Systems, Wiley Publication, ISBN: 978-1-118-97130-7, 1st Edition, 2016.
3. A.G.Ter-Gazarian, Energy Storage for Power Systems, The Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), 2nd Edition, 2011.
4. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Elelctric, Hybrid Elelctric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 1st Edition, 2004.
5. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2nd Edition, 2003.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/syllabus/108103009

IV Year B.Tech. – I Semester

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(EE23AOE702) ENERGY AUDIT, CONSERVATION AND MANAGEMENT

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the principles and procedures of energy auditing and management in various sectors.
- Learn the fundamentals of energy conservation and the current global and national energy scenarios.
- Study energy-efficient motor and lighting systems and their audit procedures.
- Explore energy measuring instruments and perform economic analysis of energy systems.
- Understand demand-side management techniques and promote energy conservation awareness.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Describe energy audit methods, tools, and management practices used in industries and buildings.
- **CO 2:** Explain energy conservation principles and assess the energy scenario in India and globally.
- **CO 3:** Analyze energy-efficient motors and lighting systems and conduct related audits.
- **CO 4:** Use energy instruments and apply economic analysis methods for energy-saving investments.
- **CO 5:** Apply DSM techniques and organize energy conservation awareness programs.

COURSE CONTENT

UNIT I: (10 Periods)
Energy Audit and Management Principles: Energy audit — definitions, concept, types of audit, energy index-cost index, pie charts, Sankey diagrams, load profiles, energy audit in industries, energy saving potential, energy audit of process industry, thermal power station, building energy audit, case study. IE rules and regulations for energy audit.
Energy management — Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting.

UNIT II: (8 Periods)
Energy Conservation Principles: Energy scenario in India and world. Rules for efficient energy conservation; technologies for energy conservation. Principles of energy conservation, current energy consumption in India, roles and responsibilities of energy managers in industries.

UNIT III: (9 Periods)
Energy Efficient Motors and Lighting: Energy efficient motors - factors affecting efficiency, loss distribution, constructional details, characteristics, variable speed, variable duty cycle systems, motor energy audit. Lighting -Good lighting system design and practice, lighting control, lighting energy audit.

UNIT IV: (9 Periods)
Energy Instruments and Economic Analysis: Energy Instruments— Infrared thermometer, data loggers, thermo-couples, pyrometers, Lux meters, tongue testers, power quality analyzer, and PLC applications.
Energy Economic Analysis— The time value of money concept. Cash flow models, payback analysis, depreciation, taxes and tax credit - numerical problems.

UNIT V: (9 Periods)

Demand Side Management: Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, and time of day models for planning, load management, load priority technique. Management and organization of energy conservation awareness programs.

Total Periods: 45

TEXT BOOKS:

1. W.R. Murphy, G. Mckay, Energy Management, Butter worth- Heinemann Publications, 2nd Edition, 2016.
2. Albert Thumann, William J. Younger, Handbook of Energy Audits, Taylor & Francis Ltd, 7th Edition, 2008.

REFERENCES:

1. Umesh Rathore, Energy management, S.K. Kataria & Sons, 2nd Edition, 2014.
2. W.C.Turner, Stevedoty, Energy Management Hand Book, CRC press, 6th Edition, 2006.
3. D.P. Sen, K.R. Padiyar, Indrane Sen, M.A. Pai, Recent Advances in Control and Management of Energy Systems, Interline Publisher, Bangalore, 1993.
4. Ashok V. Desai, Wiley Eastern, Energy Demand - Analysis, Management and Conservation Hand Book on Energy Auditing - TERI (Tata Energy Research Institute), 2005.
5. Craig B. Smith, Kelly E. Parmenter, Energy Management Principles Applications, Benefits, Savings, Elsevier Inc (Pergamon Press), 1st Edition, 2016.

ONLINE RESOURCES:

1. https://beeindia.gov.in/sites/default/files/1Ch3.pdf
2. https://www.youtube.com/watch?v=M1zijCmeXJg
3. https://www.youtube.com/watch?v=FTpMWXMBSyM
4. https://www.youtube.com/watch?v=_T1Au_P5bnQ
5. https://www.youtube.com/watch?v=ENLzwTVjxms
6. https://www.youtube.com/watch?v=7hDyLuFJ0c8
7. https://www.youtube.com/watch?v=lkNIuFkzxBk

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(EE23AOE703) SMART GRID TECHNOLOGIES

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the concept, structure, and evolution of smart grids.
- Analyze wide area monitoring systems and synchrophasor technology.
- Apply smart metering and advanced metering infrastructure (AMI) concepts.
- Evaluate information and communication technology (ICT) systems in smart grids.
- Design smart grid applications with a focus on cyber security measures.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Explain the evolution, architecture, and enabling technologies of Smart Grid and assess its implementation in India and globally.
CO 2: Analyze the structure, functions, and applications of synchrophasor technology and Wide Area Monitoring Systems using PMUs and PDCs.
CO 3: Describe the functions, specifications, and benefits of smart meters and evaluate their role in demand-side management and AMI.
CO 4: Compare various communication technologies and protocols used in Smart Grid systems.
CO 5: Evaluate Smart Grid applications including renewable integration, energy storage systems, electric vehicles, and cyber security challenges.

COURSE CONTENT

UNIT I: (10 Periods)
Introduction to Smart Grid: Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

UNIT II: (9 Periods)
Wide Area Monitoring System: Fundamentals of Synchro Phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT III: (8 Periods)
Smart Meters: Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT IV: (9 Periods)
Information and Communication Technology: Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid

UNIT V: (9 Periods)
Smart Grid Applications and Cyber Security: Applications : Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug– in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems

– Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

Total Periods: 45

TEXT BOOKS:

1. James Momoh, SMART GRID: Fundamentals of Design and Analysis, John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Smart Grid: Technology and Applications, John Wiley & Sons, New Jersey, 2012.

REFERENCES:

1. Power Grid Corporation of India Limited, Smart Grid Primer, Power Grid Corporation of India Limited, Bangalore, India, 1st Edition, 2013.
2. Fereidoon. P.Sioshansi, Smart Grid – Integrating Renewable, Distributed and Efficient Energy, Academic Press, USA, 1st Edition, 2011.
3. Stuart Borlase, Smart Grids: Infrastructure, Technology and Solutions, CRC Press Publication, England, 1st Edition, 2013.
4. Phadke A G, Thorp J S, Synchronized Phasor Measurements and Their Applications, Springer, Newyork, 1st Edition, 2012.

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(ME23AOE701) 3D PRINTING TECHNOLOGIES

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Know the importance of 3D printing in Manufacturing
- Know the different 3D Printing Technologies
- Select a suitable material for 3D Printing
- Observe the different methods for Post-processing of 3D Printing parts
- Understand the applications of 3D Printing in Automobile, Aerospace, Bio-medical etc.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Explain the importance of 3D printing in modern manufacturing and its advantages over traditional methods.
CO 2: Compare different 3D printing technologies based on process type, resolution, material compatibility, and end-use.
CO 3: Select suitable materials for 3D printing applications considering mechanical, thermal, and chemical properties.
CO 4: Demonstrate various post-processing methods for improving surface finish, strength, and functionality of 3D printed parts
CO 5: Evaluate the applications of 3D printing in various sectors and its impact on product design and manufacturing.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction and Basic Principles: 3D Printing, Generic 3D Printing Process, Benefits of 3D Printing, Distinction Between 3D Printing and CNC Machining, Other Related Technologies Development of 3D Printing Technology: Introduction, Computers, Computer-Aided Design Technology, Other Associated Technologies, The Use of Layers, Classification of 3D Printing Processes, Metal Systems, Hybrid Systems, Milestones in 3D Printing Development, 3D Printing around the World

UNIT II: (9 Periods)
3D Printing Process Chain & Photopolymerization Processes: Eight Steps in Additive Manufacture, Variations from One 3D Printing Machine to Another, Metal Systems, Maintenance of Equipment, Materials Handling Issues, Design for 3D PRINTING. Introduction to Photopolymerization Processes: Photopolymerization Materials, Reaction Rates, Vector Scan SL, SL Resin Curing Process, SL Scan Patterns, Vector Scan Micro stereolithography, Mask Projection Photopolymerization Technologies and Processes, Two-Photon SL.

UNIT III: (9 Periods)
Powder Bed Fusion Processes & Extrusion-Based Systems: Powder Bed Fusion Processes: Introduction, SLS Process Description, Powder Handling, Approaches to Metal and Ceric Part Creation, Variants of Powder Bed Fusion Processes, Applied Energy Correlations and Scan Patterns, Typical Materials and Applications, Materials - Capabilities and Limitations. Extrusion-Based Systems: Introduction, Basic Principles, Plotting and Path Control, Materials, Limitations of FDM, Bio-extrusion, Other Systems.

UNIT IV: (9 Periods)
Design, Guidelines for Process Selection & Software Issues: Design for 3D Printing - Design for Manufacturing and Assembly, Core DFM for 3D Printing Concepts and Objectives, 3D Printing Unique Capabilities, Exploring Design Freedoms, Design Tools for 3D Printing. Guidelines for Process Selection - Selection Methods for a Part, Challenges of Selection,

Preliminary Selection, Production Planning and Control. Software Issues for 3D Printing - Preparation of CAD Models – the STL File, Problems with STL Files, STL File Manipulation, Beyond the STL File, Additional Software to Assist 3D Printing

UNIT V: (9 Periods)

Medical Applications & Future Directions for 3D Printing: Medical Applications for 3D Printing - Use of 3D Printing to Support Medical Applications, Software Support for Medical Applications, Limitations of 3D Printing for Medical Applications, Further Development of Medical 3D Printing Applications. Use of Multiple Materials in 3D Printing - Discrete Multiple Material Processes, Porous Multiple Material Processes, Blended Multiple Material Processes, Embedded Component 3D Printing, Commercial Applications Using Multiple Materials, Future Directions, Business Opportunities and Future Directions.

Total Periods: 45

TEXT BOOKS:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.
2. Chua Chee Kai, Leong Kah Fai, Rapid Prototyping: Principles & Applications, World Scientific, 2003.

REFERENCES:

1. Ali K. Kamrani, Emand Abouel Nasr, Rapid Prototyping: Theory & Practice, Springer, 2006.
2. D. T. Pham, S. S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer, 2001.

ONLINE RESOURCES:

1. Fundamentals of Additive Manufacturing Technologies – IIT Guwahati http://nptel.ac.in/courses/112103306
2. 3D Printing and Additive Manufacturing Specialization, Coursera https://www.coursera.org/specializations/3d-printing-additive-manufacturing
3. https://www.youtube.com/watch?v=ICjQ0UzE2Ao

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(ME23APE706) AUTOMATION AND ROBOTICS

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce the fundamentals of industrial automation, its types, components, and strategies across manufacturing systems.
- Explain the working of automated flow lines and the methods used in assembly line balancing and flexible automation.
- Impart knowledge about industrial robots, their configurations, anatomy, and applications in manufacturing processes.
- Develop an understanding of manipulator kinematics, homogeneous transformations, actuators, and sensors used in robotics.
- Analyze manipulator dynamics and apply trajectory planning techniques for robotic motion and obstacle avoidance.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Explain the need, types, and elements of automation systems and analyze different levels of automation strategies in industry.

CO 2: Demonstrate the operation of automated flow lines and apply methods for assembly line balancing and optimization.

CO 3: Identify robotic components and describe their configuration, degrees of freedom, and industrial applications in various processes.

CO 4: Apply transformation techniques and Denavit–Hartenberg (D-H) notation to solve problems in robot kinematics and evaluate actuator and sensor selection.

CO 5: Analyze robot dynamics using Jacobians and Euler formulations and develop suitable trajectories for obstacle-free motion.

COURSE CONTENT

UNIT I: (9 Periods)

Introduction to Automation: Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT II: (9 Periods)

Automated flow lines: Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.

Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT III: (9 Periods)

Introduction to Industrial Robotics: Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – velocity sensors, Tactile sensors, Proximity sensors.

UNIT IV: (9 Periods)

Manipulator Kinematics: Manipulator Kinematics, Homogeneous transformations as applicable to rotation and translation – D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange–Euler and

Newton–Euler formations.
Trajectory Planning: Trajectory Planning and avoidance of obstacles, path planning, skew motion, joint integrated motion, straight line motion.

UNIT V: (9 Periods)
Robot Programming: Robot Programming, Methods of programming – requirements and features of programming languages, software packages. Problems with programming languages.
Robot Application in Manufacturing: Material Transfer – Material handling, loading and unloading – Process – spot and continuous arc welding & spray painting – Assembly and Inspection.

Total Periods: 45

TEXT BOOKS:

1. M. P. Groover, Automation, Production Systems and Computer-Integrated Manufacturing, Pearson Education, 4th Edition, 2016.
2. M. P. Groover, Industrial Robotics, Tata McGraw Hill, 1996.

REFERENCES:

1. K. S. Fu, Robotics, 4th Edition, McGraw Hill, 2010.
2. P. Coiffet and M. Chaironze, An Introduction to Robot Technology, Kogan Page Ltd., London, 1983.
3. Richard D. Klafter, Robotic Engineering, Prentice Hall.
4. Ashitava Ghosal, Robotics: Fundamental Concepts and Analysis, Oxford University Press, 1st Edition, 2006.
5. R. K. Mittal and I. J. Nagrath, Robotics and Control, Tata McGraw Hill.

ONLINE RESOURCES:

1. Introduction To Robotics, NPTEL, IIT Madras. https://nptel.ac.in/courses/107106090
2. Robotics, NPTEL, IIT Bombay. https://nptel.ac.in/courses/112101098

IV Year B.Tech. – I Semester

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(ME23APE710) TOTAL QUALITY MANAGEMENT

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Familiarize the basic concepts of Total Quality Management.
- Describe and interpret the principles of Deming's philosophy and other quality approaches.
- Gain Knowledge on quality control and its applications to real time.
- Understand the extent of customer satisfaction by the application of various quality concepts.
- Demonstrate the importance of Quality standards in Production

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Define and develop on quality Management philosophies and analyze quality costs frameworks.
CO 2: Understanding of the historical development of Total Quality Management (TQM), implementation, and real-world applications through case studies.
CO 3: Evaluate the cost of poor quality, process effectiveness and efficiency to analyze areas for improvement.
CO 4: Apply benchmarking and business process reengineering to improve management processes.
CO 5: Demonstrate the set of indications to evaluate performance excellence of an organization

COURSE CONTENT

UNIT I: **(8 Periods)**
Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT II: **(9 Periods)**
Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT III: **(10 Periods)**
TQM Principles: Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures Basic Concepts, Strategy, Performance Measure Case studies.

UNIT IV: **(10 Periods)**
TQM Tools: Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT V: **(8 Periods)**
Quality Systems: Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS

9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Total Periods: 45

TEXT BOOKS:

1. Dale H. Besterfield, Total Quality Management, Pearson Education, 4th Edition, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata McGraw-Hill Publishing Company Ltd., 2005.
3. Joel E. Ross, Total Quality Management, CRC Press, 3rd Edition, 2017.

REFERENCES:

1. Narayana V. and Sreenivasan N. S., Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L. Flood, Beyond TQM, John Wiley & Sons Ltd., 1st Edition, 1993.
3. Richard S. Leavenworth and Eugene Lodewick Grant, Statistical Quality Control, Tata McGraw-Hill, 7th Edition, 2015.
4. Samuel Ho, TQM – An Integrated Approach, Kogan Page Ltd., USA, 1995.

ONLINE RESOURCES:

1. Total Quality Management - I, NPTEL, IIT Kanpur. https://nptel.ac.in/courses/110104080
2. Total Quality Management - II, NPTEL, IIT Kanpur. https://nptel.ac.in/courses/110104085

IV Year B.Tech. – I Semester

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(BA23AOE701) BUSINESS DEVELOPMENT

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Provide an understanding of the role of business development in startups, SMEs, and large corporations.
- Teach strategies for identifying and pursuing growth opportunities.
- Equip students with skills in market research, lead generation, and partnership building.
- Develop an understanding of sales cycles, client management, and negotiation.
- Introduce digital tools and platforms used in business development.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Explain the principles, scope, and objectives of business development.
CO 2: Identify and evaluate new business opportunities using structured research.
CO 3: Develop effective sales strategies and communication approaches.
CO 4: Apply techniques for client acquisition, relationship building, and strategic alliances.
CO 5: Use CRM and digital tools for lead tracking, data analysis, and business growth

COURSE CONTENT

UNIT I: **(9 Periods)**

Fundamentals of Business Development: Definition, scope, and goals of business development, Difference between business development, marketing, and sales, Business growth models: organic and inorganic-Roles and skills of a business development professional.

UNIT II: **(9 Periods)**

Market Research and Opportunity Analysis: Market segmentation, targeting, and positioning, Competitor analysis and SWOT, Customer profiling and need identification, Identifying growth opportunities in new and existing markets.

UNIT III: **(7 Periods)**

Lead Generation and Sales Strategies: Lead generation: online and offline methods, Cold calling, referrals, email campaigns, and networking, B2B and B2C sales approaches, Building and managing a sales pipeline.

UNIT IV: **(10 Periods)**

Client Relationship & Partnership Management: Customer relationship management (CRM) fundamentals, Client on boarding and lifecycle management, Strategic partnerships and alliances, Negotiation techniques and conflict resolution.

UNIT V: **(10 Periods)**

Digital Tools & Tech for Business Development: Overview of CRM tools: HubSpot, Zoho, Sales force, LinkedIn and social selling, Sales analytics, dashboards, KPIs, Business development metrics and reporting.

Total Periods: 45

TEXT BOOKS:

1. Andreas Ramos, Business Development for Dummies, Wiley, 1st Edition, 2014.
2. Michael W. Johnson, Sales and Business Development, Routledge, 1st Edition, 2017.

REFERENCES:

1. Neil Rackham, SPIN Selling.
2. Sean Ellis & Morgan Brown, Hacking Growth.
3. LinkedIn Learning: Business Development & Sales Strategy Courses.
4. Hub Spot Academy (Free CRM and Sales Certifications).

ONLINE RESOURCES:

1. https://hbr.org
2. https://www.coursera.org/courses?query=business%20development

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(BA23AOE702) TECHNO MARKETING

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Introduce the concepts and strategies of marketing in the digital and technology-driven era.
- Equip students with the skills to analyze and apply technology in marketing functions such as promotion, sales, and customer engagement.
- Familiarize students with tools like digital platforms, social media, data analytics, and CRM systems.
- Explore how product innovation, e-commerce, and technology influence consumer behavior.
- Promote interdisciplinary thinking combining engineering knowledge with marketing insights.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the fundamentals of techno-marketing and its impact on modern business.
CO 2: Apply technology-driven strategies in digital marketing and sales.
CO 3: Use analytical tools and CRM platforms for marketing decision-making.
CO 4: Analyze consumer behavior using tech-based data insights.
CO 5: Design marketing campaigns integrating engineering innovations with business needs.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Techno-Marketing: Definition and evolution of techno-marketing, Role of technology in marketing decision-making, Components of marketing mix with a tech perspective, B2B vs. B2C techno-marketing, Case studies on successful tech-based marketing.

UNIT II: **(7 Periods)**
Digital & Social Media Marketing: Digital marketing channels: SEO, SEM, Email, Mobile-Social media platforms and strategies, Content marketing and influencer marketing, Website and app-based marketing tools, Introduction to performance marketing.

UNIT III: **(9 Periods)**
E-Commerce & Technology Applications: E-commerce models and platforms, Marketing automation tools - AI, AR/VR, and chatbot applications in marketing, IoT and product personalization, Use of QR codes and virtual stores.

UNIT IV: **(10 Periods)**
Marketing Analytics & CRM: Role of data analytics in marketing, Customer segmentation and targeting using data, Key Performance Indicators (KPIs) and dashboards, CRM systems: Sales force, Zoho, Hub Spot basics, Predictive marketing and A/B testing.

UNIT V: **(10 Periods)**
Consumer Behavior in the Tech Era: Understanding tech-savvy consumers, Buyer decision process in digital contexts, Ethics and data privacy in tech marketing, Cross-cultural marketing in global tech platforms, Trends: Green marketing, mobile-first consumers, phygital experiences.

Total Periods: 45

TEXT BOOKS:

1. Philip Kotler, Gary Armstrong, Principles of Marketing, Pearson Education, 18th Edition, 2020.
2. V. Rajesh, The Phenomenal Rise of E-Commerce in India: Techno Marketing Strategies, SAGE Publications, 1st Edition, 2016.

REFERENCES:

1. Philip Kotler, Marketing 5.0: Technology for Humanity.
2. Seema Gupta, Digital Marketing.
3. Google Digital Garage & HubSpot Academy (Free Online Resources).
4. Boone & Kurtz, Contemporary Marketing.

ONLINE RESOURCES:

1. https://academy.hubspot.com/courses/digital-marketing
2. https://www.coursera.org/specializations/digital-marketing

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(EG23AOE701) EMPLOYABILITY SKILLS

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Encourage all round development of the students by focusing on productive skills.
- Make the students aware of Goal setting and writing skills.
- Enable them to know the importance of presentation skills in achieving desired goals.
- Help them develop organizational skills through group activities.
- Function effectively with heterogeneous teams.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Understand the importance of goals and try to achieve them.
CO 2: Apply the knowledge of writing skills in preparing eye-catchy resumes.
CO 3: Analyze various forms of Presentation skills.
CO 4: Judge the group behavior appropriately.
CO 5: Develop skills required for employability.

COURSE CONTENT

UNIT I: **(9 Periods)**

Goal Setting and Self-Management: Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis.

UNIT II: **(9 Periods)**

Writing Skills: Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose).

UNIT III: **(9 Periods)**

Technical Presentation Skills: Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics – Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation.

UNIT IV: **(9 Periods)**

Group Presentation Skills: Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette.

UNIT V: **(9 Periods)**

Job Cracking Skills: Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews.

Total Periods: 45

TEXT BOOKS:

1. Sabina Pillai, Agna Fernandez. Soft Skills & Employability Skills, Cambridge Publisher, 2014.
2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.

REFERENCES:

1. Gangadhar Joshi. Campus to Corporate Paperback, Sage Publications. 2015.
2. Sherfield Montogomery Moody, Cornerstone, Developing Soft Skills, Pearson Publications. 4th Edition, 2008.

3. Shikha Kapoor. Personality Development and Soft Skills - Preparing for Tomorrow, Wiley, 1st Edition, 2017.
4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, The Basics for Communication Skills a Relational Perspective, Sage Press, 2012.

ONLINE RESOURCES:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

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(EG23AOE702) LIFE SKILLS

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Develop one's personality by being aware of the self.
- Make the students aware of critical thinking and problem-solving skills.
- Acquaint students with the social and inter-personal skills that will enable them to
- cope with the constantly changing environment.
- Enhance the employability and maximize the potential of the students.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Define and Identify different life skills required in personal and professional life.
CO 2: Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.
CO 3: Explain the basic mechanics of effective communication and demonstrate these through presentations.
CO 4: Take part in group discussions.
CO 5: Understand the basics of teamwork and leadership.

COURSE CONTENT

UNIT I: **(9 Periods)**

Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self awareness, Empathy, Critical thinking, Creative thinking, Quantum thinking Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Activity: Role Play/What if scenario.

UNIT II: **(9 Periods)**

Intrapersonal Communication: definition, need for self-awareness; Coping with Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback.

Emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques. Morals, Values and

Ethics: Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Co operation, Commitment, Empathy, Self- Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.

Activity: Moral story narration.

UNIT III: **(9 Periods)**

21st Century Skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Activity: Case Study.

UNIT IV: **(9 Periods)**

Group and Team Dynamics: Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams. Managing team performance and managing conflicts, Entrepreneurship.

Activity: Debate/Mock Assembly.

UNIT V: **(9 Periods)**

Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs. Transformational Leaders, Leadership Grid, Effective Leaders.
Activity: Group Discussion/Step into others' shoe.

Total Periods: 45

TEXT BOOKS:

1. Remesh S., Vishnu R.G., Life Skills for Engineers, Ridhima Publications, 1st Edition, 2016.
2. Larry James, The First Book of Life Skills, Embassy Books, 1st Edition, 2016.

REFERENCES:

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra, Personality Development & Soft Skills, Oxford Publishers, 3rd Impression, 2017.
3. Ramesh.s, Vishnu R.G., Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016.
4. Caruso, D. R. and Salovey P, The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership, John Wiley & Sons, 2004.
5. Kalyana, Soft Skill for Managers, Wiley Publishing Ltd, 1st Edition, 2015.
6. Shalini Verma, Development of Life Skills and Professional Practice, Sultan Chand (G/L) & Company, 1st Edition, 2014.
7. Daniel Goleman, Emotional Intelligence, Bantam, 2006.
8. Butterfield Jeff, Soft Skills for Everyone, Cengage Learning India Pvt Ltd, 1st Edition, 2011.
9. Stephen P. Robbins, Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6th Edition, 2015.
10. Gopala Swamy Ramesh, Mahadevan Ramesh, The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education, 1st Edition, 2013.

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(EG23AOE703) LITERARY VIBES

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Inculcate passion for aesthetic sense and reading skills.
- Encourage respecting others experiences and creative writing.
- Explore emotions, communication skills and critical thinking.
- Educate how books serve as the reflection of history and society.
- Provide practical wisdom and duty of responding to events of the times.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Identify genres, literary techniques and creative uses of language in literary texts.
CO 2: Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces.
CO 3: Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments.
CO 4: Analyze the underlying meanings of the text by using the elements of literary texts.
CO 5: Evaluate their own work and that of others critically.

COURSE CONTENT

UNIT I: **(7 Periods)**
Poetry:
8. Ulysses- Alfred Lord Tennyson
9. Ain't I woman?-Sojourner Truth
2. The Second Coming-W.B. Yeats
3. Where the Mind is Without Fear - Rabindranath Tagore

UNIT II: **(7 Periods)**
Drama: Twelfth Night- William Shakespeare:
1. Shakespeare -life and works
2. Plot & sub-plot and Historical background of the play
3. Themes and Criticism
4. Style and literary elements
4. Characters and characterization

UNIT III: **(10 Periods)**
Essay and Short Story:
1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT IV: **(10 Periods)**
Prose: Essay and Autobiography:
1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingston
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

UNIT V: **(11 Periods)**
Novel: Hard Times- Charles Dickens:
1. Charles Dickens-Life and works
2. Plot and Historical background of the novel

3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

Total Periods: 45

TEXT BOOKS:

1. Charles Dickens, Hard Times, (Sangam Abridged Texts) Vantage Press, 1983.
2. DENT JC. William Shakespeare. Twelfth Night. Oxford University Press, 2016.

REFERENCES:

1. WJ Long. History of English Literature, Rupa Publications India, 1st Edition.
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press, 2018.
3. Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4. Mohit Bhattacharya, New Horizon, Pearson publications, New Delhi, 2014
5. Vimala Ramarao, Explorations Volume-II, Prasaranga Bangalore University, 2014.
6. Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual. Pearson India, 2008.

ONLINE RESOURCES:

1. https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
2. https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
3. https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-
4. https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
5. https://www.litcharts.com/lit/twelfth-night/themes
6. https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

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(MA23AOE701) FINANCIAL MATHEMATICS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Provide mathematical foundations for financial modelling, risk assessment and asset pricing.
- Introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
- Develop analytical skills for fixed-income securities, credit risk, and investment strategies.
- Equip students with computational techniques for pricing financial derivatives.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Explain fundamental financial concepts, including arbitrage, valuation, and risk.
CO 2: Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.
CO 3: Analyze mathematical techniques for pricing options and financial derivatives.
CO 4: Evaluate interest rate models and bond pricing methodologies.
CO 5: Utilize computational techniques such as Monte Carlo simulations for financial modeling.

COURSE CONTENT

UNIT I: **(9 Periods)**
Asset Pricing and Risk Management Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT II: **(10 Periods)**
Stochastic Models in Finance: Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito‘s Lemma, Ito Integral, and Ito Isometry.

UNIT III: **(8 Periods)**
Interest Rate and Credit Modelling: Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT IV: **(9 Periods)**
Fixed-Income Securities and Bond Pricing: Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT V: **(9 Periods)**
Exotic Options and Computational Finance: Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Lookbacks. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Total Periods: 45

TEXT BOOKS:

1. Ales Cerny, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press.
2. S.R. Pliska, Introduction to Mathematical Finance: Discrete-Time Models, Cambridge University Press.

REFERENCES:

1. Ioannis Karatzas& Steven E. Shreve, Methods of Mathematical Finance, Springer, New York.
2. John C. Hull, Options, Futures, and Other Derivatives, Pearson.

ONLINE RESOURCES:

1. MIT– Mathematics for Machine Learning https://ocw.mit.edu
2. Coursera – Financial Engineering and Risk Management (Columbia University) https://www.coursera.org/
3. National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

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(MA23AOE702) WAVELET TRANSFORMS: THEORY AND APPLICATIONS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:

- Understand the basic principles and mathematical foundations of wavelets, including scaling functions and mother wavelets.
- Analyze the limitations of Fourier transforms and how wavelet transforms overcome them, especially in non-stationary signal analysis.
- Apply wavelets in signal processing, image compression, denouncing, and other engineering and scientific applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms.
CO 2: Illustrate the multi resolution analysis ad scaling functions.
CO 3: Implement discrete wavelet transforms with multi-rate digital filters.
CO 4: Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.
CO 5: Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields.

COURSE CONTENT

UNIT I: **(9 Periods)**
Wavelets: Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets - effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

UNIT II: **(8 Periods)**
A Multiresolution Formulation of Wavelet Systems: Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT III: **(10 Periods)**
Filter Banks and the Discrete Wavelet Transform: Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - Different Points of View.

UNIT IV: **(9 Periods)**
Time-Frequency and Complexity: Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT V: **(9 Periods)**
Bases and Matrix Examples: Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

Total Periods: 45

TEXT BOOKS:

1. C. Sidney Burrus, Ramesh A. Gopinath, ―Introduction to Wavelets and Wavelets Transforms‖, Prentice Hall, (1997).
2. James S. Walker, ―A Primer on Wavelets and their Scientific Applications‖, CRC Press, (1999).

REFERENCES:

1. Raghuveer Rao ―Wavelet Transforms‖, Pearson Education, Asia.
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

ONLINE RESOURCES:

1. http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html
2. http://www.wavelet.org/
3. http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm
4. https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-of-waveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf

IV Year B.Tech. – I Semester

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(PH23AOE701) INTRODUCTION TO QUANTUM MECHANICS

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Understand the fundamental differences between classical and quantum mechanics.
- Study wave-particle duality, uncertainty principle, and their implications.
- Learn and apply Schrödinger equations to basic quantum systems.
- Use operator formalism and mathematical tools in quantum mechanics.
- Explore angular momentum, spin and their quantum mechanical representations.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Explain the key principles of quantum mechanics and wave-particle duality.
CO 2: Apply Schrödinger equations to solve one-dimensional quantum problems.
CO 3: Solve quantum mechanical problems using operator and matrix methods.
CO 4: Evaluate quantum states using Dirac notation and expectation values.
CO 5: Analyze angular momentum and spin systems using Pauli matrices and operators.

COURSE CONTENT

UNIT I: **(9 Periods)**

Principles of Quantum Mechanics: Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation. Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle. Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT II: **(9 Periods)**

One Dimensional Problems and Solutions: Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT III: **(9 Periods)**

Operator Formalism: Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT IV: **(9 Periods)**

Fundamental Tools in Quantum Mechanics: The concept of row and column matrices, Matrix algebra, Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT V: **(9 Periods)**

Angular Momentum and Spin: Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half (1/2), Spin angular momentum, Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

Total Periods: 45

TEXT BOOKS:

1. P. M. Mathews, K. Venkatesan, A Text Book of Quantum Mechanics, Tata McGraw Hill, New Delhi, 1976.
2. S. L. Gupta, V. Kumar, H. V. Sharma, R. C. Sharma, Quantum Mechanics, Jai Prakash Nath and Company, Meerut, 1996.

REFERENCES:

1. L.I. Schiff, Quantum Mechanics, McGraw Hill Book Co., Tokyo, 1968.
2. Richard L. Liboff, Introduction to Quantum Mechanics, Pearson Education Ltd, 4th Edition, 2003.
3. A. Messaia Noth, Quantum Mechanics. Volume 1, Holland Publishing Company, Amsterdam, 1961.
4. R. H. Dicke and J. P. Witke, Introduction to Quantum Mechanics. Addison-Wisley Pub. Co. Inc., London, 1960.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/115/101/115101107/
2. https://archive.nptel.ac.in/courses/122/106/122106034/
3. https://nptel.ac.in/courses/115106066

IV Year B.Tech. – I Semester

L	T	P	C
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(PH23AOE702) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Provide exposure to various kinds of sensors and actuators and their engineering applications.
- Impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators.
- Explain the operating principles of various sensors and actuators.
- Educate the fabrication of sensors.
- Explain the required sensor and actuator for interdisciplinary application.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Classify different types of Sensors and Actuators along with their characteristics.
CO 2: Summarize various types of Temperature and Mechanical sensors.
CO 3: Illustrates various types of optical and mechanical sensors.
CO 4: Analyze various types of Optical and Acoustic sensors.
CO 5: Interpret the importance of smart materials in various devices.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to Sensors and Actuators: Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.
Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT II: (9 Periods)
Temperature and Mechanical Sensors: Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors
Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT III: (9 Periods)
Optical and Acoustic Sensors: Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles
Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

UNIT IV: (9 Periods)
Magnetic and Electromagnetic Sensors: Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT V: (9 Periods)
Chemical and Radiation Sensors: Chemical Sensors: Principle and working of Electro-

chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Total Periods: 45

TEXT BOOKS:

1. Clarence W. de Silva, Sensors and Actuators, CRC Press, 2nd Edition, 2015.
2. D. A. Hall and C. E. Millar, Sensors and Actuators, CRC Press, 1999.

REFERENCES:

1. D. Patranabhis, Sensors and Transducers, Prentice Hall of India Pvt. Ltd., 2003.
2. John G. Webster, Measurement, Instrumentation, And Sensors Handbook, CRC press, 1999.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ee32/preview

IV Year B.Tech. – I Semester

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(PH23AOE703) SMART MATERIALS AND DEVICES

(Open Elective-III and IV)

COURSE OBJECTIVES:

The objectives of this course are to:

- Provide exposure to smart materials and their engineering applications.
- Impart knowledge on the basics and phenomenon behind the working of smart materials.
- Explain the properties exhibited by smart materials.
- Educate various techniques used to synthesize and characterize smart materials.
- Identify the required smart material for distinct applications/devices.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.

CO 2: Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.

CO 3: Summarize various types of synthesis of smart materials.

CO 4: Analyze various characterization techniques used for smart materials.

CO 5: Interpret the importance of smart materials in various devices.

COURSE CONTENT

UNIT I: **(9 Periods)**

Introduction to smart nanomaterials: Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT II: **(9 Periods)**

Properties of Smart Materials: Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III: **(9 Periods)**

Synthesis of Smart Materials: Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV: **(9 Periods)**

Characterization Techniques (Qualitative treatment): Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT V: **(9 Periods)**

Device Technology & Applications: Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Total Periods: 45

TEXT BOOKS:

1. Yaser Dahman, Nanotechnology and Functional Materials for Engineers, Elsevier, 2017.
2. E. Zschech, C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer, Verlag London Limited, 2005.

REFERENCES:

1. P. Gauenzi, Smart Structures, Wiley, 2009.
2. Mahmood Aliofkhazraei, Handbook Of functional nanomaterials, Volume (1&2), Nova Publishers, 2014.
3. Chaudhery Mustansar Hussain, Paolo Di Sia, Handbook of Smart Materials, Technologies, And Devices: Applications of Industry 4.0, Springer, 2022.
4. Mohsen Shahinpoor, Fundamentals of Smart Materials, Royal Society of Chemistry, 2020.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_me17/preview

IV Year B.Tech. – I Semester

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(CH23AOE701) BIOLOGY FOR ENGINEERS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Provide basic understanding about life and life Process. Animal and plant systems.
- Understand what biomolecules, are, their structures are functions. Application of certain biomolecules in Industry. Brief introduction about human physiology and bioengineering.
- Understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
- How biology Principles can be applied in our daily life using different technologies. Brief introduction to the production of transgenic microbes, Plants and animals.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.
CO 2: Explain about biomolecules, their structure and function and their role in the living organisms. How biomolecules are useful in Industry.
CO 3: Illustrate briefly about human physiology.
CO 4: Describe about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.
CO 5: Know about application of biological Principles in different technologies for the production of medicines and Pharmaceutical molecules through transgenic microbes, plants and animals.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to Basic Biology: Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cells. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Characteristics of living organisms.

UNIT II: (9 Periods)
Introduction to Biomolecules: Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, bio molecular interactions. Large scale production of enzymes by Fermentation.

UNIT III: (9 Periods)
Human Physiology: Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

UNIT IV: (9 Periods)
Introduction to Molecular Biology and Recombinant DNA Technology: Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

UNIT V: (9 Periods)
Application of Biology: Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Antibiotics, Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basics of Production of Transgenic plants and animals.

Total Periods: 45

TEXT BOOKS:

1. P.K. Gupta, Cell and Molecular Biology, 6th Revised Edition, 2020.
2. U. Satyanarayana, Biotechnology, Books & Allied Ltd., 5th Edition, 2021.

REFERENCES:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, Biology: A Global Approach, Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology Panima Publications, 2nd Edition.
4. David Hames, Instant Notes in Biochemistry, 2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology, 2014.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_ge31/preview

IV Year B.Tech. – I Semester

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(CH23AOE702) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand basics and characterization of Nanomaterials.
- Understand synthetic methods of Nanomaterials.
- Apply various techniques for characterization of Nanomaterials.
- Understand Studies of Nano-structured Materials.
- Enumerate the applications of advanced Nanomaterials in engineering.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Classify the nanostructure materials; describe scope of nanoscience and importance technology.

CO 2: Utilize various top-down and bottom-up synthetic techniques to fabricate nanomaterials and evaluate their applicability based on process principles, material requirements, and desired nanostructure properties.

CO 3: Use appropriate characterization techniques such as diffraction, spectroscopy, electron microscopy to determine the structural, morphological, and particle size properties of nanomaterials.

CO 4: Apply knowledge of synthesis methods, properties, and functional characteristics of advanced nanomaterials to identify their suitable technological and industrial applications.

CO 5: Demonstrate nanostructures like nanoparticles, nanorods, and nanowires in analyzing their applications across water treatment, sensors, electronics, healthcare, engineering, agriculture, food, and environmental remediation.

COURSE CONTENT

UNIT I: **(9 Periods)**

Basics and Characterization of Nanomaterials: Introduction, Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, properties of nanomaterials, importance of nanomaterials.

UNIT II: **(9 Periods)**

Synthesis of Nanomaterials: Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapor deposition method, electrodeposition method, high energy ball milling method. Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, micro emulsions or reverse micelles, co- precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT III: **(9 Periods)**

Techniques for Characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials (SEM, TEM), BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT IV: **(9 Periods)**

Studies of Nano-Structured Materials: Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT V: **(9 Periods)**

Advanced Engineering Applications of Nanomaterials: Applications of Nano Particle, nano rods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy, defense and mechanical engineering, food science, agriculture, pollutants degradation.

Total Periods: 45

TEXT BOOKS:

1. T Pradeep, NANO: The Essentials: MaGraw-Hill, 1st Edition, 2007.
2. B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Textbook of Nanoscience and Nanotechnology, Univ. Press, 1st Edition, 2012.

REFERENCE BOOKS:

1. Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Concepts of Nanochemistry, Wiley-VCH, 2011.
2. Guozhong Cao, Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Imperial College Press, 2007.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/118104008
2. https://onlinecourses.nptel.ac.in/noc24_mm38/preview
3. https://onlinecourses.swayam2.ac.in/cec24_cy02/preview

IV Year B.Tech. – I Semester

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(CH23AOE703) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

(Open Elective-III and IV)

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand principle and concepts of green chemistry.
- Understand the types of catalysis and industrial applications.
- Apply green solvents in chemical synthesis.
- Enumerate different sourced of green energy.
- Apply alternative greener methods foe chemical reactions.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Apply the Green Chemistry Principles for day to day life as well as synthesis.
CO 2: Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis.
CO 3: Utilize the concept of green solvents and apply tools and techniques for solvent selection and ionic liquids, along with strategies for their recycling in sustainable chemical processes.
CO 4: Apply Green Chemistry for Sustainable Development.
CO 5: Use the principles of photochemical, photo-redox, microwave-assisted, and sonochemical reactions to illustrate their mechanisms, advantages, challenges, and real-world applications through relevant examples.

COURSE CONTENT

UNIT I: **(9 Periods)**
Principles and Concepts of Green Chemistry: Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT II: **(9 Periods)**
Catalysis and Green Chemistry: Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio- catalysis and Photo-catalysis with examples.

UNIT III: **(9 Periods)**
Green Solvents in Chemical Synthesis: Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbon dioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recycling of green solvents.

UNIT IV: **(9 Periods)**
Emerging Greener Technologies: Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Bio refinery, Design for energy efficiency, Mechano chemical synthesis.

UNIT V: **(9 Periods)**
Alternative Greener Methods: Photochemical Reactions - Examples, Advantages and Challenges, Photo redox catalysis, single electron transfer reactions (SET), Examples of

Photochemical Reactions, Microwave- assisted Reactions and Sonochemical reactions, examples and applications.

Total Periods: 45

TEXT BOOKS:

1. M. Lancaster, Green Chemistry an Introductory Text, Royal Society of Chemistry, 2nd Edition, 2016.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, Oxford University Press, USA, 4th Edition, 1998.

REFERENCES:

1. Sanjay K. Sharma and Ackmezv Mudhoo, Green Chemistry for Environmental Sustainability, CRC Press, 1st Edition, 2010.
2. Edited by Alvise Perosa and Maurizio Selva, Hand Book of Green chemistry Volume 8: Green Nanoscience, Wiley-VCH, 2013.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg85/preview

HONORS DEGREE

III Year B.Tech. – I Semester

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(IT23AHN501) BLOCKCHAIN TECHNOLOGY

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce the fundamental principles of blockchain technology, distributed ledger systems, and their evolution from crypto currencies.
- Provide knowledge of cryptographic techniques and consensus algorithms that ensure security and integrity in blockchain networks.
- Develop an understanding of smart contracts and blockchain platforms such a Ethereum, enabling students to write and deploy basic smart contracts.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand the fundamental concepts of blockchain technology, its architecture.
CO 2: Apply cryptographic techniques and consensus algorithms to secure.
CO 3: Design and develop smart contracts using Ethereum and Solidity.
CO 4: Analyze and evaluate different blockchain platforms.
CO 5: Critically examine the limitations, challenges, and future trends in blockchain Technology.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to Blockchain: Introduction to Blockchain Technology, Distributed Ledger Technology (DLT).
Types of Blockchains: Public, Private, Consortium.
Components of Blockchain: Block, Chain, Node, Ledger, Structure of a Blockchain Block, Advantages, Limitations, and Applications of Blockchain.
Case Study: Bitcoin and Ethereum Overview.

UNIT II: (9 Periods)
Cryptography and Consensus Mechanisms: Introduction to Cryptography in Blockchain, Hash Functions (SHA-256) Digital Signatures and Public Key Infrastructure (PKI), Merkle Trees.
Consensus Mechanisms: Proof of Work (PoW), Proof of Stake (PoS), Delegated PoS, Practical Byzantine Fault Tolerance (PBFT), Mining and Block Validation Process.

UNIT III: (9 Periods)
Smart Contracts and Ethereum: Introduction to Smart Contracts, Ethereum Blockchain: Structure, Accounts, and Transactions, Ethereum Virtual Machine (EVM), Solidity Programming Basics, Writing and Deploying Smart Contracts, Gas and Transaction Costs, Tools: Remix IDE, MetaMask, Truffle Framework.

UNIT IV: (9 Periods)
Blockchain Platforms and Use Cases
Hyperledger Fabric: Architecture, Chaincode, Membership Services**,** Corda and Quorum Overview**,** Blockchain-as-a-Service (BaaS): IBM, Azure, AWS**,** Use Cases: Supply Chain, Healthcare, Banking, Voting, Insurance**,** NFTs and Tokenization Concepts**,** Blockchain in Internet of Things (IoT).

UNIT V: (9 Periods)
Challenges, Trends, and Future Directions: Scalability and Performance Issues, Security and Privacy in Blockchain, Regulatory and Legal Implications, Interoperability Between Blockchains, Layer 2 Solutions: Sidechains, Lightning Network, Central Bank Digital Currency (CBDC), Trends: Web3, DeFi (Decentralized Finance), DAOs.

Total Periods: 45

TEXT BOOKS:

1. Arvind Narayanan et al., Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2014.
2. Imran Bashir, Mastering Blockchain, Packt Publishing, 2021.

REFERENCES:

1. Melanie Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media.
2. Roger Wattenhofer, The Science of the Blockchain.
3. Official documentation of Ethereum, Hyperledger Fabric, and Corda.

III Year B.Tech. – I Semester

L	T	P	C
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(IT23AHN502) MULTIMEDIA APPLICATIONS AND DEVELOPMENT

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the hardware and software needed to create projects using creativity and organization to create them.
- To know working with all aspects of images, Sound, video.
- Learn copyright laws associated with multimedia.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO 1: Students will understand multimedia in respect to many applications.
CO 2: Able to work with audio, video files and create animations.
CO 3: Develop multimedia skills.
CO 4: Understanding the principal players of individual players in multimedia teams.
CO 5: Learn ways to present their multimedia projects.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction: Various facets of multimedia- audio, text, graphics, animation, video Classification of multimedia technology Multimedia - hardware/software essentials, different categories of multimedia software.

UNIT II: (9 Periods)
Working with Audio, Text and Graphics: Multimedia audio: Introduction, digital audio and sound card fundamentals, sound card functionalities, audio jacks, connectors, digital audio playback, audio editing, Multimedia text: introduction, designing text for multimedia, hypermedia, hypertext Multimedia graphics: introduction, basic concepts of colour displays, monitor video modes, colour monitors and their parameters, graphics in multimedia projects.

UNIT III: (9 Periods)
Working with Video and Animation: Multimedia video : introduction, video in multimedia projects, digital video fundamental, full motion and full screen videos, digital video files sizes, digital video production techniques – video production in multimedia, shooting the sequences, video capture techniques, video capture boards, video capture software, editing video, embedding sound clips.

UNIT IV: (9 Periods)
Multimedia Animation: introduction, classifications, two- dimensional animation and three-dimensional animation technology, animation development process, names of animation software tools for 2D and 3D.

UNIT-V (9 Periods)
Multimedia Project: Multimedia project design concepts – introduction, concept and design, various facets, media content design and development, interface design and development process, Multimedia authoring: introduction, multimedia programming vs. multimedia authoring, selection between authoring and programming tool, authoring methodologies, characteristics of authoring tools.

Total Periods: 45

TEXT BOOKS:
1. Introduction to Multimedia: By Ana Weston Solomon, Tata Mc Graw-Hill Publishing Company Limited, 2005

REFERENCES:

1. Multimedia Magic. By S. Gokul, BPB Publications, 1998.

III Year B.Tech. – I Semester

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(IT23AHN503) NATURAL LANGUAGE PROCESSING

COURSE OBJECTIVES:
The objectives of this course are to:
- Basics of NLP, Morphology, Tokenization, N-gram Models.
- POS Tagging, Parsing, Treebanks, Ambiguity Handling.
- Word Sense Disambiguation, Semantic Parsing, Sentiment Analysis.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Understand morphological processing and the structure of words and documents.
CO 2: Analyze syntactic structures using various parsing algorithms.
CO 3: Apply semantic parsing techniques to interpret natural language text.
CO 4: Understand predicate-argument structures and meaning representation systems.
CO 5: Apply cross-lingual language models and speech recognition techniques in NLP applications

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to NLP: Introduction to NLP: Origins and Challenges, Language and Grammar in NLP, Regular Expressions and Finite-State Automata, Tokenization: Text Segmentation and Sentence Splitting, Morphological Parsing: Stemming and Lemmatization, Spelling Error Detection and Correction, Minimum Edit Distance and Applications, Statistical Language Models: Unigram, Bigram, and Trigram Models, Processing Indian Languages in NLP.

UNIT II: (9 Periods)
Word-Level and Syntactic Analysis: Introduction, Part-of-Speech (POS) Tagging: Rule-Based, Stochastic and Transformation-Based Approaches, Hidden Markov Models (HMM) and Maximum Entropy Models for POS Tagging, Context-Free Grammar (CFG) and Constituency Parsing, Treebanks and Normal Forms for Grammar, Top-Down and Bottom-Up Parsing Strategies, CYK Parsing Algorithm, Probabilistic Context-Free Grammars (PCFGs), Feature Structures and Unification.

UNIT III: (9 Periods)
Text Classification and Information Retrieval: Naïve Bayes Classifier for Text Classification, Training and Optimization for Sentiment Analysis, Information Retrieval: Basic Concepts and Design Features, Information Retrieval Models: Classical, Non-Classical, and Alternative Models, Cluster Model, Fuzzy Model, and LSTM-Based Information, Retrieval, Word Sense Disambiguation (WSD) Methods: Supervised and Dictionary-Based Approaches.

UNIT IV: (9 Periods)
Machine Translation and Semantic Processing: Introduction to Machine Translation (MT), Language Divergence and Typology in MT Encoder-Decoder Model for Machine Translation, Translating in Low-Resource Scenarios, MT Evaluation Metrics and Techniques, Bias and Ethical Issues in NLP and Machine Translation, Semantic Analysis and First-Order Logic in NLP, Thematic Roles and Selectional Restrictions in Semantics, Word Senses and Relations Between Senses.

UNIT V: (9 Periods)
Speech Processing and Advanced NLP Models: Speech Fundamentals: Phonetics and Acoustic Phonetics, Digital Signal Processing in Speech Analysis, Feature Extraction in Speech:

Short-Time Fourier Transform (STFT), Mel-Frequency Cepstral Coefficients (MFCC) and Perceptual Linear Prediction (PLP), Hidden Markov Models (HMMs) in Speech Recognition.

Total Periods: 45

TEXT BOOKS:

1. Daniel Jurafsky & James H. Martin – Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education, 2023.
2. Tanveer Siddiqui & U.S. Tiwary – Natural Language Processing and Information Retrieval, Oxford University Press.

REFERENCES:

1. T.V. Geetha – Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives, Pearson, 2024.
2. Akshay Kulkarni & Adarsha Shivananda – Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python, Apress, 2019.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. https://www.youtube.com/watch?v=M7SWr5xObkA
2. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
3. https://archive.nptel.ac.in/courses/106/106/106106211/

III Year B.Tech. – II Semester

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(IT23AHN601) COMPUTATIONAL INTELLIGENCE

COURSE OBJECTIVES:
The objectives of this course are to:
- Understand the concepts and foundations of computational intelligence.
- Study neural networks, fuzzy logic systems, and evolutionary algorithms.
- Explore hybrid systems and their applications.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Describe and differentiate neural networks & fuzzy logic.
CO 2: Apply neural and fuzzy systems for real-time decision-making.
CO 3: Analyze complex problems using soft computing tools.
CO 4: Develop hybrid intelligent systems.
CO 5: Evaluate and compare the performance of CI-based systems.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Computational Intelligence and Artificial Neural Networks
Definition and Scope of Computational Intelligence (CI), Components of CI: Neural Networks, Fuzzy Logic, Evolutionary Computation, Biological Neuron vs. Artificial Neuron, McCulloch-Pitts Model, Perceptron, Adaline and Madaline, Multilayer Feedforward Networks, Backpropagation Algorithm, Applications of ANN in Pattern Recognition and Classification.

UNIT II: **(9 Periods)**
Fuzzy Logic and Fuzzy Systems Introduction to Fuzzy Logic and Fuzzy Sets, Membership Functions, Fuzzy Set Operations, Fuzzy Rules and Inference Systems, Fuzzification and Defuzzification, Fuzzy Control Systems, Fuzzy Reasoning and Approximate Reasoning.

UNIT III: **(9 Periods)**
Evolutionary Computation Techniques
Basics of Evolutionary Algorithms (EA), Genetic Algorithms (GA): Operators, Encoding, Fitness Function, Selection, Crossover and Mutation, Convergence Criteria, Genetic Programming (GP), Differential Evolution (DE), Applications of GA and GP.

UNIT IV: **(9 Periods)**
Swarm Intelligence and Hybrid Systems Swarm Intelligence: Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Behavior of Swarms and Collective Intelligence, Comparison of Evolutionary Algorithms and Swarm Techniques, Hybrid Systems: Neuro-Fuzzy, Fuzzy-GA, ANN-GA Systems, Case Studies in Hybrid Systems.

UNIT V: **(9 Periods)**
Applications of Computational Intelligence CI in Image and Signal Processing, CI for Optimization Problems and Robotics, CI in Biomedical Engineering and Finance, Intelligent Agents and Decision-Making Systems, Real-time Applications and Emerging Trends in CI.

Total Periods: 45

TEXT BOOKS:
1. James M. Keller, Derong Liu, David B. Fogel, Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation, 1st Edition, 2016.
2. Rudolf Kruse, Christian Borgelt, christian Braune, Sanaz Mostaghim, Matthias Steinbrecher, Computational Intelligence: A Methodological Introduction, 3rd Edition, 2023.

REFERENCES:

1. S.N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley India.
2. Simon Haykin, Neural Networks and Learning Machines, Pearson.

ONLINE LEARNING RESOURCES:

1. NPTEL - Computational Intelligence
2. Coursera – Computational Intelligence
3. YouTube: IIT Lectures on Soft Computing and CI

III Year B.Tech. – II Semester

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(IT23AHN602) CRYPTOGRAPHY AND NETWORK SECURITY

COURSE OBJECTIVES:

The objectives of this course are to:

- Learn the concepts of classical encryption techniques and concepts of finite fields.
- Learn the Working principles and utilities of various crypto graphic algorithms. including secret key cryptography, hashes and public key algorithms.
- Learn the Design issues and working principles of various authentication protocols, PKI standards.

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1: Identify information security goals, classical encryption techniques.
CO 2: Compare and apply different encryption and decryption techniques.
CO 3: Apply the knowledge of crypto graphic check sums.
CO 4: Demonstrate the ability to apply user authentication principles including Kerberos for secure authentication.
CO 5: Gain proficiency in securing web communications using TLS and HTTPS, manage secure remote access with SSH, and design firewall policies.

COURSE CONTENT

UNIT I: **(9 Periods)**

Computer and Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Sym metric Cip her Model, Substitution Techniques, Transposition Techniques, Steganography.

Block Ciphers: Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard: AES Structure, AES Transformation Functions.

UNIT II: **(9 Periods)**

Number Theory: The Euclidean Algorithm, Modular Arithmetic, Fermat‵s and Euler‵s Theorems, The Chinese Remainder Theorem, Discrete Logarithm.

Finite Fields: Finite Fields of the Form GF(p), Finite Fields of the Form GF(2n).

Public Key Cryptography: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT III: **(9 Periods)**

Cryptographic Hash Functions: Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC &CMAC.

Digital Signatures: NIST Digital Signature Algorithm, Distribution of Public Keys, X.509 Certificates, Public- Key Infrastructure.

UNIT IV: **(9 Periods)**

User Authentication: Remote User Authentication Principles, Kerberos. **Electronic Mail Security**: Pretty Good Privacy (PGP) And S/MIME.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

UNIT V: **(9 Periods)**

Transport Level Security: Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH).

Fire walls: Fire wall Character is tics and Access Policy, Types of Fire walls, Fire wall Location and Configurations.

Total Periods: 45

TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, Pearson Education, 8th Edition.
2. Bernard Menezes, Cryptography, Network Security and Cyber Laws, Cengage Learning, 2010.

REFERENCES:

1. Behrouz A Forouzan, Debdeep, Mukhopadhyaya, Cryptography and Network Security, Mc- Graw Hill, 3rd Edition, 2015.
2. Jason Albanese and Wes Sonnenreich, Network Security Illustrated, MGH Publishers, 2003.

Online Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105031/lecture
2. https://nptel.ac.in/courses/106/105/106105162/lecturebyDr.SouravMukhopadhyayIITKharagpur[VideoLecture]

III Year B.Tech. – II Semester

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(IT23AHN603) PREDICTIVE ANALYTICS

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce the fundamental concepts and techniques of predictive analytics.
- Apply statistical models and machine learning algorithms for prediction.
- Interpret model performance using evaluation metrics.

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
CO 1: Understand the principles and importance of predictive analytics.
CO 2: Apply regression and classification models for predictive tasks.
CO 3: Perform data preprocessing, feature selection, and transformation.
CO 4: Evaluate and validate models using standard metrics.
CO 5: Design predictive solutions to solve domain-specific challenges.

COURSE CONTENT

UNIT I: **(9 Periods)**
Introduction to Predictive Analytics Introduction to Predictive Analytics and Business Intelligence, Types of Predictive Models: Classification, Regression, Time Series, Supervised vs Unsupervised Learning, Predictive Modeling Workflow, Applications in Marketing, Finance, Healthcare, Challenges in Predictive Analytics.

UNIT II: **(9 Periods)**
Data Preparation and Feature Engineering Data Cleaning: Handling Missing, Noisy, and Inconsistent Data, Feature Selection and Dimensionality Reduction (PCA, LDA), Feature Scaling: Normalization, Standardization, Encoding Categorical Variables, Feature Extraction and Construction, Dealing with Imbalanced Datasets.

UNIT III: **(9 Periods)**
Predictive Modeling with Regression and Classification Linear Regression and Polynomial Regression, Logistic Regression for Binary Classification, Decision Trees and Random Forest, k-Nearest Neighbors (k-NN) and Naïve Bayes, Support Vector Machines (SVM), Model Selection and Comparison.

UNIT IV: **(9 Periods)**
Model Evaluation and Validation: Training, Testing, and Validation Sets, Cross-Validation Techniques (k-Fold, Stratified, LOOCV), Evaluation Metrics: Accuracy, Precision, Recall, F1 Score, ROC-AUC, Confusion Matrix and Classification Report, Bias-Variance Trade-off and Overfitting, Hyperparameter Tuning: Grid Search, Random Search.

UNIT V: **(9 Periods)**
Advanced Topics and Applications: Ensemble Learning: Bagging, Boosting (AdaBoost, XGBoost), Predictive Analytics with Time Series (ARIMA, Prophet), Deep Learning for Predictive Modeling (ANNs, LSTM), Use of Predictive Analytics in IoT, Retail, and Healthcare, Ethics and Privacy in Predictive Analytics, Building and Deploying End-to-End Predictive Systems.

Total Periods: 45

TEXT BOOKS:
1. Dean Abbott, Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Wiley, 2014.
2. John D. Kelleher, Brendan Tierney, Data Science: Predictive Analytics and Data Mining, MIT Press, 2018.

REFERENCES:

1. Galit Shmueli et al.,Data Mining for Business Analytics: Concepts, Techniques, and Applications in R, Wiley, 2017.
2. Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2016.

ONLINE LEARNING RESOURCES:

1. https://www.coursera.org/specializations/predictive-analytics – Coursera Specialization
2. https://www.edx.org/course/data-science-and-machine-learning-capstone – edX Predictive Analytics Courses
3. https://www.kaggle.com/learn/intro-to-machine-learning – Kaggle Tutorials

IV Year B.Tech. – I Semester

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(IT23AHN701) CYBER- PHYSICAL SYSTEMS

COURSE OBJECTIVES:

The objectives of this course are to:

- Equip students with a comprehensive understanding of techniques and methodologies in Cyber-Physical Systems (CPS).
- Explore core topics such as symbolic synthesis, CPS security, distributed synchronization, and real-time scheduling.
- Emphasize both fundamental principles and advanced model integration techniques.

COURSE OUTCOMES:

Upon the Successful Completion of the Course, the Students would be able to:

CO 1: Understand the core principles behind CPS.
CO 2: Identify Security mechanisms of Cyber physical systems.
CO 3: Understand Synchronization in Distributed Cyber-Physical Systems.
CO 4: To Understand the Scheduling for Cyber-Physical Systems.
CO 5: To understand the various Cyber-Physical System models.

COURSE CONTENT

UNIT I: (9 Periods)

Symbolic Synthesis for Cyber-Physical Systems Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools.

UNIT II: (9 Periods)

Security of Cyber-Physical Systems Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches.

UNIT III: (9 Periods)

Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques.

UNIT IV: (9 Periods)

Real-Time Scheduling for Cyber-Physical Systems Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty.

UNIT V: (9 Periods)

Model Integration in Cyber-Physical Systems Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, For Spec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

Total Periods: 45

TEXT BOOKS

1. Raj Raj kumar, Dion is io De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2017.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.

IV Year B.Tech. – I Semester

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(IT23AHN702) GENERATIVE AI

COURSE OBJECTIVES:
The objectives of this course are to:
- Introduce the fundamentals of Generative AI, including its principles, architecture.
- Provide a deep understanding of Large Language Models (LLMs).
- Develop practical knowledge of Prompt Engineering, including prompt tuning.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

CO 1: Demonstrate a strong understanding of the architecture of Generative AI models, including transformers and LLMs.
CO 2: Be capable of applying prompt engineering techniques to steer model behavior for desired outputs across various tasks.
CO 3: Design and fine-tune generative models for applications such as text generation, image creation, music synthesis, and conversational AI.
CO 4: Analyze and evaluate the effectiveness of prompts and generated content, using Relevant metrics and methodologies.
CO 5: Apply ethical principles to ensure responsible development and deployment of generative AI systems.

COURSE CONTENT

UNIT I: (9 Periods)
Introduction to Generative AI: Overview of AI and types of AI, What is Generative AI? Definitions and Concepts, Historical evolution of generative models, Types of generative models – GANs, VAEs, Autoregressive Models, Introduction to Transformers and LLMs, Applications and use cases of Generative AI, Challenges in Generative AI development, Introduction to text-to-image and image-to-text models.

UNIT II: (9 Periods)
Fundamentals of Prompt Engineering: Definition and significance of Prompt Engineering, Types of prompts: Zero-shot, One-shot, Few-shot, Techniques for effective prompt design, Prompt templates and chaining, Prompt tuning and parameter-efficient tuning, Evaluating prompt performance, Use of APIs for testing prompts (OpenAI, Cohere, Anthropic), Best practices and prompt libraries.

UNIT III: (9 Periods)
Working with Large Language Models (LLMs): Overview of pre-trained LLMs: GPT, BERT, LLaMA, Claude, PaLM, Architectures and tokenization strategies, Fine-tuning vs. in-context learning, LLM-powered tools (ChatGPT, GitHub Copilot, Bard, Claude), Role of attention mechanism and transformer layers, Tools for model experimentation (Hugging Face, LangChain), Performance metrics for LLMs, Case studies of model adaptation and deployment.

UNIT IV: (9 Periods)
Applications of Generative AI: Text generation and summarization, Image and art generation (DALL·E, Midjourney, Stable Diffusion), Code generation and completion tools (Codex, Copilot), Music and video generation, Generative chatbots and customer service, Story generation and dialogue systems, Domain-specific applications (Legal, Healthcare, Education), Comparative study of generative models by task.

UNIT V: (9 Periods)
Ethics, Security & Responsible AI: Bias and fairness in LLMs and generative systems, Explainability and transparency in generative AI, Copyright and originality issues, Adversarial use of generative models – deepfakes, misinformation, AI safety protocols and red-teaming, Regulatory and policy frameworks for generative AI, Responsible prompt crafting and moderation.

Total Periods: 45

TEXT BOOKS:

1. François Chollet, Deep Learning with Python, Manning Publications.
2. Denis Rothman, Packt, Transformers for Natural Language Processing.

REFERENCES:

1. David Foster, Generative Deep Learning, O'Reilly.
2. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans.

ONLINE COURSES:

1. Generative AI with Large Language Models – Coursera (AWS & DeepLearning.AI)
2. Prompt Engineering for ChatGPT – Coursera
3. Generative AI Fundamentals – Google Cloud Training
4. Hugging Face – Transformers Course
5. DeepLearning.AI Short Courses

IV Year B.Tech. – I Semester

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(IT23AHN703) HONORS CAPSTONE PROJECT

COURSE DESCRIPTION: This capstone project course provides students with the opportunity to conceptualize, design, and execute a comprehensive project, either research-oriented or application-oriented, that aligns with the honors program. Students will identify a project topic, perform a critical literature survey, and gather preliminary data. They will evaluate feasibility through time, cost, and resource analysis, select suitable tools and methodologies, and carry out detailed design, analysis, and implementation. The project emphasizes creating solutions to real-world problems, supported by ethical, sustainable, and professional considerations. The outcomes are documented in a thesis and defended through a formal presentation before an evaluation committee.

COURSE OBJECTIVES:
The objectives of this course are to:
- Develop a thorough understanding of project identification, planning, and execution by integrating domain knowledge, research insights, and emerging trends in engineering practice, that aligns with the honors program.
- Equip students with the ability to design, develop, and implement project-based engineering solutions through systematic analysis, application of modern tools and techniques, project and financial management, leadership, and effective individual and team participation.
- Foster professional ethics, societal and environmental responsibility, and a lifelong learning mindset by engaging students in real-world project work that addresses contemporary challenges and community needs.

COURSE OUTCOMES:
On successful completion of the course, the students will be able to:

CO 1: Create engineering systems or processes to solve complex problems by applying appropriate tools, techniques, standards, codes, policies, regulations, and the latest developments, that aligns with the honors program.

CO 2: Evaluate societal, health, safety, environmental, sustainability, economic, and project management considerations in developing engineering solutions.

CO 3: Demonstrate effective individual or teamwork, leadership, and professional communication in written, oral, and graphical forms while executing engineering projects.