MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

MADANAPALLE

(UGC-AUTONOMOUS)

www.mits.ac.in

Estd 1998

DEPARTMENT OF CIVIL ENGINEERING

Course Structure

&

Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the Academic Year 2023-24

and

B. Tech. Lateral Entry Scheme from the Academic Year 2024-25



DEPARTMENT OF CIVIL ENGINEERING

Vision and Mission of the Institution

Vision	To become a globally recognized research and academic institution and thereby contribute to technological and socio-economic development of the nation
Mission	To foster a culture of excellence in research, innovation, entrepreneurship, rational thinking and civility by providing necessary resources for generation, dissemination and utilization of knowledge and in the process create an ambience for practice-based learning to the youth for success in their careers.

Vision and Mission of the Department

Vision	To grow as a globally recognized Civil Engineering Department through cutting-edge education and research to bring sustainable cultural, economic and social growth in the nation.
Mission	➢ To provide modern educational tools and techniques to the students in order to enrich them to solve complex civil engineering problems. ➢ To develop sustainable technologies and solutions for various organizations involved in developmental activities through consultancy and research services. ➢ To foster the socio-economic and cultural upliftment in the region through formal and informal education.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Contribute to the cost effective and sustainable infrastructural growth in the region and nationwide.

PEO2: Pursue higher education and involve in research to work out the solutions for complex civil engineering problems.

PEO3: Demonstrate to be ethical, skilled and environment friendly professionals working to advance the cultural and socio-economic status of the country.

PROGRAM OUTCOMES (POs)

At the end of the programme, graduate will be able to

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

PO2: Problem Analysis: Identify, formulate, 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 public health and safety, and cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge 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 norm of the engineering practice.

PO9: Individual and teamwork: 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 t h e society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Establish the processes of planning, analysis and design of sustainable civil engineering systems using the concepts of basic science, humanities and engineering sciences.

PSO 2: Provide cost-effective, environment-friendly solutions to civil engineering problems through laboratory experiments and field investigations.

PSO 3: Exhibit professional and ethical values towards project execution through the knowledge of project management and public policies using modern as well as contemporary skills.

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: CIVIL ENGINEERING

Total Credits	163 Credits for 2023(Regular) & 123 Credits 2024(Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No	Title	Duration
1	Induction Program (Mandatory)	Three weeks' duration at the start of First Year

R23 - Curriculum Structure
I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	23ENG101	Communicative English	2	0	0	2	2
2	BSC	23MAT101	Linear Algebra and Calculus	3	0	0	3	3
3	BSC	23CHE101	Engineering Chemistry	3	0	0	3	3
4	ESC	23CME101	Basic Civil and Mechanical Engineering	3	0	0	3	3
5	ESC	23CSE101	Introduction to Programming	3	0	0	3	3
6	BSC	23ENG201	Communicative English Laboratory	0	0	2	2	1
7	BSC	23CHE201	Engineering Chemistry Laboratory	0	0	2	2	1
8	ESC	23CSE201	Computer Programming Laboratory	0	0	3	3	1.5
9	ESC	23ME201	Engineering Workshop	0	0	3	3	1.5
10	HSMC	23HUM201	Health and Wellness, Yoga and Sports	-	-	1	1	0.5
Total				**14**	**0**	**11**	**25**	**19.5**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	23MAT102	Differential Equations and Vector Calculus	3	0	0	3	3
2	BSC	23PHY101	Engineering Physics	3	0	0	3	3
3	ESC	23EEE101	Basic Electrical and Electronics Engineering	3	0	0	3	3
4	ESC	23ME101	Engineering Graphics	1	0	4	5	3
5	PCC	23CE101	Engineering Mechanics	3	0	0	3	3
6	BSC	23PHY201	Engineering Physics Laboratory	0	0	2	2	1
7	ESC	23EEE201	Electrical and Electronics Engineering Workshop	0	0	3	3	1.5
8	ESC	23CSE202	IT Workshop	0	0	2	2	1
9	PCC	23CE201	Engineering Mechanics and Building Practices Laboratory	0	0	3	3	1.5
10	HSMC	23HUM202	NSS / NCC / Scouts and Guides / Community Service	-	-	1	1	0.5
Total				**13**	**0**	**15**	**28**	**20.5**

(L = Lecture, T = Tutorial, P = Practical, C = Credit)

R23 - Curriculum Structure
II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	23HUM101	Universal Human Values	2	1	0	3	3
2	BSC	23MAT103	Probability and Statistics for Engineers	3	0	0	3	3
3	ESC	23CE102	Strength of Materials	3	0	0	3	3
4	PCC	23CE103	Surveying	3	0	0	3	3
5	PCC	23CE104	Fluid Mechanics and Hydraulics	3	0	0	3	3
6	PCC	23CE202	Surveying Laboratory	0	0	3	3	1.5
7	PCC	23CE203	Strength of Materials Laboratory	0	0	3	3	1.5
8	SEC		**Skill Enhancement Course – I** *(Refer ANNEXURE - VI)*	1	0	2	3	2
9	AUC	23CHE901	Environmental Science	2	0	0	2	-
Total				**17**	**1**	**8**	**26**	**20**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	23HUM102	Economics and Financial Accounting For Engineers	2	0	0	2	2
2	ESC		**Design Thinking and Innovation Related Courses** *(Refer ANNEXURE - II)*	1	0	2	3	2
3	PCC	23CE105	Engineering Hydrology	3	0	0	3	3
4	PCC	23CE106	Concrete Technology	3	0	0	3	3
5	PCC	23CE107	Structural Analysis	3	0	0	3	3
6	PCC	23CE108	Environmental Engineering	3	0	0	3	3
7	PCC	23CE204	Concrete Technology Laboratory	0	0	3	3	1.5
8	PCC	23CE205	Fluid Mechanics and Hydraulics Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – II** *(Refer ANNEXURE - VI)*	1	0	2	3	2
Total				**16**	**0**	**10**	**26**	**21**

(L = Lecture, T = Tutorial, P = Practical, C = Credit)

R23 - Curriculum Structure
III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CE109	Water Resources and Irrigation	3	0	0	3	3
2	PCC	23CE110	Design of Reinforced Concrete Structures	3	0	0	3	3
3	PCC	23CE111	Geotechnical Engineering	3	0	0	3	3
4	ESC	23PHY102	Introduction to Quantum Technologies and Applications	3	0	0	3	3
		23WQT1M01	Quantum Foundation and Applied Technologies					
5	PE		**Professional Elective - I** *(ANNEXURE - IV)*	3	0	0	3	3
6	OE		**Open Elective - I** *(ANNEXURE - III)*	3	0	0	3	3
7	PCC	23CE206	Geotechnical Engineering Laboratory	0	0	3	3	1.5
8	PCC	23CE207	Environmental Engineering Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – III** *(Refer ANNEXURE - VI)*	1	0	2	3	2
10	ESC	23ECE501	Tinkering Laboratory	0	0	2	2	1
11	PROJ	23CE701	Summer Internship I	0	0	4	4	2
Total				**19**	**0**	**14**	**33**	**26**

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CE112	Design of Steel Structures	3	0	0	3	3
2	PCC	23CE113	Highway Engineering	3	0	0	3	3
3	PCC	23CE114	Construction Planning and Management	3	0	0	3	3
4	PE		**Professional Elective - II** *(Refer ANNEXURE - IV)*	3	0	0	3	3
5	PE		**Professional Elective-III** *(Annexure - IV)*	3	0	0	3	3
6	OE		**Open Elective – II** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	PCC	23CE208	Highway Engineering Laboratory	0	0	3	3	1.5
8	PCC	23CE209	IOT in Civil Engineering Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – IV** *(Refer ANNEXURE - VI)*	1	0	2	3	2
10	AUC	23ENG901	Technical paper writing and IPR	2	0	0	2	-
11	MC	23CE801	Workshop*	0	0	0	0	0
Total				**21**	**0**	**8**	**29**	**23**

(L = Lecture, T = Tutorial, P = Practical, C = Credit)

*Domain specific workshop should be completed at the end of III Year I Semester

R23 - Curriculum Structure
IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CE115	Finite Element Methods	3	0	0	3	3
2	Management Course		**Management Course** *(Refer ANNEXURE – V)*	2	0	0	2	2
3	PE		**Professional Elective – IV** *(Refer ANNEXURE - IV)*	3	0	0	3	3
4	PE		**Professional Elective – V** (Refer *ANNEXURE - IV)*	3	0	0	3	3
5	OE		**Open Elective – III** *(Refer ANNEXURE - III)*	3	0	0	3	3
6	OE		**Open Elective – IV** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	SEC		**Skill Enhancement Course – V** *(Refer ANNEXURE - VI)*	1	0	2	3	2
8	AUC	23HUM901	Gender Sensitization	2	0	0	2	-
9	PROJ	23CE702	Summer Internship II	-	-	4	4	2
Total				**20**	**0**	**6**	**26**	**21**

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	23CE703	Internship	0	0	8	8	4
		23CE704	Project Work	0	0	16	16	8
Total				**0**	**0**	**24**	**24**	**12**

(L = Lecture, T = Tutorial, P = Practical, C = Credit)

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

  - Basic Computer Proficiency
  - Interpersonal skills
  - Computer Graphics
  - Web programming
  - Mobile Apps
  - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
6. Nature and Environment
7. Innovation

ANNEXURE - II

DESIGN THINKING AND INNOVATION RELATED COURSES (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1	23IIC5M01	Design, Technology and Innovation
2	23IIC5M02	Introduction on Intellectual Property to Engineers and Technologists
3	23IIC5M03	Product Engineering and Design Thinking
4	23IIC5M04	Intellectual Property Rights and Competition Law
5	23IIC5M05	Innovation, Business Models and Entrepreneurship
6	23IIC5M06	Understanding Incubation and Entrepreneurship
7	23IIC5M07	Intellectual Property
8	23IIC5M08	Roadmap for Patent Creation
Any new Innovation and Incubation Course offered by SWAYAM NPTEL can be appended in future.		

ANNEXURE - III

OPEN ELECTIVE – I

(To be offered under Conventional Mode) – **III Year I Semester**

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	23HUM301	Indian Knowledge System	Humanities
2	23MAT301	Advanced Numerical Methods	Mathematics
3	23MAT302	Engineering Optimization	Mathematics
4	23PHY301	LASER Physics and Advanced LASER Technology	Physics
5	23PHY302	Thin Film Technology and its Applications	Physics
6	23PHY303	Waste To Sustainable Energy and Energy Systems	Physics
7	23CHE301	Chemistry of Polymers and its Applications	Chemistry
8	23CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
9	23CHE303	Chemistry of Energy Systems	Chemistry
10	23ME301	Materials Science for Engineers	Mechanical
11	23ME302	Sustainable Energy Technologies	Mechanical
12	23EEE301	Electrical Safety Practices and Standards	EEE
13	23EEE302	Introduction to MEMS	EEE
14	23ECE301	Bio-Medical Electronics	ECE
15	23ECE302	VLSI Design	ECE
16	23CSE301	JAVA Programming	CSE
17	23CST301	Operating Systems	CST
18	23CAI301	Mobile Computing	CSE (AI)
19	23CSD301	Introduction to Data Science	CSE (DS)
20	23CSM301	AI for Everyone	CSE (AI and ML)
Any new Interdisciplinary Course can be appended in future.			

OPEN ELECTIVE – II

(To be offered under MOOC's Category from SWAYAM – NPTEL) – **III Year II Semester**

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	23HUM3M01	English Language for Competitive Exams	Humanities and Social Sciences
2	23HUM3M02	Public Speaking	Humanities and Social Sciences
3	23HUM3M03	Indian Business History	Humanities and Social Sciences
4	23HUM3M04	Indian Economy: Some Contemporary Perspectives	Humanities and Social Sciences
5	23MG3M01	E – Business	Management
6	23MG3M02	AI in Human Resource Management	Management
7	23MG3M03	AI in Marketing	Management
8	23MG3M04	Artificial Intelligence for Investments	Management
9	23ME3M01	Operations Management	Mechanical
10	23EEE3M01	Transducers For Instrumentation	EEE
11	23ECE3M01	Microprocessors and Interfacing	ECE
12	23ECE3M02	Microprocessors and Microcontrollers	ECE
13	23CSE3M01	Privacy and Security in Online Social Media	CSE
14	23CSE3M02	Computer Networks and Internet Protocol	CSE
15	23CSE3M03	Introduction to Soft Computing	CSE
16	23CSE3M04	Human Computer Interaction (in Hindi)	CSE
17	23MD3M01	Research Methodology	Multidisciplinary
18	23MD3M02	Fuzzy Logic and Neural Networks	Multidisciplinary

Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.

OPEN ELECTIVE – III (To be offered under MOOC's Category from SWAYAM – NPTEL) – **IV Year I Semester**			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	23HUM3M05	Indian Society: Sociological Perspectives	Humanities and Social Sciences
2	23MAT3M01	Foundations of R Software	Mathematics
3	23MAT3M02	Foundations of R Software (in Hindi Language)	Mathematics
4	23MG3M05	HR Analytics	Management
5	23MG3M06	Management Information System	Management
6	23MG3M07	Business Analytics & Text Mining Modeling using Python	Management
7	23ME3M02	Power Plant Engineering	Mechanical
8	23EEE3M02	Design of Photovoltaic Systems	EEE
9	23ECE3M03	System Design Through Verilog	ECE
10	23CSE3M05	Multi-Core Computer Architecture	CSE
11	23CSE3M06	Introduction to Machine Learning - IITKGP	CSE
12	23CSE3M07	Introduction to Internet of Things	CSE
13	23CSE3M08	Ethical Hacking	CSE
14	23CSE3M09	Cyber Security and Privacy	CSE
15	23CSE3M10	Introduction to Machine Learning (Tamil)	CSE
16	23MD3M03	Learning Analytics Tools	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

OPEN ELECTIVE – IV

(To be offered under Conventional Mode) – **IV Year I Semester**

Sl. No.	Course Code	Course Title	Course Offered by Department of
1	23PHY304	Smart Materials and Devices	Physics
2	23CHE304	Introduction to Nano Science and Technology	Chemistry
3	23CHE305	Water Pollution and its Management	Chemistry
4	23ME303	Total Quality Management	Mechanical
5	23ME304	Additive Manufacturing	Mechanical
6	23ME305	Refrigeration and Air Conditioning	Mechanical
7	23EEE303	Robotics	EEE
8	23EEE304	Smart Grid Technologies	EEE
9	23ECE303	Embedded Systems	ECE
10	23ECE304	Community Radio Technology	ECE
11	23CSE302	Software Project Management	CSE
12	23CSD302	Cloud Computing	CSE (DS)
13	23CSC301	Cyber Laws and Security Policies	CSE (CS)
14	23CSM302	Chatbots and Virtual Assistants	CSE (AI and ML)
Any new Interdisciplinary Course can be appended in future.			

ANNEXURE - IV

LIST OF PROFESSIONAL ELECTIVES

Professional Elective – I (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	23CE4M01	Sustainable Engineering Concepts and Life Cycle Analysis
2.	23CE4M02	Municipal Solid Waste Management
3.	23CE4M03	Cost effective Housing Techniques
4.	23CE4M04	Air Pollution and Control
5.	23CE4M05	Environmental Impact Assessment
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Professional Elective – II		
Sl. No.	**Course Code**	**Course Title**
1.	23CE401	Advanced Structural Analysis
2.	23CE402	Open Channel Flow
3.	23CE403	Foundation Engineering
Any advanced courses can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	23CE404	Pre-stressed Concrete
2.	23CE405	Watershed Management
3.	23CE406	Design of Earthquake Resistant Structures
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	23CE407	Geo-synthetics and Reinforced Earth Structures
2.	23CE408	Smart rail, Airport and Port Infrastructure Engineering
3.	23CE409	Experimental Stress Analysis
Any advanced courses can be appended in future.		

Professional Elective –V		
Sl. No.	**Course Code**	**Course Title**
1	23CE410	Ground Improvement Techniques
2	23CE411	Subsurface Investigation and Instrumentation
3	23CE412	Infrastructure Economics and Contract Management
Any advanced courses can be appended in future.		

ANNEXURE – V

MANAGEMENT COURSE		
Sl. No.	**Course Code**	**Course Title**
1	23HUM801	Business Ethics and Corporate Governance
2	23HUM802	Principles of Management
3	23HUM803	Human Resource Development
4	23HUM804	Management Science
5	23HUM805	National Cadet Corps

ANNEXURE - VI

List of Skill Oriented Courses

Skill Enhancement course – I		
Sl. No.	**Course Code**	**Course Title**
1.	23CE601	Building Planning and Drawing
Any Courses can be appended in future.		

Skill Enhancement course – II		
Sl. No.	**Course Code**	**Course Title**
1.	23CE602	Remote Sensing and Geographical Information Systems
Any Courses can be appended in future.		

Skill Enhancement course – III		
Sl. No.	**Course Code**	**Course Title**
1.	23CE603	Estimation, Specifications, Costing and Valuation
Any Courses can be appended in future.		

Skill Enhancement Course – IV		
Sl. No.	**Course Code**	**Course Title**
1.	23CE604	Building Information Modelling
Any Courses can be appended in future.		

Skill Enhancement Course – V		
Sl. No.	**Course Code**	**Course Title**
1.	23ENG601	Soft Skills
Any Courses can be appended in future.		

ANNEXURE – VII

Minor in Civil Engineering

(Applicable to EEE, ME, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Stream Name: Building Planning and Constructional Technology

Sl. No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDCE101	Construction Materials	3	0	0	3	3
2	Professional Core Course	23MDCE102	Concrete Technology	3	0	0	3	3
3	Professional Core Course	23MDCE201	Concrete Technology Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDCE103	Building Planning And Drawing	3	0	0	3	3
5	Professional Core Course	23MDCE104	Surveying	3	0	0	3	3
6	Professional Core Course	23MDCE202	Surveying Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDCE105	Construction Methods	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

Minor in Quantum Computing

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Stream Name: Quantum Computing

Sl. No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDINS101	Introduction to Quantum Computing	3	0	0	3	3
2	Professional Core Course	23MDINS102	Mathematical Foundations for Quantum Computing	3	0	0	3	3
3	Professional Core Course	23MDINS201	Quantum Programming and Simulation Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDINS103	Quantum Algorithms	3	0	0	3	3
5	Professional Core Course	23MDINS104	Quantum Information and Communication	3	0	0	3	3
6	Professional Core Course	23MDINS202	Quantum Algorithms Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDINS105	Quantum Machine Learning (QML)	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

Minor in Quantum Technologies

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Stream Name: Quantum Technologies

Sl. No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDINS106	Foundations of Quantum Technologies	3	0	0	3	3
2	Professional Core Course	23MDINS107	Solid State Physics for Quantum Technologies	3	0	0	3	3
3	Professional Core Course	23MDINS203	Quantum Devices and Materials Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDINS108	Introduction to Quantum Communication	3	0	0	3	3
5	Professional Core Course	23MDINS109	Introduction to Quantum Sensing	3	0	0	3	3
6	Professional Core Course	23MDINS204	Quantum Communication and Sensing Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDINS110	Quantum Optics Prerequisites for Quantum Technologies	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

ANNEXURE - VIII

Honors in Civil Engineering

Sl.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23HDCE101	Soil Dynamics and Machine Foundation	3	0	0	3	3
2	Professional Core Course	23HDCE102	Industrial Waste and Waste Water Management	3	0	0	3	3
3	Professional Core Course	23HDCE201	NDT Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23HDCE103	Repair and Rehabilitation of Structures	3	0	0	3	3
5	Professional Core Course	23HDCE104	Design and Drawing of Irrigation Structures	3	0	0	3	3
6	Professional Core Course	23HDCE202	Structural Design Studio Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23HDCE105	Road Safety Engineering	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

I Year I Semester

B. Tech I Year I Semester

23ENG101 COMMUNICATIVE ENGLISH

L	T	P	C
2	0	0	2

Pre-requisite: None

Course Objectives:

The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

UNIT I Lesson: HUMAN VALUES: Gift of Magi (Short Story) 6 hours

Listening: Identifying the topic, the context and specific pieces of information by listeningto 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 ofinformation.
Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II Lesson: NATURE: The Brook by Alfred Tennyson (Poem) 6 hours

Listening: Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structuretalks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to linkthe 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 Lesson: BIOGRAPHY: Elon Musk 6 hours

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: Readinga text in detail by making basic inferences -recognizing and interpretingspecific 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, Collocations

UNIT IV **Lesson: INSPIRATION: The Toys of Peace by Saki** **6 hours**

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 **Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)** **6 hours**

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.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar andusage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

Course Outcomes:

CO1: Understand the topic, context, and pieces of specific information from personal , professional and social situations

CO2: Apply discourse markers to speak clearly in formal discussions

CO3: Analyze and apply grammatical structures to formulate contextualized phrases and sentences

CO4: Analyze texts and images to write summaries based on global comprehension

CO5: Draft coherent paragraphs and structured essays

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

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

Web Resources

Grammer

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/

VOCABULARY

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

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23MAT101 LINEAR ALGEBRA AND CALCULUS

L	T	P	C
3	0	0	3

Course Objectives:

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.

UNIT I MATRICES 9 hours

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 EIGENVALUES, EIGENVECTORS AND ORTHOGONAL TRANSFORMATION 9 hours

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 canonicalforms by Orthogonal Transformation.

UNIT III CALCULUS 9 hours

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 PARTIAL DIFFERENTIATION AND APPLICATIONS (MULTI VARIABLE CALCULUS) 9 hours

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 functionsof two variables, method of Lagrange multipliers.

UNIT V MULTIPLE INTEGRALS (MULTI VARIABLE CALCULUS) 9 hours

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).

Course Outcomes:

At the end of the course, the student will be able to

CO1: Solve the system of linear equations and apply the matrix algebra techniques in practical applications.

CO2: Utilize the Eigenvalues, Eigenvectors and applications of diagonalization in the field of Science and Technology.

CO3: Relate the results of mean value theorems in real life problems.

CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.

CO5: Compute the area and volume by interlinking them to appropriate double and triple integrals.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition

2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, AlphaScience International Ltd., 2021 5th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5thEdition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9thedition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement

UNIT I WATER TECHNOLOGY 9 hours

Soft and hardwater, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen - Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment – Ion-exchange processes - desalination of brackish water, reverse osmosis (RO), electrodialysis and Specifications for drinking water as per BIS and WHO standards.

UNIT II ELECTROCHEMISTRY AND APPLICATIONS 9 hours

Electrodes –electrochemical cell, Nernst equation, cell potential calculations.
Primary cells – Zinc-air battery, Sodium-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium-ion batteries- working principle of the batteries including cell reactions; Fuel Cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.
Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT III POLYMERS AND FUEL CHEMISTRY 9 hours

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization, Poly Dispersity Index (PDI) & it's significance.
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC, Nylon 6,6 and Bakelite.
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers.
Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel.

UNIT IV MODERN ENGINEERING MATERIALS 9 hours

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications
Refractories- Classification, Properties, Factors affecting the refractory materials and Applications.
Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.
Building materials- Portland Cement, constituents, Setting and Hardening of cement (with chemical reactions).

UNIT V SURFACE CHEMISTRY AND NANOMATERIALS 9 hours

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (Braggs Method), chemical and biological methods of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents,
Adsorption isotherm (Freundlich and Langmuir), BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Explain the estimation of impurities present in water like hardness and softening of impure water.

CO2: Explain the working principles of batteries & demonstrate the corrosion prevention methods and factors affecting corrosion

CO3: Explain the preparation, properties, and applications of thermoplastics, thermosetting, elastomers & conducting polymers & explain calorific values, octane number, refining of petroleum and cracking of oils.

CO4: Explain the setting and hardening of cement, properties of composites, lubricants & refractories.

CO5: Summarize the concepts of colloids, micelle and nanomaterials.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.

2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.

3. G V Subba Reddy, K N Jayaveera, C Ramachandraiah, Engineering Chemistry, McGraw-Hill; First Edition, 2019.

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.

2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992.

3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23CME101 BASIC CIVIL AND MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

PART A: BASIC CIVIL ENGINEERING

UNIT I BASICS OF CIVIL ENGINEERING 8 hours

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 - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II SURVEYING 8 hours

Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT III TRANSPORTATION ENGINEERING 8 hours

Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Course Outcomes:

CO1: Identify various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Measure of distances, angles and levels through surveying.

CO3: Identify various transportation infrastructures, sources of water and various water conveyance, storage structures like dams and reservoirs.

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt.Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers.2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. FifthEdition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, KhannaPublishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives:

The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

UNIT I **8 hours**

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries andSociety-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 hours**

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 **8 hours**

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.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Course Outcomes:

On completion of the course, the student should be able to

CO1: Understand the role and importance of mechanical engineering and engineering materials

CO2: Identify the different manufacturing processes for engineering applications and explain the basics of thermal engineering and its applications.

CO3: Explain the working of different mechanical power transmission systems, power plants and robotics.

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India)Pvt. Ltd.

2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd.

3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengagelearning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications

3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.

4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23CSE101 INTRODUCTION TO PROGRAMMING

L	T	P	C
3	0	0	3

Course Objectives:

- Comprehensive knowledge to computer systems, programming languages, and problem-solving techniques.
- Know the concept of control structures and their usage in programming.
- Introduce to the arrays, memory models, and basic string concepts
- Gain a knowledge from the concept of functions, including declaration, definition, and various aspects of function usage.
- Acquire the advanced programming concepts, including user-defined data types, pointers, and file handling.

UNIT I INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING **9 hours**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II CONTROL STRUCTURES **9 hours**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

UNIT III ARRAYS AND STRINGS **9 hours**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings, String Operations and String functions.

UNIT IV POINTERS & USER DEFINED DATA TYPES **9 hours**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions, Dynamic memory allocation.

UNIT V FUNCTIONS & FILE HANDLING **9 hours**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation**.**

Course Outcomes:

A student after completion of the course will be able to

CO1: Illustrate the basic computer concepts and programming principles of C language.

CO2: Develop programs using various control structures in 'C'.

CO3:Design applications using arrays and basic string manipulation.

CO4: Demonstrate the applications of pointers, user-defined types and dynamic memory allocation.

CO5: Design various applications using functions and file concepts.

Textbooks:

1. C Programming, A Problem Solving Approach, Forouzan, Gilberg,Prasad, CENGAGE, 3rd edition.

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-HillEducation, 2008.

2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition

3. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988

4. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education,1996

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23ENG201 COMMUNICATIVE ENGLISH LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, 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.

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

Course Outcomes:

CO1: Understand the English speech sounds, stress, rhythm, intonation and syllabic division for better listening and speaking
CO2: Apply communication strategies and implement them in language learning activities.
CO3: Analyze and enhance job-relevant writing skills
CO4: Evaluate and exhibit professionalism in debates and group discussions.
CO5: Make effective presentations by developing public speaking abilities

Suggested Software:

1. Walden Infotech
2. Young India Films

Reference Books:

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

Web 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
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & 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

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23CHE201 ENGINEERING CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

- To verify the fundamental concepts with experiments

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Estimation of Dissolved Oxygen by Winkler's method
3. Determination of Strength of an acid in Pb-Acid battery
4. Preparation of a polymer (Bakelite)
5. Determination of percentage of Iron in Cement sample by colorimetry
6. Estimation of Calcium in port land Cement
7. Preparation of nanomaterials by precipitation method.
8. Adsorption of acetic acid by charcoal
9. Determination of percentage Moisture content in a coal sample
10. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
11. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
12. Determination of Calorific value of gases by Junker's gas Calorimeter
13. Determination of Viscosity of a solution using Ostwald's Viscometer
14. Determination of cell constant and conductance of solutions

Course Outcomes:

At the end of the course, the students will be able to

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer materials.

CO3: Determine the physical properties like adsorption and viscosity.

CO4: Estimate the Iron and Calcium in cement.

CO5: Calculate the hardness of water.

Reference Books:

1. Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

2. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23CSE201 COMPUTER PROGRAMMING LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

- Provide hands-on experience in programming fundamentals, algorithm design, and basic problem-solving techniques.
- Enable students to implement control structures for program flow control in practical scenarios.
- Reinforce understanding of arrays, memory models, and string manipulation through practical exercises
- Provide hands-on practice with functions, function calls, and parameter manipulation using pointers.
- Offer practical exposure to advanced programming concepts, including user-defined data types, file handling, and pointer operations.

UNIT I

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writingthe first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a seriesof finite steps both using textual notation and graphic notation.

Suggested Experiments /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

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) 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.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.
Problems to Practice:

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II

WEEK 4
Objective: Explore the full scope of expressions, type-compatibility of variables & constantsand operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:
Lab4: Write C program to solve Simple computational problems using the operator' precedence and associativity
Problems to Practice:

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 5: Write C program for Problems involving if-then-else structures.
Problems to Practice:

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 eachof these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Write a C program for Iterative problems e.g., the sum of series
Problems to Practice:

i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III

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.

Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 7:Write a C program to solve 1D Array manipulation, linear search
Problems to Practice:

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
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 usedas 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.

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Write a C program to solve Matrix problems, String operations, Bubble sort
Problems to Practice:

i) Addition of two matrices
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

UNIT IV

WEEK 9:

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. Gainexperience processing command-line arguments received by C

Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Write a C program for Pointers and structures, memory dereference.
Problems to Practice:

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 alongwith the total.
v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures(Singly linked lists) and nested structures

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the samewithout using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11:

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

Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Write a C program to solve Simple functions using call by value, solving differential equations using Eulers theorem.

Problems to Practice:

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'smethod

WEEK 12:

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

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Write C program for Recursive functions.

Problems to Practice:

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive 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 13:

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

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Write a C program to solve Simple functions using Call by reference, Dangling pointers.

Problems to Practice:

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 othercharacters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore thedifferences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: Write a C program to handle File operations.

Problems to Practice:

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-linearguments.
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.

Course Outcomes:

CO1: Implement coding and debugging the simple programs, create algorithms, and practice problem solving strategies.

CO2: Demonstrate programs that incorporate conditional statements, loops, and break/continue statements to control program execution.

CO3: Apply coding for real time examples with arrays, array indexing, and manipulate strings in programming tasks.

CO4: Create, call, and debug functions, modify function parameters using pointers, and gain practical knowledge of variable scope within functions.

CO5: Apply user-defined data types, manipulate files, pointer operations to solve real-world programming challenges.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.

2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India

2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23ME201ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in woodworking and make following joints.
   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridlejoint
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 punctureand 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.

Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.

CO3: Apply fitting operations in various applications.

CO4: Apply basic electrical engineering knowledge for House Wiring Practice

Textbooks:

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

2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, MediaPromoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; AtulPrakashan, 2021-22.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23HUM201 HEALTH AND WELLNESS, YOGA AND SPORTS

L	T	P	C
0	0	1	0.5

Course Objectives:

The main objective of introducing this course is 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.

UNIT I **5 hours**

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:

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

UNIT II **5 hours**

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 **5 hours**

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.
ii) Practicing general and specific warm up, aerobics
iii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Course Outcomes:

After completion of the course the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.

CO2: Demonstrate an understanding of health-related fitness components.

CO3: Compare and contrast various activities that help enhance their health.

CO4: Assess current personal fitness levels.

CO5: Develop Positive Personality.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty,
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. HumanKinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as manyas Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

I Year II Semester

B. Tech I Year II Semester

23MAT102 DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

L	T	P	C
3	0	0	3

Course Objectives:

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

UNIT I DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE **9 hours**

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 LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS) **9 hours**

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 PARTIAL DIFFERENTIAL EQUATIONS **9 hours**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV VECTOR DIFFERENTIATION **9 hours**

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 VECTOR INTEGRATION **9 hours**

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.

Course Outcomes:

At the end of the course, the student will be able to

CO1: Find the solution of engineering problems formulated in the form of linear first order differential equations.

CO2: Solve the linear higher order differential equations related to various engineering fields.

CO3: Determine the solutions for linear partial differential equations that model the physical processes.

CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO5: Estimate the work done against field, circulation and flux using vector calculus.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10thEdition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, PearsonPublishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones andBartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018,5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23PHY101 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

Course Objectives:

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.

UNIT I WAVE OPTICS 9 hours

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 CRYSTALLOGRAPHY AND X-RAY DIFFRACTION 9 hours

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 QUANTUM MECHANICS AND FREE ELECTRON THEORY 9 hours

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 IV SEMICONDUCTORS 9 hours

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

UNIT V DIELECTRIC AND MAGNETIC MATERIALS 9 hours

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 - complex dielectric constant – 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.

Course Outcomes:

CO1: Apply the knowledge of Interference, Diffraction and Polarization techniques for materials testing and explore their applications in both science and technology.

CO2: Explain the crystal structure in terms of atomic positions, unit cells, and crystal symmetry and also relate the crystal symmetry to the symmetry observed in a diffraction pattern.

CO3: Evaluate the Schrodinger wave equations for simple potentials and explain the concept of conductivity of different types of materials.

CO4: Distinguish the semiconductors using Fermi level and identify the type of semiconductors using Hall effect.

CO5: Explain the origin of fundamental magnetic phenomena and types of magnetic materials. Understand the induced fields in dielectrics, and electrical behaviour of dielectrics.

Textbooks:

1. A Textbook of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS ArunMurthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23EEE101 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC CIRCUITS 8 hours

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 MACHINES AND MEASURING INSTRUMENTS 8 hours

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 ENERGY RESOURCES, ELECTRICITY BILL & SAFETY MEASURES 8 hours

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 electricitytariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker(MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types,Safety Precautions to avoid shock

Course Outcomes:

After the completion of the course students will be able to

CO1: Infer the basic AC and DC electrical circuits.

CO2: Analyze construction and operation of AC and DC machines, different electrical measuring instruments.

CO3: Illustrate operation of various power generating stations, energy consumption and electrical safety.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti,Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019,Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford UniversityPress, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

UNIT I SEMICONDUCTOR DEVICES 8 hours

Introduction - Evolution of electronics – Vacuum tubes to nano 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 BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION 8 hours

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 DIGITAL ELECTRONICS 8 hours

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 BooleanAlgebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XORand XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only).

Course Outcomes:

After the completion of the course students will be able to

CO1: Explain the theory, construction, and operation of electronic devices.

CO2: Apply the concept of science and mathematics to explain the working of diodes, transistors, and their applications.

CO3: Analyze logic gates and its applications in design of combinational circuits.

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.

2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall,India, 2002.

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

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23ME101 ENGINEERING GRAPHICS

L	T	P	C
1	0	4	3

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing.
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

UNIT I **9 hours**

Introduction: Lines, Lettering and Dimensioning,Geometrical Constructions and Constructing regular polygons by general methods.
Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.
Scales: Plain scales, diagonal scales and vernier scales.

UNIT II **9 hours**

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 **9 hours**

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.

UNIT IV **9 hours**

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 **9 hours**

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination).

Course Outcomes:

Students will use the Auto CAD software and will be able to

CO1: Construct the geometrical constructions, engineering curves and scales.

CO2: Draw the projections of points, straight lines and planes

CO3: Draw the projections of solids in various positions

CO4: Sketch the sections of solids and developments of surfaces

CO5: Draw the conversion of the isometric views to orthographic views and vice versa.

Textbooks:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.

2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.

3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, TataMcGraw Hill, 2017.

Mode of Evaluation: Day-to-day Evaluation, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23CE101 ENGINEERING MECHANICS

L	T	P	C
3	0	0	3

Course Objectives:

- To get familiarized with different types of force systems.
- To draw accurate free body diagrams representing forces and moments acting on a body to analyse the equilibrium of system of forces.
- To teach the basic principles of centre of gravity, centroid and moment of inertia and determine them for different simple and composite bodies.
- To apply the Work-Energy method to particle motion.
- To understand the kinematics and kinetics of translational and rotational motion of rigid bodies.

UNIT I **9 hours**

Introduction to Engineering Mechanics– Basic Concepts. Scope and Applications
Systems of Forces: Coplanar Concurrent Forces– Components in Space–Resultant–Moment of Force and its Application –Couples and Resultant of Force Systems.
Friction: Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction.

UNIT II **9 hours**

Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorm, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces,converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

UNIT III **9 hours**

Centroid: Centroids of simple figures (from basic principles)–Centroids of Composite Figures. Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems..
Area Moments of Inertia: Definition– Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

UNIT IV **9 hours**

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

UNIT V **9 hours**

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method.

Course Outcomes:

On Completion of the course, the student should be able to

CO1: Determine the Resultant force, frictional forces acting on bodies in contact.

CO2: Analyze different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments.

CO3: Calculate the centroids, center of gravity and moment of inertia of different geometrical shapes.

CO4: Apply the principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle.

CO5: Solve the problems involving the translational and rotational motion of rigid bodies.

Textbooks:

1. Engineering Mechanics, S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., , McGraw HillEducation 2017. 5th Edition.
2. Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V veeravalli , Universitypress. 2020. First Edition.
3. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age internationalpublications 2018. 4th Edition.

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw HillEducation. 2017. First Edition.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI, 2002. 4th Edition.
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L. G. Kraige., John Wiley, 2008. 6th Edition.
4. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press,2014. Second Edition
5. Engineering Mechanics: Statics and Dynamics, Hibbeler R.C., Pearson Education, Inc., New Delhi, 2022, 14th Edition

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23PHY201 ENGINEERING PHYSICS LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

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. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a Compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

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

Course Outcomes:

CO1: Know the various phenomena of light practically and gain knowledge about various optical technique methods.

CO2: Verify the theoretical concepts of optics, magnetism and dielectrics by hands on experiment.

CO3: Apply the scientific process in the conduct of semiconductor experiments and report the experimental findings.

CO4: Understand mechanical phenomena by instruments and apply them in real time applications.

CO5: Acquire and interpret experimental data to examine the physical laws.

Web Resources:

www.vlab.co.in
https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

Reference Books:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; AtulPrakashan, 2021-22.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23EEE201 ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set,wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be usedby the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by thestudents.
3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
   - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LABORATORY

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

Note: Minimum Six Experiments to be performed.

Course Outcomes:

At the end of the course, the student will be able to

CO1: Analyze basic DC circuits.

CO2: Understand the usage of common electrical & electronic measuring instruments.

CO3: Understand the basic characteristics of electrical machines and perform energy calculations.

PART B: ELECTRONICS ENGINEERING LABORATORY

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

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 rectifier.
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
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gatesusing ICs.
8. 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.

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

Course Outcomes:

At the end of the course, the student will be able to

CO1: Plot and discuss the characteristics of various electron devices.

CO2: Explain the operation of a digital circuit.

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

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

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23CSE202 IT WORKSHOP

L	T	P	C
0	0	2	1

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSSTo teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

PC Hardware & Software Installation

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 peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Labinstructors should verify the work and follow it up with a Viva. Also students need to go throughthe 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. Labinstructor 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 (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configuredas dual boot (VMWare) with both Windows and BOSS. 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. Finallystudents should demonstrate, to the instructor, how to access the websites and email. If there isno 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 active x 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 and logical operators, Conditional formatting

POWER POINT
Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in 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 new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another 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?'"

Course Outcomes:

CO1: Gain expertise in computer hardware, assembly, and dual-boot OS configuration, enhancing their ability to manage and troubleshoot computer systems effectively.

CO2: Learn to connect to the LAN, configure browsers, use search engines effectively, and practice cyber hygiene for secure internet use.

CO3: Create well-formatted documents and presentations using Microsoft Office and Latex

CO4: Gain proficiency in using Excel or its FOSS equivalent for tasks like scheduling, GPA calculation, data manipulation, and formatting.

CO5: Craft effective and tailored inputs to obtain desired responses from AI tools like ChatGPT.

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech,2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and KenQuamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCOPress, Pearson Education, 3rd edition

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23CE201 ENGINEERING MECHANICS AND BUILDING PRACTICES LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

The students completing the course are expected to

- Verify the Law of Parallelogram of Forces and Lami's theorem.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Understand the layout of a building, concepts of Non-Destructive Testing and different Alternative Materials.

Students have to perform any 10 of the following Experiments:

List of Experiments:

1. To study various types of tools used in construction.
2. Forces in Pin Jointed Trusses
3. Experimental Proof of Lami's Theorem
4. Verification of Law of Parallelogram of Forces.
5. Determination of Center of Gravity of different shaped Plane Lamina.
6. Determination of coefficient of Static and Rolling Friction.
7. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever
8. Study of Alternative Materials like M-sand, Fly ash, Sea Sand etc.
9. Field-Visit to understand the Quality Testing - report.
10. Safety Practices in Construction industry
11. Demonstration of Non-Destructive Testing - using Rebound Hammer & UPV
12. Study of Plumbing in buildings.

Course Outcomes:

On completion of the course, the student should be able to:

CO1: Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.

CO2: Verify Law of Parallelogram of forces and Law of Moment using force polygon and bell crank lever.

CO3: Determine the Centre of gravity different configurations

CO4: Perform Quality Testing and Assessment Procedures and principles of Non- Destructive Testing.
CO5: Exposure to safety practices in the construction industry.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23HUM202 NSS/NCC/SCOUTS AND GUIDES/COMMUNITY SERVICE

L	T	P	C
0	0	1	0.5

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

UNIT I ORIENTATION **5 hours**

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personaltalents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II NATURE & CARE **5 hours**

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 **5 hours**

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders-Surveyin 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 PopulationEducation.
v) Any other programmes in collaboration with local charities, NGOs etc.

Course Outcomes:

After completion of the course the students will be able to

CO1: Understand the importance of discipline, character and service motto.

CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.

CO3: Explore human relationships by analyzing social problems.

CO4: Determine to extend their help for the fellow beings and downtrodden people.

CO5: Develop leadership skills and civic responsibilities.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Textbook of National Service Scheme*
2. Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
3. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, DirectorateGeneral of NCC, Ministry of Defence, New Delhi
4. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering",McGraw Hill, New York 4/e 2008
5. Masters G. M., Joseph K. and Nagendran R. "Introduction to EnvironmentalEngineering and Science", Pearson Education, New Delhi. 2/e 2007

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

II Year I Semester

B. Tech II Year I Semester

23HUM101 UNIVERSAL HUMAN VALUES

L	T	P	C
2	1	0	3

Course Prerequisite: None or Universal Human Values I (desirable)

Course Description :

The course has 28 lectures and 14 tutorials in 5 Units. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

Course Objectives: None. Universal Human Values-I (desirable)

The main objectives of the course is to

1. help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure happiness and prosperity in continuity, which are the core aspirations of all human beings.
2. facilitate the development of a Holistic perspective among students towards life and profession based on right understanding of the Human reality, family, society and the rest of nature. Such holistic perspective forms the basis of Universal Human Values (UHV) and movement towards value-based living in a natural way.
3. highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. aid the students to realize their full human potential and act accordingly.
5. assist the students to live with feeling of relationship, harmony and co-existence.

UNIT I INTRODUCTION TO VALUE EDUCATION 9 hours

Lecture 1: Understanding Value Education
Lecture 2: self-exploration as the Process for Value Education
Tutorial 1: Practice Session PS1 - Sharing about Oneself
Lecture 3: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 - Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 - Exploring Natural Acceptance

UNIT II HARMONY IN THE HUMAN BEING 9 hours

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 - Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 - Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 - Exploring Harmony of self with the body

UNIT III HARMONY IN THE FAMILY AND SOCIETY **9 hours**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 - Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 - Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 - Exploring Systems to fulfil Human Goal

UNIT IV HARMONY IN THE NATURE/EXISTENCE **9 hours**

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 - Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 - Exploring Co-existence in Existence.

UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS **9 hours**

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 - Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 - Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 - Exploring Steps of Transition towards Universal Human Order

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the Natural Acceptance and basic human aspiration.
CO2: Aware of themselves and self-regulation.
CO3: Recognize human-human relationship (Justice) and identify human goals in the society.
CO4: Appreciate the harmony in the nature and existence.
CO5: Develop as socially and ecologically responsible engineers in handling problems with sustainable solutions (user-friendly and eco-friendly).

Textbooks:

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

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Online Learning Resources

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

10. https://uhv.org.in/
11. https://www.youtube.com/@UniversalHumanValues/playlists
12. https://fdp-si.aicte-india.org/index.php

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23MAT103 PROBABILITY AND STATISTICS FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Prerequisite: 23MAT101, 23MAT102

Course Description:

This course provides an introduction to probability, distributions and statistics with applications. Topics include: Conditional probability, Random variables, Probability distributions, Joint densities, Bayesian inference, Hypothesis testing, Confidence intervals, Correlation and linear regression.

Course Objectives:

This course enables students to

1. To revise the elementary concepts of probability and random variables.
2. To analyze and interpret basic summary and modeling techniques for Multi-variate data.
3. To introduce new techniques for carrying out probability calculations and identifying probability distributions.
4. To understand the foundations for statistical inference involving confidence intervals and hypothesis testing.
5. To analyze the statistical experimental designs.

UNIT I PROBABILITY AND RANDOM VARIABLES 9 hours

Introduction to Probability, sample space and events, Axioms of probability, theorems on probability, conditional probability, multiplication theorem and independence of events, Bayes theorem.

Random Variables - Types of Random Variables - Probability Mass Function - Probability Density Function- Distribution Function and its properties. Expectation – Properties of Expected Value - Variance - Moment generating function.

UNIT II PROBABILITY DISTRIBUTIONS 9 hours

Discrete Distributions: Bernoulli trail, Binomial distribution, Poisson approximation to the binomial distribution, Poisson distribution and Hyper geometric distribution –properties.

Continuous Distributions: Uniform, Exponential distribution, Gamma distribution, Normal distribution. Normal probability rule and Chebyshev's inequality

UNIT III JOINT DISTRIBUTIONS 9 hours

Joint Densities and Independence - Marginal Distributions (discrete & continuous)- Expectation and Covariance, Correlation, Conditional densities and Regression, Curves of Regression.

UNIT IV HYPOTHESIS TESTING 9 hours

Population, sampling, formulation of null hypothesis, alternative hypothesis, level of significance, types of errors and power of the test. Large Sample Tests: Test for single mean, single proportion, difference of means, difference of proportions, Confidence interval for parameters in one sample and two sample problems, t test for single mean, difference of means, test for ratio of variances.

UNIT V ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS 9 hours

Analysis of Variance: One-way and two-way classifications. Principles experimental design, Randomized Block Design (RBD) and Latin Square Design.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the probability concepts and their importance in engineering.
CO2: Apply discrete and continuous probability distributions to solve various engineering problems.
CO3: Get an idea about joint density functions, distribution functions to the random variables and analyze the multivariate problems in engineering
CO4: Perform test of hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.
CO5: Analyse the statistical experimental designs for various engineering problems.

Textbooks:

1. J.S. Milton and J.C. Arnold, Introduction to Probability and Statistics, 4th edition, 2003 Tata McGraw-Hill Publications.
2. Dr.B.S.Grewal, " Higher Engineering Mathematics", Khanna Publications, 42nd Edition.

Reference Books:

1. Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Elsevier, Academic Press, 2010.
2. Walpole, R.E., Myers R.H., Myer S.L., Ye. K: Probability and Statistics for Engineers and Scientists, 8th ed., Pearson Education, 2008.
3. Johnson, R.A. Miller Freund's: Probability and Statistics, 7th Edition, PHI, 2005.
4. Sheldon Ross: A First Course in Probability, 6th Edition, Pearson Education, 2002.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CE102 STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

Course Objectives:

1. To understand the nature of stresses and strains developed in simple geometries
2. To understand the concepts of failure modes of columns and its strength
3. To understand concept of flexural and shear stresses
4. To understand the effect of torsion on shafts, combined stresses and strains
5. To understand the deflection of various types of beams subjected to different loading Conditions.

UNIT I SIMPLE STRESSES AND STRAINS 9 hours

Concept of stress and strain- Types of stresses and strains- St. Venant's principle, Elasticity and plasticity - Hooke's law - Stress - Strain diagram for mild steel - Working stress - Factor of safety - Lateral strain, Poisson's ratio and volumetric strain - Elastic moduli and the relationship between them - Bars of varying section - composite bars - Temperature stresses. Strain Energy - Resilience - Gradual, sudden, impact and shock loadings - simple applications.

UNIT II SHEAR FORCE AND BENDING MOMENT AND COLUMNS AND STRUTS 9 hours

SHEAR FORCE AND BENDING MOMENT: Concept of Shear Force (SF) and Bending Moment (BM) - SF and BD diagrams for Cantilever and Simply supported and Overhanging beams (One side and both sides) under point load(s) (Vertical and Inclined), part and whole Uniformly Distributed Load(s), Uniformly Varying Load(s) and moment(s) -Calculation of maximum value and its location of SF and BM for all above load cases- Analyzing the basic problems from SF diagram.

COLUMNS AND STRUTS: Axially loaded compression members- Crushing load and Buckling load - Euler's theory for long columns- Rankine's theory- Analyzing the basic problems for Euler's and Rankine's theory.

UNIT III FLEXURAL AND SHEAR STRESSES 9 hours

BENDING STRESSES: Assumptions - Derivation of bending - Neutral axis - Determination of bending stresses - Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle, Channel sections and built-up sections - Design of simple beam sections.

SHEAR STRESSES: Shear Stresses- Derivation of shear stress formula - Shear stress distribution across various beam sections.

UNIT IV TORSION AND COMPOUND STRESSES AND STRAINS 9 hours

TORSION: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

COMPOUND STRESSES AND STRAINS: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress and their applications, Two dimensional stress-strain system, principal strains and principal axis of strain.

UNIT V DEFLECTIONS OF BEAMS 9 hours

Slope and deflection- Relationship between moment, slope and deflection, Determine slopes and deflections of the determinate beams (Simply supported and Cantilever) using Double integration method, Macaulay's method, Moment area method and Conjugate beam method.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Analyse the simple stress and strain in mechanics of solids

CO2: Analyse the beams to find the max shear force and bending moment and analysis the columns to find crushing and buckling strength.

CO3: Analyse bending and shear stresses for different types of beams with different sections

CO4: Analyse structural members subjected to torsion, compound stresses and strain.

CO5: Compute deflections of various beams.

Textbooks:

1. S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Company
2. R K Rajput, Strength of Material, S Chand Publications
3. Gere and Timoshenko , Mechanics Of Materials, 2nd Edition, CBS Publisher.

Reference Books:

1. Beer, F. P., Johnston, E. R. and DeWolf, J. T., Mechanics of Materials, Third Edition, McGraw- Hill International Edition, 2002.
2. Lardner, T. J, Archer, R. R., Mechanics of Solids, an introduction, International Edition, McGraw-Hill, 1994.
3. Shames, I. H., Introduction to Solid Mechanics, 2nd Edition, Prentice Hall of India Private Ltd. New Delhi, 1980.
4. Vaidyanathan R., Perumal P. and Lingeswari S., Mechanics of Solids and Structures, Volume I, Laxmi Publications (P) Ltd., New Delhi II, First Ed. 2017.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CE103 SURVEYING

L	T	P	C
3	0	0	3

Course Objectives:

1. To apply knowledge of mathematics, science, and engineering to understand the measurement
2. Techniques and equipment used in land surveying
3. To Prepare the student to plan and conduct field work and application of scientific methodology in handling field samples.
4. To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
5. To develop the skills in surveying and thematic mapping.

UNIT I **9 hours**

INTRODUCTION TO SURVEYING: Definition- Classifications - Basic Principles-Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting.

COMPASS AND PLANE TABLE SURVEYING: Compass – Basic principles - Types - Bearing - Systems and conversions- Sources of errors - Local attraction - Magnetic Declination -Dip Traversing - Plotting - Adjustment of closing error – applications - Plane table and its accessories - Merits and demerits - Radiation - Intersection - Resection – Traversing- sources of errors – applications.

UNIT II LEVELLING: **9 hours**

Level line - Horizontal line - Datum - Bench marks -Levels and staves – temporary and permanent adjustments – Methods of levelling - Fly levelling - Check leveling – Procedure in levelling - Booking -Reduction - Curvature and refraction - Reciprocal levelling – Sources of Errors in levelling- Precise levelling - Types of instruments - Adjustments - Field procedure and it application.

UNIT III THEODOLITE SURVEYING **9 hours**

Theodolite - Types - Description - Horizontal and vertical angles - Temporary and permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense method - Stadia constants – Anallactic

UNIT IV CURVES **9 hours**

Elements of simple and compound curves; Method of setting out- Elements of Reverse curve; Transition curve- length of curve- Elements of transition curve; Vertical curves.

UNIT V MODERN FIELD SURVEY SYSTEMS **9 hours**

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total Station - Parts of a Total Station - Accessories -Advantages and Applications; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations - Introduction to GIS, different GIS software, basic data types and coordinate systems

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Apply the knowledge, techniques, skills, and applicable tools for surveying activities.

CO2: Determine the levels of real world boundaries and points.

CO3: Identify the different types of theodolite surveying at field.

CO4: Identify different types of curves setting at field.

CO5: Apply the basics of modern survey instrument for surveying and mapping purpose.

Textbooks:

1. 1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling Parts 1 & 2
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015
3. C Venkatramaiah, Textbook of Surveying, Universities Press

Reference Books:

1. Elements of Geomatics by P.R. Wolf.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
3. C Venkatramaiah, Textbook of Surveying, Universities Press
4. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
5. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
6. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
7. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CE104 FLUID MECHANICS AND HYDRAULICS

L	T	P	C
3	0	0	3

Course Prerequisites: 23MAT101, 23MAT101, 23CE101

Course Objectives:

1. To provide a basic understanding of the properties and behavior of matter (fluids) by means of analytical equations.
2. To develop an understanding about hydrostatic and dynamics law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
3. To measure the flow using Bernoulli equation, flow through pipes and flow past immersed bodies.
4. To provide a basic knowledge on the importance of dimensional analysis and similarity techniques.

UNIT I **10 hours**

FLUID PROPERTIES: The Concept of a Fluid - Physical Properties of Fluids (Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity: Dynamic and Kinematic Viscosity, Compressibility, Surface tension, Capillary Effect, Vapour Pressure and Cavitation), Newtons law of viscosity, Types of Fluids.

FLUID STATICS: Types of Pressure, Pascal's Law, Hydrostatic Law, Pressure Measurement Devices, Pressure Head, Pressure Diagram, Centre of Pressure, Forces on Plane and Curved Surfaces, Buoyancy and Floatation: Archimedes's Principle, Metacentre, Stability of Submerged and Floating Bodies.

UNIT II FLUID KINEMATICS AND DYNAMICS **9 hours**

KINEMATICS: Types of Flows, Stream lines, Equipotential lines, Stream Function and Velocity Potential Function, Flow Net- (Properties and Uses), Continuity Equation (3-D Cartesian Form).

DYNAMICS: Forces Acting on Fluid in Motion, Euler's Equation along a Streamline, Bernoulli's Theorem, Limitations , Bernoulli's Applications: Venturimeter (Horizontal and Vertical), Orificemeter, Orifices, Time required for Emptying the Tank, Concept of HGL and TEL.

UNIT III PIPE FLOW **8 hours**

Reynold's Experiment, Hazen Poisulle's Equation for Viscous Flow through Circular Pipes, Major and Minor Losses, Concept of Equivalent Pipe, Dupit's Equation , Pipes in Series, Parallel and Syphon

UNIT IV OPEN CHANNEL FLOW **9 hours**

Classification of Flows In Open Channel, Geometric Elements, Chezy's and Manning's Formula, Uniform Flow Computations, Hydraulically Efficient Section (Rectangular, Triangular, Trapezoidal), Depth Energy Relationship in OCF.

UNIT V **9 hours**

GVF: Classification of Channel Slopes, Dynamic Equation of GVF (Assumption and Derivation), Classification of GVF Profiles- Practical Examples, Direct Step Method of Computation of GVF Profiles

RVF: Hydraulic Jump, Conjugate Depth Relationship, Characteristics, Uses and Types of Hydraulic Jump, Hydraulic Jump as an Energy Dissipater.

DIMENSIONAL AND MODEL ANALYSIS: Buckingham's π theorem - model analysis dimensionless number - scales ratios for distributed models.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Identify the important fluid properties and application of hydrostatic law to determine the forces on plane and curved surfaces.

CO2: Classify flows and determine the rate of flow through tanks / pipes using discharge measurement devices.

CO3: Compute the energy losses in pipe flow and understand the concept of equivalent pipe.

CO4: Identify the types of flows, energy-depth relationship in OCF and design hydraulically most efficient channel sections.

CO5: Analyze the GVF profiles and compute the energy loss in hydraulic jump and its efficiency as energy dissipating device.

Textbooks:

1. R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines (SI Units), Laxmi Publication
2. K Subramanya, "Flow in Open Channels," 5th Edition, McGraw Hill Education.

Reference Books:

1. A.K. Jain "Fluid Mechanics" Khanna Publication.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
3. Yunus A Cengel and John M Cimbala, "Fluid Mechanics Fundamentals and Applications" (SI Units), Tata McGraw-Hill Education, 3rd Edition, 2017.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CE202 SURVEYING LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites Intermediate Mathematics, Physics

Course Description:

This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes and elevations.

Course Objectives:

1. Know about various linear and angular measuring instruments .
2. Take Measurements in the linear and angular view.
3. Determine the area and volume by interpreting the data obtained from surveying activities
4. Know modern equipment such as total station.
5. Draft field notes from survey data

List of Experiments:

1. Chain survey of road profile with offsets in case of road widening..
2. Plot the site by referring the FMB (field measurement book)
3. Determination of distance between two inaccessible points by using compass.
4. Plane table survey; finding the area of a given boundary by the method of Radiation
5. Fly levelling: Height of the instrument method and rise & fall method (differential leveling) and draw the contours
6. Theodolite survey: determining the horizontal and vertical angles by the method of repetition method
7. Theodolite survey: finding the distance between two in accessible points.
8. Theodolite survey: finding the height of far object.
9. Determination of distance between two inaccessible point by using total station.
10. Determination of area and perimeter using total station.
11. Setting out a curve
12. Surveying camp.

(Minimum of 10 Experiments to be performed)

List of Major Equipment

1. Chains, tapes, Ranging rods (2M and 3M), cross staff, arrows
2. Compasses and Tripods, Optical square.
3. Plane tables, Alidade, Plumbing fork, trough compasses.
4. Levelling instruments.
5. Total Station and Digital Theodolite

Course Outcomes:

The students after completing the course will be able to:

CO1: Measure various linear and angular measurements of a land.

CO2: Measure the vertical measurements and able to draw contours of land.

CO3: Calculate the area and volume by interpreting the data obtained from surveying activities.

CO4: Measure the heights and distances along with area by using modern equipment such as total station.

CO5: Prepare field notes from survey data.

Textbook

1. Surveying and Levelling Parts 1 & 2 by T. P. Kanetkar and S. V. Kulkarni.
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

URLs

1. Video Lectures, IIT Kanpur
Online Course http://freevideolectures.com/Course/98/Surveying

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year I Semester

23CE203 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites None

Course Description:

This course covers the different tests that are necessary for any structure before construction. The materials to be tested in the laboratory are MS steel, HYSD steel, Wood, Concrete/Brick, springs.

Course Objectives:

1. To understand the behaviour of materials under different types of loading.
2. To find tensile strength, compressive strength, bending strength and shear strength of the supplied specimen.
3. To find the hardness of different materials.
4. To find the modulus of elasticity and modulus of rigidity of the materials.
5. To find the strain energy required to break the specimen.

List of Experiments:

1. Tension test on Steel bar.
2. Bending test on (Steel/Wood) Cantilever beam
3. Bending test on simply supported beam.
4. Torsion test
5. Hardness test (Rockwell/Brinell).
6. Compression test on wood or concrete.
7. Shear test
8. Impact test (Izod and Charpy)
9. Compression test on masonry/Brick
10. Water absorption and efflorescence test on brick.
11. Use of electrical resistance strain gauges (for demonstration).

(Minimum of 10 Experiments to be performed)

LIST OF EQUIPMENTS

1. UTM for conducting tension test on rods
2. Steel or Wooden beam for flexure test
3. Torsion testing machine
4. Brinell /Rock well hardness testing machine

5. Spring testing machine
6. Compression testing machine
7. Izod / Charpy Impact machine
8. Beam setup for Maxwell's theorem verification.
9. Electrical Resistance gauges
10. Continuous beam setup.

Course Outcomes:

The students after completing the course will be able to:

CO1: Determine the tensile and shear strength of various types and grades of ductile materials.

CO2: Examine the compressive strength of various types of brittle materials.

CO3: Analyse the deflections at various positions along the length of the beam for different types of beams/spring and correlate it with existing theorems.

CO4: Determine the torsional properties of ductile materials.

CO5: Examine the hardness and impact value for different kinds of metals.

Textbooks

1. 1. Moondra, H. S., and Gupta R., Laboratory Manual for Civil Engineering, CBS Publication, 2013

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year I Semester
Audit Course

23CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

Course Objectives:
This course enables students to

1. To make the students to get awareness of the environment.
2. To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
3. To save the earth from the inventions by the engineers.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 6 hours

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 ECOSYSTEMS 7 hours

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 ecosystem:
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 ORDERED STRUCTURES 6 hours

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 SOCIAL ISSUES AND THE ENVIRONMENT 5 hours

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 HUMAN POPULATION AND THE ENVIRONMENT 6 hours

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.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Exploring different types of renewable and non-renewable energy sources.

CO2: Students will learn about the structure and function of different ecosystems.
CO3: Students will learn about different types of pollution (air, water, soil) and their sources, effects, and control measures.
CO4: Exploring the science behind climate change, its evidence, and its impacts on ecosystems and human societies.
CO5: Understanding demographic factors and their environmental implications.

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press, Third Edition, 2021.
2. Palaniswamy, “Environmental Studies”, Pearson Education, Second Edition, 2014.
3. S. Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K. Raghavan Nambiar, “Textbook of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd. Second Edition, 2008.
5. A. Koushik & C. P. Koushik, Perspectives in Environmental Studies, New Age International, Fourth Edition, 2006.

Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications, Second Edition, 2012.
2. M. Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, Second Edition, 2023.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, Third Edition, 2009.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice Hall of India Private Limited, Second Edition, 2004.
5. G.R. Chatwal, “A Textbook of Environmental Studies” Himalaya Publishing House, Fourth Edition, 2014.
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private Limited, Third Edition, 2007.

Online Resources:

1. Atika Qazi; Fayaz Hussain; Nasrudin ABD. Rahim; Glenn Hardaker; Daniyal Alghazzaw, "Towards sustainable energy: a systematic review of renewable energy sources, technologies, and public opinions," 10.1109/ACCESS.2019.2906402, IEEE Access, vol. 7, pp. 63837-63851, 2019.
2. Gina Garland, Samiran Banerjee, Anna Edlinger, Emily Miranda Oliveira, Chantal Herzog, Raphaël Wittwer, Laurent Philippot, Fernando T. Maestre, Marcel G. A. van der Heijden, "A closer look at the functions behind ecosystem multifunctionality: A review," https://doi.org/10.1111/1365-2745.13511, Journal of Ecology, vol. 109, no. 2, pp. 600-613, 2021.
3. Siddiqua, A, Hahladakis, J.N. and Al-Attiya, “An overview of the environmental pollution and health effects associated with waste landfilling and open dumping,” https://doi.org/10.1007/s11356-022-21578-z, Environmental Science and Pollution Research, 29(39), pp.58514-58536, 2022.
4. Seddon N, Chausson A, Berry P, Girardin C.A, Smith A. and Turner B, “Understanding the value and limits of nature-based solutions to climate change and other global challenges,” https://doi.org/10.1098/rstb.2019.0120, Philosophical Transactions of the Royal Society B, 375(1794), p.20190120, 2020.
5. Hannes Weber and Jennifer Dabbs Sciubba, "The effect of population growth on the environment: evidence from European regions," https://doi.org/10.1007/s10680-018-9486-0, European Journal of Population, vol. 35, pp. 379-402, 2019.

Mode of Evaluation: Assignments and Mid Term Tests

II Year II Semester

B. Tech II Year II Semester

23HUM102 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
2	0	0	2

Course Prerequisite: NIL

Course Description:

The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the positions of financial statements are explained to know the analysis of financial matters.

Course Objectives:

This course enables students to

1. Describe the nature of engineering economics in dealing with the issues of scarcity;

2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;

3. Explain the different market structures and price determination in various market conditions.

4. Explain the accounting principles, types of accounting and preparation of final accounts; and

5. Describe the financial statement analysis and investment evaluation through ratios and capital budgeting techniques.

UNIT I DEMAND ANALYSIS **7 hours**

Scope and Significance of Economics- Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

UNIT II PRODUCTION AND COST ANALYSIS **7 hours**

Production Function – Short-run and long-run production – Cost Analysis: Cost concepts - Cost Structure of Firms and Output Decision- Break-Even Analysis (BEA) – significance and Limitations of BEA - Determination of Break Even Point (Simple Problems).

UNIT III MARKET STRUCTURE AND PRICING **6 hours**

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic – Price determination under Perfect, Monopoly, and Monopolistic Competition, Pricing objectives- Pricing Strategies.

UNIT IV BASICS OF ACCOUNTING **7 hours**

Accounting - Double Entry System - Accounting Principles - Classification of Accounts - Rules of Debit & Credit- Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems).

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING 7 hours

Ratio Analysis - Liquidity, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand Engineering economics basic concepts,

CO2: Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,

CO3: Compare various different market structures and identify suitable market,

CO4: Demonstrate an understanding and analyzing the accounting statements, and

CO5: Exhibit the ability to apply knowledge of ratio analysis and capital budgeting techniques in financial statement analysis and investment evaluation respectively.

Textbooks:

1. Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8th Edition, 2007
2. Aryasri: Business Economics and Financial Analysis, 4/e. MGH.
3. Financial Accounting, S. N. Maheshwari, Sultan Chand, 2009
4. Varshney & Maheswari: Management Economics, Sultan Chand
5. Financial Statement Analysis, Khan and Jain, PHI, 2009
6. Financial Management, Prasanna Chandra, T.M.H, 2009

Reference Books:

1. Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11th Edition, 2007
2. Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18th Edition, 2007
3. Financial Management and Policy, Van Horne, James, C., Pearson, 2009.
4. Financial Management, I. M. Pandey, Vikas Publications

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CE105 ENGINEERING HYDROLOGY

L	T	P	C
3	0	0	3

Course Description:

The course covers Hydrological cycle, Measurement of precipitation and various losses, Infiltration, Evaporation, Runoff and its measurement, Stream Flow Measurement, Hydrographs, Concept of Unit Hydrographs and its use in practical field, Estimation and Prediction of Floods, Wells and aquifers, well discharge.

Course Objectives:

1. To introduce the basics/fundamentals of hydrological cycle, precipitation, runoff, evaporation and other losses.
2. To introduce the concepts of Hydrographs and their use.
3. To measure and predict runoff and flood.
4. To understand the concepts in flood and well hydraulics.

UNIT I HYDROLOGIC CYCLE 9 hours

INTRODUCTION: Hydrologic cycle - watershed and water-budget equation - history of hydrology - world water balance - applications in engineering.

PRECIPITATION: forms of precipitation - characteristics of precipitation in India - measurement of precipitation - rain gauge network - mean precipitation over an area - depth-area-duration relationships - maximum intensity/depth-duration-frequency relationship - Probable Maximum Precipitation (PMP) - rainfall data in India.

EVAPORATION: Process evaporimeters - evapotranspiration - measurement of evapotranspiration – evapotranspiration equations - potential evapotranspiration over India - actual evapotranspiration - interception - depression storage

UNIT II 9 hours

INFILTRATION: Infiltration capacity - measurement of infiltration - modelling infiltration capacity - classification of infiltration capacities - infiltration indices.

RUNOFF: Surface Runoff Models - SCS-CN method of estimating runoff volume - flow-duration curve - flow-mass curve.

UNIT III 9 hours

STREAM FLOW MEASUREMENT: Measurement of Stage and Velocity - Direct and Indirect methods - Stage-Discharge relationships-Rating curve - Extrapolation of rating curve.

HYDROGRAPHS: hydrograph - factors affecting runoff hydrograph - components of hydrograph - base flow separation - effective rainfall - unit hydrograph - S-Curve - Instantaneous UH Synthetic UH.

UNIT IV FLOODS 9 hours

FLOOD ESTIMATION: Flood Estimation by Rational method - empirical method -Unit Hydrograph Method - Flood frequency studies: Gumbel's method - Log-Pearson Type III Distribution

FLOOD HYDRAULICS: Basic Equations - Flood Routing-Reservoir routing - Channel routing - Hydrologic Storage Routing - Attenuation - Hydrologic Channel Routing - Muskingum Method - Runge Kutta Method

UNIT V WELL HYDRAULICS 9 hours

Introduction-Forms of Subsurface water - Aquifer Properties – Compressibility - Equation of Motion - Wells - Steady flow into well - Unsteady flow in a confined aquifer – Well Losses - Specific capacity - Ground water recharge

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Estimate the areal average precipitation over the basin using the knowledge of hydrological cycle.
CO2: Identify losses and calculate runoff excluding the initial losses.
CO3: Measure stream flow, use hydrograph to estimate runoff.
CO4: Estimate flood using flood routing techniques.
CO5: Estimate ground water flow under various circumstances.

Textbooks:

1. V. T. Chow, D. R. Maidment, and L. W. Mays; Applied Hydrology, McGraw Hill International Editions

Reference Books:

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc- Graw Hill.
3. G L Asawa, Irrigation Engineering, Wiley Eastern
4. L W Mays, Water Resources Engineering, Wiley.
5. J D Zimmerman, Irrigation, John Wiley & Sons
6. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CE106 CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

Course Description:

This course covers ingredients of concrete and admixtures,properties of fresh concrete and hardened concrete, testing of hardened concrete and mix design. The course further covers special concretes used in construction industry.

Course Objectives:

1. The main aim of this course is to explain properties of ingredients of concrete admixtures and procedures for testing concrete ingredients.
2. To make the student to understand fresh and hardened characteristics of concrete and also to enable the students to identify different mix design procedures and produce concrete mix proportions.
3. To explains the characteristics of emerging concretes.

UNIT I **9 hours**

CEMENTS: Types of cement – Chemical composition – Hydration, Setting of cement, Fineness of cement, Structure of hydrate cement – Test for physical properties – Different grades of cements – Admixtures – Mineral and chemical admixtures – accelerators, retarders, air entrainers.
AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregates – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand –Deleterious substances – Soundness – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Maximum aggregate size .

UNIT II **9 hours**

FRESH CONCRETE: Steps in Manufacture of Concrete–proportion, mixing, placing, compaction, finishing, curing – including various types in each stage - Water / Cement ratio and admixtures – Properties of fresh Concrete -Workability and its tests– Factors affecting workability – Segregation & bleeding – Mixing and vibration of concrete, Shotcrete.

UNIT III **9 hours**

HARDENED CONCRETE: AAbram's Law – Nature of strength of concrete –Maturity concept – casting and curing of concrete, mechanical properties – Factors affecting mechanical properties – Relation between compression & tensile strength – Codal provisions for NDT..

UNIT IV **9 hours**

ELASTICITY, CREEP & SHRINKAGE : Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage –types of shrinkage - Factors affecting of shrinkage.

UNIT V **9 hours**

MIX DESIGN AND SPECIAL CONCRETES: Factors in the choice of mix proportions –Quality control of concrete- Statistical methods -Concepts Proportioning of concrete mixes by ACI method and IS Code method Polymer concrete - Fibre reinforced concrete – Factors affecting properties of FRC, High performance concrete – Self-healing concrete.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Identify different properties of concrete ingredients and estimate the properties through various test procedures.
CO2: Explain the basic characteristics of fresh and hardened concrete.
CO3: Test the mechanical properties of hardened concrete..
CO4: Design the concrete mix as per various international codes.
CO5: Explain the characteristic and applications of special concrete.

Textbooks:

1. T. Chow, D. R. Maidment, and L. W. Mays; Applied Hydrology, McGraw Hill International Editions
2. Shetty, M.S., Concrete Technology, S.Chand & Co, 2004.

Reference Books:

1. Gambhir, M.L., Concrete Technology, Tata Mc. Graw Hill Publishers, New Delhi.
2. Santha Kumar, A.R., Concrete Technology, Oxford university Press, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CE107 STRUCTURAL ANALYSIS

L	T	P	C
3	0	0	3

Course Description:

This course includes the basics of Structural analysis including the idealizations of different types of structures, support conditions and its loadings, and analysing the determinate and indeterminate structures using different methods.

Course Objectives:

1. To determine the whether a structure is determinate or indeterminate.
2. To analyse the beams and frames using slope deflection method.
3. To analyse the beams and frames using moment distribution method.
4. To analyse the beams and frames using Kani's method.
5. To analyse the continuous beams using three moment theorem.

UNIT I ENERGY THEOREMS 9 hours

Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces – Castigliano's first and second theorem, Deflections of simple beams and pin jointed trusses.

UNIT II ANALYSIS OF INDETERMINATE STRUCTURES 9 hours

Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Solution of trusses with upto two degrees of internal and external indeterminacies – Rolling loads, Influence Lines, Unit load method & other methods.

UNIT III FIXED BEAMS & CONTINUOUS BEAMS 9 hours

Introduction to statically indeterminate beams with uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads – Shear force and Bending moment diagrams – Deflection of fixed beams effect of sinking of support, effect of rotation of a support.

UNIT IV SLOPE-DEFLECTION METHOD 9 hours

Introduction-derivation of slope deflection equations- application to continuous beams with and without settlement of supports - Analysis of single bay portal frames without sway.

UNIT V MOMENT DISTRIBUTION METHOD 9 hours

Introduction to moment distribution method and Kanis method- Application to continuous beams with and without settlement of Supports-Analysis of single bay storey portal frames without sway.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Determine the whether a structure is determinate or indeterminate

CO2. Analyse the continuous beams using three moment theorem.

CO3. Analyse the beams and frames using slope deflection method.

CO4. Analyse the beams and frames using moment distribution method.

CO5. Analyse the beams and frames using Kani's method.

Textbooks:

1. Ramamrutham, S., & Narayan, R.,Theory of Structures, Dhanpat Rai Publishing Co. (P.) Ltd., 2017.
2. Menon, D., Structural Analysis, Narosa publishers, 2008.

Reference Books:

1. Ghali,A., Nevilee, A.M., & Brown, T.G., Structural Analysis, CRC Press, 2012
2. Wang, C. K., Intermediate Structural Analysis, McGraw Hill, 1989.
3. Reddy, C. S., Basic Structural Analysis, Tata McGraw Hill, 2007.
4. Hibbler, R. C., Structural Analysis, Pearson Education, 2006.
5. Negi, L. S., and Jangid R.S, Structural Analysis, Tata McGraw Hill, 2006

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CE108 ENVIRONMENTAL ENGINEERING

	L	T	P	C
Course Prerequisites: 23CE104	**3**	**0**	**0**	**3**

Course Description:

The course covers demand, quality, treatment and distribution of water along with characterization, collection, low cost treatment of waste water and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included. Further the course also covers basic laboratory

Course Objectives:

1. To explain water quality standards, treatment, distribution of water and design of various water treatment units.
2. To analyze the characteristics of wastewater and design various units of sewage treatment system.
3. To design various low cost wastewater treatment system and sludge disposal units.
4. To explain various impacts of air and noise pollution and various methods to control them air and noise pollution
5. To describe about solid waste generation, characterization, impacts and various management Techniques.

UNIT I WATER SUPPLY ENGINEERING 9 hours

Water- Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demands, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs, water treatment plant layout and design of various treatment units.

UNIT II WASTEWATER ENGINEERING 9 hours

Sewage- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

UNIT III LOW COST WASTEWATER AND SLUDGE TREATMENT 9 hours

Working principle of oxidation ponds, oxidation ditches, design of - septic tanks, soak pits and Imhoff tanks, Sludge characterization, sludge thickening, sludge digestion, factors affecting sludge digestion, Biogas recovery, various methods of sludge conditioning, dewatering and disposal.

UNIT IV AIR AND NOISE POLLUTION 9 hours

Air - Composition and properties of air, urban air pollution, Air quality standards, Measures and major equipment for air pollution control, Noise - Basic concept, measurement and various noise control methods.

UNIT V SOLID WASTE MANAGEMENT 9 hours

Solid waste management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle, Disposal methods.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Estimate water demand and design various units of surface water treatment plant

CO2. Estimate sewage generation and perform basic design of the unit operations that are used in sewage treatment.

CO3. Explain various low cost wastewater and sludge treatment techniques

CO4. Describe the impacts of air and noise pollution and review various air and noise pollution control methods

CO5. Discuss about the impacts of solid waste and various solid waste management techniques

Textbooks:

1. Birdie, G.S, Birdie, J.S., Water supply and sanitary Engineering, Including Environmental Engineering, Water and Air Pollution Laws and Ecology, Dhanpat Rai Publications, 1996.
2. Punmia, B.C, Ashok Kr Jain, Arun Kr Jain., Waste Water Engineering, Laxmi Publications, 1998.
3. Peavy, H., Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985
4. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
5. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Reference Books:

1. Gambhir, M.L., Concrete Technology, Tata Mc. Graw Hill Publishers, New Delhi.
2. Santha Kumar, A.R., Concrete Technology, Oxford university Press, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CE204 CONCRETE TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites None

Course Description:

The course will provide knowledge and skills of concrete material testing

Course Objectives:

1. To gain experience regarding the determination of properties of different building materials.
2. To provide an opportunity to learn how to measure the parameters which governs the quality of the materials,
3. To learn the principles and procedures of testing concrete materials and to get hands on experience by conducting the tests and evolving inferences.

List of Experiments:

Aggregate:

1. Specific Gravity and Water Absorption of fine and coarse aggregate.
2. Sieve analysis of fine and coarse aggregate
3. Bulk density for fine and coarse aggregates
4. Bulking of sand

Cement:

5. Normal Consistency of cement
6. Fineness of cement.
7. Initial setting time and final setting time of cement.
8. Specific gravity and soundness of cement.
9. Compressive strength of cement mortar cube.

Concrete:

10. Workability test on concrete by compaction factor, slump, Vee-bee and flow table.
11. Cube strength of concrete
12. Split tensile strength of concrete
13. Non-Destructive testing on concrete

Special concretes:

14. Tests on Self Compacting Concrete (for demonstration)

(Minimum of 10 Experiments to be performed)

LIST OF EQUIPMENTS

1. Pycnometers.
2. Vicat's apparatus
3. Specific gravity bottle.
4. Le-chatelier's apparatus.
5. Slump cone and compaction factor apparatus
6. Rebound hammer, Pulse velocity equipments.
7. CTM
8. Flow table

Course Outcomes:

The students after completing the course will be able to:

CO1: Identify different properties of aggregates through various test procedures.

CO2. Apply different test method to check the physical and mechanical properties of cement.

CO3. Test the mechanical properties of fresh concrete

CO4. Test the mechanical properties of hardened concrete.

CO5. Test various types of special concrete.

Reference Books

1. Concrete Technology Laboratory Manual Prepared by MITS Staff.

2. Shetty.M.S (2002), Concrete Technology, S.Chand& Co., Ltd, Ramnagar.

3. IS: 10262 - 2009, Indian Standard specification for Methods of Mix design.

4. IS: 383 - 1987, Indian Standard specification for Test for Fine and Coarse aggregates.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year II Semester

23CE205 FLUID MECHANICS AND HYDRAULICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Prerequisites None

Course Description:

The course includes Calibration of flow meters; Bernoulli's apparatus; performance of turbines And pumps; various losses through pipes.

Course Objectives:

Students should be able to verify the principles studied in theory by performing the experiments in lab.

List of Experiments:

1. Determination of Coefficient of discharge for Venturimeter
2. Determination of Coefficient of discharge for Orifice meter.
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable

Head method.

5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes
9. Performance test on Pelton wheel turbine.
10. Performance test on Francis turbine
11. Efficiency test on centrifugal pump
12. Efficiency test on reciprocating pump

(Minimum of 10 Experiments to be performed)

List of Equipments

1. Venturimeter setup
2. Orifice meter setup.
3. Small orifice setup.
4. External mouthpiece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Pelton wheel and Francis turbines.
10. Centrifugal and Reciprocating pumps.

Course Outcomes:

The students after completing the course will be able to:

CO1: Use flow measurement instruments and notches.

CO2. Apply Bernoulli's equation to find the losses in pipe and discharge.

CO3. Perform the test on pumps and turbines to find their efficiency.

CO4. Prepare reports on the data collected and use graphical techniques to interpret the data.

CO5. Use pumps and turbines for supply of water and power generation for the benefit of society.

Textbooks:

1. Majumdar Bireswar, Fluid Mechanics with Laboratory Manual, Second Edition, PHI Learning.

2. Raikar, R. V., Laboratory Manual Hydraulics And Hydraulic Machines, PHI Learning

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

III Year I Semester

B. Tech III Year I Semester

23CE109 WATER RESOURCES AND IRRIGATION

L	T	P	C
3	0	0	3

Pre-requisite: 23CE101, 23CE103, 23CE104, 23CE105

Course Objectives:

1. Evaluate the necessity, importance, and methods of irrigation, along with soil-water-plant relationships and irrigation efficiencies.
2. Apply silt theories and principles of canal design to ensure efficient water conveyance and management in irrigation systems. Design reservoir capacity, its yield. Estimate life of reservoir.
3. Identify causes of waterlogging and measures to mitigate it. Select suitable lining for canals.
4. Assess the principles of diversion head works, water logging, canal lining, and the stability of hydraulic structures on permeable foundations.
5. Analyse stability of gravity and earth dams, identify suitable type of energy dissipators

UNIT I IRRIGATION: 9 hours

Introduction; Necessity and Importance of Irrigation; Advantages and Ill Effects of Irrigation; Types of Irrigation; Methods of Application of Irrigation Water; Quality for Irrigation Water. Duty and Delta; Duty at Various Places; Relation Between Duty and Delta; Factors Affecting Duty; Methods of Improving Duty.

WATER REQUIREMENT of CROPS: Types of Soils, Indian Agricultural Soils, Preparation of Land for Irrigation; Soil Fertility; Soil-Water-Plant Relationship; Vertical Distribution of Soil Moisture; Soil Moisture Tension; Soil Moisture Stress; Various Soil Moisture Constants; Limiting Soil Moisture Conditions; Depth and Frequency of Irrigation; Gross Command Area; Culturable Command Area; Cultivated and Uncultivated Area; Kor Depth and Kor Period; Crop Seasons and Crop Rotation; Irrigation Efficiencies; Determination of Irrigation Requirements of Crops; Assessment of Irrigation Water. Consumptive Use of Water-Factors Affecting Consumptive Use.

UNIT II RESERVOIR PLANNING and CANALS 9 hours

RESERVOIR PLANNING:

Investigations for reservoir planning - selection of site for a reservoir - Zones of storage in a reservoir - Storage capacity, Catchment Yield and Reservoir Yield – mass inflow curve and demand curve - Calculation of reservoir capacity for a specified yield from the mass inflow curve - Determination of safe yield from a reservoir of a given capacity – Sediment flow in streams: Reservoir Sedimentation - Life of reservoir. Reservoir sediment control, Reservoir Losses.

CANALS:

Classification; Canal Alignment; Inundation Canals; Cross–Section of An Irrigation Channel; Balancing Depth; Borrow Pit; Spoil Bank; Land Width; Silt Theories–Kennedy's Theory, Kennedy's Method of Channel Design; Drawbacks in Kennedy's Theory; Lacey's Regime Theory- Lacey's Theory Applied to Channel Design; Defects in Lacey's Theory; Comparison of Kennedy's and Lacey's Theory.

UNIT III CANALS 9 hours

WATER LOGGING and CANAL LINING: Water Logging; Effects of Water Logging; Causes of Water Logging; Remedial Measures; Saline and Alkaline Soils and their Reclamation; Losses in Canal; Lining of Irrigation Channels – Necessity, Advantages and Disadvantages; Types of Lining; Design of Lined Canal.

CANAL REGULATION WORKS: Canal falls: Necessity and location of falls - Types of falls - Classification of falls, Canal regulators, off-take alignment - head regulators and cross-regulators - outlets and escapes.

UNIT IV DIVERSION HEAD WORKS: 9 hours

Types of Diversion Head Works; Diversion and Storage Head Works; Weirs and Barrages; Layouts of Diversion Head Works; Components; Causes and Failure of Hydraulic Structures On Permeable Foundations; Bligh's Creep Theory; Khosla's Theory; Determination of Uplift Pressure, Impervious Floors Using Bligh's and Khosla's Theory; Exit Gradient.

CROSS DRAINAGE WORKS: Introduction - types of cross drainage works - selection of suitable type of cross drainage work - classification of aqueducts and siphon aqueducts.

UNIT V DAMS 9 hours

Introduction - Types of dams - Site selection for a dam - Problems with dam construction.

GRAVITY DAMS: Introduction - Forces acting on a gravity dam - Combination of loading for design, Modes of failure, stability requirements - principal and shear stresses - Stability analysis, Elementary Profile of a Gravity dam - Practical profile of a gravity dam - Limiting height of a gravity dam- High and low gravity dams - Galleries - Stability analysis of non - overflow section of Gravity dam.

EARTH DAMS: Introduction - Types of earth dams - Causes of failure of earth dams - Criteria for safe design of earth dams - Section of an earth dam - Design to suit available materials – Seepage control measures - Slope protection. Seepage through earth dam.

SPILLWAYS: Types of Spillways - Types of Energy Dissipators.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Evaluate irrigation requirements, soil-water-plant relationships, duty, delta, and irrigation efficiencies for sustainable agricultural productivity.

CO2: Apply silt theory to design irrigation canals and design reservoir capacity and its life.

CO3: Identify causes of waterlogging, and lining materials to be used in canals.

CO4: Assess the stability of diversion head works, including weirs and barrages, using Bligh's and Khosla's theories for hydraulic structure design.

CO5: Analyse stability of dams

Textbooks:

1. Irrigation Engineering and Hydraulic Structures By S. K. Garg; Khanna Publishers, Delhi 38th Edition

Reference Books:

1. Irrigation and Water Power Engineering By Punmia & Lal, Laxmi Publications Pvt. Ltd., New Delhi 17th Edition 2021
2. Irrigation and Water Resources & Water Power By P.N.Modi, Standard Book House 11th Edition 2020

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc25_ag25

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CE110 DESIGN OF REINFORCED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 23CE101, 23CE102, 23CE106, and 23CE107

Course Description:

This course includes design philosophies of structural elements. Furthermore, it includes design of singly and doubly reinforced beams, flanged beams, shear and development length, slabs, columns, foundations and staircase as per IS 456-2000 and SP 16-1984 codes.

Course Objectives:

1. Understand the fundamental methods of concrete structure design, including elastic, ultimate load, and limit state methods.
2. Analyze and design reinforced concrete beams, slabs, staircases, columns, and footings using the Limit State Method as per IS codes.
3. Evaluate the behavior of reinforced concrete members in terms of flexure, shear, torsion, bond, and anchorage.
4. Apply design principles to ensure the serviceability and safety of concrete structures under various loading conditions.
5. Develop skills to use design aids and professional software for the analysis and design of RC structures.

UNIT I BASICS OF STRUCTURAL DESIGN 9 hours

Introduction to Methods of Design-Concept of Elastic Method, Ultimate Load Method and Limit State Method - Loads & Forces acting on structures - Stress-strain curve for concrete - Size effect - behaviour of concrete in tension - properties of Steel - Stress-strain curve for steel - A review on various design Philosophies - Types of Limit States - partial safety factors for materials and loads.

UNIT II FLEXURE 9 hours

Assumptions and basic principles of Working Stress and Limit State method - Analysis and design of singly and doubly reinforced concrete beams- Limit State method, Analysis and Design of Flanged sections for various cases.

UNIT III SHEAR, TORSION, BOND AND LIMIT STATE OF SERVICEABILITY 9 hours

Design bond strength - development length - check for development length in tension - Anchoring of reinforcing bars - bearing stress at bonds - reinforcement splicing - Design for bond - Development length - Curtailment of reinforcement - Lap splice. Modes of failure due to shear - shear strength of concrete - critical section under shear, minimum shear reinforcement - Design of shear strength - check for shear at point of tension reinforcement curtailment - Design of beams for combined bending, shear and torsion.

Short term deflection calculation for beams – Deflection due to shrinkage and creep.

UNIT IV SLABS AND STAIRCASE 9 hours

Design shear strength of concrete in slabs - design consideration for slabs - design and reinforcement detailing of one way simply supported and continuous slabs - design and reinforcement detailing of two way slabs - Types of stair cases - components of staircase - structural system of stair cases - effective span - Design of stair cases spanning transversely and longitudinally.

UNIT V COLUMNS AND FOOTINGS 9 hours

Classification of columns based on slenderness ratio, reinforcement & loading, Design of columns subjected to axial load, uni-axial bending, and bi-axial bending.

Different Types of Footings - Design of isolated, square, rectangular and combined footings.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain the different methods, concepts of concrete structure design, and their advantages.

CO2: Analyze and design of singly and doubly reinforced beams, flanged beams using the Limit State Method and draw the reinforcement details.

CO3: Analyze and design of R.C. beams for shear, torsion and draw the reinforcement details and Apply the concept of serviceability.

CO4: Design of slabs, and staircases using the Limit State Method and draw the reinforcement details.

CO5: Design of columns and footings considering axial and eccentric loading conditions using the Limit State Method and draw the reinforcement details.

Textbooks:

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Limit State Design, Laxmi Publications Pvt. Ltd., New Delhi
2. P. C. Varghese, Limit State—Designed of Reinforced Concrete ,Prentice Hall of India, New Delhi

Reference Books:

1. N. Krishnaraju, —Structural Design and Drawing, Universities Press Pvtltd, Hyderabad. 4th edition 2020.
2. N.C. Sinha and S.K. Roy,—Fundamentals of Reinforced Concrete, S. Chand Publishers.
3. N.Subramanian, —Design of Reinforced Concrete Structures, Oxford University Press

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CE111 GEOTECHNICAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: **23CE101, 23CE103, 23MAT101**

Course Objectives:

The objectives of this course are to enable the student to:

1. Understand the classification and compaction characteristics of different soil types and their engineering significance.
2. Analyze the concepts of effective stress, permeability, and seepage in soils and their impact on soil behavior.
3. Apply stress distribution theories and settlement computations to evaluate soil response under loads.
4. Evaluate shear strength properties of soil using various testing methods and their applications in geotechnical engineering.
5. Assess the shear strength properties of the soil using different analytical methods

UNIT I **9 hours**

INTRODUCTION: Soil Formation - Soil structure - Adsorbed water – Mass - Volume relationship — Relative density. Index Properties of Soils: Moisture Content, Specific Gravity, In-situ density, Grain size analysis — Sieve and Hydrometer methods — Consistency limits and indices - I.S. Classification of soils.

UNIT II **9 hours**

PERMEABILITY: Soil Water — Capillary Rise — Flow of Water Through Soils - Darcy's Law- Permeability Factors Affecting — Laboratory Determination of Coefficient of Permeability- Permeability of Layered Systems. SEEPAGE THROUGH SOILS: Total, Neutral and Effective Stresses - Quick Sand Condition — Seepage Through Soils — Flow Nets: Characteristics and Uses.

UNIT III **9 hours**

STRESS DISTRIBUTION IN SOILS: Boussinesq's and Wester Guard's Theories for Point Loads and Areas of Different Shapes — Newmark's Influence Chart Compaction: Mechanism of Compaction — Factors Affecting — Effects of Compaction on Soil Properties. — Field Compaction Equipment — Compaction Control

UNIT IV **9 hours**

CONSOLIDATION: Types of Compressibility -Primary Consolidation and Secondary Consolidation - Stress History of Clay; E-P And E-Log P Curves — Normally Consolidated Soil, Over Consolidated Soil and Under Consolidated Soil — Pre-Consolidation Pressure and Its Determination — Terzaghi's I-D Consolidation Theory — Coefficient of Consolidation: Square Root Time and Logarithm of Time Fitting Methods.

UNIT V **9 hours**

SHEAR STRENGTH OF SOILS: Importance of Shear Strength - Mohr's- Coulomb Failure Theories — Types of Laboratory Tests for Strength Parameters Strength Tests Based on Drainage Conditions — Critical Void Ratio —Liquefaction.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Apply standard soil classification systems (IS and Unified) to categorize soils based on index properties.

CO2: Analyzes seepage and permeability characteristics of soils using laboratory results and flow net techniques.

CO3: Compute stress distribution under applied loads using established geotechnical theories.

CO4: Evaluate the consolidation behavior from experimental data for field application in soil improvement.

CO5: Recommend suitable shear strength parameters for different geotechnical applications.

Textbooks:

1. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers and Distributors, Delhi, 7th edition, 2009.
2. Geotechnical Engineering by C. Venkataramiah, New Age International Pvt. Ltd, (2002).

Reference Books:

1. Soil Mechanics and Foundation by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, Publications Pvt. Ltd, New Delhi, 17th edition 2017
2. Geotechnical Engineering by Iqbal H. Khan, PHI Publishers, 4th edition
3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New Age International Pvt. Ltd, New Delhi, 3rd edition 2016

Online Learning Resources:

1. https://nptel.ac.in/courses/105101201
2. https://nptel.ac.in/courses/105105185

Mode of Evaluation: Assignments, Midterm Tests and End Semester Examination.

B.Tech III Year I Semester

23PHY102 INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. Introduce fundamental quantum concepts like superposition and entanglement.
2. Understand theoretical structure of qubits and quantum information.
3. Explore conceptual challenges in building quantum computers.
4. Explain principles of quantum communication and computing.
5. Examine real-world applications and the future of quantum technologies.

UNIT I INTRODUCTION TO QUANTUM THEORY AND TECHNOLOGIES 9 hours

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 THEORETICAL STRUCTURE OF QUANTUM INFORMATION SYSTEMS 9 hours

What is a 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 BUILDING A QUANTUM COMPUTER – THEORETICAL CHALLENGES AND REQUIREMENTS 9 hours

What is required to build a quantum computer (conceptual overview)?,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 **QUANTUM COMMUNICATION AND COMPUTING – THEORETICAL PERSPECTIVE** **9 hours**

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 **APPLICATIONS, USE CASES, AND THE QUANTUM FUTURE** **9 hours**

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

Course Outcomes:

CO1: Explain core quantum principles in a non-mathematical manner.
CO2: Compare classical and quantum information systems.
CO3: Identify theoretical issues in building quantum computers.
CO4: Discuss quantum communication and computing concepts.
CO5: Recognize applications, industry trends, and career paths in quantum technology.

Textbooks:

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.

Reference Books:

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. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, *Principles of Quantum Computation and Information, Volume I: Basic Concepts*, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, *Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document*, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, *National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers*, MeitY/DST Publications, 2020 onward.

Online Learning 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

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CE206 GEOTECHNICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CE101, 23CE103, 23MAT101

Course Description:

This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes and elevations.

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the fundamental index properties of soils and their significancein geotechnical engineering.
2. Perform field and laboratory tests to determine in-situ density and compaction characteristics of soils.
3. Evaluate the engineering properties of soil, including permeability, shear strength, and consolidation.
4. Analyze the strength and deformation characteristics of soils through shear and compression tests.
5. Interpret test results and relate engineering properties of soils to real-world geotechnical problems and design considerations.

List of Experiments:

1. Determination of Index Properties
    a. Specific Gravity of Soil
    b. Grain Size Distribution – Sieve Analysis
    c. Grain Size Distribution - Hydrometer Analysis
    d. Liquid Limit and Plastic Limit Tests
    e. Shrinkage Limit and Differential Free Swell Tests
2. Determination of In-Situ Density and Compaction Characteristics
    a. Field Density Test (Sand Replacement Method).
    b. Determination of Moisture–Density Relationship Using Standard Proctor Compaction Test.
3. Determination of Engineering Properties
    a. Permeability Determination (Constant Head Method)
    b. Permeability Determination (Falling Head Methods)
    c. Determination of Co-Efficient of Consolidation
    d. Direct Shear Test in Cohesion Less Soil
    e. Unconfined Compression Test in Cohesive Soil
    f. Laboratory Vane Shear Test in Cohesive Soil
    g. Tri-Axial Compression Test in Cohesion Less Soil
    h. California Bearing Ratio Test

Note: Any 10 of the above Experiments

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1: Determine index properties of soil, including specific gravity, grain size distribution, and consistency limits.

CO2: Conduct field and laboratory compaction tests to evaluate the moisture-density relationship of soil.

CO3: Evaluate permeability and consolidation characteristics of soil using appropriate laboratory techniques.

CO4: Analyze the shear strength and compressibility of soil through direct shear, unconfined compression, and tri-axial tests.

CO5: Integrate test results and engineering judgment to interpret soil behavior and make informed decisions in geotechnical engineering applications.

Textbooks

1. Lambe T.W., ―Soil Testing for Engineers‖, John Wiley and Sons, New York, 1951. Digitized 2008.
2. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
3. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

Reference Books:

1. Saibaba Reddy, E. Ramasastri, K. ―Measurement of Engineering Properties of Soils‖, New Age International (P) Limited publishers, New Delhi, 2008.
2. G. Venkatappa Rao and Goutham.K. Potable, ―Geosynthetics Testing – A laboratory Manual‖, Sai Master Geoenvironmental Services Pvt. Ltd., 1st Edition, 2008.

BrajaM. Das., ―Soil Mechanics: Laboratory Manual‖, Oxford University Press, eighth edition, 2012

Online Learning Resources:

1. https://nptel.ac.in/courses/105101160

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year I Semester

23CE207 ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CE108

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the principles and methods of water and wastewater sampling and preservation.
2. Perform standard laboratory tests to determine water quality parameters.
3. Analyze wastewater characteristics and assess pollution levels.
4. Evaluate the effectiveness of treatment processes using chemical and biological tests.
5. Develop hands-on skills in advanced laboratory techniques for environmental monitoring.

List of Experiments:

I. ANALYSIS of WATER SAMPLE

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water
6. Determination of Optimum Coagulant Dosage by Jar test apparatus
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water

II. ANALYSIS of WASTEWATER SAMPLE

1. Estimation of suspended, volatile and fixed solids
2. Determination of Sludge Volume Index in waste water
3. Determination of Dissolved Oxygen
4. Estimation of B.O.D.
5. Estimation of C.O.D.
6. Determination of TKN and Ammonia Nitrogen in wastewater
7. Determination of total and fecal coliform (Demonstration only)

Note: Minimum 10 out of the above experiments are to be carried out.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1: Apply appropriate sampling and preservation techniques for water and wastewater.

CO2: Measure physical and chemical parameters such as turbidity, conductivity, and chlorine content.

CO3: Analyze key water and wastewater quality indicators like BOD, COD, and TKN.

CO4: Assess the efficiency of water treatment processes through laboratory tests.

CO5: Perform microbiological analysis for coli form detection and sludge characterization.

Textbooks:

1. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
2. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

Reference Books:

1. Environmental Engineering Laboratory Manual by Dr. S.K. Panigrahi, L. Mohanty, S.K. Kataria& Sons

Online Learning Resources:

1. https://ee1-nitk.vlabs.ac.in/
2. https://ee2-nitk.vlabs.ac.in/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year II Semester

23ECE501 TINKERING LABORATORY

L	T	P	C
0	0	2	1

Course Description:

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge. These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

Course Objectives:

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning and Impart Skill Development
3. Foster Collaboration and Teamwork
4. Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5. Impart Problem-Solving mind-set

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. 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.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Apply the principles of design thinking to identify real-world problems and develop feasible solutions.

CO2: Demonstrate proficiency in using basic tools, components, and digital fabrication technologies (e.g., Arduino, sensors, 3D printing, etc.).

CO3: Develop functional prototypes through iterative design, fabrication, and testing.

CO4: Collaborate effectively in multidisciplinary teams to brainstorm, plan, and execute tinkering projects.

CO5: Document the development process, evaluate outcomes, and communicate project results clearly using oral, visual, and written formats.

Reference Books:

1. "Make: Getting Started with Arduino" by Massimo Banzi, Maker Media Publications.

Online Resources:

1. https://aim.gov.in/pdf/equipment-manual-pdf.pdf

2. https://atl.aim.gov.in/ATL-Equipment-Manual/

3. https://aim.gov.in/pdf/Level-1.pdf

4. https://aim.gov.in/pdf/Level-2.pdf

5. https://aim.gov.in/pdf/Level-3.pdf

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

III Year II Semester

B. Tech III Year II Semester

23CE112 DESIGN OF STEEL STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 23CE101, 23CE103, 23CE106, and 23CE107

Course Description:

The course covers basic design concepts of steel structures, loads and stresses to be used as per Indian standards for steel design work. The course deals with designing of Steel structural elements subjected to axial tension, axial Compression and bending. Emphasis, will be also given to the special structures such as plate girders. In addition, analysis and design of various types of connections such as bolted and welded will be discussed. All design approaches will be based on Limit State of strengths and serviceability as per IS 800 - 2007.

Course Objectives:

1. To understand the properties, types, and applications of structural steel in construction, analyze and design of bolted and welded connections.
2. To design tension members, including built-up members.
3. To design compression members, including built-up members and column bases.
4. To Apply plastic analysis concepts, to design steel structural elements such as beams, plate girders.
5. To develop steel structural elements such as purlin and gantry girders.

UNIT I INTRODUCTION TO STRUCTURAL STEEL and DESIGN OF CONNECTIONS 9 hours

General -Types of Steel -Properties of Structural Steel - I.S. Rolled Sections - Concept of Limit State Design - Design of Simple and Eccentric Bolted and Welded Connections - Types of Failure and Efficiency of Joint – Prying Action - Introduction to HSFG bolts

UNIT II TENSION MEMBER 9 hours

Types of Failure Modes in Tension Members, Analysis and Design of Simple and Built-Up Members Subjected to Tension - and Efficiency of Tension Member - Shear Lag Effect, Design of Lug Angles - Tension Splice and Gussets.

UNIT III DESIGN OF COMPRESSION MEMBERS 9 hours

Behaviour of compression members- possible failure modes - single angle struts- I section - design built- up compression members - Lacings and Battens - column bases

UNIT IV PLASTIC ANALYSIS, DESIGN of BEAMS 9 hours

Theorems of plastic collapse - methods of plastic analysis - to calculate the Shape factor of various cross section - to find the plastic moment capacity of Beams.

Design of Laterally Supported and Unsupported Beams - Design of Built-Up Beams - Design of Plate Girders.

UNIT V INDUSTRIAL STRUCTURES 9 hours

Introduction to Pre-Engineered Buildings – Components of Industrial Building - Types of Roof Trusses - Loads Acting on Roof Trusses - End Bearings - Purlin Design Using Angle and Channel Sections - Design of Gantry Girder.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain the properties of structural steel, types of sections, the concept of limit state design, and analysis and design of bolted and welded connections for structural steel members.

CO2: Analysis and design of bolted and welded tension members.

CO3: Analysis and design of Compression member.

CO4: Perform plastic analysis, Analysis and Design of beams (Rolled steel and Built-up sections), plate girders.

CO5: Analysis and Design of Purlin and Design of Gantry Girder.

Textbooks:

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010

2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017

Reference Books:

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013

2. Jack C. McCormac& Stephen F. Csernak - Structural Steel Design, Pearson, 7th Edition, 2023.

3. William T. Segui&FaridSoleimani - Steel Design, Cengage, 7th Edition, 2023

4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CE113 HIGHWAY ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: 23CE102, 23CE202, 23CE602

Course Objectives:

1. To understand the history, importance, and planning aspects of highway development in India.
2. To apply geometric design principles for highway alignment, sight distance, and curves.
3. To analyze traffic characteristics, capacity, level of service, and road safety measures.
4. To design flexible and rigid pavements using IRC guidelines.
5. To evaluate highway construction materials, testing methods, and maintenance techniques.

UNIT I PLANNED HIGHWAY DEVELOPMENT IN INDIA 9 hours

Highway development in India – Necessity for Highway Planning- Different Road Development Plans- Classification of Roads- Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9 hours

Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.

UNIT III TRAFFIC ENGINEERING STUDIES 9 hours

Basic Parameters of Traffic-Volume, Speed and Density – Definitions and their interrelation – Highway capacity and level of service concept – factors affecting capacity and level of service - Traffic Volume Studies- Data Collection and Presentation-Speed studies- Data Collection and Presentation- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams.

UNIT IV INTERSECTION DESIGN 9 hours

Conflicts at Intersections- Channelization: Objectives –Traffic Islands and Design criteria- Types of At-Grade Intersections – Types of Grade-Separated Intersections- Rotary Intersection – Concept of Rotary and Design Criteria- Advantages and Disadvantages of Rotary Intersections.

UNIT V PAVEMENT DESIGN 9 hours

Types of Pavements – Difference Between Flexible and Rigid Pavements – Pavement Components – Sub Grade, Sub Base, Base and Wearing Course – Functions of Pavement Components – Design Factors – Flexible Pavement Design Methods – G.I Method, CBR Method, (As Per IRC 37-2002) –Design of Rigid Pavements – Critical Load Positions - Westergaard'S Stress Equations – Computing Radius of Relative Stiffness and Equivalent Radius of Resisting Section – Stresses in Rigid Pavements – Design of Expansion and Contraction Joints in CC Pavements. Design of Dowel Bars and Tie Bars.

Course Outcomes:

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

CO1: Explain the significance, planning, and alignment of highways.

CO2: Design geometric elements of highways, including curves, gradients, and sight distances.

CO3: Analyze traffic flow, capacity, level of service, and implement road safety measures.

CO4: Design flexible and rigid pavements as per IRC guidelines.

CO5: Assess construction practices, highway materials, and pavement maintenance techniques.

Textbooks:

1. Highway Engineering – S.K.Khanna&C.E.G.Justo, Nemchand& Bros., 9th edition (2011).
2. Transportation Engineering, Volume I, C Venkatramaiah, Universities Press, 2015

Reference Books:

1. Principles of Highway Engineering by L.R.Kadiyali, Khanna Publishers
2. Traffic Engineering and Transportation Planning by L.R.Kadiyali andLal- Khanna Publications 9th edition
3. Highway Engineering – Dr. S.K.Sharma, S.Chand Publishers 2014 edition

Online Learning Resources:

https://nptel.ac.in/courses/105101087

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

III Year II Semester

23CE114 CONSTRUCTION PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: 23CE601, 23HUM102, 23MAT101

Course Description:
The course covers fundamentals of construction technology, different construction equipment, project management, Time estimates and computations, CPM, PERT and network analysis

Course Objectives:
To make the students to learn about planning of construction projects, scheduling procedures and techniques, cost and quality control projects and use of project information as decision making tool.

UNIT I CONSTRUCTION PLANNING 6 hours

Basic concepts in the development of construction plans-choice of Technology and Construction Method -Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 6 hours

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling; Use of PERT - Time estimates -Mean, variance and standard deviation - Probability distribution - Expected time Problems - Earliest expected time -Combined tabular computations for TE and TL problems.

UNIT III IT IN CIVIL ENGINEERING PROJECT MANAGEMENT 6 hours

IT in Construction -Database management systems - spatial data management - Communication and Computer network.

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 6 hours

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality Control - Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables.

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 6 hours

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data Bases-Other Conceptual Models of Databases-Centralized Database Management Systems-Databases and application programs-Information transfer and Flow.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Plan construction projects, schedule the activities using network drawing and coding

CO2: Design the construction schedules using CPM and PERT methods.

CO3: Explain the use of information technology in project management.

CO4: Identify the quality control and safety measures during construction.

CO5: Identify and use project data information for successful project management.

Textbooks:

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2005.
2. Srinath,L.S., "PERT and CPM Principles and Applications", Affiliated East West Press,2001.

Reference Books:

1. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
2. Moder.J., Phillips. C. and Davis E, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3rd Edition, 1985.
3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.
4. Halpin,D.W., "Financial and Cost Concepts for Construction Management", John Wiley and Sons, New York, 1985.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CE208 HIGHWAY ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CE102, 23CE202, 23CE602

Course Objectives:

1. To understand the properties and behavior of aggregates and bitumen used in highway construction.
2. To perform standard laboratory tests on aggregates and bitumen to evaluate their suitability for road construction.
3. To analyze the strength, durability, and performance characteristics of pavement materials.
4. To assess the quality and compliance of highway materials with standard specifications.
5. To develop hands-on skills for material testing and interpretation of test results.

List of Experiments:

I. **TEST ON AGGREGATES**

1. Specific Gravity Determination of the Coarse Aggregate Sample.
2. Determination of Abrasion Value of the Coarse Aggregate Sample.
3. Determination of Impact Value of Coarse Aggregate.
4. Determination of Elongation Index of Coarse Aggregate.
5. Determination of Flakiness Index of Coarse Aggregate.
6. Determination of Aggregate Crushing Value of Coarse Aggregate.
7. Determination of Water Absorption Capacity of the Coarse Aggregate Sample.

II. **TEST ON BITUMEN**

1. Specific Gravity Determination of The Bitumen/Asphalt Sample.
2. Penetration Test On Bitumen.
3. Viscosity Determination of Bituminous Binder.
4. Determination of Softening Point of The Asphalt/Bitumen Sample.
5. Determination of Ductility Value of The Bitumen Sample.
6. Estimation of Loss of Bitumen On Heating.
7. Bitumen Extraction Test.

Course Outcomes:

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

CO1: Determine the physical properties of coarse aggregates, such as specific gravity, water absorption, and shape characteristics.

CO2: Evaluate the mechanical properties of aggregates, including abrasion resistance, impact strength, and crushing value.

CO3: Analyze the physical and chemical properties of bituminous materials through standard tests.

CO4: Perform Marshall stability tests and assess the optimum binder content for bituminous mixes.

CO5: Interpret test results to assess the suitability of aggregates and bitumen for pavement construction.

Textbooks:

1. Highway Material Testing Manual, Khanna, Justo and Veera Raghavan, Nemchand Brothers.

Reference Books:

1. IS 383 :1993 "Specification for Coarse and Fine Aggregates From Natural Sources for Concrete"
2. 1S 1201 -1220 (1978) "Methods for testing tars and bituminous materials"
3. IRC SP 53 -2010 "Guidelines on use of modified bitumen"
4. MS-2 Manual for Marshalls Mix design 2002

Online Learning Resources:

https://ts-nitk.vlabs.ac.in/

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year II Semester

23CE209 IOT IN CIVIL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CSE201, 23CSE101

Course Description:

This is a hands-on, project-based laboratory course that introduces the principles and applications of the Internet of Things (IoT) within the context of modern civil and environmental engineering. Students will learn to design, build, and deploy sensor networks to collect and analyze real-world data from civil infrastructure systems. The course covers the full IoT stack, from sensors and microcontrollers to wireless communication protocols, cloud data platforms, and data analytics. This technological integration is transforming civil engineering from a reactive to a proactive discipline, enabling real-time monitoring, predictive maintenance, and efficient resource management essential for the development of smart, resilient, and sustainable infrastructure.[1] Key application areas explored through laboratory exercises and a capstone project include Structural Health Monitoring (SHM), smart construction management, and intelligent urban systems (e.g., transportation, water, and energy). The course aims to equip the next generation of civil engineers with the interdisciplinary skills required to create, manage, and maintain the smart infrastructure of the future[3].

Course Objectives:

This lab equips civil engineering students with practical IoT skills to monitor infrastructure.

1. This lab equips civil engineering students with practical IoT skills to monitor infrastructure.
2. Students will assemble and interface sensors (strain, vibration, environmental) with microcontrollers on physical models, develop and debug embedded code (Python) to acquire, process, and wirelessly transmit sensor data.
3. They will implement cloud platforms (e.g., AWS, Azure) to ingest, store, and visualize real-time data on dashboards.
4. Students will analyze collected time-series data using basic techniques (statistics, trends) to interpret structural behavior or condition.
5. Crucially, they will diagnose hardware/software issues and rigorously apply lab safety protocols throughout, mastering the full IoT workflow for infrastructure monitoring.

Required Hardware, Software, and Accounts

"IoT for Civil Engineers Lab Kit."

1. **Key Hardware Components:**
   Arduino UNO/Nano, Raspberry Pi 4, Breadboards, Jumper Wires, Resistors, LEDs, DHT11 (Temperature/Humidity), Ultrasonic Sensor (HC-SR04), Strain Gauges with Amplifier(HX711), GPS Module, Wi-Fi Module (ESP8266), and LoRa WAN transceivers.
2. **Key Software:**
   Python, Arduino IDE, MIT App Inventor, Fritzing, and IoT MQTT Panel.

List of Experiments:

1. The IoT Ecosystem; Lab Safety, Setup & Basic I/O
2. Sending Sensor Data via Serial, Multi-Sensor Data Acquisition, Local Data Logging
3. Strain Detection in Concrete
4. Real-Time Air Quality Monitoring at Construction Site
5. Water Quality Monitoring for Civil Systems
6. Smart Water Level Monitoring in Overhead Tanks
7. Concrete Curing Temperature Monitoring
8. Water Leak Detection
9. Soil Moisture Monitoring
10. Smart waterbody Monitoring System
11. Cloud-Connected SHM System and Cloud Dashboard
12. Water flow sensor

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1. Identify the core components, technologies, and architectures that constitute a complete IoT system, from hardware to cloud services.

CO2. Select interfacing, and programming sensors, actuators, and microcontrollers (e.g., Arduino, Raspberry Pi) for civil engineering data acquisition.

CO3. Design and implement prototype IoT solutions for specific civil engineering domains, including Structural Health Monitoring, construction management, and smart city applications.

CO4. Transmit sensor data to the cloud, store it, and apply data analytics techniques to derive actionable insights from infrastructure performance data.

CO5. Develop a holistic, complex systems approach to infrastructure challenges, integrating technological, environmental, and societal considerations to design robust and resilient solutions.

Textbook

1. Raj Kamal, "Internet of Things (IoT): Principles and Applications".
2. Vijay Madisetti & Arshdeep Bahga, "Internet of Things: Architecture and Applications".

URLs

1. https://nptel.ac.in/courses/106105166

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech III Year I Semester

23ENG901 TECHNICAL PAPER WRITING AND IPR

L	T	P	C
2	0	0	0

Pre-requisite: None

Course Objectives:

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

UNIT I **6 hours**

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 **6 hours**

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and Framing Research Questions- Synopsis

UNIT III **6 hours**

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 **6 hours**

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, ncies and treaties, importance of intellectual property rights

de Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting evaluating trade mark, trade mark registration processes.

UNIT V **6 hours**

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.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Identify key secondary literature related to their proposed technical paper writing.

CO2: Explain various principles and styles in technical writing

CO3: Use the acquired knowledge in writing a research/technical paper

CO4: Analyse rights and responsibilities of the holder of Patent, Copyright, Trademark, International Trademark etc.

CO5: Evaluate different forms of IPR available at National & international levels
CO6: Develop skill of making search of various forms of IPR by using dern tools and techniques.

Textbooks:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013

2. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and Practives. Oxford.

Reference Books:

1. R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.

2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001

3. P.Naryan, Intellectual Property Law, 3rd Ed ,Eastern Law House, 2007.

4. Adrian Wallwork. English for Writing Research Papers Second Edition. Springer Cham Heidelberg New York ,2016

5. Dan Jones, Sam Dragga, Technical Writing Style

Online Learning Resources

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriti ng.html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriti ng.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/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

Mode of Evaluation: Assignments and Mid Term Tests

IV Year I Semester

B. Tech IV Year I Semester

23CE115 FINITE ELEMENT METHODS

	L	T	P	C
Pre-requisites: 23CE101, 23CE102	**3**	**0**	**0**	**3**

Course Description:

This course introduces the fundamental principles and computational procedures of the Finite Element Method (FEM) for solving engineering problems. It covers basic concepts such as discretisation, boundary value problems, and variational methods, followed by stiffness matrix formulation and analysis of 1D bar, truss, and beam elements. The course further extends to two-dimensional problems using CST elements and plane stress/strain conditions. It also includes isoparametric formulation, numerical integration, and solution techniques, enabling students to model and analyse structural systems using FEM approaches.

Course Objectives:

The objectives of this course are to enable the student to:

1. Understand the fundamentals of the Finite Element Method (FEM), including discretisation, boundary value problems, and basic variational concepts.
2. Develop stiffness matrix formulation and analyse one-dimensional bar elements using shape functions and numerical solution techniques.
3. Analyse truss and beam elements by formulating stiffness matrices and evaluating responses of simple and continuous beam systems.
4. Apply FEM formulation to two-dimensional problems, including CST elements and plane stress/strain conditions.
5. Implement isoparametric formulation and FEM solution techniques such as numerical integration and global system assembly for engineering applications.

UNIT I FUNDAMENTALS OF FINITE ELEMENT METHOD **9 hours**

Introduction to Finite Element Method and FEM software tools – Basic Steps in Finite Element Analysis – Discretisation – Discrete and Continuous Models – Concepts of Boundary, Initial and Eigen Value Problems – Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Rayleigh-Ritz Method – Advantages and Limitations of FEM.

UNIT II STIFFNESS MATRIX FORMULATION AND FEA OF 1D BAR ELEMENTS **9 hours**

Introduction to Discrete and Continuous Elements – Discrete Elements – Direct Stiffness Method – Special Characteristics of Stiffness Matrix – Assemblage of Elements – Boundary Condition and Reaction – Differential Equilibrium Equations – Strain-Displacement Relation – Linear Constitutive Relation – Numerical Methods in Finite Element Analysis - Gauss Elimination Method.

FEA of One-Dimensional Elements – Element types – Linear and Higher Order Elements – Displacement Models – Convergence Requirements – Natural Coordinate Systems – Shape Function – Interpolation Function – FEA of 1D Linear Bar Elements: Derivation of Shape Functions and Stiffness Matrices.

UNIT III FEA OF 1D TRUSS AND BEAM ELEMENTS **9 hours**

Introduction – Stiffness Matrix for Truss Element – Finite Element Equation for Two Noded Truss Element – FEA of Truss Elements: Nodal Displacements, Stresses, and Reactions.

Introduction – Derivation of Shape Functions and Stiffness Matrices for Beam Elements – Analysis of Simply Supported and Continuous Beams (Up to Two Spans).

UNIT IV FINITE ELEMENT FORMULATION FOR TWO-DIMENSIONAL PROBLEMS **9 hours**

Introduction – CST and LST Elements – Plane Stress and Plane Strain – Finite Element Modelling – Derivation of Shape functions for CST Elements – Strain-Displacement Matrix for CST Elements – Stress-Strain Relationship Matrix – Stiffness Matrix Equation for CST Element.

UNIT V ISOPARAMETRIC FORMULATION AND FEM SOLUTION TECHNIQUES **9 hours**

Introduction – Isoparametric 4-Noded Quadrilateral Elements: Shape Functions – Element Stiffness Matrix Equation – Jacobian Matrix and its Significance – Strain-Displacement Relationship Matrix – Element Force Vector.

Solution Techniques in FEM: Numerical Integration – Solution Techniques for Static Loads – Introduction to FEM Case Studies.

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1. Explain the fundamental principles of FEM, including discretisation, elasticity concepts, and interpolation using shape functions for different element types *(L1–L3)*.

CO2. Develop and apply stiffness matrix formulation to analyse one-dimensional bar elements using shape functions and numerical methods *(L3–L4)*.

CO3. Analyse truss and beam elements, including continuous beams (up to two spans), using finite element formulations *(L3–L4)*.

CO4. Formulate and solve two-dimensional FEM problems using CST elements under plane stress and plane strain conditions *(L4–L5)*.

CO5. Apply isoparametric formulation and FEM solution techniques, including numerical integration and global system assembly, to solve engineering problems *(L3–L5)*.

Textbooks:

1. A First Course in Finite Element Method by Daryl L. Logan, 5th Edition, Cengage Learning India Pvt. Ltd.

2. Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla and Ashok D. Belegundu, Prentice Hall of India.

3. *Finite Element Analysis* by Dr. S. Senthil and R. Panneerdhass, Lakshmi Publications, Chennai.

Reference Books:

1. Finite Element Analysis by P. Seshu, PHI Learning Private Limited

2. Concepts and Applications of Finite Element Analysis by Robert D. Cook et al., Wiley India Pvt. Ltd.

3. Applied Finite Element Analysis by G. Ramamurty, I.K. International Publishing House Pvt. Ltd.

Mode of Evaluation: Assignments, Midterm Tests and End-Semester Examination.

Audit Course

23HUM901 GENDER SENSITIZATION

L	T	P	C
2	0	0	0

Pre-requisite: Nil

Course Description:

The Gender Sensitization course aims to develop students' critical understanding of gender as a social construct and its impact on various aspects of life, including family, workplace, education, media, and society. It explores gender roles, stereotypes, discrimination, division of labour, gender-based violence, and cultural representations of gender. The course encourages students (especially in engineering and technical fields) to reflect on gender issues in STEM education and workplaces, constitutional safeguards for gender equality, legal frameworks against gender violence, and the importance of building inclusive, gender-sensitive environments in professional and personal spheres.

Course Objectives:

This course enables students

1. Understand the basic concepts of gender, related terminology, and the processes of gender construction and socialization.
2. Familiarize students with the biological, sociological, psychological, and legal aspects of gender and gender roles.
3. Analyse how gender discrimination operates in society and explore ways to counter it.
4. Examine the gendered division of labour, its political and economic dimensions, and its implications in professional settings, including tech companies and start-ups.
5. Develop awareness of various forms of gender-based violence, their causes, consequences, and relevant legal protections in India.
6. Foster critical reflection on the influence of gender on culture, media, language, and relationships, and to promote gender-sensitive practices in engineering teams and workplaces.

UNIT I UNDERSTANDING GENDER 6 hours

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.

UNIT II GENDER ROLES AND RELATIONS 6 hours

Two or Many? - Struggles with Discrimination - Gender Roles and Relations -Types of Gender Roles - gender stereotypes; Gender Roles and Relationships Matrix - Missing Women-Sex Selection and its Consequences-Declining Sex Ratio - Demographic Consequences - Gender Spectrum in STEM education and workplace (e.g., women in engineering)

UNIT III GENDER AND LABOUR 6 hours

Division and Valuation of Labour - Housework: The Invisible Labour - "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work - Gender Development Issues- Gender and Mainstreaming Gendered division of labour in tech companies/start-ups - case studies on work-life balance in IT

UNIT IV GENDER BASED VIOLENCE **6 hours**

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 - Cyber gender-based violence and online safety; gender-based laws in India (POSH, Domestic Violence Act, Immoral Traffic Prevention Act, Dowry Prohibition Act, Indecent representation of women prohibition Act, Maternity benefit Act, Equal remuneration Act, etc.

UNIT V GENDER AND CULTURE **6 hours**

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Issues - Gender Sensitive Language- Just Relationships- Gender-sensitive language and inclusive practices in engineering teams/projects

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand the basic concepts of gender and its related terminology (L1, L2)

CO2: Identify the biological, sociological, psychological and legal aspects of gender. (L1, L2)

CO3: Use the knowledge in understanding how gender discrimination works in our society and how to counter it. (L3)

CO4: Analyze the gendered division of labour and its relation to politics and economics. (L4)

CO5: Analyze depiction of gender and culture in media projections (L4)

Textbook(s)

1. A.Suneetha, Uma Bhrugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*", Telugu Akademi, Telangana, 2015.

Reference Books

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India,*London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *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

Mode of Evaluation: Assignments and Mid Term Tests

OPEN ELECTIVE – I

Open Elective – I

23HUM301 INDIAN KNOWLEDGE SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The main objectives of the course is to

1. To introduce the scope, significance, and interdisciplinary nature of Indian Knowledge Systems and their relevance in the modern world.
2. To explore the philosophical and epistemological foundations of Indian Knowledge Systems, including key concepts like Pramāṇa, Dharma, and Rta.
3. To examine the scientific contributions of ancient India in fields such as mathematics, astronomy, medicine, and engineering.
4. To understand Indian perspectives on society, governance, literature, and aesthetics through classical texts and traditions.
5. To appreciate the cultural richness, ethical values, and traditional educational systems that shaped Indian civilization.

UNIT I INDIAN KNOWLEDGE SYSTEM: AN INTRODUCTION 9 hours

Indian Knowledge System: An Overview- Historical evolution and contemporary Relevance- Interdisciplinary approach and integration in education-The Vedic Corpus, The Four Vedas and their components, Oral transmission and cultural continuity--Philosophical Systems, Orthodox (Āstika) and Heterodox (Nāstika) schools, Logic, metaphysics, and epistemology in Indian philosophy -Wisdom through the Ages- Scientific and Mathematical Contributions, Ayurveda, Astronomy, Metallurgy, Mathematics, Key scholars: Charaka, Sushruta, Aryabhata, Bhaskaracharya

UNIT II FOUNDATIONAL CONCEPTS IN INDIAN KNOWLEDGE SYSTEMS 9 hours

Shaping India's intellectual traditions- Ancient Indian linguistics, highlighting phonetics, grammar, and language philosophy-traditional number systems, units of measurement, and their practical applications in science and trade -indigenous frameworks for organizing and classifying knowledge, offering insights into how Indian scholars approached learning, epistemology, and the systemic cultivation of wisdom across disciplines.

UNIT III SCIENCE AND TECHNOLOGY IN INDIAN KNOWLEDGE SYSTEMS 9 hours

India’s classical achievements in mathematics, astronomy, architecture, and science. Learners explore ancient texts and applications—highlighting concepts like zero, planetary motion, and structural design. integration of science with philosophy and sustainability. Through notable scholars and indigenous techniques, how Indian scientific thought continues to influence contemporary innovations-offering wisdom for solving modern challenges.

UNIT IV HUMANITIES AND SOCIAL SCIENCES IN INDIAN KNOWLEDGE SYSTEMS 9 hours

Indian insights on leadership, wellbeing, and governance through ancient texts like the Srimad Bhagavad Gita. Topics include holistic management principles, psychological well-being, ethical governance, and traditional administrative models—emphasizing their relevance to modern society, personal growth, and nation-building.

UNT V CULTURAL, EDUCATIONAL, AND ETHICAL DIMENSIONS OF INDIAN KNOWLEDGE SYSTEMS **9 hours**

Art, Architecture, and Aesthetics-Temple architecture and sculpture-Music, dance, and literary traditions-**Education Systems and Institutions,** Gurukula system and pedagogical practices, Ancient universities: Nalanda, Takshashila-**Ethics and Values in Indian Thought-**Dharma, Karma, Moksha — principles of righteous living, Sustainability, harmony, and spiritual ecology-**Contemporary Relevance and Global Influence,** Indian knowledge systems in modern science and culture, Resurgence through NEP 2020 and academic initiatives

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Learners will be able to **describe** the scope and interdisciplinary relevance of Indian Knowledge Systems in contemporary contexts.

CO2: Learners will be able to **analyze** foundational philosophical concepts such as *Pramāṇa*, *Dharma*, and *Rta* within Indian epistemology.

CO3: Learners will be able to **apply** ancient Indian scientific principles to understand traditional practices in mathematics, astronomy, and medicine.

CO4: Learners will be able to **evaluate** classical Indian texts to interpret perspectives on governance, society, and aesthetics.

CO5: Learners will be able to **design** culturally informed ethical frameworks and educational models inspired by traditional Indian systems.

Reference Books:

1. Introduction to Indian knowledge system: concepts and applications
   By B. Mahadevan , Nagendra Pavana , Vinayak Rajat Bhat, PHI publications
2. Bhagavad Gita: As It Is" by A.C. Bhaktivedanta Swami Prabhupada Published by The Bhaktivedanta Book Trust
3. "Indian Philosophy, Volume 1 and 2 by S. Radhakrishnan Published by Oxford university press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101, 23MAT102

Course Description:

This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis.

Course Objectives:

The main objectives of the course is to

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To avail the basics of numerical techniques for solving the system of linear equations.
3. To familiarize the knowledge of interpolation and numerical calculus.
4. To use numerical calculus for solving ordinary differential equations.
5. To introduce the computational techniques for solving partial differential equations.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9 hours

Errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial. Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.

UNIT II SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS 9 hours

LU decomposition, Thomas algorithm for the tridiagonal systems, Norms-Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.

UNIT III INTERPOLATION & NUMERICAL CALCULUS 9 hours

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature.

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.

UNIT V NUMERICAL SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS 9 hours

Laplace and Poisson equations (five-point formula), Finite difference methods for one-dimensional Heat and Wave equations.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Solve the system of algebraic and transcendental equations.

CO2: Apply the numerical techniques to find the solution to system of equations.

CO3: Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.

CO4: Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.

CO5: Compute the solutions for engineering problems represented by partial differential equations.

Textbooks:

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.
2. Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.
3. E. Kreyszig, Advanced Engineering Mathematics, 10th ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101, 23MAT102, 23MAT104

Course Description:
Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course Objectives:
The main objectives of the course is to

1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to apply the game theory and project management techniques to find the solutions to the complex problems.
5. Understand the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

UNIT I CLASSICAL OPTIMIZATION 9 hours

Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

UNIT II LINEAR PROGRAMMING PROBLEM 9 hours

Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method. Duality, dual Simplex method.

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM 9 hours

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

UNIT IV GAME THEORY AND PROJECT MANAGEMENT 9 hours

Formulation of games, Two Person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property. Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT).

UNIT V QUEUING MODELS 9 hours

Introduction to queuing system, Birth and Death processes, Single and multiple server queueing models, Little's formula - Finite Calling Population Queuing Models – Multi-Phase Service Queuing Model.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understood the importance of unconstrained and constrained optimization to solve engineering problems.

CO2: Get an idea about the linear programming techniques.

CO3: Solve transportation and assignment problems in engineering situations.

CO4: Analyze the problems of network analysis for project management and game theory.

CO5: Apply the Queuing system models to solve problems in engineering & industry.

Textbooks:

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.

2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

Reference Books:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.

2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.

3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.

4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2nd edition.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY301 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:

Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:

The main objectives of the course is to

1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I INTRODUCTION TO LASER TECHNOLOGY 9 hours

Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours

Energy levels & Radiative properties of Atoms and molecules**;** *Atomic lasers*: He-Ne laser, Argon Ion laser**;** *Molecular Lasers*: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

UNIT III SOLID STATE LASERS 9 hours

Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)

Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only)

UNIT IV PULSED OPERATION OF LASERS 9 hours

Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

UNIT V **LASER APPLICATIONS** **9 hours**

Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology- Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.

CO2: Estimate stability requirements in producing laser light by different types of sources

CO2: CO3: Differentiate or list the various types of lasers and their means of excitation.

CO4: Assess (Identify) which laser would best meet the need for a particular industrial or research task.

CO5: Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Textbooks:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.
2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer
3. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
4. Principles of Laser: O. Svelto
5. Laser Physics: Peter W Miloni, Joseph H Eberly.

Reference Books:

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.
2. Ultrafast Optics, Andrew M. Weiner
3. Laser spectroscopy: Demtroder
4. Laser Applications: Monte Ross

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY302 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:

The main objectives of the course is to

1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I PHYSICS OF THIN FILMS **8 hours**

Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation.

UNIT II THIN FILM DEPOSITION TECHNIQUES **10 hours**

Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating.

UNIT III PROPERTIES OF THIN FILMS **8 hours**

Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films

UNIT IV CHARACTERIZATION OF THIN FILMS **10 hours**

Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry).

UNIT V APPLICATIONS OF THIN FILMS **9 hours**

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.

CO2: Asses the relation between deposition technique, film structure, and film properties.

CO3: Know the typical thin film applications.

CO4: Motivate selection of deposition techniques for various applications.

Textbooks:

1. Thin Film Deposition: Principles and Practice, *Donald L. Smith*, McGraw Hill, Singapore, 2001.

2. Maissel, L.I and Glang. R, "Handbook of thin film technology", McGraw Hill, 1970.

Reference Books:

1. Thin film phenomena / *Kasturi L. Chopra,* New York: McGraw-Hill, c1969.

2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.

3. An introduction to physics and technology of thin films / *Alfred Wagendristel, Yuming Wang*, Singapore: World Scientific, c1994.

4. Thin film processes, *John L Vossen, Werner Kehn* editors, Academic Press, New York, 1978.

5. Thin film physics / *O.S. Heavens*, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY303 WASTE TO SUSTAINABLE ENERGY AND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of Physics and chemistry at the intermediate (10+2) level is sufficient

Course Description:

This course covers waste-to-energy conversion and energy storage technologies, including thermal, biological, and chemical methods. It introduces relevant policies, case studies, and trends to help students design sustainable energy solutions aligned with the circular economy and climate goals.

Course Objectives:

The main objectives of the course is to

1. Understand various methods of energy generation from waste.
2. To explore thermal, biological, and chemical conversion technologies.
3. To examine modern energy storage devices and their integration with waste-to-energy systems.
4. To analyse the techno-economic feasibility of these systems for sustainable development.
5. To develop interdisciplinary skills in waste-to-energy technologies, enhancing student employability in sustainable energy and environmental sectors.

UNIT I INTRODUCTION TO WASTE PROCESSING, TRANSPORT, AND MANAGEMENT **9 hours**

Types of Wastes, Agricultural Residues, and Wastes Including Animal Wastes, Industrial Wastes, Municipal Solid Wastes and Characterization. Waste Processing Types and Composition of Various Types of Wastes- Industrial Waste and Biomedical Waste- Waste Collection and Transportation- Waste Processing- Size Reduction, Separation- Waste Management Hierarchy- Waste Minimization and Recycling of Municipal Solid Waste.

UNIT II THERMAL WASTE CONVERSION TECHNOLOGIES **9 hours**

Combustion, incineration, pyrolysis, gasification, Process parameters, design considerations, Emission control, energy recovery, and Case studies of WTE (Waste to Energy) plants in India and abroad

UNIT III BIOLOGICAL AND CHEMICAL CONVERSION **9 hours**

Bio gasification: Biomethanation process, biogas digester types. Chemical Conversion: Hydrolysis & hydrogenation; solvent extraction of hydrocarbons; solvolysis of wood, bio crude, biodiesel production via chemical process; transesterification methods; Chemicals from biomass.

UNIT IV ENERGY STORAGE SYSTEMS **9 hours**

Introduction to Energy Storage Systems - Types of energy storage- electrical, mechanical, chemical, thermal; Batteries (Li-ion, lead-acid, flow batteries), Supercapacitors and hybrid storage, Hydrogen storage and fuel cells.

UNIT V WASTE MANAGEMENT AND ENERGY RECOVERY **9 hours**

Characteristics and Perspectives of Waste, Unit Operations & Transformation Technologies, Waste Disposal, Hazardous Waste Management & Waste Recycling

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: To understand various methods of energy recovery from waste.

CO2: To explore thermal conversion technologies.

CO3: To explore biological and chemical conversion technologies

CO4: To examine modern energy storage devices and their integration with waste-to-energy systems.

CO5: To analyse the techno-economic feasibility of these systems for sustainable development.

Textbooks:

1. Waste-to-Energy. Technologies and Project Implementation by Marc J. Rogoff And Francois Screve (Auth.) Publisher: William Andrew, 2011/2019
2. Robert C. Brown Thermo-chemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, John Wiley and Sons, 2019.
3. Sergio Capareda, Introduction to Biomass Energy Conversions, CRC Press, 2013.
4. Fundamentals of Energy Storage, J. Jensen, B. Squrensen, John Wiley, NY
5. Techobanoglous, Theisen, and Vigil, "Integrated Solid Waste Management", 2d Ed. McGraw-Hill, New York, 1993.

Reference Books:

1. Industrial and Urban Waste Management in India, TERI Press
2. B. Lal and M. Patwardhan, "Wealth from Waste: Trends and Technologies", TERI Press
3. Municipal Solid Waste to Energy Conversion Processes: Processes Technical, and Renewable comparisons, by Gary C. Young, ISBN:9780470539675, Publisher: John Wiley & Sons, Publication Date: June 2010.
4. Parker Colin, and Roberts, "Energy from Waste – An Evaluation of Conversion Technologies", Elsevier Applied Science, London, 1985.
5. La Grega, M., et al., "Hazardous Waste Management", McGraw-Hill, c. 1200 pp., 2nd ed.,2001

Journals & Reviews:

1. Updated Journals and Reviews of the last 5 Years
2. Home (https://swayam.gov.in) > Courses (https://swayam.gov.in/explorer) > Waste to Energy Conversion, By Prof. P. Mondal | IIT Roorkee

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE301 CHEMISTRY OF POLYMERS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. To understand the basic principles of polymers
2. To understand natural polymers and their applications.
3. To impart knowledge to the students about synthetic polymers, their preparation and importance.
4. To enumerate the applications of hydogel polymers
5. To enumerate applications of conducting and degradable polymers in engineering.

UNIT I Polymers-Basics and Characterization:- 9 hours

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT II Natural Polymers & Modified cellulosics 9 hours

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

UNIT III Synthetic Polymers 9 hours

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,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

UNIT IV Hydrogels of Polymer networks 9 hours

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 Conducting and Degradable Polymers: 9 hours

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.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Classify the polymers, explain polymerization mechanism, differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer

CO2: Describe the physical and chemical properties of natural polymers and Modified cellulosics.

CO3: Differentiate Bulk, solution, Suspension and emulsion polymerization, describe fibers and elastomers, Identify the thermosetting and thermo polymers.

CO4: Identify types of polymer networks, describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,

CO5: Explain classification and mechanism of conducting and degradable polymers.

Textbooks:

1. A Textbook of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

Reference Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Online Learning Resources

1. https://nptel.ac.in/courses/104105124

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing Nanoscience

UNIT I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY 9 hours

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide.

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

Course Outcomes:

Upon completion of this course the students should:

CO1: Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
CO2: Understand and apply catalysis for developing eco-friendly processes.
CO3: Be in a position to use environmental benign solvents where ever possible.
CO4: Have knowledge of current trends in alternative energy sources.
CO5: Apply green chemistry principles in practicing green Nanoscience.

Textbooks:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Online Learning Resources

1. https://nptel.ac.in/courses/104105124

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE303 CHEMISTRY OF ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Objectives:

1. To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2. To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3. To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4. Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5. To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

UNIT I Electrochemical Systems 9 hours

Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel- cadmium, Lithium ion batteries and their applications**.**

UNIT II Fuel Cells 9 hours

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), Fuel cell efficiency and applications.

UNIT III Photo and Photo electrochemical Conversions 9 hours

Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT IV Solar Energy 9 hours

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

UNIT V Hydrogen Storage 9 hours

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.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Solve the problems based on electrode potential, Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer

CO2: Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells, Classify the fuel cell

CO3: Differentiate between Photo and Photo electrochemical Conversions, Illustrate the

photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion.

CO4: Apply the photo voltaic technology, Demonstrate about solar energy and prospects Illustrate the Solar cells, Discuss about concentrated solar power

CO5: Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures
Describe the liquification methods.

Textbooks:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23ME301 MATERIALS SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: 23PHY101 ENGINEERING PHYSICS

Course Objectives:

This course is designed to:

1. Understand the fundamental classification and properties of engineering materials.
2. Explore the structure, properties, and applications of metals and alloys.
3. Gain knowledge on composite materials and their relevance in engineering fields.
4. Learn about the structure and characteristics of ceramics and polymers.
5. Develop an appreciation of smart and advanced materials for modern technologies.

UNIT I CLASSIFICATION OF MATERIALS **9 hours**

Introduction to materials science, Classification: Metals, Ceramics, Polymers, Composites, Semiconductors, Biomaterials, Properties: Mechanical, Electrical, Thermal, Optical, Magnetic, Atomic structure and bonding, Crystal structures and defects, Structure–property relationships, Materials selection charts for engineering design.

UNIT II METALS AND ALLOYS **9 hours**

Types of metals: Ferrous and non-ferrous, Microstructure of metals, Phase diagrams (binary alloys), Heat treatment of steels, Corrosion and prevention methods, Mechanical behavior and testing: Stress-strain, hardness, fatigue, Common engineering alloys and their applications.

UNIT III COMPOSITES **9 hours**

Definition and classification: Particle-reinforced, fiber-reinforced, structural composites, Matrix materials: Polymer, metal, and ceramic matrix, Manufacturing techniques: Hand lay-up, pultrusion, Powder Metallurgy, Slurry Infiltration and Sintering, Properties and performance, Applications in aerospace, automotive, construction, and electronics.

UNIT IV CERAMICS AND POLYMERS **9 hours**

Structure and types of ceramics: Crystalline and amorphous, Properties: Thermal resistance, brittleness, conductivity, Processing of ceramics: Sintering, slip casting, hot pressing, Types of polymers: Thermoplastics, thermosets, elastomers, Polymerization processes: Addition and condensation, Mechanical and thermal properties, Applications in electronics, biomedical, and structural sectors.

UNIT V SMART AND ADVANCED MATERIALS **9 hours**

Definition and need for smart materials, Shape memory alloys, piezoelectric materials, magnetostrictive materials, Electroactive polymers, self-healing materials, photonic crystals, Nanomaterials and carbon-based materials (graphene, CNTs), Biomaterials and biocompatibility, Materials for electronics, aerospace, and green energy systems, Emerging trends and future directions.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Identify and classify materials based on their properties and structure.

CO2: Understand the behaviour and applications of metals and alloys in engineering.

CO3: Compare the types and uses of composites in structural and functional applications.

CO4: Understand the processing and properties of ceramics and polymers.

CO5: Identify the emerging applications of smart and advanced materials in multidisciplinary domains.

Textbooks:

1. Callister, W. D., & Rethwisch, D. G. (2020). Materials science and engineering: An introduction (10th ed.). Wiley.
2. Smith, W. F., Hashemi, J., & Prakash, R. (2021). Materials science and engineering (6th ed., SI units). McGraw Hill Education.
3. Upadhyaya, G. S., & Upadhyaya, A. (2022). Materials science and engineering (Revised ed.). Viva Books.

Reference Books:

1. Raghavan, V. (2018). Materials science and engineering (6th ed.). Prentice Hall of India.
2. C. Barry Carter and M. Grant Norton, Ceramic Materials: Science and Engineering, Springer, 3rd Edition, 2023.
3. Bhattacharya, D. (2023). Smart materials and structures (2nd ed.). Oxford University Press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23ME302 SUSTAINABLE ENERGY TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

This course is designed to:

1. Introduce the global and national energy scenario and emphasize the importance of sustainability in energy systems.
2. Explain the principles and technologies associated with solar and wind energy systems.
3. Familiarize students with hydropower, wave, and tidal energy generation systems and their real-world applications.
4. Describe bioenergy and geothermal systems, including design considerations and environmental implications.
5. Evaluate the economics of renewable energy projects and explore integration techniques including storage and smart grids.

UNIT I INTRODUCTION TO SUSTAINABLE ENERGY SYSTEMS 9 hours

Energy demand and supply scenario – global and Indian context, Environmental impacts of conventional energy sources, Concept of sustainability and carbon footprint, Overview of renewable energy sources, Policy frameworks and SDGs.

UNIT II SOLAR AND WIND ENERGY TECHNOLOGIES 9 hours

Solar radiation basics, types of solar collectors (thermal and photovoltaic), Photovoltaic cell operation, efficiency factors, MPPT basics, Solar thermal applications: water heating, drying, Wind resource assessment, turbine types and operation, Onshore vs offshore wind power.

UNIT III HYDROPOWER, WAVE, AND TIDAL ENERGY 9 hours

Types of hydropower plants, turbine types, site selection, Ocean energy: wave and tidal principles, design concepts, Challenges in marine energy utilization, Case studies from India and abroad.

UNIT IV BIOENERGY AND GEOTHERMAL TECHNOLOGIES 9 hours

Biomass types, anaerobic digestion, biodiesel, bioethanol, Biogas plant design and efficiency, Geothermal energy basics, types of geothermal systems, Environmental and economic impacts.

UNIT V ECONOMICS AND INTEGRATION OF RENEWABLE ENERGY 9 hours

Economic analysis: LCOE, payback, IRR, Energy storage technologies: batteries, pumped hydro, Grid integration issues and smart grids, Future trends: hybrid systems, microgrids, hydrogen. Concept of waste to wealth.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Explain the global and Indian energy scenario, sustainability concepts, and the role of renewable energy in achieving SDGs. (L2)

CO2: Analyze the working principles, components, and efficiency factors of solar and wind energy systems. (L3)

CO3: Illustrate the operation and site requirements of hydropower, wave, and tidal energy systems with relevant case studies. (L2)

CO4: Apply basic design and performance analysis for bioenergy and geothermal energy systems considering environmental aspects. (L3)
CO5: Evaluate the techno-economic feasibility of renewable energy systems and their integration into smart grids with energy storage. (L3)

Textbooks:

1. Boyle, G. (2021). Renewable energy: Power for a sustainable future (4th ed.). Oxford University Press.
2. Twidell, J., & Weir, T. (2021). Renewable energy resources (4th ed.). Routledge.
3. Kothari, D. P., Singal, K. C., & Ranjan, R. (2020). Renewable energy sources and emerging technologies (3rd ed.). PHI Learning.

Reference Books:

1. Sorensen, B. (2019). Renewable energy: Physics, engineering, environmental impacts, economics & planning (5th ed.). Academic Press.
2. Kalogirou, S. A. (2022). Solar energy engineering: Processes and systems (3rd ed.). Academic Press.
3. Lund, H. (2021). Renewable energy systems: A smart energy systems approach to the choice and modeling of 100% renewable solutions (4th ed.). Academic Press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - I

23EEE301 ELECTRICAL SAFETY PRACTICES AND STANDARDS

	L	T	P	C
Pre-requisite: 23EEE101	**3**	**0**	**0**	**3**

Course Objectives:

1. To introduce the fundamentals of electrical safety, hazards of electric shock, arc, blast, and failure causes.
2. To explain the function and importance of electrical safety components, voltage classification, and protection devices.
3. To impart knowledge on grounding systems, bonding, and arc hazard categorization to ensure workplace safety.
4. To develop awareness about safety practices across various environments including residential, industrial, and special installations.
5. To familiarize students with relevant electrical safety standards, statutory regulations, and compliance requirements.

UNIT I INTRODUCTION TO ELECTRICAL SAFETY: **9 hours**

Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

UNIT II SAFETY COMPONENTS **9 hours**

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 GROUNDING **9 hours**

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 SAFETY PRACTICES **9 hours**

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 STANDARDS FOR ELECTRICAL SAFETY **9 hours**

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.

Course Outcomes:

CO1: Understand the fundamental principles of electrical safety and the physiological effects of electric shock-L2

CO2: Apply knowledge of electrical safety components and protective devices to mitigate over-voltages and static hazards -L3

CO3: Analyze equipment grounding, system grounding, and arc flash hazard categories in practical installations -L4

CO4: Implement appropriate safety procedures in varied environments such as homes, public spaces, and medical areas- L4

CO5: Evaluate the applicability and compliance of electrical systems with respect to national and international safety standards-L5

Textbooks:

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.

Reference Books:

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.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective-I

23EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite 23EEE101

Course Objectives:

This course enables students to

1. To provide foundational knowledge on MEMS, its historical development, working principles, and scaling effects.
2. To understand the operation of micro sensors and actuators, and their integration into MEMS structures.
3. To explore MEMS materials and comprehend various microfabrication and micromachining techniques.
4. To develop competency in modeling MEMS devices using simulation methods such as FEM for sensor and actuator behavior.
5. To examine various applications of MEMS in different domains including RF, optical, microfluidic, and robotics systems.

UNIT I INTRODUCTION **9 hours**

Overview – History and industry perspectives – Working principles – Mechanics and dynamics Scaling law

UNIT II MICRO SENSORS & ACTUATORS **9 hours**

Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING **9 hours**

Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS **9 hours**

Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS **9 hours**

Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Explain the history, structure, operating principles, and scaling challenges of MEMS – L2

CO2: Describe the working of micro sensors and actuators and their roles in MEMS – L2

CO3: Analyze the materials and various microfabrication techniques used in MEMS manufacturing – L4

CO4: Apply modeling techniques like FEM to simulate MEMS device behavior such as gyroscopes and piezoelectric sensors – L3

CO5: Evaluate MEMS applications in RF, fluidics, optics, and robotics through real-world case studies – L5

Textbook(s)

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006
2. G.K. Ananthsuresh et al ,'Micro and Smart Systems', Wiley, India, 2010

Reference Books

1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.
3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005
4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective – I

23ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:
This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids

UNIT I HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS 9 hours

Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1: Understand the applications of biological transducers in medical field.

CO2: Analyze the design of bio-electrodes and bio-amplifiers.

CO3: Apply suitable measuring instruments to measure various medical parameters.

CO4: Understand and test various imaging techniques used in bio-medical diagnosis.

CO5: Analyze the applications of artificial medical aids.

Textbooks:

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.
2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014
2. R.S.Khandpur,"Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw - Hill, New Delhi, 2005
3. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – I

23ECE302 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET models, CMOS design rules, Design of VLSI Systems, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives:
This course enables students to

1. Study the fundamentals of CMOS circuits and its characteristics
2. Learn the design and realization of combinational digital circuits.
3. Learn the design and realization of sequential digital circuits.
4. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
5. Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Realize the concepts of digital building blocks using MOS transistor.

CO2: Design combinational MOS circuits and power strategies

CO3: Design and construct Sequential Circuits and Timing systems.

CO4: Design arithmetic building blocks and memory subsystems.

CO5: Apply and implement FPGA design flow and testing.

Textbooks:

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson , 2017.
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – 1

23CSE301 JAVA PROGRAMMING

		L	T	P	C
Pre-requisite	NIL	**3**	**0**	**0**	**3**

Course Objectives:

The learning objectives of this course are to:

1. Identify Java language components and how they work together in applications.
2. Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3. Learn how to extend Java classes with inheritance and interfaces in Java applications.
4. Understand how to use Java packages, Exceptions and I/O Streams for program development.
5. Understand how to design applications with threads in Java.
6. Understand how to use Java APIs for program development

UNIT I **9 hours**

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 **9 hours**

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, this and static Keywords.

Methods: Introduction, Defining Methods, Overloaded Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods

UNIT III **9 hours**

Arrays: Introduction, Declaration and Initialization of Arrays, Operations on Array Elements, Assigning Array to Another Array, Two-dimensional Arrays, Arrays of Varying Lengths

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes,

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 hours**

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.

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.

UNIT V **9 hours**

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.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.

CO2: Design and implement classes to model real-world entities, with a focus on attributes, behaviours, and relationships between objects.

CO3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and interface concept.

CO4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.

CO5: Develop multithreaded applications with synchronization.

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson
3. JAVA for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - I

23CST301 OPERATING SYSTEMS **L T P C**
3 0 0 3

Pre-requisite NIL

Course Description:

This course introduces the fundamental concepts and principles of operating systems, covering process and thread management, CPU scheduling, synchronization, deadlocks, memory management, file systems, and system protection mechanisms. Students will gain practical understanding of how modern operating systems function, focusing on process coordination, resource allocation, and system-level design. Through theoretical insights and hands-on exposure, learners will be equipped to analyze, design, and optimize OS components for better performance and reliability in computing systems.

Course Objectives:

The main objectives of the course is to make student

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

UNIT I OPERATING SYSTEMS OVERVIEW 9 hours

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 PROCESS AND THREADS 9 hours

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 SYNCHRONIZATION 9 hours

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 MEMORY MANAGEMENT 9 hours

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 FILE SYSTEM 9 hours

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.

Course Outcomes:

After completion of the course, students will be able to

CO1: Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.

CO2: Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.

CO3: Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.

CO4: Illustrate different conditions for deadlock and their possible solutions.

CO5: Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms.

Textbook(s)

1. Operating System Concepts, Silber schatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.

2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018

2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective – I

23CAI301 MOBILE COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite: **None**

Course Objectives:

The main objectives of the course is to

1. To understand the basic concepts of mobile computing.
2. To learn the basics of mobile telecommunication system.
3. To be familiar with the network layer protocols and Ad-Hoc networks.
4. To know the basis of transport and application layer protocols.
5. To gain knowledge about different mobile platforms and application development.

UNIT I INTRODUCTION **9 hours**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT II MOBILE TELECOMMUNICATION SYSTEM **9 hours**

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover - Security

UNIT III MOBILE NETWORK LAYER **9 hours**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER **9 hours**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

UNIT V MOBILE PLATFORMS AND APPLICATIONS **9 hours**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain the basics of mobile telecommunication systems

CO2: Illustrate the generations of telecommunication systems in wireless networks

CO3: Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network

CO4: Explain the functionality of Transport and Application layers

CO5: Develop a mobile application using android/blackberry/ios/Windows SDK

Textbooks:

1. Jochen Schiller, Mobile Communications, Addison-Wesley, Second Edition, 2009.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012

Reference Books:

1. Dharma Prakash Agarval, Qing and an Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. Windows Phone DevCenter : http://developer.windowsphone.com

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - I

23CSD301 INTRODUCTION TO DATA SCIENCE

L	T	P	C
3	0	0	3

Pre-requisite: **None**

Course Objectives:

The main objectives of the course is to

1. Knowledge and expertise to become a data scientist.
2. Essential concepts of statistics and machine learning that are vital for data science;
3. Significance of exploratory data analysis (EDA) in data science.
4. Critically evaluate data visualizations presented on the dashboards
5. Suitability and limitations of tools and techniques related to data science process

UNIT I **9 hours**

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 **9 hours**

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 hours**

NoSQL movement for handling Bigdata: 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 **9 hours**

Tools and Applications of Data Science: Introducing **Neo4j**for 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 **9 hours**

Data Visualization and Prototype Application Development: Data Visualization options, Crossfilter, 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.

Course Outcomes:

At the end of this course students will demonstrate the ability to
CO1: Understand the fundamental concepts and applications of data science.
CO2: Apply machine learning techniques to solve data science problems.
CO3: Compare and contrast relational and NoSQL databases.
CO4: Utilize graph databases for data analysis.
CO5: Create interactive data visualizations.

Textbooks:

1. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016

2. Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics

Reference Books:

1. Joel Grus, "Data Science From Scratch", OReilly, 2019

2. Doing Data Science: Straight Talk From The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

Online Learning Resources

1. https://www.coursera.org/specializations/introduction-data-science

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - I

23CSM301 AI FOR EVERYONE

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Objectives:

The objectives of the course are to

1. Understand the basics of artificial intelligence and its subfields.
2. Explore real-world applications of AI across different industries.
3. Gain insights into the ethical, social, and economic implications of AI.
4. Develop an appreciation for the potential of AI to drive innovation and transformation.

UNIT I INTRODUCTION **9 hours**

Introduction to Artificial Intelligence (AI): Significance, Historical Overview & Evolution, Artificial Intelligence: Types, Applications, Challenges & Opportunities, Introduction to Intelligent Agents, Branches of AI: Machine Learning, NLP, Robotics, Expert Systems, Deep Learning: Concept of Neural Networks, AI vs Human Intelligence.

UNIT II APPLICATIONS OF AI **9 hours**

AI in Everyday Life: Smart Assistants, Chatbots, Recommendation Systems, AI in Engineering: Robotics, Predictive Maintenance, AI in Healthcare, Education, Agriculture, Transport, Real-World AI Systems: Google Maps, Siri, Amazon, Tesla.

UNIT III PROBLEM SOLVING AND CASE STUDIES **9 hours**

How AI Solves Problems: Search, Logic, Pattern Recognition, Introduction to Rule-Based Systems. Case Studies: Smart Speaker, Self-Driving Car, AI in Climate Monitoring, AI in Disaster Response Example Roles of an AI Team, Survey of Major AI Application Areas.

UNIT IV AI AND SOCIETY **9 hours**

Impact of AI on Jobs and Employment, AI in Governance and Public Services, Human-AI Collaboration: Assistive AI, Digital Divide and Accessibility Challenges, AI in Developing Countries – Opportunities and Challenges, Case Studies on Social Applications.

UNIT V ETHICAL AND SOCIAL IMPLICATIONS OF AI **9 hours**

Bias And Fairness in AI Systems, Privacy and Data Protection Concerns, Responsible AI: Policies and Frameworks, AI and Social inequality, Ethical Guidelines and Responsible AI Practices, AI and Innovation, Emerging Trends and Future Directions in AI, AI and Creativity: Generative Models and Artistic Applications

Course Outcomes:

At the end of this course students will be able to

CO1: Apply basic AI concepts and identify different types and branches of AI.

CO2: Analyze how AI is used in real-life applications across various fields.

CO3: Apply AI techniques to understand how problems are solved using real-world case studies.

CO4: Analyze the impact of AI on jobs, governance, and social development.

CO5: Analyze ethical issues in AI and understand the importance of responsible AI practices.

Textbooks:

1. “Artificial Intelligence A Guide for Thinking Humans”, Melanie Mitchell .
2. “Artificial Intelligence: The Basics”, Kevin Warwick, Routledge, 2011.

Reference Books:

1. "AI for Everyone: The Essential Guide", Dale Lane, Wiley, 2021.
2. “Artificial Intelligence Basics: A Non-Technical Introduction”, Tom Taulli, Apress, 2019

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

OPEN ELECTIVE – IV

Open Elective - IV

23PHY304 SMART MATERIALS AND DEVICES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course introduces the fundamentals and evolution of smart materials and their responsive behavior to external stimuli. It covers key types such as shape memory, chromoactive, magnetorheological, photoactive materials, and polymer composites. The course explores important properties including electrical, optical, dielectric, piezoelectric, and magnetic characteristics. Students learn synthesis techniques like sol-gel, chemical vapor deposition, and thin-film fabrication methods. It also includes characterization techniques and applications in devices such as MEMS, sensors, actuators, and robotic systems.

Course Objectives:

1. To provide exposure to smart materials and their engineering applications.
2. To impart knowledge on the basics and phenomenon behind the working of smart materials
3. To explain the properties exhibited by smart materials
4. To educate various techniques used to synthesize and characterize smart materials
5. To identify the required smart material for distinct applications/devices

UNIT I INTRODUCTION TO SMART MATERIALS 9 hours

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 PROPERTIES OF SMART MATERIALS 9 hours

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III SYNTHESIS OF SMART MATERIALS 9 hours

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV CHARACTERIZATION TECHNIQUES 9 hours

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT V SMART MATERIALS BASED DEVICES 9 hours

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

CO1: Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.

CO2: Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.

CO3: Summarize various types of synthesis of smart materials

CO4: Analyze various characterization techniques used for smart materials

CO5: Interpret the importance of smart materials in various devices

Textbooks:

1. YaserDahman, 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 Books:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0, Chaudhery MustansarHussain, Paolo Di Sia, Springer,2022.
4. **Fundamentals of Smart Materials,**Mohsen Shahinpoor, Royal Society of Chemistry, 2020

Online Recourses

NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

23CHE304 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

This is primarily a lecture course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology.

Course Objectives:

This course enables students to

1. To understand the emergence of nanoscience and technology through history.
2. The various process techniques available for nanostructured materials.
3. The role of nanotechnology in electronics how basic nano-systems work
4. To use physical reasoning to develop simple nanoscale models to interpret the behaviour of such physical systems.

UNIT I MOLECULE TO MATERIALS: BASICS OF NANOTECHNOLOGY **8 hours**

Atomic Structures: Rutherford and Bohr's model of atom. Bohr's model to Quantum: Wave function, Uncertainty principle, Orbital quantum numbers, Shape of the orbitals. Types of simple crystal structures, defects in nanocrystals. History & emergence (Feynman to present) of Nanoscience and Nanotechnology, Challenges in Nanotechnology.

UNIT II TYPES AND SYNTHESIS OF NANOSTRUCTURES **10 hours**

Definition of a Nano system - Zero Dimensional (OD), One Dimensional (1D) - Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials. Top-down and Bottom-up approaches, Nanoscale building blocks. Synthesis of Nanomaterials – Physical & Chemical methods: Chemical Vapour Deposition (CVD), Atomic Layer Deposition (ALD), Chemical Reduction, Electrochemical, Co-precipitation, Emulsion synthesis, Template based synthesis, Sol-Gel, Hydrothermal, Role of plants in Nanoparticle (NP) synthesis.

UNIT III PROPERTIES OF NANOMATERIAL **8 hours**

Thermal, Mechanical, Optical, Electrical and Magnetic properties of nanomaterials (Metal oxides, Ceramics, Composites, Semiconductors) Carbon age materials: CNTs, and other Carbon-based materials). Relationship between surface effects on the properties of nanomaterials.

UNIT IV CHARACTERIZATION OF NANOMATERIALS **10 hours**

Crystal Structure – XR; Composition: XPS; Optical & Electron microscopes: Scanning probe microscope, Scanning tunneling microscopes, Atomic force microscopes (AFM), Scanning electron microscope (SEM), Transmission electron microscope (TEM); Magnetic characterization (SQUID).

UNIT V APPLICATIONS OF NANOMATERIALS 9 hours

Molecular electronics and nano-electronics – Quantum electronic devices - CNT based transistor and Field Emission Display - Biological applications - Biochemical sensor - Membrane based water purification, Target based drug delivery system, LED applications.

Course Outcomes:

Upon completion of this course the students will be able to:

CO1: Understand the correlation between atomic, molecular structures and nanomaterials

CO2: Classify the types and synthesis the nanomaterials based on the needs of the society and environment.

CO3: Infer and interpret the properties of nanomaterials

CO4: Apply the knowledge of characterization tools towards making the sustainable engineering products.

CO5: Illustrate the application of various nanomaterials in daily life, industry towards the sustainable development.

Textbook(s)

1. Erich Gamma , Design Patterns ; Publisher, Pearson Education India, 1995; ISBN, 8131769461, 9788131769461. 1. M. Wilson, K. Kannangara, G. Smith, M. Simmons, and B. Raguse, *Nanotechnology: Basic science and Emerging technologies*, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C. N. R. Rao, A. Muller, and A. K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
3. Kenneth J. Klabunde (Eds), *Nanoscale Materials Science*, John Wiley & Sons, InC, 2001.
4. C. S. S. R. Kumar, J. Hormes, and C. Leuschner, Nanofabrication towards biomedical applications, Wiley - VCH Verlag GmbH & Co, Weinheim, 2004.
5. T. Pradeep, Nano: *The Essentials, Understanding Nanoscience and Nanotechnology*, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2007.

Reference Books

1. W. Rainer, Nano Electronics and information Technology, Wiley, 2003.
2. K. E. Drexler, *Nano systems*, Wiley, 1992.
3. G. Cao, *Nanostructures and Nanomaterials: Synthesis, properties and applications*, Imperical College Press, 2004.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - IV

23CHE305 WATER POLLUTION AND ITS MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite Nil

Course Description:

This is primarily a lecture course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology.

Course Objectives:

This course enables students

1. To learn the fundamental concepts in the field of water pollution
2. To know the standards and importance of water pollution
3. To study the various industrial effects and mitigation management
4. To learn the importance of methods of control of water pollution
5. To study the various water control act and functions of regulatory boards

UNIT I SOURCES & CHARACTERISTICS OF WATER POLLUTION 9 hours

Water and wastewater pollution – Sources & Types of water and wastewater pollution – Physical, chemical and biological characteristics – Effects of water pollution. Drinking water - quality standards – WHO, ICMR, ICAR, Central and State quality control norms.

UNIT II WATER QUALITY & TESTING PROCEDURES 9 hours

Quality of surface water – Water quality in flowing water, Water quality in impounded water, Ground water quality – Testing procedures of important water quality parameters (pH, Electrical Conductivity, Total Dissolved Solids, Calcium, Magnesium, Chloride, Sulfate, Sodium, Potassium, Dissolved Oxygen, Iron, Total Kjeldahl nitrogen, FRC, FAC).

UNIT III INDUSTRIAL ACTIVITY & MITIGATION MEASURES 9 hours

Role of water in different industries – Effluent discharge characteristics – Discharge Standards for River and Streams – Role of stakeholders, public, NGOs, Government in Protection of Water bodies – Control measures – Industrial water contamination due to industries, ETP, Case Studies (Dye Industry, Pharmaceutical Industry, Cement Industry)

UNIT IV WATER POLLUTION REGULATION 9 hours

Administrative regulations under recent legislations in water pollution control. Water (Prevention & Control of Pollution) Act 1974 and its Amendment Act 1988, Rules 1975, Cess Act 1977 and its Amendment Act 1991.

UNIT V FUNCTIONS AND MANAGEMENT OF REGULATORY BOARDS 9 hours

Sustainable Development, Rain Water Harvesting – Methods – Water Pollution – Causes and Effects – Role of Regulatory bodies and Local bodies – CPCB – SPCB etc. – Case studies related to Effective Water Management.

Course Outcomes:

Upon completion of this course the students will be able to:

CO1: Understand the fundamental concepts with respect to water pollution **(L2)**

CO2: Recognize the standards and importance of water pollution **(L1)**

CO3: Understand the various industrial effects and mitigation management of pollution (**L2)**

CO4: Apply the different methods of control of water pollution (**L3)**

CO5: Awareness of the various water control acts and functions of regulatory boards **(L2)**

Textbook(s)

1. Metcalf & Eddy, Wastewater engineering, Treatment and Reuse, MacGrawhill publications, 2017.
2. Aruna Venkat, Environmental law and policy, PHI learning private limited, New Delhi, 2011

Reference Books

1. Fair, Geyer, and Okun', Water and Wastewater engineering, Vol I & II, John Wiley and Sons, Newyork, 2010.
2. P.K. Goel, Water Pollution: Causes, Effects and Control, New Age International, 2006.
3. S.K. Agarwal, Water Pollution, APH Publishing, 2005.
4. Anita Singh (Editor), Madhoolika Agrawal (Editor), Shashi Bhushan Agrawal (Editor), Water Pollution and Management Practices, Springer Verlag, Singapore, 1st Edition, 2021.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - IV

23ME303 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees for the improvement of processes and products. TQM encompasses various principles, techniques, and tools for identifying and solving problems, fostering a culture of quality, promoting teamwork, and striving for excellence in all areas of the organization. The goal of TQM is to achieve sustainable and long-term success by consistently delivering high-quality products and services that meet or exceed customer expectations while improving overall organizational performance.

Course Objectives:

1. Study comprehensive knowledge about the principles, practices, tools and techniques of total quality management.
2. Gain knowledge on leadership, customer satisfaction, addressing customer complaints, team work, employee involvement, related to customer and supplier partnership.
3. Gather information on various tools and techniques, concept on Six Sigma, bench marking and failure Mode Effective Analysis (FMEA).
4. Know the importance of Quality circle, Quality Function Deployment, Taguchi design and case studies related to TQM.
5. Facilitate the understanding of standards of quality.

UNIT I INTRODUCTION **9 hours**

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. Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM.

UNIT II TQM PRINCIPLES **9 hours**

TQM principles - Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Role of Leadership and Commitment in Quality Deployment, Team Building, Motivation and Rewards, Total Employee Empowerment, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection.

UNIT III TOOLS OF TQM **9 hours**

TQM Tools: Benchmarking – Reasons to Benchmark, Benchmarking Process, 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 IV TQM TECHNIQUES 9 hours

Quality circles – Quality Function Deployment (QFD) – House of Quality – Design of Experiments – Taguchi quality engineering – Orthogonal Arrays – Signal to Noise Ratio –
TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V IMPELMENTATION OF TQM 9 hours

Introduction – Benefits of ISO Registration – ISO 9000 Series of Standards –Implementation – Environmental Management System: Introduction – ISO 14000 Series Standards – Concepts of ISO 14001 – Requirements of ISO 14001, Real Case studies on TQM principles followed by Indian Industries.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

CO1: Understand the various principles and practices of TQM to achieve quality.

CO2: Identify the various statistical approaches for Total Quality Control.

CO3: Demonstrate the TQM tools for continuous process improvement.

CO4: Adopt the importance of ISO and Quality systems.

CO5: Make use of the concepts of TQM to solve case studies.

Textbooks:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

References Books:

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd. (2006).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

23ME304 ADDITIVE MANUFACTURING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides an introduction to additive manufacturing technologies, focusing on their principles, processes, materials, and industrial applications. It covers various additive manufacturing techniques such as FDM, SLA, SLS, and metal-based processes, along with material selection and process parameters. The course also emphasizes CAD modeling for additive manufacturing, STL file preparation, slicing, and preprocessing techniques. Post-processing methods, quality control, and inspection of printed parts are discussed. The course enables students from various engineering disciplines to understand the potential of additive manufacturing in modern product development and production systems.

Course Objectives:

1. Understand the underlying principles of additive manufacturing.
2. Describe major additive manufacturing processes and their differences.
3. Identify suitable materials and process parameters for different applications.
4. Use CAD tools to prepare and export files for AM systems.
5. Apply post-processing techniques and quality control for AM parts

UNIT I INTRODUCTION TO ADDITIVE MANUFACTURING 9 hours

Definition and fundamentals of Additive Manufacturing (AM), Evolution of AM and comparison with conventional manufacturing, Process chain in AM (concept to finished part), Classification of AM processes, Advantages, limitations, and applications across industries (Automotive, Aerospace, Medical, Consumer products.

UNIT II ADDITIVE MANUFACTURING PROCESSES 9 hours

Stereolithography (SLA), Fused Deposition Modeling (FDM), Selective Laser Sintering (SLS), Selective Laser Melting (SLM), Laminated Object Manufacturing (LOM), Binder Jetting, Electron Beam Melting (EBM), Overview of wire-based and metal AM processes, Process parameters, advantages, and limitations of each technology.

UNIT III MATERIALS FOR ADDITIVE MANUFACTURING 9 hours

Materials used in AM: Polymers, Metals, Ceramics, Composites, Material forms: filaments, powders, resins, wires, Material properties and their influence on process selection, Introduction to material behavior during layer-by-layer deposition, Emerging materials in additive manufacturing

UNIT IV CAD, FILE HANDLING & PRE-PROCESSING 9 hours

CAD modelling for AM, STL and other AM file formats: generation and issues, Data translation and conversion, STL file repair and preparation, Slicing fundamentals and build file generation, Part orientation and support generation strategies, Software tools used in pre-processing for 3D printing.

UNIT V POST-PROCESSING & QUALITY 9 hours

Post-processing techniques: heat treatment, surface finishing, support removal Inspection, testing, and quality control of printed parts, Common defects and remedial practices

Course Outcomes:

Upon successful completion of this course, the student will be able to:

CO1: Explain fundamental AM processes and their principles.
CO2: Compare various AM technologies with respect to process characteristics.
CO3: Select appropriate materials and process parameters for specific AM applications.
CO4: Prepare and export CAD models for additive manufacturing.
CO5: Apply post-processing and inspection techniques to Additive Manufactured parts.

Textbooks:

1. Gibson, I., Rosen, D.W., & Stucker, B., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 3rdEdition (2021).
2. Chua, C.K., Leong, K.F., & Lim, C.S., Rapid Prototyping: Principles and Applications, 3rd ed., World Scientific Publishing (2010).

References:

1. Pham, D.T., & Dimov, S.S., Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer (2011).
2. Jacobs, P.F., Rapid Prototyping & Manufacturing: Fundamentals of Stereolithography, Society of Manufacturing Engineers (1992).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

23ME305 REFRIGERATION AND AIR CONDITIONING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

This course is designed to:

1. Understand the fundamental concepts, performance metrics, and cycle analysis of vapour compression refrigeration systems.
2. Study the functional components of VCR systems and the selection criteria of refrigerants based on thermophysical and environmental properties.
3. Explore the working principles and applications of vapour absorption and alternative refrigeration systems.
4. Introduce psychrometric concepts, heat load analysis, and various air conditioning configurations.
5. Learn about air conditioning components and human thermal comfort requirements for effective HVAC design.

UNIT I INTRODUCTION TO REFRIGERATION AND VCR SYSTEM 9 hours

Introduction to Refrigeration, Necessity and Applications, Unit of Refrigeration, COP, EER, Methods of refrigeration.

Vapour compression refrigeration system: Working principle, effect of sub cooling and super heating, ideal and actual cycle, multi-stage, cascading VCR systems, numerical problems.

UNIT II COMPONENTS OF VCR SYSTEM AND REFRIGERANTS 9 hours

Vapour Compression Refrigeration System Components: General classification of compressors, condensers, evaporators and expansion devices and working principles.

Refrigerants: Desirable properties, Classification of refrigerants, Nomenclature, Environmental impact.

UNIT III VAR SYSTEM AND OTHER REFRIGERATION SYSTEMS 9 hours

Vapour Absorption Refrigeration system: Introduction to Vapour absorption refrigeration system, Lithium-Bromide absorption refrigeration system, three fluid absorption refrigeration system and comparison of compression and absorption refrigeration systems.

Other Refrigeration systems: Working principles of Steam jet refrigeration system, Thermoelectric refrigeration system, Solar refrigeration system, Vortex & Pulse tube refrigeration system.

UNIT IV INTRODUCTION TO AIR CONDITIONING SYSTEMS 9 hours

Psychrometric Properties & Processes, Characterization of Sensible and Latent Heat Loads, Need for Ventilation, Consideration of Infiltrated Air, Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling), Window, Split, Summer, Winter, Year-Round, Central Air Conditioning Systems.

UNIT V AIR CONDITIONING EQUIPMENT 9 hours

Air Conditioning Equipment: Humidifiers, Dehumidifiers, Air Filters, Fans and Blowers. Inverter Technology in Air conditioners.

Human Comfort: Requirements of Temperature, Humidity and Concept of Effective Temperature, Comfort Chart. Heat Pump, Heat Sources, Different Heat Pump Circuits.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply thermodynamic principles to evaluate the performance of vapor compression refrigeration systems including subcooling and superheating effects. (L3)

CO2: Explain the function and classification of VCR components and identify suitable refrigerants based on their properties and environmental impact. (L2)

CO3: Analyze and compare vapour absorption refrigeration systems with alternative refrigeration technologies for specific applications. (L4)

CO4: Apply psychrometric principles to assess heat loads and select appropriate air conditioning systems for various climate conditions. (L3)

CO5: Describe the role of air conditioning equipment and heat pump systems in achieving indoor human comfort conditions. (L2)

Textbooks:

1. Arora, C. P. (2020). Refrigeration and air conditioning (4th ed.). McGraw Hill Education.
2. Domkundwar, S. C., Arora, A., & Domkundwar, V. M. (2021). A course in refrigeration and air conditioning (Revised ed.). Dhanpat Rai & Co.
3. Ballaney, P. L. (2023). Refrigeration and air conditioning (Revised ed.). Khanna Publishers.

Reference Books:

1. Stoecker, W. F., & Jones, J. W. (2020). Refrigeration and air conditioning (2nd ed.). McGraw Hill Education.
2. Dossat, R. J., & Horan, T. J. (2019). Principles of refrigeration (5th ed.). Pearson Education.
3. Threlkeld, J. L. (2018). Thermal environmental engineering (3rd ed.). Pearson Education.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - IV

23EEE303 ROBOTICS

	L	T	P	C
Pre-requisite: Nil	**3**	**0**	**0**	**3**

Course Objectives:

The objectives of the course are to make the students learn about:

Robotics is an interdisciplinary area ranging from mechanical & electrical component design to advanced sensor technology, incorporating computer systems and Artificial Intelligence (AI). With advances in AI-techniques & computational power in recent years, it has become one of the most interesting areas for multidisciplinary research, with lots of commercial applications already in market.

UNIT I INTRODUCTION, TRANSFORMATION AND MAPPING 9 hours

Evolution of Robots and Robotics, Laws of Robotics, Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Robotic Programming and Future Prospects. Coordinate Frames, Object Description in Space, Transformation of Vectors, Inverting a homogenous transform, Fundamental Rotation Matrices.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9 hours

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers. Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9 hours

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors, binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS 9 hours

Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems.

UNIT V ROBOT PROGRAMMING, IMPLEMENTATION AND ECONOMICS 9 hours

Commands, Sensor Commands, End Effector commands and simple Programs. RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand the fundamentals of Robotics.

CO2: Analyze the robot drive system.

CO3: Understand the various sensors and actuators.

CO4: Analyze the mechanical structure and notations kinematic model.

CO5: Implement the basic commands for robots.

Textbooks:

1. Mittal, R. K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547

Reference Books:

1. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, 1988.
2. Craig, J.J., Introduction to Robotics: Mechanism & Control. Addison Wesley, 1986.
3. Paul, R.P., Robot Manipulator: Mathematics Programming & Control. MIT Press, 1981.
4. Pugh, A., Robot Sensors, Vision Vol.-I. Springer Verlag, 1986.
5. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - IV

23EEE304 SMART GRID TECHNOLOGIES

	L	T	P	C
Pre-requisite: 23EEE101	**3**	**0**	**0**	**3**

Course Objectives:

The objectives of the course are to make the students learn about:

1. To understand the evolution, need, architecture, and enabling technologies of smart grids.
2. To analyze synchro phasor technology and the operation of wide area monitoring systems using PMU and PDC.
3. To apply smart metering concepts including AMR, AMI, and demand side management techniques.
4. To evaluate communication technologies and protocols used in smart grid systems.
5. To design smart grid applications with renewable integration, energy storage, and cybersecurity measures.

UNIT I INTRODUCTION TO SMART GRID 9 hours

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 WIDE AREA MONITORING SYSTEM 9 hours

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 SMART METERS 9 hours

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 INFORMATION AND COMMUNICATION TECHNOLOGY 9 hours

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 SMART GRID APPLICATIONS AND CYBER SECURITY 9 hours

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.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understanding the Concept and Evolution of Smart Grids. L2

CO2: Analyzing Wide Area Monitoring System and Synchrophasor Technology. L4

CO3: Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts. L3

CO4: Evaluating Information and Communication Technology (ICT) Systems in Smart Grids. L5

CO5: Designing Smart Grid Applications and Cybersecurity Measures. L6

Textbooks:

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

Reference Books:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013
2. Fereidoon.P.Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy",1st Edition, Academic Press, USA, 2011.
   Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.
3. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - IV

23ECE303 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. Introduce the building blocks in embedded hardware and firmware design
2. Explore Real-Time Operating Systems (RTOS) and their implementation.
3. Understand multitasking, scheduling, and real-time constraints.
4. Design embedded applications using ARM Cortex architecture.
5. Apply software/hardware co-design and UML modeling techniques.

UNIT I FUNDAMENTALS OF EMBEDDED SYSTEMS 9 hours

Embedded System Overview & Characteristics, Embedded vs General Purpose Systems, Embedded Processors: RISC, CISC, DSP, ARM Cortex-M, Memory Architecture: Flash, SRAM, EEPROM; Sensors, Actuators, ADC / DAC Interfaces, Case Studies of Consumer and Industrial Embedded Systems

UNIT II EMBEDDED SOFTWARE DEVELOPMENT & RTOS BASICS 9 hours

Embedded C: Startup Code, Interrupts, GPIOs, Timers; IDEs, Cross Compilers, Linkers, Debuggers, Operating System Concepts, Real-Time Operating System (RTOS) Introduction, RTOS Concepts: Task Scheduling, Context Switching, Preemptive vs Cooperative Scheduling, Task Creation, Priorities, Stack Management, Multitasking: Processes, Threads, Scheduling (Round Robin, Priority-based), RTOS Examples: FreeRTOS, Zephyr RTOS, Mbed OS (Concepts only).

UNIT III INTERFACING, COMMUNICATION AND RTOS SERVICES 9 hours

Interfacing with Peripherals: UART, SPI, I2C; Semaphores, Mutexes, Message Queues, Pipes; Shared Memory and Synchronization Issues; ISRs and Event flags, Device Drivers Basics (Polling, Interrupts), Choosing and Porting RTOS to Microcontrollers.

UNIT IV FIRMWARE DEVELOPMENT AND ARM ARCHITECTURE 9 hours

Firmware Boot Process, Startup Code, Linker Scripts, Memory Map, Startup Routine, ARM CortexM Architecture Overview, System Control Block (SCB), NVIC, Systick Timer, Memory Protection Unit (MPU), Exception Handling, Real-world Applications of ARM-based Embedded Systems.

UNIT V EMBEDDED SYSTEM DESIGN AND MODELING 9 hours

System Design Cycle: Requirement Analysis to Testing, Hardware/Software Partitioning, UML for Embedded Design: Use Case, Sequence, Activity Diagrams, Co-design Techniques, Co-simulation Tools, Single-Core vs Multi-Core Embedded Systems, Performance Metrics, Power Optimization in Embedded Systems.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Describe the structure and functionality of embedded systems.
CO2: Develop embedded programs using C and understand RTOS principles.
CO3: Design multitasking embedded applications using RTOS mechanisms.
CO4: Implement firmware with real-time constraints on ARM microcontrollers.
CO5: Apply UML and co-design techniques for embedded system modeling.

Textbooks:

1. Mazidi M.A., Mazidi J.G., "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2013.
2. Sloss, A.N., Symes, D., "ARM System Developer's Guide", Morgan Kaufmann, 2004.
3. Jonathan Valvano, "Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers", CreateSpace, 2017.

Reference Books:

1. Steve Furber, "ARM System-on-Chip Architecture", Pearson, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 2008.
3. Heath S., "Embedded Systems Design", Elsevier, 2009.
4. Joseph Yiu, "The Definitive Guide to ARM Cortex-M3/M4 Processors", Newnes.
5. Peter Marwedel, "Embedded System Design", Springer.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - IV

23ECE304 COMMUNITY RADIO TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The main objectives of the course are to

1. Associate the concept of fundamentals in Community Radio in Local Communication and development.
2. Gain knowledge of Studio technology and operations including Soundboards, Microphones, Recording, scheduling, content creation, and team coordination.
3. Develop skills in Audio Pre-production and post-production such as recording, editing, and mixing audio content.
4. Categorize the Radio Transmission Technology comprising signal requirements aligning with factors affecting Coverage and Shadow Areas.
5. Explore Radio Transmission technology essentials and understand the technical aspects of setting up and maintaining an FM transmitter.

UNIT I COMMUNITY RADIO CONCEPT AND CR STATION 9 hours

Introduction to Radio Broadcasting - Evolution of Community Radio (CR) - CR Policy Guidelines and Implications – CR Technology and Equipment; Components of a CR Station - Studios for Community Radio- Power Consumption and Conservation- Alternative Sources of Energy

UNIT II STUDIO TECHNOLOGY & OPERATIONS 9 hours

Basics of Sound - Components of Sound - Propagation of Sound Waves - Components of the Audio Chain - Audio Chain in a typical Broadcast Studio - Studio Acoustics; Techniques of Handling Various Tools - Types of Connectors & Audio Cables - Preventive and Corrective Maintenance - Content Distribution: Internet, Wireless Mesh Networking (WiMesh) & Mobile Telephony

UNIT III AUDIO PRE & POST PRODUCTION 9 hours

Audio Cables and Connectors– Recording Audio in the Field - Audio Cables and Connectors - Open Source Software for CR - Conventional Landline Systems- GSM/CDMA - Voice Over Internet Protocol (VoIP); Sound Recording and Editing - Mixing and Mastering - File Formats and Compression Transmission - Storing and Retrieval

UNIT IV RADIO TRANSMISSION TECHNOLOGY 9 hours

Transmission Chain Overview – Connectivity & Audio Processor/Limiter - Antenna (Types and Polarization) – Transmitter Maintenance and Fault Diagnosis - Antenna and Coaxial Cable - Antenna System - Propagation and Coverage – Field Strength Measurements and Drawing an Actual Coverage Map

UNIT V FM TRANSMITTER SETUP 9 hours

Mounting and Connecting the Transmitter- Interpretation of the Transmitter Meter Readings and Indications - Mounting and Connecting the Transmitter - Reporting on the Basis of Visual Observation - Checking Earth Conductivity - Transmitter Operation and Upkeep Issues

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Interpret the evolution with a framework of Community Radio with Technical Principles and essential Radio Spectrums. (L2)

CO2: Apply Studio Technology and Operational practices with the components of the Audio Chain including Acoustics and Equipment maintenance. (L3)

CO3: Conduct Comprehensive Audio Pre & Post-production to operate field Recordings with Hardware and Open-source software to manage sound recording, editing, mixing, mastering and file compression. (L4)

CO4: Infer the principles of FM transmission, Antenna systems, Radio wave propagation and factors affecting coverage. (L5)

CO5: Demonstrate knowledge of the connecting audio feeds for Transmitter setup by resolving operational Issues with corrective maintenance. (L6)

Textbook(s)

1. Pooja Murada R. Sreedher, *Community Radio in India*, Aakar Books, 2019.
2. Prof. Raj Misra, *Community Radio By the people, For the People*, Orange Books Publication, 2022
3. Fraser, Colin, and Sonia Restrepo Estrada, *Community radio handbook*. Paris: Unesco, 2001.

Reference Books

1. Juliet Fox, *Community Radio's Amplification of Communication for Social Change*, 7th Edition, Palgrave Macmillan (Springer International Publishing.), 2019.
2. Kanchan K. Malik, Vinod Pavarala, *Community Radio in South Asia: Reclaiming the Airwaves*, Routledge India, 2020.

Online Material links:

1. "Certificate in Community Radio Technology (CCRT)" **https://www.cemca.org/resources/certificate-community-radio-technology-ccrt-0**

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - IV

23CSE302 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite 23CSE108

Course Description:

This course introduces principles and practices of software project management, including planning, scheduling, team coordination, and process control. It equips students to manage software projects effectively using both traditional and modern approaches.

Course Objectives:

This course enables students to

1. Understand the fundamental principles, methodologies, and frameworks of Software Project Management.
2. Develop the ability to plan, execute, monitor, and control software projects effectively.
3. Gain knowledge of the roles, responsibilities, and skills required for successful project management.
4. Learn techniques for cost estimation, scheduling, risk management, and quality assurance in software projects.
5. Familiarize students with team management, communication, and documentation practices in project environments.

UNIT I CONVENTIONAL SOFTWARE MANAGEMENT 9 hours

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, IntroAgile vs Waterfall Comparative Study.

UNIT II THE OLD WAY AND THE NEW (TRADITIONAL VS. MODERN SOFTWARE MANAGEMENT APPROACHES) 9 hours

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 WORK FLOWS OF THE PROCESS 9 hours

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 PROCESS AUTOMATION 9 hours

Automation Building Blocks, The Project Environment. Project Control and Process instrumentation: The seven core Metrics, Management indicators, and quality indicators Tailoring the Process: Process discriminants. Managing people and organizing teams, Project Management Tools (e.g., JIRA, MS Project)

UNIT V PROJECT ORGANIZATIONS AND RESPONSIBILITIES 9 hours

Line - of-Business Organizations, Project Organizations, evolution of Organizations. Future Software Project Management: modern Project Profiles, Next generation Software economics, modern process transitions. Case Study: The Command Center Processing and Display System-Replacement (CCPDS-R)

Course Outcomes:

After completing this Unit, students will be able to

CO1: Describe the fundamentals of Project Management
CO2: Recognize and use Project Scheduling Techniques
CO3: Familiarize with Project Control Mechanisms
CO4: Analyze team roles, collaboration strategies, and leadership practices to effectively manage software development teams.
CO5: Recognize the importance of Project Documentation and Evaluation

Textbook(s)

1. Software Project Management, Walker Royce, Pearson Education,2012
2. BobHughes,MikeCotterellandRajibMall―SoftwareProjectManagement‖,6thEdition, Mc Graw Hill Edition, 2017

Reference Books

1. PankajJalote,―SoftwareProjectManagementinpractice‖,5thEdition,PearsonEducation, 2017.
2. Murali K.Chemuturi,Thomas M.Cagley Jr.‖Mastering Software Project Management: Best Practices, Tools and Techniques‖, J.Ross Publishing, 2010
3. SanjayMohapatra,―SoftwareProjectManagement‖,CengageLearning,2011

Online Learning Resources:

http://nptel.ac.in/courses/106101061/29

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - IV

23CSD302 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The main objective of the course is to

1. To explain the evolving computer model called cloud computing.
2. To introduce the various levels of services that can be achieved by cloud.
3. To describe the security aspects in cloud.

UNIT I BASICS OF CLOUD COMPUTING 9 hours

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications

Cloud concepts 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 Platforms: 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 hours

Hadoop MapReduce: 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 hours

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Frame work, Designing a RESTful web API.

Cloud Application Development in Python: Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App.

UNIT IV BIG DATA, MULTIMEDIA AND TUNING 9 hours

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 Transcoding 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, Hadoop benchmarking case Study.

UNIT V APPLICATIONS AND ISSUES IN CLOUD **9 hours**

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 Healthcare, 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 Approaches to migrating into the cloud, the seven step model of migration into a cloud.

Organizational readiness 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 maturity models, Organizational readiness self – assessment.

Legal Issues in 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.

Course Outcomes:

At the end of this course students will demonstrate the ability to
CO1: Ability to create cloud computing environment.
CO2: Ability to design applications for Cloud environment.
CO3: Design & develop backup strategies for cloud data based on features.
CO4: Use and Examine different cloud computing services.
CO5: Apply different cloud programming model as per need.

Textbooks:

1. Cloud computing A hands-on Approach‖ By ArshdeepBahga, Vijay Madisetti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms: By Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2016

Reference Books:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, SThamaraiSelvi, TMH
2. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O ‘Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press.

Online Learning Resources

1. Cloud computing - Course (nptel.ac.in)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - IV

23CSC301 CYBER LAWS AND SECURITY POLICIES

		L	T	P	C
Prerequisite:	Nil	**3**	**0**	**0**	**3**

Course Description:
The Cyber Laws and Security Policies course provides an understanding of the legal, ethical, and regulatory aspects of cybersecurity. It focuses on laws related to cybercrime, data protection, privacy, and digital evidence. The course also introduces the development and implementation of security policies used to protect information systems and organizational data.

Course Objectives:
Students will be able to:

1. Gain an understanding of the evolution and jurisprudence of cyber law in India, including the IT Act 2000.
2. Learn about digital signatures, e-governance, and their legal implications under the IT Act.
3. Understand the legal framework for electronic contracts, their formation, and international perspectives.
4. Explore taxation issues in cyberspace, cybercrimes, electronic evidence, and their adjudication under the IT Act.
5. To create awareness about legal, ethical, and regulatory issues in cybersecurity and information security management.

UNIT I INTRODUCTION **9 hours**

History of Internet and World Wide Web, Need for cyber law, Cybercrime on the rise, Important terms related to cyber law.
Cyber law in India: Need for cyber law in India, History of cyber law in India.
Information Technology Act, 2000: Overview of other laws amended by the IT Act, 2000, National Policy on Information Technology 2012.

UNIT II OVERVIEW OF THE IT ACT 2000 **9 hours**

Applicability of the Act, Important provisions of the Act: Digital signature and Electronic signature, Digital Signature under the IT Act, 2000, E-Governance Attribution, Acknowledgement and Dispatch of Electronic Records, Certifying Authorities, Electronic Signature Certificates, Duties of Subscribers, Penalties and Offences, Intermediaries.

UNIT III OVERVIEW OF RULES OF IT ACT **9 hours**

Overview of rules issued under The IT Act, 2000, Electronic Commerce, Electronic Contracts, Cyber Crimes, Cyber Frauds, GRC and DPDP Act

UNIT IV REGULATORY AUTHORITIES **9 hours**

Department of Electronics and Information Technology, Controller of Certifying Authorities (CCA), Cyber Appellate Tribunal, Indian Computer Emergency Response Team (ICERT), Cloud Computing, Case Laws.

UNIT V INTRODUCTION TO CYBERCRIME AND PROCEDURE TO REPORT CYBER CRIME **9 hours**

Procedure to report cybercrime, some basic rules for safe operations of the computer and internet, the criminal law (amendment) act, 2013: legislative remedies for online harassment and cyberstalking in India.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Learn evolution and key aspects of Indian cyber law, including recent amendments.

CO2: Gain knowledge about the legalities of digital signatures and the role of e-governance in the IT Act.

CO3: Develop an understanding of the legalities involved in electronic contracts and international conventions.

CO4: Adapt in understanding and analyzing cybercrime, electronic evidence, and intellectual property rights in the context of IT.

CO5: To develop knowledge about security practices and measures to prevent cyber threats and attacks.

Textbooks:

1. Textbook on “Cyber Law”, 2 Ed Rp 2023, Pavan Duggal, Universal Law Publishing.
2. Textbook on “Indian Cyber law on Cybercrimes”, Pavan Duggal.

Reference Books:

1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)”, 2nd Edition, O’Reilly Media, 2006.
2. Thomas R. Peltier, “Information Security policies and procedures: A Practitioner’s Reference”, 2nd Edition Prentice Hall, 2004.
3. Kenneth J. Knapp, “Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions”, IGI Global, 2009.
4. Thomas R Peltier, Justin Peltier and John Blackley,” Information Security Fundamentals”, 2nd Edition, Prentice Hall, 1996.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - IV

23CSM302 CHATBOTS AND VIRTUAL ASSISTANTS

L	T	P	C
3	0	0	3

Prerequisite: Nil

Course Objectives:

1. To introduce the fundamentals of chatbots and virtual assistant technologies.
2. To understand the role of Natural Language Processing and Machine Learning in conversational systems.
3. To design and develop conversational agents using modern frameworks.
4. To analyze conversational system performance and user experience.
5. To explore real-world applications, ethical issues, and future trends in conversational AI.

UNIT I INTRODUCTION TO CHATBOTS AND CONVERSATIONAL SYSTEMS — 9 hours

Introduction to Conversational Systems – Evolution of Chatbots and Virtual Assistants – Types of Chatbots (Rule-based, Retrieval-based, Generative) – Modes of Human–Computer Interaction – Use Cases and Applications – Overview of Conversational AI Architecture – Role of AI, ML, and NLP in Chatbots – Market Trends and Industry Applications – Ethical and Legal Considerations in Conversational AI.

UNIT II FOUNDATIONS OF PROGRAMMING AND CHATBOT ARCHITECTURE — 9 hours

Programming Fundamentals for Conversational Systems – Python Basics for Chatbot Development – Conversational System Architecture – Components of a Chatbot – User Interface and Backend Services – Messaging Platforms and Channels – Web, Mobile, and Voice Interfaces – Introduction to APIs and SDKs for Chatbots – Best Coding Practices for Conversational Applications.

UNIT III NATURAL LANGUAGE PROCESSING FOR CHATBOTS — 9 hours

Introduction to NLP – Text Preprocessing Techniques – Tokenization, Stemming and Lemmatization – Lexical and Syntactic Analysis – Part-of-Speech Tagging – Parsing Techniques – Semantic Analysis – Named Entity Recognition – Intent Detection and Slot Filling – Sentiment Analysis – NLP Libraries for Chatbots (NLTK, spaCy, Stanford NLP).

UNIT IV DESIGN AND DEVELOPMENT OF CHATBOTS AND VIRTUAL ASSISTANTS — 9 hours

Conversational Design Principles – Dialogue Management – Rule-based and ML-based Dialogue Systems – Intent Classification using Machine Learning and Deep Learning – Natural Language Understanding (NLU) and Natural Language Generation (NLG) – Chatbot Frameworks – Google Dialogflow, Microsoft Bot Framework, Amazon Lex, RASA – Testing and Debugging Chatbots – Security, Privacy, and Compliance Considerations.

UNIT V ADVANCED CONVERSATIONAL AI AND ANALYTICS — 9 hours

Role of Machine Learning and AI in Conversational Systems – Speech-to-Text and Text-to-Speech Technologies – Voice Assistants – Emotion and Sentiment-aware Chatbots – Conversational Analytics and Performance Metrics – User Experience Evaluation – Case Studies in Customer Support, Healthcare, and Education – Future Trends in Conversational AI.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the fundamentals and applications of chatbots and virtual assistants.

CO2: Apply programming and architectural concepts to conversational systems.

CO3: Use NLP techniques for intent recognition and dialogue understanding.

CO4: Design and develop chatbots using popular conversational AI frameworks.

CO5: Analyze chatbot performance and evaluate real-world conversational AI applications.

Textbooks:

1. "Conversational AI: Dialogue Systems, Conversational Agents and Chatbots", Michael McTear, Morgan & Claypool, 2020.
2. "Conversational Dialogue Systems for the Next Decade", Luis Fernando D'Haro, Zoraida Callejas, Satoshi Nakamura, Springer, 2021.

Reference Books:

1. "Chatbots and Conversational UI Development", Srini Janarthanam, Packt Publishing, 2017.
2. "Conversational Agents and Natural Language Interaction", Diana Pérez-Marín, Ismael Pascual-Nieto, IGI Global, 2011.
3. "Speech and Language Processing", Daniel Jurafsky, James H. Martin, Pearson, 2019.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

PROFESSIONAL ELECTIVES

Professional Elective – II

23CE401 ADVANCED STRUCTURAL ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisite: **23MAT101, 23MAT102, 23CE101, 23CE107**

Course Description: This course, Advanced Structural Analysis (PE-III), covers fundamental and advanced techniques for analyzing structures, including arches, portal frames, and continuous beams. Students will learn methods such as the Moment Distribution Method, Kani's Method, Flexibility Method, and Stiffness Method to evaluate structural behavior under various conditions, like side sway and support settlements. The course emphasizes practical problem-solving and ensures students can apply these techniques to ensure structural stability and performance.

Course Objectives:

1. Understand the fundamental concepts of arches, including three-hinged and two-hinged arches, and analyze the effects of horizontal thrust, bending moment, normal thrust, and radial shear.
2. Apply the moment distribution method to analyze single-bay, single-story portal frames with and without side sway.
3. Analyze continuous beams and portal frames using Kani's Method, including cases with and without settlement of supports.
4. Solve structural problems using the flexibility method for continuous beams and single-bay portal frames, considering support settlements and side sway effects.
5. Evaluate the stiffness method for analyzing continuous beams and single-bay portal frames with and without side sway, ensuring structural stability and performance.

UNIT I ARCHES 9 hours

Three-Hinged and Two-Hinged Arches, Elastic Theory of Arches– Eddy's Theorem –Determination of Horizontal Thrust, Bending Moment, Normal Thrust and Radial Shear–Effect of Temperature-Determination of Horizontal Thrust, Bending Moment, Normal Thrust and Radial Shear–Rib Shortening and Temperature Stresses.

UNIT II MOMENT DISTRIBUTION METHOD for FRAMES 9 hours

Analysis of Single Bay Single Storey Portal Frame Including Side sway–Substitute Frame Analysis by Two Cycle Method.

UNIT III KANI`S METHOD 9 hours

Analysis of Continuous Beams with and Without Settlement of Supports-Single Bay Single Storey Portal Frames with and Without Side Sway.

UNIT IV FLEXIBILITY METHODS 9 hours

Flexibility Methods- Introduction-Application to Continuous Beams Including Support Settlements—Analysis of Single Bay Single Storey Portal Frames Without and With Side Sway.

UNIT V STIFFNESS METHODS 9 hours

Stiffness Methods – Introduction – Application to Continuous Beams Including Support Settlements – Analysis of Single Bay Single Storey Portal Frames Without and With Side Sway.

Course Outcomes:

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

CO1: **Explain** the behavior of three-hinged and two-hinged arches and analyze the effects of horizontal thrust, bending moment, normal thrust, and radial shear. (Bloom's Level: Understand - L2, Analyze - L4)
CO2: **Apply** the moment distribution method to analyze single-bay, single-story portal frames with and without side sway. (Bloom's Level: Apply - L3, Analyze - L4)
CO3: **Analyze** continuous beams and portal frames using Kani's Method, including cases with and without settlement of supports.
CO4: **Solve** structural problems using the flexibility method for continuous beams and single-bay portal frames, considering support settlements and side sway effects.
CO5: **Evaluate** the stiffness method for analyzing continuous beams and single-bay portal frames with and without side sway, ensuring structural stability and performance

Textbooks:

1. Analysis of structures by Vazrani & Ratwani– Khanna Publications.
2. Theory of structures by Ramamurtham, Jain Book Depot, New Delhi.

Reference Books:

1. Structural analysis by R.S. Khurmi, S. Chand Publications, New Delhi.
2. Basic Structural Analysis by K.U. Muthuetal, I.K. International Publishing House Pvt.Ltd
3. Theory of Structures by Gupta SP, GS Pundit and R Gupta, Vol II, Tata McGraw-Hill Publications Company Ltd
4. D. S. Prakash Rao,—Structural Analysis: A Unified Approach, Universities Press

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – II

23CE402 OPEN CHANNEL FLOW

L	T	P	C
3	0	0	3

Pre-requisite: **23CE101, 23CE104**

Course Objectives:

1. Explain the principles governing fluid flowing pipelines and networks, including steady and unsteady flow conditions.
2. Apply fundamental concepts of uniform and varied flowing open channels for analysing hydraulic structures and networks.
3. Analyse the behaviour of unsteady flowing open channels, including wave motion and dam break scenarios.
4. Evaluate sediment transport mechanisms and their impact on hydraulic structures, reservoirs, and river morphology.
5. Design and assess hydraulic models, flow measurement devices, and physical models for hydraulic applications.

UNIT I HYDRAULICS of PIPELINES and PIPE NETWORKS 9 hours

Review of Fluid Mechanics. Reynolds Transport Theorem and Applications. Steady Flow Analysis of Pipe Network Systems. Unsteady Flows - Basic Equations of Water Hammer, Solution By Method of Characteristics. Network Analysis

UNIT II STEADY VARIED FLOWS in OPEN CHANNELS 9 hours

Basic Concepts of Uniform Flow. Specific Energy and Specific force Concepts. Dynamic Equation for Spatially Varied Flows. Flow Profile Computations. Introduction to Hec-Ras. Spatially Varied Flows and Rapidly Varied Flows – Applications.

UNIT III UNSTEADY FLOWS in OPEN CHANNELS 9 hours

Equations of Motion. Uniformly Progressive Wave. Rapidly Varied Unsteady Flow – Positive and Negative Surges. Dam Break Problem

UNIT IV SEDIMENT TRANSPORT 9 hours

Sediment Properties – Inception of Sediment Motion – Bed forms. Bed Load Suspended Load – total Sediment Transport. Design of Stable Channels and Regime Channels. Reservoir Sedimentation and Trap Efficiency.

UNIT V FLOW MEASUREMENTS and HYDRAULIC MODELING 9 hours

Sharp-Crested Weirs, Broad-Crested Weirs, Critical Depth Flumes. Recent Advancement in Open Channel Flow Measurements. Physical Modelling in Hydraulics. Dimensional Analysis. Modelling Closed Flows and Free Surface Flows. Distorted Models. Design of Physical Models.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Describe the fundamental principles of fluid flow in pipelines and networks under steady and unsteady conditions.

CO2: Solve problems related to uniform and varied flow in open channels using theoretical and computational approaches.

CO3: Analyse the impact of unsteady flow phenomena such as surges and dam-breaks in open channels.

CO4: Evaluate sediment transport processes and their influence on river morphology and hydraulic structures.

CO5: Develop and validate hydraulic models for flow measurement and physical modelling applications in fluid mechanics.

Textbooks:

1. Flow in Open Channels, Subramanya K., Tata McGraw Hill Pub., N Delhi2015
2. Flow through Open Channels, Rajesh Srivastava, Oxford Univ. Press. N Delhi, 2011
3. OpenChannelHydraulics,Chow,V.T.,McGrawHillInc.NYork,1979

Reference Books:

1. Open Channel Hydraulics, French, R.H., McGraw Hill PubCo.,NYork,1986
2. Open Channel Hydraulics, Terry Sturm, Tata McGraw Hill Pub. N Delhi,2011

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – II

23CE403 FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: 23CE101, 23CE103, 23MAT101

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the need for soil exploration and various methods used in site investigations.
2. Analyze the stability of slopes under different conditions using various stability methods.
3. Apply earth pressure theories to analyze retaining walls and soil pressures.
4. Evaluate the bearing capacity and settlement characteristics of shallow foundations.
5. Assess the load-carrying capacity and settlement of deep foundations, including pile and well foundations.

UNIT – I **9 hours**

SOIL EXPLORATION: Need – Methods of Soil Exploration – Boring and Sampling Methods – Field Tests – Penetration Tests – Plate Load Test – Pressure Meter – Planning of Programme and Preparation of Soil Investigation Report.

LATERAL EARTH PRESSURE & RETAINING WALLS

Introduction; effect of wall movement on earth pressure; Earth pressure at rest; Rankine's theory of Earth pressure; Coulomb's theory of earth pressure; Culmann's graphical method for active earth pressure; Design considerations for retaining walls.

UNIT – II **9 hours**

STABILITY OF SLOPES

Introduction; Stability Analysis - Infinite Slopes and Finite Slopes – total Stress Analysis for Saturated Clay – Friction Circle Method – Use of Stability Number – Method of Slices – Fellenious and Bishop's Method - Slope Protection Measures.

UNIT – III **9 hours**

SHALLOW FOUNDATIONS

Concept of foundations; Types of foundations and their applicability; General requirements of foundations; Location and Depth of foundation.

BEARING CAPACITY OF SHALLOW FOUNDATION

Terminology relating to bearing capacity; Bearing Capacity of Shallow Foundations– Terzaghi's Bearing Capacity theory; Skempton's Bearing Capacity Analysis for Clay soils; IS-Code Recommendations for Bearing Capacity; Influence of water table on bearing capacity;

UNIT – IV **9 hours**

PILE FOUNDATIONS

Introduction; Uses of Piles; Types of Piles; Cast- in-situ Pile construction; Selection of Pile type; Pile driving; Pile load carrying capacity in compression – Static Pile Load formula, load tests, Dynamic Pile formulae; Correlations with Penetration test data; Group action of Piles – load carrying capacity and settlement; Negative skin friction.

UNIT – V **9 hours**

WELL FOUNDATIONS

Types of wells; Components of well foundation; Shapes of wells; Forces acting on well foundation; Construction and Sinking of wells; Depth of well foundation; stability check up of well-Terzaghi method.

FOUNDATIONS IN EXPANSIVE SOILS

Clay minerals, Clay water relations, Identification of expansive soil; Field conditions that favor swelling; consequences of swelling; Different alternative foundation practices in swelling soils; Construction practice of UR piles in swelling soils.

Course Outcomes (COs):

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

CO1: Explain the principles of soil exploration, field testing, and soil investigation reporting.
CO2: Analyze slope stability using different failure theories and numerical methods.
CO3: Apply earth pressure theories to determine the stability of retaining walls.
CO4: Evaluate the bearing capacity and settlement of shallow foundations using theoretical and field methods.
CO5: Analyze deep foundations, including pile and well foundations, for their load-carrying capacity and settlement.

TEXTBOOKS:

1. Geotechnical Engineering by C.Venkataramaiah, New Age Pubilications(2002)
2. Soil Mechanics and Foundation Engineering by Arora, Standard Publishers and Distributors, Delhi 7th edition 2009
3. Soil Mechanics and Foundations by B.C.Punmia, Ashok Kumar Jain andArun Kumar Jain, Laxmi publications Pvt. Ltd., New Delhi 17th edition 2017

REFRENCE BOOKS:

1. Soil Mechanics and Foundation Engineering by Purushtoma Raj, Pearson Pubilications 2nd edition 2013
2. Principles of Foundation Engineering by Das, B.M., - (1999)–6th edition (Indian edition) Thomson Engineering
3. Foundation Engineering by Varghese,P.C., Prentice Hall of India., New Delhi
4. Foundation Engineering by V.N.S.Murthy, CRC Press, New Delhi

Online Learning Resources:

https://nptel.ac.in/courses/105105176

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – III

23CE404 PRE-STRESSED CONCRETE

L	T	P	C
3	0	0	3

Pre-requisite: 23CE103, 23CE106

Course Description:

This course covers the fundamentals and applications of prestressed concrete in structural engineering, introduces pre- and post-tensioning methods, examines key factors affecting prestress losses, and explores design strategies for beams, deflections, and composite members.

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the principles, methods, and materials used in prestressed concrete.
2. Analyze various losses of prestress in both pre-tensioned and post-tensioned members.
3. Design prestressed concrete beams considering flexure and shear forces.
4. Evaluate deflections in prestressed concrete structures and their controlling factors.
5. Analyze the behavior of composite beams under different loading conditions.

UNIT I **9 hours**

Introduction

Principles of Pre-Stressing – Prestressing Systems - Pre-Tensioning and Post Tensioning- Advantages and Limitations of Pre-Stressed Concrete- Need for High Strength Materials. Methods of Pre-Stressing: Pre-Tensioning (Hoyer System) and Post-Tensioning Methods (Freyssinet System and Gifford- Udall System)

UNIT II **9 hours**

Losses of pre-stress

Loss of Pre-Stress in Pre-Tensioned and Post-Tensioned Members Due to Elastic Shortening, Shrinkage and Creep of Concrete, Relaxation of Stress in Steel, Anchorage Slip and Frictional Losses.

UNIT III **9 hours**

Flexural and Shear

Analysis of Beams for Flexure and Shear - Beams Pre-Stressed with Straight, Concentric, Eccentric, Bent and Parabolic Tendons- Kern Line - Cable Profile - Design of PSC Beams (Rectangular and I Sections) Using IS 1343. Analysis and Design of Rectangular and I Beams for Shear. Introduction to Transmission Length and End Block (No Design and Analytical Problems).

UNIT IV **9 hours**

DEFLECTIONS

Control of Deflections- Factors Influencing Deflections - Short Term Deflections of Uncracked Beams - Prediction of Long Time Deflections

UNIT V **9 hours**

Composite beams

Different Types- Propped and Un-Propped- Stress Distribution- Differential Shrinkage- Analysis of Composite Beams.

Course Outcomes:

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

CO1: Explain the principles and methods of prestressing and the need for high-strength materials.
CO2: Analyze the different types of prestress losses and their impact on structural performance.
CO3: Design prestressed concrete beams considering flexural and shear stresses.
CO4: Evaluate deflections in prestressed beams and suggest control measures.
CO5: Analyze the stress distribution and differential shrinkage in composite beams.

Textbooks:

1. Prestressed Concrete by N. Krishna Raju, Tata McGraw Hill Publications 6th edition 2018
2. Prestressed concrete by N.Rajagopalan, Narosa Publishing House 2nd edition 2017

Reference Books:

1. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns, John Wiley & Sons 3rd edition 2010
2. Prestressed Concrete Design by Praveen Nagrajan, Pearson publications, 2013.
3. Prestressed Concrete by Ramamuratam, Dhanpatrai Publications 2020 edition
4. BIS code on "prestressed concrete", IS: 1343 to be permitted into the examination Hall

Online Learning Resources:

1. **https://archive.nptel.ac.in/courses/105/106/105106118/**
2. **https://nptel.ac.in/courses/105106117**

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – III

23CE405 WATERSHED MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: **23CE104, 23CE105**

Course Objectives:

1. Understand the concept of watershed management, stakeholder roles, pollution sources, and environmental guidelines for water quality.
2. Analyze soil erosion processes, sediment yield, and wetland hydrology, including the role of water in wetland ecosystems.
3. Identify drought and select various measures to harvest water and drought mitigation measures.
4. Apply principles of wetland hydrologic assessment, water harvesting, and watershed treatment system design to real-world scenarios.
5. Assess irrigation planning, participatory water management, and water footprint concepts to ensure sustainable water resource utilization.

UNIT I **9 hours**

Concept of Watershed, Introduction to Watershed Management, Different Stakeholders and Their Relative Importance, Watershed Management Policies and Decision Making, Watershed Management Practices in Arid and Semiarid Regions, Short Term and Long Term Strategic Planning, Types and Sources of Pollution, Environmental Guidelines for Water Quality, Perspective On Recycle and Reuse

UNIT II **9 hours**

Morphometry, Soil Erosion - Erosion - Factors Affecting Erosion, Effects of Erosion On Land Fertility and Land Capability, Soil Erosion Modelling, Erosivity and Erodibility - Sediment Yield and Sedimentation- Wetland Definitions and The Role of Water in Wetland Structure and Function, Introduction to Wetland Water Budgets and Hydro-Period Components of The Water Budget: Inflows, Outflows, and Storage, Precipitation and Runoff, Evapotranspiration.

UNIT III **9 hours**

WATER HARVESTING: Rain water harvesting - catchment harvesting - harvesting structures, soil moisture conservation - check dams - artificial recharge from pond - percolation tanks.
DROUGHT MANAGEMENT: Definition and classification of drought – drought analysis techniques - drought mitigation planning.

UNIT IV **9 hours**

Wetland Hydrologic Assessment: Physical and Biological Processes, Anthropogenic and Climate Change Impacts On Wetland Hydrology, Modeling Wetland Hydrology, Hydraulics, and Hydrodynamics, Introduction to Wetland Treatment Systems Design - Water Harvesting: Rainwater Harvesting, Catchment Harvesting, Harvesting Structures - Model Watershed – Government and Ngo Projects.

UNIT V

Rainwater Management. Planning and Operation of Irrigation Systems. Conjunctive Use of Water. Participatory Irrigation Management and Integrated Water Resources Management (IWRM), Water Management Policy During Droughts. Predicting the Effect of Water Shortage On Crops. Introduction to Water Footprint of Crops and Its Applications. Blue, Green and Grey Water Footprint.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1: Explain watershed management concepts, pollution control strategies, and environmental policies related to water quality.

CO2: Analyze erosion processes, wetland water budgets, and sediment transport models to assess land degradation and conservation needs.

CO3: Select water harvesting structures and drought mitigation measures

CO4: Apply water harvesting techniques, hydrologic modeling, and wetland design methods for sustainable watershed management.

CO5: Assess irrigation water management strategies, drought mitigation policies, and the role of water footprint in agricultural sustainability.

Textbooks:

1. T. O. Randhir, Watershed Management: Issues and Approaches, IWA Publishing, 2006
2. J. V. S. Murty, Watershed Management, New Age International, 2013

Reference Books:

1. D. K. Majumdar, Irrigation Water Management, Prentice Hall, 2014
2. K. N. Brooks, P. F. Folliott, J. A. Magner, Hydrology and the Management of Watersheds, Wiley-Blackwell, Fourth edition, 2012
3. E. M. Tideman, Watershed Management: Guidelines for Indian Conditions, Omega Scientific Publishers, 1996
4. R. Rajora, Integrated Watershed Management: Field Manual for Equitable, Productive and Sustainable Development, Rawat Publications, 2019

Online Learning Resources:

1. https://nptel.ac.in/courses/105101010
2. https://nptel.ac.in/courses/126105334

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – III

23CE406 DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: **23MAT103, 23CE107, 23CE110**

Course Description:

This course covers the practical use of various surveying instruments for different field measurements, including lengths, angles, areas, volumes, and elevations.

Course Objectives:

The objectives of this course are to enable the student to:

1. Understand the fundamental concepts of engineering seismology, including earthquake phenomena, seismic waves, and measuring instruments.
2. Analyse the principles of structural vibrations, degrees of freedom, and dynamic response of structures to earthquake ground motions.
3. Evaluate conceptual design strategies, seismic design principles, and methods for improving earthquake resistance in structures.
4. Apply earthquake-resistant design principles to reinforced concrete and masonry buildings using IS codes and lateral force methods.
5. Assess the role of structural walls, non-structural elements, and ductility considerations in enhancing earthquake resistance.

UNIT – I **9 hours**

Engineering Seismology: Earthquake Phenomenon - Cause of Earthquakes-Faults- Plate Tectonics-Seismic Waves- Terms Associated with Earthquakes-Magnitude/Intensity of an Earthquake Scales-Energy Released-Earthquake Measuring Instruments Seismogram - Seismoscope, Seismograph - Strong Ground Motions- Seismic Zones of India.

Theory of Vibrations: Elements of A Vibratory System- Degrees of Freedom-Continuous System-Lumped Mass Idealization-Oscillatory Motion-Simple Harmonic Motion-Free Vibration of Single Degree of Freedom (SDOF) System- Undamped and Damped- Critical Damping- Logarithmic Decrement- Forced Vibrations- Harmonic Excitation- Dynamic Magnification Excitation by Rigid-Based Translation for SDOF System-Earthquake Ground Motion.

UNIT – II **9 hours**

Conceptual Design: Introduction-Functional Planning-Continuous Load Path-Overall form-Simplicity and Symmetry-Elongated Shapes-Stiffness and Strength-Horizontal and Vertical Members-Twisting of Buildings-Ductility-Ductility Relationships-Flexible Buildings- Framing Systems-Choice of Construction Materials-Unconfined Concrete-Confined Concrete-Masonry-Reinforcing Steel.

Introduction to Earthquake Resistant Design: Seismic Design Requirements-Regular and Irregular Configurations, Basic Assumptions, Design Earthquake Loads-Basic Load Combinations- Permissible Stresses- Seismic Methods of Analysis-Factors in Seismic Analysis-Equivalent Lateral Force Method.

UNIT – III **9 hours**

Reinforced Concrete Buildings: Principles of Earthquake Resistant Design of RC Members-Structural Models for Frame Buildings - Seismic Methods of Analysis- IS Code Based Methods for Seismic Design - Vertical Irregularities - Plan Configuration Problems- Lateral Load Resisting Systems- Determination of Design Lateral forces as Per IS 1893 (Part-1):2016- Equivalent Lateral Force Procedure- Lateral Distribution of Base Shear.

UNIT – IV **9 hours**

Masonry Buildings: Introduction- Elastic Properties of Masonry Assemblage- Categories of Masonry Buildings- Behavior of Unreinforced and Reinforced Masonry Walls- Behavior of Walls- Box Action and Bands- Behavior of Infill Walls- Improving Seismic Behavior of Masonry Buildings- Load Combinations and Permissible Stresses-Seismic Design Requirements-Lateral Load Analysis of Masonry Buildings.

UNIT – V **9 hours**

Structural Walls and Non-Structural Elements: Strategies in The Location of Structural Walls-Sectional Shapes- Variations in Elevation- Cantilever Walls Without Openings – Failure Mechanism of Non-Structures- Effects of Non-Structural Elements On Structural System- Analysis of Non-Structural Elements- Prevention of Non-Structural Damage Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility-Assessment of Ductility- Factors Affecting Ductility- Ductile Detailing Considerations as Per Is 13920-2016 - Behavior of Beams,
Columns and Joints in RC Buildings During Earthquakes

Textbooks:

1. Earthquake Resistant Design of Structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd

Reference books:

1. Seismic Design of Reinforced Concrete and Masonry Buildings – T. Paulay and M.J.N. Priestly, John Wiley & Sons.
2. Earthquake Resistant Design Building Structures by Vinod Hosur, Wiley India Pvt. Ltd.
3. Elements of Mechanical Vibration by R.N. Iyengar, I.K. International Publishing House Pvt. Ltd.
4. Masonry and Timber structures, including earthquake-resistant Resistant Design –Anand S. Arya, Nemchand & Bros
5. Earthquake Tips – Learning Earthquake Design and Construction, C.V.R. Murthy
6. BIS Codes: 1. IS 1893(Part-1):2016 or Latest codes; 2. IS 13920:2016. 3. IS 4326. 4. IS 456:2000 or latest

Online Learning Resources:
https://nptel.ac.in/courses/105107204

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – IV

23CE407 GEO-SYNTHETICS AND REINFORCED EARTH STRUCTURES

	L	T	P	C
Pre-requisites: 23CE111	**3**	**0**	**0**	**3**

Course Description:

This course introduces the fundamental concepts, materials, and engineering applications of geo-synthetics and reinforced earth systems in civil engineering. The course covers classification, properties, testing methods, design principles, and practical applications of geotextiles, geogrids, geomembranes, and geo-composites. Emphasis is placed on reinforced soil behavior, design of reinforced earth structures, construction practices, durability, and sustainable infrastructure solutions.

Course Objectives:

1. Provide knowledge on types, properties, and engineering functions of geo-synthetic materials.
2. Explain filtration, drainage, separation, and reinforcement mechanisms in geotechnical applications.
3. Introduce principles of reinforced earth and soil–reinforcement interaction.
4. Develop capability to design reinforced earth retaining structures, slopes, and pavements.
5. Familiarize students with field applications, construction practices, and sustainability aspects of geo-synthetics.

UNIT I INTRODUCTION TO GEO-SYNTHETICS 9 hours

Historical development and scope of geo-synthetics; Classification: geotextiles, geogrids, geomembranes, geonets, geocells, geo-composites; Manufacturing methods and polymer types; Physical, mechanical, hydraulic, and durability properties; Functions: separation, filtration, drainage, reinforcement, barrier and protection; Standard testing methods (ASTM / ISO / IS)

UNIT II GEOTEXTILES – FILTRATION, DRAINAGE AND SEPARATION 9 hours

Hydraulic behavior of geotextiles; Filtration criteria and clogging mechanisms; Drainage systems using geotextiles; Design considerations for separation and filtration; Applications in roads, railways, embankments, and erosion control; Performance evaluation through laboratory and field studies

UNIT III PRINCIPLES OF REINFORCED EARTH 9 hours

Concept and theory of soil reinforcement; Composite action in reinforced soil; Soil–reinforcement interaction mechanisms; Pull-out resistance and anchorage; Internal and external stability concepts; Failure mechanisms in reinforced earth structures

UNIT IV DESIGN OF REINFORCED EARTH STRUCTURES 9 hours

Components and design philosophy of reinforced earth retaining walls; Design of reinforced slopes and embankments; Geogrid reinforced pavements and subgrade stabilization; Reinforced foundations and load transfer platforms; Stability checks: sliding, overturning, bearing capacity and tensile failure; Design guidelines: FHWA, IRC and relevant standards

UNIT V APPLICATIONS, CONSTRUCTION AND SUSTAINABILITY 9 hours

Construction methodology and quality control practices; Installation damage and durability issues; Geo-synthetics in landfills, canals, environmental containment systems; Erosion control and coastal applications; Case studies of reinforced earth structures; Sustainability aspects and future trends in geo-synthetics

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Identify and classify geo-synthetic materials and explain their engineering properties and functions.

CO2: Analyze filtration, drainage, and separation behavior of geo-synthetics in geotechnical systems.

CO3: Explain soil–reinforcement interaction and evaluate reinforced earth behavior.

CO4: Design basic reinforced soil structures such as retaining walls, slopes, and embankments using geosynthetics.

CO5: Assess construction practices, case studies, and sustainability benefits of geo-synthetic applications.

Textbooks:

1. Koerner, R. M., Designing with Geosynthetics, 6th Edition, Xlibris Publishing.
2. Shukla, S. K., Fundamentals of Geosynthetic Engineering, CRC Press.
3. Jones, C. J. F. P., Earth Reinforcement and Soil Structures, Thomas Telford.

Reference Books:

1. Holtz, R. D., Christopher, B. R., & Berg, R. R., Geosynthetic Design and Construction Guidelines, FHWA.
2. Jewell, R. A., Soil Reinforcement with Geotextiles, CIRIA.
3. Relevant IRC, IS Codes and FHWA Manuals.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – IV

23CE407 GEO-SYNTHETICS APPLICATIONS

	L	T	P	C
Pre-requisites: 23CE111	**3**	**0**	**0**	**3**

Course Description:

This course introduces the fundamental concepts, materials, and engineering applications of geo-synthetics and reinforced earth systems in civil engineering. The course covers classification, properties, testing methods, design principles, and practical applications of geotextiles, geogrids, geomembranes, and geo-composites. Emphasis is placed on reinforced soil behavior, design of reinforced earth structures, construction practices, durability, and sustainable infrastructure solutions.

Course Objectives:

1. Provide knowledge on types, properties, and engineering functions of geo-synthetic materials.
2. Explain filtration, drainage, separation, and reinforcement mechanisms in geotechnical applications.
3. Introduce principles of reinforced earth and soil–reinforcement interaction.
4. Develop capability to design reinforced earth retaining structures, slopes, and pavements.
5. Familiarize students with field applications, construction practices, and sustainability aspects of geo-synthetics.

UNIT I INTRODUCTION TO GEO-SYNTHETICS 9 hours

Introduction: An overview on the development, functions and applications of various geosynthetics - the geotextiles, geogrids, geonets, geomembranes, geo-composites and other products.

Designing with geotextiles: Manufacture of geotextiles, Geotextile properties and test methods – functions - Designing geotextiles for separation, reinforcement, stabilization, filtration and drainage works.

UNIT II DESIGNING WITH GEOGRIDS 9 hours

Manufacture of geogrids, Types of geogrids, Geogrid properties and test methods – physical properties, mechanical properties, endurance properties and environmental properties – Designing geogrid for reinforcement in pavements, retaining walls and bearing capacity. New generation polymeric strap reinforcing materials.

UNIT III DESIGNING WITH GEONETS 9 hours

Manufacture of geonets, Geonet properties and test methods – Physical properties, mechanical properties, hydraulic properties, endurance properties and environmental properties -Designing geonet for drainage applications.

UNIT IV DESIGNING WITH GEOMEMBRANES 9 hours

Geomembrane properties and test methods – physical properties, mechanical properties, chemical properties and biological hazard - Applications of geomembranes and design.

UNIT V DESIGNING WITH GEO-COMPOSITES 9 hours

Geocomposites in separation, reinforcement – reinforced geotextile composites – reinforced geomembrane composites – reinforced soil composites using discontinuous fibres and meshes, continuous fibres and three –dimensional cells -Designing for bearing capacity, geo-composites in drainage and filtration.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Identify and classify geo-synthetic materials and explain their engineering properties and functions.

CO2: Analyze filtration, drainage, and separation behavior of geo-synthetics in geotechnical systems.

CO3: Explain soil–reinforcement interaction and evaluate reinforced earth behavior.

CO4: Design basic reinforced soil structures such as retaining walls, slopes, and embankments using geosynthetics.

CO5: Assess construction practices, case studies, and sustainability benefits of geo-synthetic applications.

Textbooks:

1. Mandal, J.N., Geosynthetics Engineering: in Theory and Practice, Research Publishing, Singapore, 2018, 1st edition.
2. Swami Saran, I.K. Reinforced Soil and its Engineering Applications, International Publishing House
   Pvt. Ltd., 2019, 1st edition.
3. Rao, G.V. and Goutam K. Pothal " Geosynthetics Testing – A laboratory Manual" Sai Master Geoenvironmental Services Pvt. Ltd. Hyderabad, 2008
4. Rao, G.V. – "Geosynthetics – an Introduction", Sai Master Geoenvironmental Services Pvt. Ltd. Hyderabad, 2011.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/101/105101143/
2. https://freevideolectures.com › course › 3352 › geosynthetics

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – IV

23CE408 SMART RAIL, AIRPORT AND PORT INFRASTRUCTURE ENGINEERING

	L	T	P	C
Pre-requisites: 23CE113	**3**	**0**	**0**	**3**

Course Description:

This course introduces next-generation transportation infrastructure systems with emphasis on digital railway engineering, smart airport systems, modern airside pavement technologies, intelligent port logistics, coastal resilience, and sustainable multimodal mobility. The course focuses on infrastructure planning, automation, sensing technologies, asset management, safety, and climate-adaptive design practices relevant to current and future transportation engineering challenges.

Course Objectives:

1. Understand modern railway infrastructure systems, digital track technologies, and transit systems.
2. Learn smart airport planning, airside systems, airport pavement management, and digital aviation infrastructure.
3. Understand smart port planning, marine logistics, and resilient harbour infrastructure.
4. Apply intelligent asset monitoring and sustainable engineering concepts in transport systems.
5. Analyze emerging tools such as BIM, GIS, IoT, AI, and digital twins in transportation infrastructure.

UNIT I SMART RAILWAY INFRASTRUCTURE AND DIGITAL TRACK SYSTEMS **9 hours**

Evolution of modern rail transport – High-speed rail systems and dedicated freight corridors – Ballast-less/slab tracks – Long welded rails and advanced fastening systems – Track geometry measurement systems – Railway drainage and track resilience – Digital track inspection using drones, LiDAR, GPR and machine vision – Predictive maintenance using sensors and AI – Digital twins in railway asset management – Railway electrification and energy-efficient systems.

UNIT II URBAN RAIL TRANSIT, SAFETY AND RAIL ASSET MANAGEMENT **9 hours**

Metro rail systems – suburban rail and rapid transit systems – Station planning and passenger flow – Rail signaling: ETCS, CBTC, automatic train protection – Rail safety and risk management – derailment prevention – Smart rail traffic control – Rail asset lifecycle management – GIS-based railway corridor planning – Sustainability in rail transport – Indian case studies: metro rail, bullet train and freight corridors.

UNIT III SMART AIRPORT PLANNING AND ADVANCED AIRSIDE SYSTEMS **9 hours**

Airport master planning in smart cities – Airport site suitability using GIS and remote sensing – Greenfield and brownfield airport development – Runway and taxiway planning with ICAO latest practices – Airport airside capacity analysis – Obstacle limitation and safety zones – Airfield lighting automation – Advanced navigation aids – Sustainable airport planning – Carbon-neutral airports – UAV integration and vertiports.

UNIT IV AIRPORT PAVEMENT MANAGEMENT, TERMINAL AUTOMATION AND AVIATION SAFETY **9 hours**

Airport pavement distress and maintenance systems – PCI-based airport pavement management – ACN-PCN and aircraft load evaluation – Runway friction and skid resistance – Sensor-based pavement health monitoring – Smart terminal systems – baggage automation – contactless passenger systems – BIM in airport design – Airport security systems – safety management systems – emergency planning – resilient airport infrastructure under climate stress.

UNIT V SMART PORTS, HARBOUR DIGITALIZATION AND COASTAL RESILIENCE **9 hours**

Smart port concepts – port planning and digital logistics – automated cargo handling systems – IoT in port operations – berthing optimization – marine terminals and container yards – breakwater performance monitoring – dredging technologies – coastal erosion and shoreline protection – climate change impacts on ports – resilient harbour infrastructure – green ports and decarbonization – blue economy concepts – Indian port modernization initiatives.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Explain advanced railway infrastructure systems and digital track technologies.

CO2: Analyze smart rail transit systems, signaling, safety and asset management.

CO3: Understand smart airport planning, airside systems and aviation infrastructure.

CO4: Apply airport pavement management and terminal automation concepts.

CO5: Analyze smart port systems, harbour digitalization and climate-resilient coastal infrastructure.

Textbooks:

1. Saxena, S.C. and Arora, S.P., *A Textbook of Railway Engineering*, Dhanpat Rai Publications.
2. Khanna, S.K., Arora, M.G. and Jain, S.S., *Airport Planning and Design*, Nem Chand & Bros.
3. Bindra, S.P., *A Course in Docks and Harbour Engineering*, Dhanpat Rai Publications.

Reference Books:

1. Rangwala, S.C., *Railway Engineering*, Charotar Publishing House.
2. Indian Railway Permanent Way Manual (IRPWM).
3. Quinn, A.D., *Design and Construction of Ports and Marine Structures*, McGraw Hill.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective – IV

23CE409 EXPERIMENTAL STRESS ANALYSIS

L	T	P	C
3	0	0	3

Pre-Requisites: 23CE101, 23CE102, 23MAT102, 23PHY101, 23EEE101

Course Description:

This course introduces the principles and modern techniques used to experimentally determine stress and strain in engineering materials and structural components. It covers strain measurement using various gauges and instrumentation, analysis using strain rosettes, and both conventional and advanced non-destructive testing (NDT) methods. The course also emphasizes contemporary approaches such as digital image correlation (DIC), computational and hybrid techniques, finite element model validation, and structural health monitoring (SHM). Additionally, it provides an overview of data acquisition systems and emerging data-driven methods for stress analysis, enabling practical and industry-relevant applications.

Course Objectives:

The objectives of this course are to enable the student to:

1. Understand the basic principles, significance, and various methods of the experimental approach to stress analysis.
2. Learn the concepts of strain measurement, different types of strain gauges, and associated instrumentation for experimental stress evaluation.
3. Analyse strain using strain rosettes and apply both conventional and advanced non-destructive testing (NDT) techniques, along with modern data acquisition systems and digital image correlation (DIC).
4. Understand and apply computational and hybrid methods, including inverse analysis, FEM model validation, and DIC-based full-field deformation analysis.
5. Apply concepts of structural health monitoring (SHM), sensor-based diagnostics, and data-driven stress analysis techniques, including basic machine learning approaches for structural assessment.

UNIT I PRINCIPLES OF EXPERIMENTAL APPROACH 9 hours

Introduction to experimental stress analysis and its role in engineering practice, Advantages of experimental methods, Different experimental methods - model studies and problem simplification.

UNIT II STRAIN MEASUREMENT USING STRAIN GAUGES 9 hours

Definition of strain and its experimental measurement, Properties of Strain Gauges, Types of Strain Gauges – Mechanical, Acoustic and Optical strain gauges.

Introduction to Electrical Strain Gauges – Inductance, LVDT and Resistance Strain Gauges, Gauge Factor, Materials used for gauge backing and adhesive bonding.

UNIT III STRAIN ROSETTES AND ADVANCED NON-DESTRUCTIVE TESTING OF CONCRETE **9 hours**

Introduction – Three-Element Rectangular and Delta Rosettes – Determination of Principal Strains and Stresses – Correction for transverse sensitivity of strain gauges.

Principles of Non-Destructive Testing (NDT) of concrete – Conventional Methods: Ultrasonic Pulse Velocity (UPV) Method and Rebound Hammer Test – Advanced NDT Techniques: Ultrasonic Testing (UT), Infrared Thermography, Acoustic Emission Testing, and Digital Radiography – Fundamentals and Engineering Applications.

Introduction to Multichannel Strain Measurement Systems and Data Acquisition Systems (DAQ) – Digital Image Correlation (DIC) and Modern Optical Methods for Full-Field Strain Measurement.

UNIT IV COMPUTATIONAL AND HYBRID METHODS IN EXPERIMENTAL STRESS ANALYSIS **9 hours**

Introduction to Computational Methods – Role of Numerical Techniques in Experimental Mechanics – Inverse Analysis for Determination of Material Properties and Stress Fields – Hybrid Techniques: Integration of Experimental Data with Numerical Models – Validation of FEM using Experimental Results – Digital Image Correlation (DIC) – Principles, Image Acquisition, Displacement and Strain Measurement – Full-Field Deformation Analysis – Applications in Structural Engineering.

UNIT V STRUCTURAL HEALTH MONITORING AND DATA-DRIVEN STRESS ANALYSIS **9 hours**

Introduction to Structural Health Monitoring (SHM) – Need and Importance in Civil Engineering Structures – Sensor-Based Diagnostics – Types of Sensors: Strain Gauges, Fiber Optic Sensors, Accelerometers – Data Acquisition Systems and Signal Processing – Damage Detection and Condition Assessment – Vibration-Based Monitoring Techniques – Real-Time Monitoring of Structures.

Data-Driven Stress Analysis – Introduction to Machine Learning Concepts in Stress Prediction – Pattern Recognition and Predictive Modeling in Structural Engineering.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the principles and significance of experimental stress analysis and select appropriate experimental methods for engineering applications (L1–L3).

CO2: Describe and apply the working principles of various strain gauges and associated instrumentation for accurate strain measurement (L2–L4).

CO3: Analyse multi-directional strain using strain rosettes and evaluate structural materials using conventional and advanced non-destructive testing (NDT) techniques, including modern data acquisition systems and DIC (L3–L4).

CO4: Apply and interpret computational and hybrid techniques, including inverse analysis, FEM model validation, and digital image correlation (DIC) for full-field stress and deformation analysis (L3–L5).

CO5: Apply concepts of structural health monitoring (SHM), sensor-based diagnostics, and data-driven stress analysis methods for condition assessment and prediction of structural behavior (L3–L5).

Textbooks:

1. J.W. Dally and W.F. Riley, Experimental Stress Analysis, College House Enterprises, 2005.
2. Sadhu Singh, Experimental Stress Analysis, New Delhi: Khanna Publishers, 4th Edition.

Reference Books:

1. U.C. Jindal, Experimental Stress Analysis, New Delhi: Pearson Publications, 2012 Edition.
2. L.S. Srinath, Experimental Stress Analysis, New Delhi: McGraw-Hill Education, 2011.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Professional Elective - V

23CE410 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisites: 23CE111, 23CE403

Course Description:

Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geosynthetics; improvement of expansive soils.

Course Objectives:

1. To evaluate the suitability of different dewatering methods—such as sumps, wells, and electro-osmosis—and to understand the properties and application methods of various grouts used for ground modification.
2. To compare in-situ densification techniques for both cohesionless soils (using surface/depth vibration and impact) and cohesive soils (using preloading, vertical sand drains, and stone columns).
3. To analyze the mechanisms of soil stabilization using mechanical means as well as chemical admixtures, including cement, lime, bitumen, calcium chloride, and sodium silicate.
4. To design reinforced earth walls by understanding the factors governing their stability and to identify the diverse engineering functions of geotextiles, geogrids, and geomembranes.
5. To identify the unique problems posed by expansive soils, perform tests to determine swell pressure, and apply specialized foundation techniques like under-reamed piles to control soil movement.

UNIT I INTRODUCTION TO GROUND IMPROVEMENT 9 hours

Overview of ground improvement techniques, Importance of ground improvement in construction projects, Factors influencing the need for ground improvement, Historical development and evolution of ground improvement methods

UNIT II SHALLOW STABILIZATION TECHNIQUES 9 hours

Introduction to shallow stabilization techniques, Types of shallow stabilization methods: compaction, preloading, vibro compaction, soil reinforcement, and chemical stabilization, Principles and mechanisms of each technique, Influence on bearing capacity and settlements in cohesive and cohesionless soils, Design considerations and factors affecting the selection of shallow stabilization methods, Case studies and real-world applications of shallow stabilization techniques

UNIT III DEEP STABILIZATION TECHNIQUES 9 hours

Introduction to deep stabilization techniques, Types of deep stabilization methods: deep compaction (dynamic compaction, vibro compaction), deep mixing (deep soil mixing, jet grouting), stone columns, and grouted ground, Principles and mechanisms of each technique, Influence on bearing capacity and settlements in cohesive and cohesionless soils Design considerations and factors affecting the selection of deep stabilization methods, Case studies and real-world applications of deep stabilization techniques

UNIT IV COMBINED METHODS AND HYBRID TECHNIQUES 9 hours

Overview of combined methods and hybrid techniques in ground improvement, Integration of shallow and deep stabilization techniques for complex ground conditions, Case studies demonstrating the effectiveness of combined methods, Challenges and considerations in implementing combined and hybrid techniques, Future trends and innovations in combined ground improvement methods

UNIT V QUALITY CONTROL AND MONITORING IN GROUND IMPROVEMENT **9 hours**

Importance of quality control and monitoring in ground improvement projects, Key parameters to monitor during ground improvement activities, Instrumentation and techniques for monitoring ground improvement processes, Precautions to avoid different type of errors, Data interpretation and analysis for assessing the effectiveness of ground improvement measures, Case studies highlighting the role of quality control and monitoring in successful ground improvement projects

Course Outcomes:

After successful completion of the course, student will be able to

CO1: Identify basic deficiencies of various soil deposits and able to decide various dewatering methods to improve the soil.
CO2: Implement different techniques of soil densification.
CO3: Use admixtures in stabilizing the soil.
CO4: Use geo-synthetics materials in engineering applications.
CO5: Suggest different types of foundation techniques and methods to control swelling of soil

Textbooks:

1. Manfred R. Hausmann, Engineering Principles of Ground Modification, McGraw-Hill College, 2013, First Edition
2. Bujang B.K. Huat, Arun Prasad, Sina Kazemian, Vivi Anggraini, Ground Improvement Techniques, 2021, First Edition

Reference Books

1. Klaus Kirsch and Fabian Kirsch, Ground Improvement by Deep Vibratory Methods, CRC Press, 2017, Second Edition
2. Buddhima Indraratna, Jian Chu and Cholachat Rujikiatkamjorn, Ground Improvement Case Histories, Elsevier, 2015, First Edition

Other Suggested Readings:

1. https://nptel.ac.in/courses/105108075

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - V

23CE411 SUBSURFACE EXPLORATION AND INSTRUMENTATION

	L	T	P	C
Pre-requisites: 23CE111, 23CE206	**3**	**0**	**0**	**3**

Course Description:

This course covers importance of soil exploration, methods of subsurface exploration, different drilling techniques, borings, and sampling. Further the course also covers various field test.

Course Objectives:

1. To understand the importance of subsurface exploration and apply suitable boring methods such as wash boring, percussion, and rotary drilling.
2. To use indirect methods like seismic and electrical resistivity techniques for interpreting subsurface conditions.
3. To stabilize boreholes and conduct groundwater observations considering time lag effects.
4. To identify sample disturbances and design appropriate samplers for obtaining representative soil samples.
5. To perform and interpret field tests (SPT, CPT) and apply corrections to evaluate soil properties such as deformation modulus.

UNIT I INTRODUCTION OF SOIL EXPLORATION 9 hours

Necessity and Importance of soil exploration-method of sub surface exploration Test pits- Wash boring- Percussion drilling- Rotary drilling. Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes- Spacing and depth of various Civil engineering structures.

UNIT II INDIRECT METHODS OF EXPLORATION 9 hours

Indirect method of exploration: Seismic method- Electrical resistivity, -Resistivity sounding and profiling, ground penetration radar, working with Multichannel Analysis of Surface Waves (MASW) Qualitative and quantitative interpretation of test results- Comparison of resistivity and seismic surveys.

UNIT III STABILIZATION OF BORE HOLES AND GROUND WATER OBSERVATION 9 hours

Stabilization of bore holes: Different method of stabilization of the bore holes- their relative merits and demerits. Ground water Observation: Different method of ground water observation: Time lag in observation- sampling of ground water.

UNIT IV SOIL SAMPLING 9 hours

Source of disturbance and their influence. Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils. Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log.

UNIT V FIELD TESTS 9 hours

Penetration tests, Standard penetration tests, Dynamic cone penetration tests with and without bentonite slurry, Static cone penetration tests, factor affecting the penetration tests. Various corrections in the test results. Interpretation of test result for design and determination of modulus of deformation. Small size penetrometers. Correlation among various test results.

Course Outcomes:

The students after completing the course will be able to:

CO1: Know the Importance of soil exploration.
CO2: Get the knowledge about soil sampling from field.
CO3: Apply the concepts to prevent the collapse of bore holes
CO4: Prepare Soil investigation report.
CO5: Do various field tests.

Textbooks:

1. Punmia B. C, Ashok Kumar Jain, and Arun Kumar Jain. Soil Mechanics and Foundations, 16th Edition, Laxmi Publications
2. Arora, K.R., Soil Mechanics and Foundation Engg, Standard Publishers and Distributors, Delhi.

Reference Books:

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
4. Principles of Geotechnical Engineering, by Braja M. Das, 6 Edition,Cengage Learning
5. Principles of Foundation Engineering, by Braja M. Das, 7 Edition,Cengage Learning

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - V

23CE412 INFRASTRUCTURE ECONOMICS AND CONTRACT MANAGEMENT

	L	T	P	C
Pre-requisites: 23CE113, 23CE603, 23HUM102	**3**	**0**	**0**	**3**

Course Description:

This course provides fundamental knowledge of transport economics, investment analysis, and pricing policies in transportation systems. It covers system evaluation, life cycle cost analysis, project appraisal, and private sector participation models. The course also introduces Total Quality Management (TQM) principles in highway and transportation projects.

Course Objectives:

1. To introduce basic economic principles relevant to infrastructure development.
2. To develop understanding of financial and economic evaluation of civil engineering projects.
3. To familiarize students with infrastructure financing and PPP models.
4. To provide knowledge of construction contracts and tendering processes.
5. To develop awareness of contract management, risks, and dispute resolution in projects.

UNIT I INTRODUCTION TO INFRASTRUCTURE AND ECONOMIC CONCEPTS — 9 hours

Definition and classification (physical & social infrastructure) - Role of infrastructure in economic development - Overview of infrastructure sectors (transport, water, energy, urban) - Basic economic concepts: demand, supply, elasticity - Market equilibrium and pricing - Infrastructure challenges in India

UNIT II ENGINEERING ECONOMICS FOR INFRASTRUCTURE PROJECTS — 9 hours

Time value of money - Interest calculations - Cash flow diagrams -Cost concepts: fixed, variable, marginal costs - Inflation and its impact on projects - Basic economic decision-making techniques - Introduction to project costing

UNIT III PROJECT EVALUATION AND INFRASTRUCTURE FINANCING — 9 hours

Cost–Benefit Analysis (CBA)- Net Present Value (NPV), Internal Rate of Return (IRR) - Benefit-Cost Ratio (BCR) & Payback Period - Introduction to infrastructure financing - Sources of finance: equity, debt, government funding - Basics of Public-Private Partnerships (PPP)

UNIT IV CONSTRUCTION CONTRACTS AND TENDERING PROCESS — 9 hours

Basics of contracts in civil engineering - Types of contracts: lump sum, item rate, EPC - Tendering process: notice, bidding, evaluation, award - Contract documents: drawings, specifications, BOQ
Roles of client, contractor, and consultant

UNIT V CONTRACT MANAGEMENT, RISK, AND DISPUTE RESOLUTION **9 hours**

Contract execution and administration - Time and cost control in projects - Risks in construction projects and mitigation - Claims and variations - Dispute resolution: arbitration and mediation - Case studies of infrastructure projects

Course Outcomes:

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

CO1: Apply basic economic concepts to infrastructure planning and development.

CO2: Evaluate infrastructure projects using standard economic and financial techniques.

CO3: Understand various financing methods and PPP models in infrastructure projects.

CO4: Interpret contract documents and understand the tendering process.

CO5: Identify risks, manage contracts, and understand dispute resolution mechanisms.

Textbooks:

1. Chitkara, K. K. (2019). *Construction Project Management: Planning, Scheduling and Controlling* (4th ed.). McGraw Hill Education, India.
2. Sharma, S. K. (Year). *Engineering Economics*. Khanna Publishers, New Delhi.
3. Rajan, C. S. (Year). *Construction Contracts and Management*. McGraw Hill / Standard Publishers.

Reference Books:

1. E. R. Yescombe, *Public-Private Partnerships: Principles of Policy and Finance*, Butterworth-Heinemann.
2. Joseph E. Stiglitz, *Economics of the Public Sector*, W. W. Norton & Company.
3. Park Chan S, *Contemporary Engineering Economics*, Pearson.
4. K. K. Chitkara, *Construction Project Management: Planning, Scheduling and Control*, Tata McGraw Hill.
5. Jonathan L. Gross, *Fundamentals of Engineering Economics*, Wiley.

NPTEL/Online resources

1. https://nptel.ac.in/courses/110107122
2. https://nptel.ac.in/courses/110105112
3. https://nptel.ac.in/courses/105103093

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

MANAGEMENT COURSE

Management Courses

23HUM801 BUSINESS ETHICS AND CORPORATE GOVERNANCE

L	T	P	C
2	0	0	2

Pre-requisite Nil

Course Description:

The course introduces students to the fundamental principles of business ethics and corporate governance. It equips engineering students with the knowledge and analytical skills required to navigate ethical dilemmas in professional life, understand ethical practices in various management functions, appreciate the role of corporate culture, and comprehend the legal and regulatory framework of corporate governance. Special emphasis is given to contemporary issues such as ethics in emerging technologies (AI, data privacy), fair trade practices, corporate social responsibility (CSR), and ESG (Environmental, Social, Governance) reporting, particularly relevant to Indian tech companies and start-ups.

Course Objectives:

This course enables students to:

1. Describe the concepts of Management theories, approaches and their application with organizations around us
2. Know the concepts of planning and management
3. Explain the basic concepts of organization, types and structure of organization
4. Make the students know leading, good communication, theories of motivation

UNIT I ETHICS **6 hours**

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior.. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management - Issues of Management

UNIT II ETHICS IN MANAGEMENT **6 hours**

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; Ethical issues in AI, data privacy, and emerging technologies (e.g., bias in algorithms, ethical hacking dilemmas)

UNIT III CORPORATE CULTURE **6 hours**

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 – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change

UNIT IV LEGAL FRAMEWORK **6 hours**

Law and Ethics - Salient features of Companies Act 2013, Agencies enforcing Ethical Business Behavior – Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances – Corporate law, Securities and financial regulations, corporate governance code and principles: DPDP Act; Ethical considerations in Digital privacy

UNIT V CORPORATE GOVERNANCE 6 hours

Introduction - Meaning – Corporate governance code, transparency & disclosure - Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory framework - Corporate scams - Committees in India and abroad, corporate social responsibility (CSR) BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations; ESG (Environmental, Social, Governance) reporting and its relevance to Indian start-ups/tech companies

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand the Ethics and different types of ethics. (L2)

CO2: Understand business ethics and ethical practices in management (L2)

CO3: Understand the role of ethics in management (L2)

CO4: Apply the knowledge of professional ethics & technical ethics (L3)

CO5: Analyze corporate law, ethics, codes & principles (L4)

Textbook(s)

1. CSV Murthy: Business Ethics and Corporate Governance, Himalaya Publishing House, 2022

2. Linda K. Trevino & Katherine A. Nelson: Managing Business Ethics: Straight Talk about How to Do It Right, Wiley, 8E, 2025

Reference Books

1. Domènec Melé: Business Ethics in Action: Managing Human Excellence, Bloomsbury, 3e, Nov., 2025
2. Andrea Bonime-Blanc: Governing Pandora: Leading in the Age of Generative AI and Exponential Technology, Georgetown University Press, February, 2026

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Management Courses

23HUM802 PRINCIPLES OF MANAGEMENT

L	T	P	C
2	0	0	2

Pre-requisite Nil

Course Description:

The course provides students with a practical and concrete explanation of management concepts and techniques they will need to manage today's and tomorrow's organizations. The course will follow the "planning, organizing, leading, controlling" format of managerial functions while putting together many small pictures presented by individual modules into one bigger meaningful picture in which managerial knowledge would apply. At the end of the course students are expected to understand role of components of bigger picture and interactions between and among components.

Course Objectives:

This course enables students to:

1. Describe the concepts of Management theories, approaches and their application with organizations around us
2. Know the concepts of planning and management
3. Explain the basic concepts of organization, types and structure of organization
4. Make the students know leading, good communication, theories of motivation

UNIT I INTRODUCTION TO MANAGEMENT 6 hours

Introduction to Management and Organizations- Management definition, skills, roles, goals and functions of a manager, organization, value of studying management - Managing in a Global Environment- Global Perspective, Understanding global environment

UNIT II PLANNING 6 hours

Decision-making process, Types of decisions and decision making conditions, styles, biases and errors, Planning: Meaning of planning, establishing goals and developing plans - Strategic Management-Importance of strategic management, strategic management process, types of organizational strategies; Basics of agile and digital project management in engineering organizations

UNIT III ORGANIZING 6 hours

Organization vs organizing **-** Organizational structures – Principles and types of organizational structure - Departmentation – decentralization – delegation of Authority

UNIT IV COMMUNICATION, MOTIVATION & LEADING 6 hours

Functions of communication, Inter-personal communication –Motivation: Theories of motivation and current issues in motivation. Leading: Leaders and Leadership, Leadership theories - Leadership in virtual/hybrid tech teams and Indian industry case studies (e.g., Infosys, Tata).in digital privacy

UNIT V CONTEMPORARY ISSUES IN MANAGEMENT 6 hours

Adapting to rapid technological advancements (AI integration), managing hybrid/remote work, and fostering employee well-being amid high burnout rates, value-chain management – Diversity-Equity- Inclusion – Communication gaps – environmental sustainability

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand the various concepts, approaches and theories of management in the real situation (L2)

CO2: Analyze the concept of planning and apply on the decisions in strategic management (L3, L4)

CO3: Compare organization structure designs and chart diligently with theoretical learning concepts (L4)

CO4: Apply communication and theories of motivation in an organization (L3)

CO5: Understand various tools for controlling organizational performance, management audit and apply to achieve the corporate objectives (L2, L3)

Textbook(s)

1. Stephen P. Robbins, Mary Coulter, and others, MANAGEMENT, Pearson, 16E, 2024
2. P.C. Tripathi and P.N. Reddy: PRINCIPLES OF MANAGEMENT, McGrawHill, 2021

Reference Books

1. Mohit Tiwari and Tripti Tiwari: PRINCIPLES OF MANAGEMENT FOR ENGINEERS, Leilani Katie Publications, November, 2025
2. J K Mitra, PRINCIPLES AND PRACTICE OF MANAGEMENT, Oxford University Press, 2023

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Management Courses

23HUM803 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
2	0	0	2

Pre-requisite Nil

Course Description:

The course content includes: Introduction to HRM, strategic human resource challenges, work flows, job analysis, managing diversity, concepts, goals, mechanism and system of HRD, recruitment and selection, downsizing and outplacement, appraising and managing employee performance, training, career development, managing compensation, rewarding performance, designing benefit plans, employee relation and employee discipline, and workplace safety and health.

Course Objectives:

This course enables students to:

1. Explain the nature and scope of HRM, its functions, policies and strategies
2. Describe the human resource planning, work analysis and importance in designing jobs
3. Know the recruitment, selection and the process of performance appraisal
4. Make the student to learn about training and development, compensation management
5. To appraise them of AI applications in HRD

UNIT I INTRODUCTION **6 hours**

Understanding the nature and scope of Human Resource Management- Definition, Evolution of HRD, Functions - objectives, organization of department, Role and responsibility of HRM.

UNIT II HUMAN RESOURCE PLANNING **6 hours**

Human Resource Planning- Factors affecting HRP, the planning process, managerial succession planning. Job Analysis, Methods of collecting job data, Competency based Job Analysis,
Job design Approach

UNIT III RECRUITMENT, SELECTION & PERFORMANCE APPRAISAL **6 hours**

Recruiting and selecting employees-, Selection process. Performance Management, Process of Performance Appraisal, Bell curve, Methods of Performance Appraisal - AI in recruitment, ATS and performance tracking tools (relevant for tech/engineering roles).

UNIT IV TRAINING AND DEVELOPMENT **6 hours**

Meaning – importance and benefits of Training and Development, Training v/s Development – Training Methods - challenges in training - Career development: Definition-objectives—importance of career development – HR analytics

UNIT V AI APPLICATIONS IN HRD **6 hours**

AI Impact – adoption of AI for human resource development – integration of AI into HRD – goal setting and OKR, content management, on-boarding support, handling performance bias, employee engagement and retention; Managing remote/hybrid teams and employee engagement.

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand the concept of HRM, its nature, scope, functions, policies and strategies (L2)

CO2: Analyze human resource planning and apply in designing jobs (L3, L4)

CO3: Evaluate the recruitment, selection and the process of performance appraisal (L5)

CO4: Understand the importance of training and development activities, compensation management (L2)

CO5: Understand the AI applications in HRD and apply the applications in a real-time setting (L2, L3)

Textbook(s)

1. Stephen P. Robbins, Mary Coulter, and others, MANAGEMENT, Pearson, 16E, 2024
2. P.C. Tripathi and P.N. Reddy: PRINCIPLES OF MANAGEMENT, McGrawHill, 2021

Reference Books

1. Mohit Tiwari and Tripti Tiwari: PRINCIPLES OF MANAGEMENT FOR ENGINEERS, Leilani Katie Publications, November, 2025
2. Andrea Bonime-Blanc: Governing Pandora: Leading in the Age of Generative AI and Exponential Technology, Georgetown University Press, February, 2026

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Management Courses

23HUM804 MANAGEMENT SCIENCE

L	T	P	C
2	0	0	2

Pre-requisite: Nil

Course Description:

This course provides a comprehensive understanding of the core concepts and techniques of management science with a focus on their application in engineering and industrial organizations. It covers the evolution of management thought, operations management, human resource management practices, project management tools (PERT/CPM), and marketing management. The course emphasizes practical tools such as work study, quality control, inventory management, strategic analysis (SWOT), and contemporary issues in modern management and technology, enabling students to apply management principles effectively in real-world technical environments.

Course Objectives:

This course enables students to:

1. Provide fundamental knowledge of management concepts, principles, schools of thought, and various organizational designs.
2. Familiarize students with operations management principles, including plant layout, production methods, work study, quality control, inventory management, TQM, Six Sigma, SCM, and ERP.
3. Impart knowledge of human resource management practices such as job analysis, recruitment, selection, training & development, performance appraisal, and wage administration.
4. Develop skills in project management using network analysis techniques like PERT and CPM, including project crashing and cost analysis.
5. Introduce the concepts of marketing management, marketing mix, customer relationship management (CRM), and contemporary issues in modern management and technology.

UNIT I INTRODUCTION TO MANAGEMENT SCIENCE 6 hours

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

UNIT II OPERATIONS MANAGEMENT 6 hours

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 - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP)

UNIT III HUMAN RESOURCE MANAGEMENT 6 hours

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 – Bell Curve Performance - Wage and Salary Administration

UNIT IV PROJECT MANAGEMENT 6 hours

Project Management **-** Basic simulation and decision support systems - SWOT Analysis - 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).

UNIT V MARKETING MANAGEMENT 6 hours

Marketing Management **-** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle. Customer Relations Management (CRM) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking

Course Outcomes:

After completing this Unit, students will be able to

CO1: Remember the concepts & principles of management and designs of organization in a practical world (L1)

CO2: Understand the knowledge of Work-study principles & Quality Control techniques in industry (L2)

CO3: Apply the HRM processes in organization (L3)

CO4: Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT (L5)

CO5: Apply Marketing Management in organizations (L5)

Textbook(s)

1. Frederick S. Hillier and Mark S. Hillier: Introduction to Management Science: A Modeling and Case Studies Approach with Spreadsheets, McGrawHill, 7e, 2023
2. AR Aryasri: MANAGEMENT SCIENCE, Tata McGrawHill, 4e, 2011

Reference Books

1. Stoner, Freeman, Gilbert: MANAGEMENT, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, *Essentials of Management*, 11e, TMH, 2020.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Management Courses

23HUM805 NATIONAL CADET CORPS

L	T	P	C
2	0	0	2

Pre-requisite: Nil

Course Description:
The course aims to instil knowledge about NCC, national integration, self-awareness, and social service, while promoting critical thinking and teamwork

Course Objectives:

This course enables students

1. To develop discipline, leadership, and character among students
2. To impart basic military training and physical fitness
3. To inculcate spirit of patriotism and social responsibility
4. To enhance personality, teamwork, and self-confidence

UNIT I NCC ORGANIZATION & LEADERSHIP 6 hours

Introduction to NCC: Aim, Motto, Objectives, Organizational structure of NCC, Role and responsibilities of cadets, Leadership traits and qualities, Types of leadership and leadership development, Personality development and communication skills

UNIT II DRILL & PARADE 6 hours

Importance and principles of drill, General drill instructions and words of command, Basic drill movements: *Savdhan, Vishram, Aaram Se*, *Dahine Mud, Bayen Mud, Piche Mud*, Formation of squad and line, Saluting and marching techniques, Practical drill sessions

UNIT III WEAPON TRAINING AND FIELD CRAFT 6 hours

Introduction to small arms (.22 rifle), Safety precautions and handling of weapons, Parts and mechanism of rifle, Aiming and firing techniques (theory), Field craft basics: camouflage and concealment, Introduction to map reading

UNIT IV PHYSICAL FITNESS AND ADVENTURE ACTIVITIES 6 hours

Importance of physical fitness in NCC, Basic exercises and endurance training, Obstacle training and its benefits, Yoga and mental fitness, Adventure activities: trekking, mountaineering, cycling, Disaster management basics and first aid

UNIT V SOCIAL AWARENESS AND NATIONAL INTEGRATION 6 hours

Social service and community development, Environmental awareness and sustainability, Swachh Bharat and health awareness programs, National integration and unity in diversity, Role of NCC in nation building, Participation in Camps and Community Service

Course Outcomes:

After completing this Unit, students will be able to

CO1: Understand and describe the aims and objectives of the National Cadet Corps (NCC) vis-à-vis concepts of leadership traits, personality development (discipline), and communication skills in the context of NCC) (L1)

CO2: Demonstrate basic drill movements, words of command, saluting, marching techniques and parade procedures. (L2)

CO3: Apply the fundamentals of weapon training, safety precautions, field craft, camouflage, concealment and map reading. (L3)

CO4: Demonstrate physical fitness through basic exercises, endurance training, obstacle courses, yoga and adventure activities (L3)

CO5: Develop social responsibility, national integration, environmental awareness, patriotism and contribute to community service and nation-building activities. (L3 / L4)

Textbook(s)

1. R. Gupta: Handbook for NCC Cadets for A, B, & C Certificates, Kindle Edition, Ramesh Publishing House, 2026
2. Major RC Mishra & Sanjay Sharma: A Hand Book of NCC, Kanti Prakashan Etawah, 2025

Reference Books

1. RPH Team, A Concise Handbook of NCC Cadets For A / B & C Certificate Examinations Including N=Model Papers & Solved Questions 2018 In English, RPH, 2018

2. R Gupta NCC (National Cadet Corps) - (A Concise Handbook Of Ncc Cadets For "A", "B" & "C" Certificate Examinations) Including Model Papers & Solved Questions , New 31th Edition (August, 2025)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

SKILL ENHANCEMENT COURSES

Skill Enhancement Course - I

23CE601 BUILDING PLANNING AND DRAWING **L T P C**
1 0 2 2

Pre-requisite: None

Course Description:

The Building Planning and Drawing Laboratory course teaches students to create precise architectural drawings using industry standards and tools. Emphasis is on building plans, elevations, sections, and detailing for effective communication and constructability.

Course Objectives:

1. Initiating the student to different building bye-laws and regulations.
2. Imparting the planning aspects of residential buildings and public buildings.
3. Giving training exercises on various signs and bonds.
4. Giving training exercises on different building units.
5. Imparting the skills and methods of planning of various buildings.

UNIT I INTRODUCTION – CONVENTIONAL SIGNS AND SYMBOLS 6 hours

Introduction: In architecture and construction, building drawings must meet standards for clarity and precision, typically including views like plans, elevations, sections, and details. Dimensions are expressed in standard units, ensuring consistency and accuracy. Good drawings clearly communicate all necessary information, using correct scales, symbols, and annotations to avoid misunderstandings during construction. This ensures the architect's vision is effectively translated into a tangible structure.

Sample Experiments:

1. Detailing & Drawing of Sign Conventions.

UNIT II DESIGN OF BONDING 6 hours

Masonry bonding, Types of bonding.

Sample Experiments:

2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.

UNIT III DESIGN OF OPENINGS 6 hours

Sample Experiments:

4. Detailing & Drawing of Doors.
5. Detailing & Drawing of Windows
6. Detailing & Drawing of Ventilators & Roofs

UNIT IV RESIDENTIAL BUILDING LINE DIAGRAMS USING BUILDING BYE-LAWS 6 hours

In this unit, students will create line diagrams of residential buildings following building bye-laws. They will then develop detailed plans, elevations, and sections from these diagrams for single-story buildings. The focus is on accurate drafting and adherence to architectural standards.

Sample Experiments:

7. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.

8. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building.

UNIT V ARCHITECTURAL DRAWINGS FOR SPECIALIZED BUILDINGS 6 hours

In this unit, students will focus on creating detailed plans, elevations, and sections for specialized building types, specifically hospital and industrial buildings. Emphasis will be placed on understanding the unique design requirements and functional aspects of these structures, ensuring that the architectural drawings meet the specific needs of each building type.

Sample Experiments:

9. Drawing of Plan, Elevation & Section for Hospital Building.

10. Drawing of Plan, Elevation & Section for Industrial Building.

Course Outcomes:

The students after completing the course will be able to:

CO1: Plan various buildings as per the building by-laws.

CO2: Distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings.

CO3: Draw signs and bonds.

CO4: Draw different building units.

CO5: Draw building elements and plan the buildings as per requirements.

Textbook(s)

1. Planning, designing and Scheduling, Gurcharan Singh and Jagdish Singh

2. Building planning and drawing by M. Chakraborti.

3. Building drawing, M G Shah, C M Kale and S Y Patki, Tata McGraw Hill, New Delhi.

Reference Books

1. National Building Code 2016 (Volume- I & II).
2. Principles of Building Drawing, M G Shah and C M Kale, Trinity Publications, New Delhi.
3. Civil Engineering drawing and House planning, B. P. Verma, Khanna publishers, NewDelhi.
4. Civil Engineering Building practice, Suraj Singh: CBS Publications, New Delhi, and Chennai.
5. Building Materials and Construction, G. C Saha and Joy Gopal Jana, McGrawHill Education (P)India Ltd. New Delhi.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Skill Enhancement Course - II

23CE602 REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS

L	T	P	C
1	0	2	2

Course Objectives:

1. Introduce the basic principles of Remote Sensing and GIS techniques and its application to Civil Engineering.
2. Learn various types of sensors and platforms and understand the principles of spatial analysis techniques in GIS.
3. Introduce GIS software to understand the process of digitization, creation of thematic map from toposheets and maps.

UNIT I INTRODUCTION TO REMOTE SENSING 6 hours

Digital Image Characteristics, Digital Image Data Formats, Band Interleaved by Pixel (BIP), Band Interleaved by Line (BIL), Band Sequential (BSQ) - Visual Interpretation Elements, Preprocessing, Enhancement, Classification, Supervised classification, Unsupervised classification.

Sample Experiments:

1. Georeferencing a Toposheet or Map
2. Digitization and Attribute table creation.

UNIT II DIGITAL IMAGE ANALYSIS 6 hours

Digital Image Characteristics, Digital Image Data Formats, Band Interleaved by Pixel (BIP), Band Interleaved by Line (BIL), Band Sequential (BSQ) - Visual Interpretation Elements, Preprocessing, Enhancement, Classification, Supervised classification, Unsupervised classification.

Sample Experiments:

3. Creation of Thematic Map

UNIT III INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEM 6 hours

Principles, Components and Applications of GIS - Map projections, Spatial Data Structure.

Sample Experiments:

4. Calculation of Feature geometry – Length, Area & Perimeter.

UNIT IV RASTER AND VECTOR DATA FORMATS 6 hours

Data Inputs, Data Manipulation, Data Retrieval, Data Analysis - Spatial data analysis: Overlay Function-Vector Overlay Operations, Raster Overlay Operations, Arithmetic Operators, Comparison and Logical Operators, Conditional Expressions - Network Analysis: Components of network, Transportation network - Optimum path analysis.

Sample Experiments:

5. Contour map – developing TIN & DEM from Contour.
6. Stream network – Stream ordering map.

UNIT V OVERLAY FUNCTION **6 hours**

Vector Overlay Operations, Raster Overlay Operations, Arithmetic Operators, Comparison and Logical Operators, Conditional Expressions - Network Analysis: Components of network, Transportation network - Optimum path analysis.

Sample Experiments:

7. Watershed - calculate Hydro-geomorphological parameters.
8. Transportation Network Map – Route analysis.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain the concepts of remote sensing, sensors and their characteristics.
CO2. Develop data models and data structures to introduce various Raster and Vector Analysis capabilities in GIS.
CO3. Digitize and create thematic map and extract important features to calculate geometry.
CO4. Perform surface analysis over Contour to develop digital elevation model.
CO5. Perform simple analysis in water resources and transportation engineering.

GIS SOFTWARE: QGIS / ArcGIS

Textbooks:

1. QGIS User Guide
2. ArcGIS User Manual by ESRI

Reference Books:

1. Schowengerdt, R. A (2006) 'Remote Sensing', Elsevier publishers.
2. Burrough P A and R.A. McDonnell, (1998) 'Principals of Geographical Information Systems', Oxford University Press.
3. George Joseph (2013) 'Fundamentals of Remote Sensing', Universities Press.

Web Reference:

https://onlinecourses.nptel.ac.in/noc22_ce26/preview

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course - III

23CE603 ESTIMATION, SPECIFICATIONS, COSTING AND VALUATION

L	T	P	C
1	0	2	2

Pre-requisite: Nil

Course Description:

This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes and elevations.

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the various methods and types of estimates used in civil engineering projects.
2. **Develop** detailed estimates for single and multi-story buildings using standard estimation methods.
3. **Analyze** rate analysis, abstract estimation, and bill preparation as per standard procedures.
4. **Prepare** detailed specifications and tender documents for construction works.
5. **Evaluate** the valuation, cost escalation, and value analysis of buildings.

UNIT I INTRODUCTION 9 hours

Procedure of Estimating: Methods of estimating - Main items of work - Methods of building estimates: Individual wall method - Centre line method - Estimate of Buildings: Estimate of residential building - Estimate of a building from a line plan.

Sample Experiments:

1. Activity Based on Learning Methods and Types of Estimates
2. Preparation of Detailed Estimate of a Residential Building Using Centre Line Method
3. Preparation of Detailed Estimate of a Residential Building Using short wall and long wall method.
4. Preparation of Detailed Estimate for A Two Storied Residential Building Using Centre Line Method for Earthwork, Foundations, Super Structure, Fittings Including Sanitary and Electrical Fittings & Paintings.

UNIT II ESTIMATE OF RCC WORKS AND ROAD ESTIMATING 9 hours

Estimate of RCC works: Standard hooks and cranks - Estimate of RCC slab - RCC beam and RCC column with foundation - Road Estimating: Estimate of earthwork - Estimate of pitching of slopes - Estimate of earthwork of road, Canal estimate: Earthwork in canals - Estimate of earthwork in irrigation channels.

Sample Experiments:

5. Preparation of Bar Bending Schedule (BBS) and Quantity Estimate for RCC Slab, Beam, and Column with Foundation.
6. Estimation of Earthwork for Irrigation Canal Section with Side Slopes.
7. Estimation of Earthwork for Road Embankment Using Cross-Sectional Area Method

UNIT III ANALYSIS OF RATES AND SPECIFICATIONS 9 hours

Preparation for analysis of rates, Quantity of materials per unit rate of work, Labour estimate - Specifications: Necessity, Types of specifications, Specifications for different civil engineering materials.

Sample Experiments:

8. Preparation of Rate Analysis for Cement Concrete and Brick Masonry Work.
9. Drafting of Specifications for Major Civil Works (i.e. RCC, Brickwork, and Plastering)
10. Writing of Measurement Book and Bill Preparation as Per AP State Govt Procedure for Detailed Estimate.

UNIT IV CONTRACTS AND TENDERS 9 hours

Contracts: Essentials of contracts, Types of engineering contracts, Advantages and disadvantages - Tender forms, Tender documents & notices, time limits, Necessity.

Sample Experiments:

11. Drafting and Filling a Standard Tender Document for Government Construction Work
12. Comparative Study of Different Types of Engineering Contracts (Item Rate, Lump Sum, Cost Plus, EPC).
13. Preparation of Tender Notice and Timeline for a Medium-Scale Infrastructure Project

UNIT V VALUATION 9 hours

Cost - Price & value - Methods of valuation - Outgoings - Depreciation - Methods for Estimating cost depreciation - Valuation of building - Gross income - Net income - Scrap value - Salvage value - Obsolescence - Annuity - Capitalized value - Years purchase - Life of structures - Sinking fund - Standard rent - Process of fixing standard rent - Mortgage.

Sample Experiments:

14. Valuation of a Residential Building Using Rental Method and Estimation of Standard Rent.
15. Estimation of Cost Depreciation and Salvage Value of a Commercial Structure Using Straight Line and Sinking Fund Methods.
16. Activity Based Learning for Valuation of Buildings, Cost Escalation Procedures and Value Analysis for Any One Work

Course Outcomes:

Upon successful completion of this course, students will be able to:

CO1: Apply different methods to prepare detailed estimates for residential and public buildings from line plans.

CO2: Apply standard methods to compute material quantities and prepare bar bending schedules for RCC structures and estimate earthwork quantities for road embankments and canal sections.

CO3: Analyze the components of rate analysis for major civil engineering works and examine standard specifications for construction materials and methods as per relevant codes

CO4: Evaluate different types of engineering contracts and tendering procedures to select appropriate contracting mechanisms for various types of civil engineering projects.

CO5: Analyze the valuation of buildings considering depreciation, annuity, standard rent, and capitalized value using industry-accepted methods.

Textbooks

1. B.N. Dutta - Estimating and Costing in Civil Engineering, CBS Publishers & Distributors, 28th Revised Edition (2020).
2. Rangwala - Estimating, Costing and Valuation, Charotar Publishing House, 2023.
3. D.D. Kohli& R.C. Kohli - A Textbook of Estimating and Costing (Civil), S. Chand Publishing, 2011.

Reference Books:

1. M. Chakraborti - Estimating, Costing, Specification & Valuation in Civil Engineering, 29th Edition (2021).
2. Gurcharan Singh - Estimating, Costing and Valuation, Standard Publishers, 2018
3. V.N. Vazirani & S.P. Chandola - Civil Engineering Estimating & Costing, Khanna Publishers, 4th Edition (2001).

URLs

1. **https://onlinecourses.swayam2.ac.in/nou20_cs11/preview**
   https://www.coursera.org/learn/construction-cost-estimating

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course - IV

23CE604 BUILDING INFORMATION MODELLING

L	T	P	C
1	0	2	2

Pre-requisite: Nil

Course Description:

This course covers the fundamentals of Building Information Modelling (BIM), Autodesk Revit for creating 3D models of building components, including architectural and structural elements.

Course Objectives:

The objectives of this course are to enable the student to:

1. Understand the fundamentals of Building Information Modeling (BIM) and Autodesk Revit, including its interface, basic terminology, and project setup workflow.
2. Develop proficiency in Revit's basic drawing and editing tools for structural and architectural modeling.
3. Create 3D models of buildings, including walls, doors, windows, and components, using Revit families.
4. Analyze different components such as curtain walls, floors, roofs, and ceilings with structural detailing.
5. Create and detail stairs, ramps, railings, and apply various visualization and detailing techniques to generate callouts, elevations, and sections.

UNIT I INTRODUCTION TO BIM AND REVIT ENVIRONMENT 9 hours

BIM concepts, Autodesk, Revit vs AutoCAD. Overview of Revit interface and templates. Explore views (plan, section, 3D) and use navigation tools. Setting up a basic project with levels, grid lines, and defining project units.

Sample Experiments:

1. Creating and Navigating a New Revit Project.

UNIT II BASIC DRAWING TOOLS, LEVELS & GRIDS 9 hours

Using drawing and modification tools to model basic geometry. Creating and adjusting levels and structural grids. Importing and aligning external CAD files.

Sample Experiments:

2. Creating a Structural Grid and Level System.
3. Drawing and Modifying Architectural Elements.

UNIT III ARCHITECTURAL MODELING – WALLS, OPENINGS, AND COMPONENTS 9 hours

Modeling and modifying walls (interior and exterior). Inserting and customizing door/window types. Loading and placing the system and loadable families for architectural components.

Sample Experiments:

4. Modeling Building Enclosure with Walls, Doors, and Windows.
5. Placing and Modifying Architectural Components.

UNIT IV ADVANCED BUILDING ELEMENTS – CURTAIN WALLS, FLOORS, ROOFS, AND CEILINGS **9 hours**

Creating curtain walls with grids, panels, and mullions. Creating different types of floor slabs, including shafts and sloped floors. Modeling gable, hip, and flat roofs using sketch-based tools. Designing false ceilings with lighting fixtures.

Sample Experiments:

6. Modeling Floors, Slabs and Roof Structures.
7. Designing Curtain Walls and Ceilings.

UNIT V DETAILING, STAIRCASE & VIEW DOCUMENTATION **9 hours**

Creating and modifying components and custom stairs, ramps, and railings. Generating sections, elevations, and callouts for construction detailing. Assembling sheets with views, title blocks, and exporting to PDF/DWG.

Sample Experiments:

8. Creating Stairs, Ramps and Railings.
9. Generating Elevations, Sections and Callouts.
10. Creating Drawing Sheets and Printing.

Course Outcomes:

The students, after completing the course, will be able to:

CO1: Describe the fundamental concepts of BIM and Autodesk Revit, including interface navigation and project setup workflows. (L1, L2).

CO2: Apply drawing tools, levels, grids, and CAD linking to create basic structural layouts in Revit. (L3).

CO3: Model architectural components such as walls, doors, and windows using Revit families and modify them for building design. (L3, L4)

CO4: Develop and customize complex building elements such as floors, roofs, ceilings, and curtain walls, integrating construction detailing. (L3, L6).

CO5: Construct staircases, ramps, and railing systems and generate sheets with plans, sections, elevations, and printing documentation. (L3, L5).

Textbooks:

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston ―BIM HANDBOOK, Wiley, 2nd Edition, 2011
2. Wing, Eric. Autodesk Revit Architecture 2017: No Experience Required. Indianapolis: John Wiley & Sons, 2016

Reference Books:

1. Kim, Marcus, Lance Kirby, and Eddy Krygiel. Mastering Autodesk Revit 2017 for architecture. 1st ed. INpolis, IN: John Wiley & Sons, 2016
2. Garber, Richard. BIM Design: Realizing the Creative Potential of Building Information Modeling. AD Smart 02. Chichester, U.K.: Wiley, 2004
3. Peter B. and Nigel D., "BIM in Principle and Practice", 1st Edition, ICE Publishing, 2014
4. BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors

5. Chuck Eastman, Paul Teicholz, Rafael Sacks and Kathleen Liston, John Wiley & Sons, 2008
6. BIM and Construction Management: Proven Tools, Methods, and Workflows, Brad Hardin, Sybex, 2009
7. Building Information Modeling: BIM in Current and Future Practice, Karen Kensek and Douglas Noble, Wiley, 2014, First Edition

URLs

1. https://minnodillc.com/building-information-modeling-bim/
2. https://www.skyfilabs.com/online-courses/building-information-modelling-course

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course - V

23ENG601 SOFT SKILLS

L	T	P	C
1	0	2	2

Course Objectives:

1. To encourage all round development of the students by focusing on soft skills
2. To make the students aware of critical thinking and problem-solving skills
3. To enhance healthy relationship and understanding within and outside an organization
4. To function effectively with heterogeneous teams
5. To prepare students for job interviews, group discussions, and workplace communication with confidence and clarity.

UNIT I SOFT SKILLS & COMMUNICATION SKILLS 9 hours

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 example 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 9 hours

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 9 hours

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 9 hours

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 written and oral presentation, Organizing Debates

UNIT V CORPORATE ETIQUETTE 9 hours

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cellphoneetiquette-Diningetiquette-Netiquette-Jobinterviewetiquette- 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.

Case studies may be given wherever feasible for example for Decision Making-The decision of King Lear.

Course Outcomes:

After completion of the course, students will be able to

CO1: List out various elements of soft skills
CO2: Describe methods for building professional image.
CO3: Apply critical thinking skills in problem solving
CO4: Analyse the needs of an individual and team for well-being
CO5: Assess the situation and take necessary decisions

Textbooks:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, 2018 ,esuo HgnihsilbuPlanoitanretnIKI

Reference Books:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)

3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills(Paperback English)Publisher: Vayu Education of India, 2014

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://onlinecourses.nptel.ac.in/noc24_hs15/preview
5. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

Mode of Evaluation: Continuous Internal Evaluation, Assignments, Mid Term Tests and End Semester Examination.

Minor in Civil Engineering

(Applicable to EEE, ME, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Minor

23MDCE101 CONSTRUCTION MATERIALS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

This course covers the application of various building materials across structural elements like foundations, lintels, walls, and roofs. This course focus on various building materials based on the performing standards and codes, wherein application of each material would be discussed in detail, both in the context of historical and contemporary methodology.

Course Objectives:

1. To develop foundational knowledge of building materials in relation to varied construction methodologies.
2. To analyze the properties and performance of various traditional and emerging construction materials.
3. To apply informed material selection strategies considering structural integrity, durability, sustainability, and cost-effectiveness.
4. To develop a holistic understanding of material integration across structural elements—from foundation to parapet wall.

UNIT I **9 hours**

Introduction to fundamental components of a building

Introduction to building construction, understanding relation between architectural designs, building components (Foundation, plinth, wall, sill, lintel, roof, doors, windows, ventilators, staircases, sunshades etc.) along with the building materials.

UNIT II **9 hours**

Introduction to Building Materials (Sand, Clay, Stone, Lime, Metal and Glass)

Source of the material, classification, tests and various grades available and their uses, physical and chemical properties. Introduction to ferrous and non-ferrous metals-their properties, types and application in building components. Composition of glass, brief study on manufacture, properties, treatment, and uses of glass. Types of glass.

UNIT III **9 hours**

Timber

Types of timber, defects, seasoning and preservation of timber. Ecological impact due to use of wood, deforestation etc. Study of engineered wood used in buildings, i.e., plywood, block boards, particleboards, and other types. Application of timber in building components with Joinery details. Terms defined; mitring, ploughing, grooving, rebating, veneering. Types of joints in wood work: lengthening joints, bearing joints, halving, dovetailing, housing, notching, tusk and tenon etc

UNIT IV **9 hours**

Cement Manufacturing process, physical and chemical properties, classification of cast-in situ and precast systems. Foundation, column & beam structure, lintels, sunshades, floor and roof slabs in concrete, granolithic flooring, CC blocks (solid & hollow), Autoclaved Aerated Concrete (AAC) blocks, fly ash bricks as a walling material, cement bonded particle boards. Different grades, composition, preparation and properties of cement mortar. Use and selection of mortar for different construction works.

UNIT V **9 hours**

Roofs and Roof coverings Introduction, characteristics of roof, types of roofs (flat- madras terrace roof, RCC slab, classification of roofs by the method of geometry and methods of construction – pitched, lean-to, coupled, couple-closed, collar, scissor, king post and queen post), and by materials (GI sheets, Fibre, Glass, Aluminium, asphaltic, polycarbonate, clay tiles, coir-based corrugated sheets, etc). Roof fixing details along with gutter.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Identify suitable materials for structural applications using technical criteria.
CO2: Demonstrate knowledge of material integration across full building systems.
CO3: Evaluate historical and modern approaches in construction techniques.
CO4: Apply material knowledge to practical design decisions in load-bearing structures.
CO5: Advocate for sustainable and cost-effective solutions in building design and construction.

Textbooks:

1. Rangwala, S. C., Building Construction: Materials and types of Construction. 3rd Ed. New York : John Wiley and Sons.
2. Bindra, S.P. and Arora, S.P., Building Construction: Planning Techniques and Methods of Construction, 19th Ed. New Delhi : Dhanpat Rai Publications

Reference Books:

1. Edward, A. and Piano, J.,Fundamentals of Building Construction: Materials and Methods. 5th Ed. Hoboken : John Wiley & Sons, 2009
2. Rangwala, S. Building Construction. 22nd Ed. Anand.: Charotar Pub. House. 11., 2004
3. Sushil-Kumar, T. B., Building Construction, 19th Ed. Delhi : Standard Publishers., 2003
4. Barry, R. Construction of Buildings Vol. 2. 5th Ed. New Delhi : East-West Press.,1999

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCE102 CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

This course covers ingredients of concrete and admixtures,properties of fresh concrete and hardened concrete, testing of hardened concrete and mix design. The course further covers special concretes used in construction industry.

Course Objectives:

1. The main aim of this course is to explain properties of ingredients of concrete admixtures and procedures for testing concrete ingredients.
2. To make the student to understand fresh and hardened characteristics of concrete and also to enable the students to identify different mix design procedures and produce concrete mix proportions.
3. To explains the characteristics of emerging concretes.

UNIT I CEMENTS & AGGREGATES 9 hours

CEMENTS: Types of cement – Chemical composition – Hydration, Setting of cement, Fineness of cement, Structure of hydrate cement – Test for physical properties – Different grades of cements – Admixtures – Mineral and chemical admixtures – accelerators, retarders, air entrainers.
AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregates – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand –Deleterious substances – Soundness – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Maximum aggregate size .

UNIT II FRESH CONCRETE 9 hours

Steps in Manufacture of Concrete–proportion, mixing, placing,compaction, finishing, curing – including various types in each stage - Water / Cement ratio andadmixtures – Properties of fresh Concrete -Workability and its tests– Factors affecting workability– Segregation & bleeding – Mixing and vibration of concrete, Shotcrete.

UNIT III HARDENED CONCRETE 9 hours

AAbram's Law – Nature of strength of concrete –Maturity concept– casting and curing of concrete, mechanical properties – Factors affecting mechanical properties– Relation between compression & tensile strength – Codal provisions for NDT..

UNIT IV ELASTICITY, CREEP & SHRINKAGE 9 hours

Modulus of elasticity – Dynamic modulus ofelasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation betweencreep & time – Nature of creep – Effects of creep – Shrinkage – types of shrinkage – Factors affecting of shrinkage

UNIT V MIX DESIGN AND SPECIAL CONCRETES 9 hours

Factors in the choice of mix proportions–Quality control of concrete- Statistical methods -Concepts Proportioning of concrete mixes byACI method and IS Code method Polymer concrete - Fibre reinforced concrete – Factors affectingproperties of FRC, High performance concrete – Self-healing concrete.

Course Outcomes:

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

CO1: Identify different properties of concrete ingredients and estimate the properties through various test procedures.
CO2: Analyze the basic characteristics of fresh and hardened concrete.
CO3: Apply the test on the mechanical properties of hardened concrete..
CO4: Design the concrete mix as per various international codes
CO5: Evaluate the characteristic and applications of special concrete.

Textbooks:

1. T. Chow, D. R. Maidment, and L. W. Mays; Applied Hydrology, McGraw Hill

2. Shetty, M.S., Concrete Technology, S.Chand & Co, 2004.

Reference Books:

1. Gambhir, M.L., Concrete Technology, Tata Mc. Graw Hill Publishers, New Delhi

2. Santha Kumar, A.R., Concrete Technology, Oxford university Press, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCE201 CONCRETE TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: **None**

Course Description:

The course will provide knowledge and skills of concrete material testing

Course Objectives:

1. To gain experience regarding the determination of properties of different building materials.
2. To provide an opportunity to learn how to measure the parameters which governs the quality of the materials.
3. To learn the principles and procedures of testing concrete materials and to get hands on experience by conducting the tests and evolving inferences.

List of Experiments:

Aggregate:

1. Specific Gravity and Water Absorption of fine and coarse aggregate.
2. Sieve analysis of fine and coarse aggregate
3. Bulk density for fine and coarse aggregates
4. Bulking of sand

Cement:

5. Normal Consistency of cement
6. Fineness of cement.
7. Initial setting time and final setting time of cement.
8. Specific gravity and soundness of cement.
9. Compressive strength of cement mortar cube.

Concrete:

10. Workability test on concrete by compaction factor, slump, Vee-bee and flow table.
11. Cube strength of concrete
12. Split tensile strength of concrete
13. Non-Destructive testing on concrete

Special concretes:

14. Tests on Self Compacting Concrete (for demonstration)

(Minimum of 10 Experiments to be performed)

List of Major Equipment

1. Pycnometers.
2. Vicat's apparatus
3. Specific gravity bottle.
4. Le-Chatelier's apparatus.
5. Slump cone and compaction factor apparatus
6. Rebound hammer, Pulse velocity equipments.
7. CTM
8. Flow table

Course Outcomes:

The students after completing the course will be able to:

CO1: Identify different properties of aggregates through various test procedures.

CO2: Apply different test method to check the physical and mechanical properties of cement.

CO3: Test the mechanical properties of fresh concrete

CO4: Test the mechanical properties of hardened concrete.

CO5: Test various types of special concrete.

Reference Book

1. Concrete Technology Laboratory Manual Prepared by MITS Staff.
2. Shetty.M.S (2002), Concrete Technology, S.Chand & Co., Ltd, Ramnagar.
3. IS: 10262 - 2009, Indian Standard specification for Methods of Mix design.
4. IS: 383 - 1987, Indian Standard specification for Test for Fine and Coarse aggregates.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

Minor

23MDCE103 BUILDING PLANNING AND DRAWING

L	T	P	C
3	0	0	3

Pre-requisite: **None**

Course Description:

The Building Planning and Drawing Laboratory course teaches students to create precise architectural drawings using industry standards and tools. Emphasis is on building plans, elevations, sections, and detailing for effective communication and constructability.

Course Objectives:

6. **To familiarize** students with the fundamental principles of architectural drawing, including conventional symbols, scales, and standard representations used in civil engineering plans.
7. **To develop** an understanding of brick bonding patterns such as English and Flemish bonds, and their applications in structural wall detailing.
8. **To enable** students to design and draft various architectural openings, including doors, windows, ventilators, and roofs, using standard specifications.
9. **To apply** building bye-laws and residential planning principles in the preparation of line diagrams, floor plans, elevations, and sections for residential buildings.
10. **To introduce** the planning and drawing of specialized buildings such as hospitals and industrial structures, with an emphasis on space zoning, function, and code compliance.

UNIT I **INTRODUCTION – CONVENTIONAL SIGNS AND SYMBOLS** **9 hours**

This unit introduces architectural drawing standards, including plans, elevations, sections, and detail views. It emphasizes accuracy, dimensional consistency, and effective communication using scales, conventional symbols, and annotations.

UNIT II **DESIGN OF BONDING** **9 hours**

Covers various types of masonry bonds, such as English and Flemish bonds. Students will understand structural interlocking and aesthetic arrangement of bricks in wall construction.

UNIT III **DESIGN OF OPENINGS** **9 hours**

This unit focuses on the design and representation of architectural openings, such as doors, windows, ventilators, and roofs, ensuring compliance with functional and design requirements.

UNIT IV **RESIDENTIAL BUILDING LINE DIAGRAMS USING BUILDING BYE-LAWS** **9 hours**

This unit emphasizes the preparation of line diagrams of residential buildings adhering to building bye-laws. It progresses to the development of complete architectural drawings—plans, elevations, and sections—for single-story buildings.

UNIT V **ARCHITECTURAL DRAWINGS FOR SPECIALIZED BUILDINGS** **9 hours**

In this unit, students will focus on creating detailed plans, elevations, and sections for specialized building types, specifically hospital and industrial buildings. Emphasis will be placed on understanding the unique design requirements and functional aspects of these structures, ensuring that the architectural drawings meet the specific needs of each building type.

Course Outcomes:

The students after completing the course will be able to:

CO1: Identify and interpret conventional signs, symbols, and scales used in civil engineering drawings. (L1, L2).

CO2: Illustrate and draft various brick bonding patterns such as English and Flemish bonds in plan and elevation views. (L2, L3).

CO3: Design and draw standard openings like doors, windows, ventilators, and roofs with dimensional accuracy and construction logic. (L3, L4).

CO4: Develop line plans, elevations, and sections of residential buildings based on given requirements and local bye-laws. (L3, L5).

CO5: Plan and draw functional layouts for specialized buildings (e.g., hospitals, industrial sheds), integrating spatial and regulatory requirements. (L4, L6).

Textbooks:

1. Planning, designing and Scheduling, Gurcharan Singh and Jagdish Singh
2. Building planning and drawing by M. Chakraborti.
3. Building drawing, M G Shah, C M Kale and S Y Patki, Tata McGraw-Hill, New Delhi.

Reference Books:

1. National Building Code 2016 (Volume I & II).
2. Principles of Building Drawing, M G Shah and C M Kale, Trinity Publications, New Delhi.
3. Civil Engineering drawing and House planning, B. P. Verma, Khanna Publishers, New Delhi.
4. Civil Engineering Building practice, Suraj Singh: CBS Publications, New Delhi, and Chennai.
5. Building Materials and Construction, G. C Saha and Joy Gopal Jana, McGraw-Hill Education (P)India Ltd., New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCE104 SURVEYING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

This course covers Principles of Surveying, different measurement techniques, Compass and Plane table surveying, Levelling, Theodolite Surveying and Curves. The course further covers Modern field survey systems like Electronic distance measurement(EDM) using Total station, Global Positioning Systems and Geographical Information System.

Course Objectives:

1. To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying
2. To prepare the student to plan and conduct field work and application of scientific methodology in handling field samples.
3. To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
4. To develop the skills in surveying and thematic mapping.
5. To introduce concepts of modern surveying techniques, including remote sensing, GIS, and photogrammetry.

UNIT I **9 hours**

INTRODUCTION TO SURVEYING: Definition- Classifications - Basic Principles-Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting.
COMPASS AND PLANE TABLE SURVEYING: Compass – Basic principles - Types - Bearing - Systems and conversions- Sources of errors - Local attraction - Magnetic Declination -Dip Traversing – Plotting - Adjustment of closing error – applications - Plane table and its accessories - Merits and demerits - Radiation - Intersection - Resection – Traversing- sources of errors – applications.

UNIT II **9 hours**

LEVELLING: Level line - Horizontal line - Datum - Bench marks -Levels and staves – temporary and permanent adjustments – Methods of levelling - Fly levelling - Check leveling – Procedure in levelling - Booking -Reduction - Curvature and refraction - Reciprocal levelling – Sources of Errors in levelling- Precise levelling - Types of instruments - Adjustments - Field procedure and it application.

UNIT III **9 hours**

THEODOLITE SURVEYING: Theodolite - Types - Description - Horizontal and vertical angles - Temporary and permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense method - Stadia constants – Anallactic

UNIT IV **9 hours**

CURVES: Elements of simple and compound curves; Method of setting out- Elements of Reverse curve; Transition curve- length of curve- Elements of transition curve; Vertical curves.

UNIT V **9 hours**

MODERN FIELD SURVEY SYSTEMS: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total Station - Parts of a Total Station - Accessories -Advantages and Applications; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations - Introduction to GIS, different GIS software, basic data types and coordinate systems.

Course Outcomes:

At the end of this course students will demonstrate the ability to
CO1: Apply the knowledge, techniques, skills, and applicable tools for surveying activities.
CO2: Determine the levels of real-world boundaries and points.
CO3: Identify the different types of theodolite surveying at field.
CO4: Identify different types of curves setting at field.
CO5: Apply the basics of modern survey instrument for surveying and mapping purpose.

Textbooks:

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling Parts 1 & 2
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015
3. C Venkatramaiah, Textbook of Surveying, Universities Press

Reference Books:

1. Elements of Geomatics by P.R. Wolf.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
3. C Venkatramaiah, Textbook of Surveying, Universities Press
4. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
5. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
6. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
7. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications,

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCE202 SURVEYING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: None

Course Description:

This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes, and elevations.

Course Objectives:

1. Know about various linear and angular measuring instruments.
2. Take Measurements in the linear and angular views.
3. Determine the area and volume by interpreting the data obtained from surveying activities
4. Know modern equipment such as total station.
5. Draft field notes from survey data

List of Experiments:

1. Chain survey of road profile with offsets in case of road widening..
2. Plot the site by referring the FMB (field measurement book)
3. Determination of distance between two inaccessible points by using compass.
4. Plane table survey; finding the area of a given boundary by the method of Radiation
5. Fly levelling: Height of the instrument method and rise & fall method (differential levelling) and draw the contours
6. Theodolite survey: determining the horizontal and vertical angles by the method of repetition method
7. Theodolite survey: finding the distance between two in accessible points.
8. Theodolite survey: finding the height of far object.
9. Determination of distance between two inaccessible point by using total station.
10. Determination of area and perimeter using total station.
11. Setting out a curve
12. Surveying camp.

(Minimum of 10 Experiments to be performed)

List of Major Equipment

1. Chains, tapes, Ranging rods (2M and 3M), cross staff, arrows
2. Compasses and Tripods, Optical square.
3. Plane tables, Alidade, Plumbing fork, trough compasses.
4. Levelling instruments.
5. Total Station and Digital Theodolite

Course Outcomes:

The students after completing the course will be able to:

CO1: Measure various linear and angular measurements of a land.

CO2: Measure the vertical measurements and able to draw contours of land.

CO3: Calculate the area and volume by interpreting the data obtained from surveying activities.

CO4: Measure the heights and distances along with area by using modern equipment such as total station.

CO5: Prepare field notes from survey data.

Textbook

1. Surveying and Levelling Parts 1 & 2 by T. P. Kanetkar and S. V. Kulkarni.
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

URLs

1. Video Lectures, IIT Kanpur
Online Course http://freevideolectures.com/Course/98/Surveying

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Minor

23MDCE105 CONSTRUCTION METHODS

		L	T	P	C
Pre-requisites:	23MDCE101, 23MDCE102 & 23MDCE104	**3**	**0**	**0**	**3**

Course Description:

This course covers modern construction methods and equipment used in civil engineering works such as foundations, basements, bridges, roads, railways, dams, harbours, river works, pipelines, excavation, tunnelling, dewatering, and concrete production. It also introduces the selection and application of machinery for various construction operations.

Course Objectives:

1. To understand modern construction methods for foundations, basements, and excavation works.
2. To study advanced construction techniques and digital tools for major infrastructure projects.
3. To learn the application of automated and AI-enabled equipment in earthwork, drilling, blasting, tunnelling, hoisting, and erection.
4. To understand current industry practices and equipment used for dredging, dewatering, and floor finishing.
5. To gain knowledge of modern equipment and sustainable technologies in aggregate and concrete production.

UNIT I MODERN CONSTRUCTION AND BASEMENT WORKS 9 hours

Modern Construction Methods: Open excavation, shafts and tunnels, pile, pier and caisson foundations. Basement construction – construction methods - supporting the excavations – control of groundwater - shoring and underpinning – basement waterproofing.

UNIT II CONSTRUCTION OF MAJOR INFRASTRUCTURES 9 hours

Modern construction methods for: Bridges (precast segmental, cable-stayed, accelerated bridge construction), Roads (smart pavements, automated paving), Railways (high-speed track laying, ballastless tracks), Dams (roller-compacted concrete, instrumentation and monitoring), Harbours (modern dredging, smart port infrastructure), River works (real-time flood monitoring, geotextile applications), Pipelines (trenchless technology, smart pigging, leak detection systems). Case studies of recent Indian infrastructure projects (Bharatmala, Sagarmala, Bullet train).

UNIT III EQUIPMENT FOR CIVIL CONSTRUCTION OPERATIONS 9 hours

Earth moving and excavating equipment – GPS-enabled dozers, automated graders, remote-controlled excavators. Drilling equipment – automated rigs, real-time data logging. Blasting techniques. Tunnelling equipment – Tunnel Boring Machines (TBM with AI guidance), road headers, micro-tunnelling. smart cranes with load monitoring, tower cranes, hydraulic jacks, launching girders. Introduction to IoT and telematics for fleet management and productivity tracking.

UNIT IV EQUIPMENT FOR DREDGING, TUNNELLING, AND FINISHING 9 hours

Dredging equipment – modern cutter suction dredgers, trailing suction hopper dredgers, eco-friendly dredging practices. Dewatering equipment – automated wellpoint systems, smart pumps, real-time water level monitoring. Floor finishing equipment – laser screed machines, power trowels, robotic floor grinders and polishers, concrete vibrators (high-frequency, smart vibrators), vacuum dewatering systems for high-strength floors. Industry standards (IS codes, OSHA, ASTM) for finishing operations.

UNIT V EQUIPMENT FOR AGGREGATE AND CONCRETE PRODUCTION **9 hours**

Crushers – automated cone and impact crushers with real-time particle size monitoring. Feeders – smart vibrating feeders with load sensors. Screening equipment – high-frequency multi-slope screens. Batching and mixing equipment – fully automated batching plants, ready-mix concrete (RMC) with IoT-based quality control. Hauling equipment – autonomous dump trucks, conveyor systems with belt scales. Pouring and pumping equipment – smart concrete pumps, robotic placing booms, concrete distribution systems. Transporters – GPS-enabled transit mixers, volumetric concrete mixers. Green concrete technologies, recycled aggregates, and carbon-negative concrete production methods.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1: Explain modern construction methods used in excavation, foundation, and basement works.

CO2: Describe construction methods for bridges, roads, railways, dams, harbours, river works, and pipelines.

CO3: Select suitable equipment for construction operations such as earth moving, drilling, blasting, and tunnelling.

CO4: Explain the use of equipment in dredging, dewatering, and floor finishing.

CO5: Describe the equipment and processes used in aggregate and concrete production.

Textbooks:

1. Peurifoy, R.L., Ledbetter, W.B., Construction Planning, Equipment and Methods, McGraw Hill, 2000
2. Varma, M., Construction Equipment and its Planning & Application, Metropolitan Book Co., 1979
3. Smith, R.C., Andres, C.K., Principles and Practice of Heavy Construction, Prentice Hall, 1986

Reference Books:

1. Antil J.M., Civil Engineering Construction, McGraw Hill Book Co., 1982.
2. Ratay, R.T., Hand Book of Temporary Structures in Construction, McGraw Hill, 1984.
3. Koerner, R.M.,Construction & Geotechnical Methods in Foundation Engineering, McGraw Hill,1984.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor in Quantum Computing

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Minors

23MDINS101 INTRODUCTION TO QUANTUM COMPUTING

	L	T	P	C
Pre-requisite: None	**3**	**0**	**0**	**3**

Course Description:

This course introduces the basics of quantum mechanics as applied to computing. Students learn about qubits, quantum gates, circuits, and key algorithms like Grover's and Shor's. Concepts such as superposition, entanglement, and quantum communication are explored. Practical exposure is given through programming on platforms like IBM Qiskit.

Course Objectives:

1. Understand quantum mechanics principles in computing.
2. Explore qubits, quantum gates, and circuits.
3. Analyze the advantages of quantum algorithms.
4. Study entanglement, superposition, and interference.
5. Investigate real-world applications and platforms.

UNIT I QUBITS AND QUANTUM FOUNDATIONS 9 hours

Classical Bits vs Qubits, Postulates of Quantum Mechanics, Superposition and Probability Amplitudes, Dirac Notation (Bra-Ket), Bloch Sphere Representation, Measurement in Quantum Systems, Quantum State Collapse.

UNIT II QUANTUM GATES AND CIRCUITS 9 hours

Quantum Logic Gates: Pauli-X, Y, Z; Hadamard (H); Phase (S, T), Controlled Gates: CNOT, Toffoli, Unitary and Reversible Operations, Quantum Circuit Representation, Building Basic Quantum Circuits, Quantum Parallelism and Interference, No-Cloning Theorem and Quantum Gate Simulation.

UNIT III QUANTUM ALGORITHMS 9 hours

Need for Quantum Algorithms, Deutsch and Deutsch-Jozsa Algorithm, Grover's Search Algorithm (Quadratic Speed-up), Shor's Factoring Algorithm (Exponential Speed-up), Simon's Algorithm (Overview), Complexity Comparison: Classical vs Quantum.

UNIT IV ENTANGLEMENT AND QUANTUM COMMUNICATION 9 hours

Quantum Entanglement and Bell States, Quantum Teleportation Protocol, Superdense Coding, Quantum Key Distribution: BB84, E91 Protocols, Decoherence and Quantum Noise, Quantum Error Correction Codes (Bit Flip, Phase Flip, Shor Code).

UNIT V QUANTUM PLATFORMS AND APPLICATIONS 9 hours

Overview of Quantum Programming Platforms: IBM Qiskit, Microsoft Q#, Google Cirq, Quantum Circuit Simulation using Qiskit, Executing Code on Real Quantum Hardware (IBM Q). Quantum Applications in:Cryptography, Machine Learning, Optimization, Chemistry, Building and Testing a Sample Quantum Program.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain concepts of quantum mechanics
CO2: Illustrate quantum gates/circuits
CO3: Analyze algorithms (e.g., Shor, Grover)
CO4: Evaluate communication protocols
CO5: Develop quantum programs on IBM Q

Textbooks:

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition.
2. **David McMahon** – *Quantum Computing Explained*, Wiley.
3. **Bernhardt, Chris** – *Quantum Computing for Everyone*, MIT Press.

Reference Books:

1. **Mermin, N. David** – *Quantum Computer Science: An Introduction*, Cambridge University Press.
2. **William H. Press et al.** – *Numerical Recipes in C: The Art of Scientific Computing* (for simulation background)
3. **Rieffel&Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press.
4. **Mermin, N. David** – *Quantum Computer Science: An Introduction*, Cambridge University Press.
5. **William H. Press et al.** – *Numerical Recipes in C: The Art of Scientific Computing* (for simulation background)
6. **Rieffel&Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press.

Online Courses & Resources:
IBM Qiskit: IBM Qiskit Textbook:Hands-on, beginner-friendly curriculum for quantum programming
Coursera:*Quantum Mechanics for Scientists and Engineers* by Stanford (Leonard Susskind)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS102 MATHEMATICAL FOUNDATIONS FOR QUANTUM COMPUTING

	L	T	P	C
Pre-requisite: None	3	0	0	3

Course Description:

This course covers the mathematical tools required for quantum computing. It focuses on linear algebra, complex vector spaces, eigenvalues, and probability theory in quantum systems. Students gain skills to model quantum states and analyze measurements. These foundations prepare them for understanding quantum algorithms.

Course Objectives:

1. Cover linear algebra & complex vector spaces.
2. Model quantum states mathematically.
3. Apply probability theory to measurements.
4. Study eigenvalues and transformations.
5. Prepare for algorithm analysis with rigor.

UNIT I FOUNDATIONS OF COMPLEX VECTOR SPACES 9 hours

Complex Numbers: Polar form, Euler's formula, Vectors in $\mathbb{C}^n$, Inner Product Spaces, Dirac Notation (Bra-Ket), Hilbert Space: Definitions and Properties, Orthogonality and Completeness, Norms, Metrics, and Distance in Complex Spaces.

UNIT II MATRIX ALGEBRA AND OPERATORS 9 hours

Matrix Multiplication and Linear Transformations, Special Matrices: Identity, Diagonal, Unitary, Tensor Products of Matrices and Vectors, Kronecker Product Applications, Unitary and Invertible Operators, Quantum Gates as Linear Operators.

UNIT III EIGEN CONCEPTS AND QUANTUM OBSERVABLES 9 hours

Eigenvalues and Eigenvectors, Hermitian Operators and Spectral Theorem, Quantum Observables and Expectation Values, Commutators and Compatibility, Measurement Operators and Matrix Diagonalization, Applications in Quantum Gate Analysis.

UNIT IV QUANTUM MEASUREMENT & PROBABILITY 9 hours

Basics of Probability Theory in Quantum Systems, Born's Rule and Measurement Probabilities, Projection Postulate, Density Matrix Formalism, Mixed States and Pure States, Trace, Partial Trace, and Operator Sums.

UNIT V ADVANCED STRUCTURES IN QUANTUM MATH 9 hours

Group Theory Basics: Symmetry, Permutations, Pauli Group, Clifford Group, and their roles, Fourier Transform in Quantum Context, Gram-Schmidt Orthogonalization, Lie Groups and Lie Algebras, Use of Lie Algebra in Hamiltonian Formulation.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain concepts of quantum mechanics
CO2: Illustrate quantum gates/circuits
CO3: Analyze algorithms (e.g., Shor, Grover)
CO4: Evaluate communication protocols
CO5: Develop quantum programs on IBM Q

Textbooks:

1. **Nielsen & Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. **Brian C. Hall** – *Quantum Theory for Mathematicians*, Springer
3. **T.S. Blyth & E.F. Robertson** – *Basic Linear Algebra*, Springer

Reference Books:

1. **Roman S.** – *Advanced Linear Algebra*, Springer
2. **Axler, Sheldon** – *Linear Algebra Done Right*, Springer
3. **Shankar, R.** – *Principles of Quantum Mechanics*, Springer
4. **W. Greiner** – *Quantum Mechanics: An Introduction*, Springer

Online Courses & Resources:
MIT OpenCourseWare:*Linear Algebra (Gilbert Strang):*Link
edX:*Mathematics for Quantum Computing* by TUDelft:Link
Khan Academy:*Linear Algebra*, *Probability & Statistics:*Link
Quantum Country:*Spaced Repetition & Essays on Quantum Math:*Link

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS201 QUANTUM PROGRAMMING AND SIMULATION LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisties: None

Course Description:

This lab provides hands-on experience with quantum algorithms. Students implement and simulate algorithms such as Deutsch-Jozsa, Grover's search, Shor's algorithm, and teleportation. Both simulation and real hardware platforms are used. The focus is on practical understanding and experimentation.

Course Objectives:

1. To train students in programming quantum circuits using Qiskit, Q#, and related tools.
2. To explore advanced quantum simulations for teleportation, QFT, and hybrid models.
3. To develop practical skills in debugging and optimizing quantum programs.
4. To expose learners to both simulated environments and real quantum devices.
5. To motivate students through project-based learning in quantum applications.

List of Experiments:

1. State Vector Simulation (Qiskit)
2. Bell State Implementation
3. Deutsch-Jozsa Circuit
4. Grover's Search in Qiskit
5. QFT Circuit in Python
6. Shor Algorithm Simulation
7. Quantum Teleportation in Code
8. VQE (Hybrid Circuit)
9. QAOA Simulation
10. Quantum Random Number Generator
11. Comparison: Real vs Simulated Runs
12. Mini-Project: Quantum Password Cracker

Course Outcomes:

CO1: Ability to program and simulate quantum algorithms effectively.
CO2: Proficiency in using platforms like IBM Qiskit and Microsoft Q# for experimentation.
CO3: Understanding of differences between simulated and real hardware execution.
CO4: Skills to implement hybrid quantum-classical solutions such as VQE and QAOA.
CO5: Experience in developing a mini-project showcasing applied quantum computing.

Reference Books:

1. Michael Nielsen & Isaac Chuang – *Quantum Computation and Quantum Information*
2. Eric R. Johnston et al. – *Programming Quantum Computers*
3. David McMahon – *Quantum Computing Explained*
4. Gilbert Strang – *Introduction to Linear Algebra*
5. Sarah Kaiser & Chris Granade – *Learn Quantum Computing with Python and Q#*

Online Learning Resources/Virtual Labs:
IBM Qiskit Textbook: https://qiskit.org/learn
Microsoft Q# Documentation: https://learn.microsoft.com/en-us/azure/quantum/
Coursera: *Introduction to Quantum Computing*
edX: *Quantum Computing Fundamentals*, *Quantum Algorithms*
Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minors

23MDINS103 QUANTUM ALGORITHMS

	L	T	P	C
Pre-requisite: None	**3**	**0**	**0**	**3**

Course Description:

This course explores the design and analysis of algorithms in the quantum domain. Students study key algorithms like Deutsch, Grover's search, and Shor's factoring, along with Fourier-based methods. The course highlights the speed-up of quantum methods over classical ones. Implementation on real frameworks like Qiskit is emphasized.

Course Objectives:

1. Understand algorithm design principles in the quantum domain.
2. Use mathematical tools such as linear algebra and probability in algorithm analysis.
3. Implement quantum algorithms and compare them with classical equivalents.
4. Study key applications in cryptography, database search, and optimization.

UNIT I MATHEMATICAL TOOLS FOR QUANTUM ALGORITHMS 9 hours

Review of Complex Numbers & Linear Algebra for Quantum Computing, Inner Product Spaces, Hilbert Spaces, Dirac Notation and Interpretations, Quantum State Vectors and Superposition, Overview of Quantum Gates and Operators, Building Block Concepts for Algorithmic Design.

UNIT II SEARCH AND ORACLE-BASED ALGORITHMS 9 hours

Deutsch's Algorithm: Problem and Solution Strategy, **Simon's Algorithm**: Period-finding and Speed-up Over Classical, **Grover's Search Algorithm**: Amplitude Amplification, Oracle Construction in Grover's Algorithm, Circuit Analysis and Complexity Comparison, Limitations and Applications in Database Search.

UNIT III EIGEN CONCEPTS AND QUANTUM OBSERVABLES 9 hours

Eigenvalues and Eigenvectors, Hermitian Operators and Spectral Theorem, Quantum Observables and Expectation Values, Commutators and Compatibility, Measurement Operators and Matrix Diagonalization, Applications in Quantum Gate Analysis.

UNIT IV FOURIER-BASED & CRYPTOGRAPHIC ALGORITHMS 9 hours

Quantum Fourier Transform (QFT): Theory and Circuit, **Phase Estimation Algorithm**: Foundations and Usage, **Shor's Algorithm**: Integer Factorization and Discrete Logarithms, Modular Arithmetic and Period Finding, Cryptographic Implications of Quantum Algorithms, Efficiency Analysis vs Classical RSA Factorization.

UNIT V ADVANCED & HYBRID QUANTUM ALGORITHMS 9 hours

Variational Quantum Eigensolver (VQE), Quantum Approximate Optimization Algorithm (QAOA), Quantum Machine Learning (QML): Classification & Clustering, Hybrid Quantum-Classical Models, IBM Qiskit&Cirq for Implementation, Building Custom Quantum Algorithms for NISQ Devices.

Course Outcomes:

CO1: Understand quantum algorithm building blocks

CO2: Analyze well-known quantum algorithms

CO3: Apply quantum algorithms to application domains

CO4: Evaluate efficiency and complexity of algorithms

CO5: Create and simulate quantum algorithms

Textbooks:

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. **Cristopher Moore & Stephan Mertens** – *The Nature of Computation*, Oxford University Press
3. **Eleanor G. Rieffel& Wolfgang Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press

Reference Books:

1. **Gideon Amir** – *Quantum Algorithms via Linear Algebra*, MIT Press
2. **S. Jordan** – *Quantum Algorithm Zoo*, [Online repository]
3. **T. G. Wong** – *Quantum Algorithm Design Techniques*
4. **Roland, Cerf** – *Quantum Search Algorithms*, Springer

Online Courses & Resources:

edX (MIT)	*Quantum Algorithms for Cybersecurity*	Link
Coursera	*Quantum Computing* by University of London	Link
Qiskit Textbook	*Algorithms & Quantum Machine Learning Modules*	Link
Braket (AWS)	*Quantum Computing Developer Tools & Tutorials*	Link

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS104 QUANTUM INFORMATION AND COMMUNICATION

	L	T	P	C
Pre-requisite:	**3**	**0**	**0**	**3**

Course Description:

This course introduces quantum information theory and its role in communication. Topics include entropy, fidelity, quantum teleportation, and quantum key distribution. Students analyze security protocols and the challenges of building quantum networks. Practical tools like Qiskit and NetSquid are used for simulation.

Course Objectives:

1. Understand the principles of quantum information theory.
2. Explore quantum entropy, fidelity, and mutual information.
3. Study quantum communication protocols and networks.
4. Analyze quantum key distribution and cryptographic security.
5. Implement protocols like teleportation and superdense coding.

UNIT I QUANTUM INFORMATION BASICS 9 hours

Classical vs Quantum Information, Density matrices and mixed states, Quantum entropy and Shannon entropy, Von Neumann entropy, Quantum data compression.

UNIT II QUANTUM COMMUNICATION PROTOCOLS 9 hours

Quantum teleportation, Superdense coding, Quantum repeaters and communication channels, No-cloning theorem, Quantum channel capacity.

UNIT III FIDELITY, DISTANCE & INFORMATION THEORY 9 hours

Fidelity and trace distance, Quantum mutual information, Holevo bound, Information trade-offs in communication, Channel noise and error modeling.

UNIT IV QUANTUM CRYPTOGRAPHY 9 hours

Principles of quantum cryptography, BB84 and B92 key distribution protocols, Eavesdropping and security analysis, Quantum bit commitment, Post-quantum cryptography relevance.

UNIT V APPLICATIONS & TOOLS 9 hours

Quantum internet: architecture and challenges, Networked quantum systems, Simulation using Qiskit, NetSquid, QuTiP, IBM Q Network and cloud-based setups, Practical implementation of QKD in simulation.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand quantum information concepts

CO2: Apply quantum communication protocols

CO3: Analyze fidelity, entropy, and data transfer limits

CO4: Evaluate quantum cryptographic techniques

CO5: Create and simulate quantum communication models

Textbooks:

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. Mark M. Wilde – *Quantum Information Theory*, Cambridge University Press
3. John Watrous – *The Theory of Quantum Information*, Cambridge University Press

Reference Books:

1. Peter W. Shor – *Foundations of Quantum Computing* (Lecture notes)
2. Charles H. Bennett & Gilles Brassard – *Original Papers on QKD (BB84)*
3. Stephanie Wehner – *Quantum Communication Networks*, arXiv

Online Courses & Resources:

Coursera	*Quantum Cryptography* by University of Geneva	Coursera Link
edX	*Quantum Information Science I* (Harvard/MIT)	edX Course
Qiskit	*Quantum Information Applications in Qiskit Textbook*	Qiskit Info
QuTech	*Quantum Internet Tutorials & Tools*	QuTech

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minors

23MDINS202 QUANTUM ALGORITHMS LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisties: None

Course Descriptions: This lab provides hands-on experience with quantum algorithms. Students implement and simulate algorithms such as Deutsch-Jozsa, Grover's search, Shor's algorithm, and teleportation. Both simulation and real hardware platforms are used. The focus is on practical understanding and experimentation.

Course Objectives:

1. To provide hands-on practice in implementing quantum algorithms.
2. To understand the working of algorithms like Grover's, Shor's, and Deutsch-Jozsa.
3. To strengthen the link between theoretical knowledge and practical applications.
4. To familiarize students with quantum simulators and real hardware platforms.
5. To encourage problem-solving through quantum circuit design.

List of Experiments

1. Deutsch Algorithm
2. Deutsch-Jozsa
3. Grover's Algorithm
4. QFT Visualization
5. Shor's Algorithm
6. QRNG Implementation
7. Bell State Entanglement
8. Bernstein-Vazirani Algorithm
9. Quantum Teleportation
10. Phase Estimation
11. Circuit Simulation
12. Mini-Project: RSA Key Breaking

Course Outcomes:

CO1: Ability to design and implement basic quantum algorithms.
CO2: Skill to simulate and test quantum circuits using software tools.
CO3: Competence in analyzing the performance of algorithms on quantum platforms.
CO4: Capability to compare classical vs quantum approaches for given problems.
CO5: Practical experience in applying algorithms to real-world inspired use cases.

Reference Books:

1. Michael A. Nielsen & Isaac L. Chuang – *Quantum Computation and Quantum Information*, Cambridge University Press.
2. Eleanor G. Rieffel & Wolfgang Polak – *Quantum Computing: A Gentle Introduction*, MIT Press.
3. David McMahon – *Quantum Computing Explained*, Wiley.

Online Learning Resources/Virtual Labs:

IBM Qiskit Textbook – https://qiskit.org/learn
Coursera – *Introduction to Quantum Computing* (University of Toronto / University of London).
edX – *Quantum Computing Fundamentals and Quantum Algorithms* (MIT / Delft).

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minors

23MDINS105 QUANTUM MACHINE LEARNING (QML)

	L	T	P	C
Pre-requisite: Nil	**3**	**0**	**0**	**3**

Course Description:

This course blends quantum computing with machine learning. Students learn quantum data encoding, supervised and unsupervised quantum algorithms, and hybrid models. Case studies such as quantum-enhanced fraud detection and NLP are included. Practical implementation is done using Qiskit and PennyLane.

Course Objectives:

1. Introduce the fundamentals of quantum-enhanced machine learning.
2. Understand quantum data encoding and kernel methods.
3. Explore quantum algorithms for supervised and unsupervised learning.
4. Analyze hybrid quantum-classical architectures.
5. Implement QML models using frameworks like Qiskit and PennyLane.

UNIT I INTRODUCTION TO QML **9 hours**

Need for QML: Why quantum for ML?,Classical vs quantum machine learning, Quantum states as information carriers, Data encoding: amplitude, angle, basis encoding, Introduction to quantum feature space.

UNIT II QML ALGORITHMS – SUPERVISED LEARNING **9 hours**

Quantum classifiers (quantum SVMs, qNN), Quantum perceptron, Variational quantum classifiers (VQC), Quantum kernels, Cost functions in quantum models.

UNIT III QML ALGORITHMS – UNSUPERVISED LEARNING **9 hours**

Quantum k-means and clustering, Quantum PCA, Quantum generative models (QGANs), Dimensionality reduction and similarity metrics, Performance analysis and limitations.

UNIT IV HYBRID MODELS & OPTIMIZATION **9 hours**

Variational Quantum Circuits (VQCs), Hybrid quantum-classical training loops, Barren plateaus and optimization issues, Quantum gradient descent and parameter shift rule, Comparative study of classical and QML models.

UNIT V QML TOOLS AND CASE STUDIES **9 hours**

Implementing QML with Qiskit Machine Learning, PennyLane and TensorFlow Quantum integration, Case studies: quantum-enhanced fraud detection, NLP, Quantum datasets and benchmark models, Project: design a small QML application.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand foundations of quantum machine learning

CO2: Apply QML algorithms to datasets

CO3: Analyze quantum kernels, data encoding, and models

CO4; Evaluate hybrid quantum-classical models

CO5: Create and simulate QML models using frameworks

Textbooks:

1. Maria Schuld, Francesco Petruccione – *Machine Learning with Quantum Computers*, Springer
2. Peter Wittek – *Quantum Machine Learning: What Quantum Computing Means to Data Mining*, Academic Press

Reference Books:

1. Jacob Biamonte – *Quantum Machine Learning*, Nature, 2017
2. Seth Lloyd – *Quantum algorithms for supervised/unsupervised learning* (Research papers)
3. VojtěchHavlíček – *Supervised Learning with Quantum-Enhanced Feature Spaces*, Nature, 2019

Online Courses & Resources:

edX	*Quantum Machine Learning* by UTS	edX Course
Qiskit	*Qiskit Machine Learning Module*	Qiskit ML
Xanadu	*QML with PennyLane (Free online textbook)*	PennyLane QML Book
Coursera	*Quantum Machine Learning* by University of Toronto	Coursera

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor in Quantum Technology

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Minor

23MDINS106 FOUNDATIONS OF QUANTUM TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course introduces the fundamental principles of quantum mechanics and their application in quantum information science. It covers the mathematical foundations, including linear algebra and complex vector spaces, to describe quantum states and operators. Key topics include superposition, measurement, entanglement, and quantum dynamics, along with the probabilistic nature of quantum systems. The course also explores practical aspects of quantum technologies, such as qubits, quantum logic gates, decoherence, and basic quantum circuit modeling using simulation tools. By the end, students will gain both theoretical understanding and foundational skills for working with quantum systems and emerging quantum technologies.

Course Objectives:

1. Introduce the fundamental quantum mechanics concepts essential for quantum technologies.
2. Build strong mathematical foundations for quantum state modeling.
3. Develop understanding of superposition, entanglement, and measurement.
4. Explain the physical principles behind quantum devices.
5. Prepare students for advanced studies in quantum computation, communication, sensing, and materials.

UNIT I: QUANTUM MECHANICS FOUNDATIONS **9 hours**

Classical vs Quantum systems, Wave-particle duality, Schrödinger equation (Time-dependent and Time-independent), Postulates of Quantum Mechanics, Quantum states and state vectors, Complex Hilbert spaces, Dirac notation (Bra-Ket notation), Probabilistic interpretation of quantum mechanics.

UNIT II: LINEAR ALGEBRA FOR QUANTUM SYSTEMS **9 hours**

Complex vector spaces and inner products, Orthonormal basis and orthogonality, Linear operators and transformations, Unitary operators and Hermitian operators, Tensor products for multi-qubit

systems, Eigenvalues and Eigenvectors, Commutators and anti-commutators, Representing quantum states with matrices.

UNIT III: SUPERPOSITION, MEASUREMENT, AND ENTANGLEMENT 9 hours

Principle of superposition, Measurement postulate, Probability amplitudes and Born rule, State collapse upon measurement, Entanglement and Bell states, EPR paradox and non-locality, Density matrices and mixed states, Quantum decoherence.

UNIT IV: OPERATORS AND QUANTUM DYNAMICS 9 hours

Time evolution operators, Hamiltonian and energy eigenstates, Quantum harmonic oscillator (brief overview), Unitary evolution and Schrödinger equation solutions, Quantum tunnelling, Adiabatic theorem basics, Operator algebra in quantum systems, Expectation values and observables.

UNIT V: QUANTUM TECHNOLOGIES BUILDING BLOCKS 9 hours

Basic qubit systems (spin-1/2, photon polarization, superconducting qubits), Two-level quantum systems modelling, Bloch sphere representation, Quantum logic gates fundamentals, Multi-qubit systems: controlled operations, Introduction to decoherence and quantum error correction, Quantum technologies: hardware platforms overview, Basic quantum circuit modeling using simulators (Qiskit or Q# demo examples).

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand postulates of quantum mechanics for quantum technologies

CO2: Apply linear algebra and Dirac notation to quantum state analysis

CO3: Analyze superposition, entanglement, and measurement processes

CO4: Evaluate quantum systems through operators and probability amplitudes

CO5: Create mathematical models for simple quantum systems

Textbooks:

1. Michael A. Nielsen & Isaac L. Chuang – Quantum Computation and Quantum Information

2. N. David Mermin – Quantum Computer Science: An Introduction

3. David McMahon – Quantum Computing Explained (Wiley)

Reference Books

1. Griffiths, D. – Introduction to Quantum Mechanics
2. Sakurai, J.J. – Modern Quantum Mechanics
3. ohnWatrous – The Theory of Quantum Information
4. V.K. Krishnan – Linear Algebra and its Applications to Quantum Computing

Online Courses & Resources

Platform	**Course Title**
MIT OpenCourseWare	Quantum Physics I, II (MIT OCW 8.04 & 8.05)
edX (Berkeley)	Quantum Mechanics and Quantum Computation

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS107 SOLID STATE PHYSICS FOR QUANTUM TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides a comprehensive understanding of the fundamental materials science and physics concepts essential for quantum technologies. It covers crystal structures, electronic properties, and semiconductor physics relevant to quantum devices, including quantum wells, dots, and superconductors. Students will explore quantum confinement in low-dimensional systems, lattice vibrations, phonon interactions, and their impact on qubit performance. The course also examines advanced materials for quantum technologies, such as topological insulators, NV centers, and photonic crystals, along with fabrication challenges and design strategies for achieving long coherence times.

Course Objectives:

1. Understand fundamental solid-state physics principles relevant to quantum technologies.
2. Study the electronic properties of materials used in quantum hardware.
3. Explore quantum confinement and nanostructures for qubit implementation.
4. Analyze crystal structures, band theory, and defects influencing quantum devices.
5. Build foundations for material selection and engineering for quantum systems.

UNIT I: CRYSTAL STRUCTURE AND ELECTRONIC PROPERTIES 9 hours

Crystal lattices and unit cells, Bravais lattices, Miller indices, Reciprocal lattice and Brillouin zones, Atomic bonding in solids (covalent, ionic, metallic, van der Waals), X-ray diffraction and crystal structure determination, Electronic structure of solids, Free electron theory, Energy bands: metals, semiconductors, and insulators.

UNIT II: SEMICONDUCTOR PHYSICS FOR QUANTUM DEVICES 9 hours

Intrinsic and extrinsic semiconductors, Charge carriers: electrons, holes, effective mass, Carrier concentration and Fermi level, p-n junctions and semiconductor heterostructures, Quantum wells and quantum dots as qubits, Superconductors and Josephson junctions,

Semiconductor fabrication basics, Materials for quantum hardware: Si, GaAs, diamond NV centers, topological insulators.

UNIT III: QUANTUM CONFINEMENT AND LOW-DIMENSIONAL SYSTEMS 9 hours

Quantum size effects: nanowires, nanotubes, 2D materials, Quantum dots: discrete energy levels, Quantum Hall effect, Topological quantum materials, Spintronics and spin qubits, Quantum confinement in superconducting qubits, Heterostructure-based quantum devices, Valleytronics and emerging 2D materials (MoS_2 , graphene).

UNIT IV: LATTICE VIBRATIONS AND PHONON INTERACTIONS 9 hours

Lattice vibrations and phonons, Heat capacity and thermal conductivity of solids, Electron-phonon interaction, Decoherence in solid-state qubits due to phonons, Magnetic impurities and Kondo effect, Defects and dislocations in crystals, Dopants and quantum impurity systems, Nuclear spin environments and coherence times.

UNIT V: MATERIALS FOR QUANTUM TECHNOLOGIES 9 hours

Material engineering for superconducting qubits, NV centers in diamond for quantum sensing, Topological materials for robust qubits, Photonic crystal materials for optical qubits, Hybrid quantum systems: coupling different materials, Fabrication challenges and material purity, Advances in quantum materials research, Designing material systems for long coherence time.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand crystal structures and band theory

CO2: Apply knowledge of semiconductors, insulators, and conductors in quantum materials

CO3: Analyze quantum confinement effects and low-dimensional systems

CO4: Evaluate defects, phonons, and interactions in solid-state systems

CO5: Create models for quantum device material systems

Textbooks:

1. Charles Kittel – Introduction to Solid State Physics
2. Michael A. Nielsen & Isaac Chuang – Quantum Computation and Quantum Information
3. Simon L. Altmann – Band Theory of Solids

Reference Books

1. Ashcroft &Mermin – Solid State Physics
2. Yu & Cardona – Fundamentals of Semiconductors: Physics and Materials Properties
3. David Awschalom – Semiconductor Spintronics and Quantum Computation
4. Dieter Vollhardt – Introduction to the Theory of Many-Body Systems

Online Courses & Resources

Platform	**Course Title**
MIT OpenCourseWare	Solid State Physics (MIT 8.231)
edX	Quantum Materials and Devices (U. Tokyo)
Coursera	Quantum Materials (ÉcolePolytechnique)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS203 QUANTUM DEVICES AND MATERIALS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Nil

Course Objectives:

1. Simulate quantum devices and materials behavior.
2. Explore quantum optics and solid-state quantum systems.
3. Model quantum dots, superconductors, and photonic devices.
4. Perform quantum simulation of condensed matter systems.
5. Build foundational skills for quantum hardware understanding.

List of Experiments (12 Experiments)

1. Simulation of Single-Qubit Optical Devices
2. Modeling Quantum Dots and Energy Level Transitions
3. Simulation of Two-Level Atom and Rabi Oscillations
4. Quantum Harmonic Oscillator: Energy Levels Visualization
5. Spin-1/2 Systems and Magnetic Resonance Simulation
6. Superconducting Qubits Circuit Simulation
7. Josephson Junction Modeling for Quantum Circuits
8. Quantum Photonic Interferometer Simulation
9. Simulation of NV Centers in Diamond for Quantum Sensing
10. Solid-State Quantum Materials Simulation (Band Structures)
11. Modeling Quantum Light-Matter Interactions (Jaynes-Cummings Model)

Platforms & Tools:

1. QuTiP (Quantum Toolbox in Python)
2. Qiskit Nature / Qiskit Metal
3. MATLAB Simulink
4. COMSOL Multiphysics (for materials simulation)
5. Silvaco TCAD (for device-level modeling)

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minor

23MDINS108 INTRODUCTION TO QUANTUM COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides a comprehensive introduction to quantum communication principles, technologies, and protocols. It covers the fundamental differences between classical and quantum communication, including quantum entanglement, qubits, and quantum information security. Key topics include Quantum Key Distribution (QKD) protocols, quantum teleportation, and entanglement distribution techniques for secure and long-distance communication. Students will explore quantum networks, quantum internet architecture, and advanced quantum communication applications such as quantum secure direct communication, quantum secret sharing, and post-quantum cryptography. The course also discusses practical implementation challenges, hybrid quantum-classical models, and emerging trends shaping the future of quantum communication.

Course Objectives:

1. Introduce fundamental principles of quantum communication.
2. Study quantum key distribution (QKD) protocols.
3. Analyze quantum teleportation, entanglement swapping, and quantum repeaters.
4. Evaluate quantum security principles and their advantages.
5. Prepare students for designing secure communication protocols for future quantum networks.

UNIT I: INTRODUCTION TO QUANTUM COMMUNICATION 9 hours

Classical communication vs quantum communication, No-cloning theorem and quantum information security, Qubits and qubit transmission channels, Quantum entanglement fundamentals, EPR paradox and Bell's inequalities, Quantum states and measurement, Role of superposition and measurement collapse, Overview of quantum internet and its architecture.

UNIT II: QUANTUM KEY DISTRIBUTION (QKD) PROTOCOLS 9 hours

Classical cryptography limitations, BB84 protocol, B92 protocol, E91 entanglement-based protocol, Decoy-state QKD, Device-independent QKD, Practical implementation challenges in QKD, Experimental QKD systems (fiber, free-space, satellites).

UNIT III: QUANTUM TELEPORTATION AND ENTANGLEMENT DISTRIBUTION **9 hours**

Quantum teleportation protocol, Entanglement swapping, Quantum repeaters for long-distance communication, Error sources in quantum teleportation, Resource requirements for teleportation, Entanglement purification techniques, Bell state measurements, Applications of teleportation in distributed quantum computing.

UNIT IV: QUANTUM NETWORKS AND QUANTUM INTERNET **9 hours**

Architecture of quantum networks, Quantum routers and switching, Quantum memories and storage nodes, Distributed entanglement generation and management, Multiparty quantum communication Blind quantum computing, Performance metrics for quantum networks (fidelity, key rate), Challenges in large-scale quantum network deployment.

UNIT V: ADVANCED QUANTUM COMMUNICATION PROTOCOLS AND APPLICATIONS **9 hours**

Quantum secure direct communication, Quantum digital signatures, Position-based quantum cryptography, Quantum secret sharing, Post-quantum cryptography overview, Quantum cloud communication protocols, Building hybrid quantum-classical communication models, Future directions in quantum communication technology.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand quantum communication concepts

CO2: Apply quantum entanglement to communication protocols

CO3: Analyze QKD protocols and teleportation mechanisms

CO4: Evaluate security of quantum communication

CO5: Design quantum communication networks and protocols

Textbooks:

1 M. Nielsen & I. Chuang – Quantum Computation and Quantum Information

2. Mark M. Wilde – Quantum Information Theory

3. Scarani – Quantum Cryptography: A Primer

Reference Books

1. Vedran Dunjko – Introduction to Quantum Communication and Cryptography
2. Norbert Lütkenhaus – Practical Security in Quantum Key Distribution
3. David McMahon – Quantum Computing Explained
4. Bouwmeester et al. – The Physics of Quantum Information

Online Courses & Resources

Platform	Course Title
edX	Quantum Cryptography (ETH Zurich)
Coursera	Quantum Communication (Delft University of Technology)
MIT	OpenCourseWare Quantum Information Science (MIT 6.443)
YouTube	Quantum Internet & Quantum Networking Tutorials
IBM Qiskit	Qiskit tutorials on quantum teleportation and QKD

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS109 INTRODUCTION TO QUANTUM SENSING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides a comprehensive introduction to the principles and technologies of quantum sensing and metrology, highlighting how quantum phenomena such as superposition, entanglement, and squeezing enable precision measurements beyond classical limits. Students will explore fundamental concepts like the Standard Quantum Limit, Heisenberg limit, and quantum phase estimation, along with key measurement techniques including quantum interferometry, atomic clocks, magnetometry, and quantum imaging. The course also covers noise sources, decoherence, and error mitigation strategies, and examines cutting-edge applications in navigation, medical imaging, environmental monitoring, and space-based sensing. By the end, learners will gain both theoretical understanding and practical insight into the design and operation of advanced quantum sensor systems.

Course Objectives:

1. Introduce the principles of quantum sensing and metrology.
2. Explain how quantum superposition and entanglement enhance measurement sensitivity.
3. Study applications of quantum sensors across multiple domains.
4. Analyze noise, decoherence, and quantum limits on measurement.
5. Prepare students to design and analyze quantum-enhanced sensors.

UNIT I: INTRODUCTION TO QUANTUM SENSING AND METROLOGY 9 hours

Classical vs quantum sensing, Precision limits: Standard Quantum Limit (SQL), Quantum metrology fundamentals, Heisenberg limit, Quantum phase estimation for precision measurements, Quantum non-demolition measurements, Quantum error correction in sensing, Importance of coherence and entanglement in sensors.

UNIT II: QUANTUM MEASUREMENT PRINCIPLES **9 hours**

Superposition and interference in measurement, Quantum Fisher information, Squeezed states for noise reduction, Photon counting and single-photon detectors, Spin-based measurements (NV centers, trapped ions), Ramsey interferometry, Quantum state tomography, Applications of quantum-enhanced interferometry.

UNIT III: QUANTUM SENSOR TECHNOLOGIES **9 hours**

Atomic clocks (optical & microwave), Gravimeters and accelerometers, Magnetometers (SQUIDs, NV centers), Quantum gyroscopes, Quantum imaging & super-resolution microscopy, Quantum lidar and radar, Force and electric field sensing, Photonic quantum sensing systems.

UNIT IV: DECOHERENCE, NOISE, AND ERROR MITIGATION IN QUANTUM SENSING **9 hours**

Sources of decoherence in quantum sensors, Thermal noise and quantum noise sources, Quantum back-action, Squeezing and noise reduction techniques, Dynamical decoupling techniques, Noise spectroscopy for sensor calibration, Robust error mitigation protocols, Evaluating sensitivity vs noise tradeoffs.

UNIT V: ADVANCED APPLICATIONS AND FUTURE QUANTUM SENSING SYSTEMS **9 hours**

Quantum sensing for biological and medical imaging, Navigation and positioning without GPS, Quantum-enhanced gravitational wave detection (LIGO), Quantum-enhanced environmental monitoring, Sensors for national defense and security, Space-based quantum sensors, Integrated quantum photonic sensing platforms, Design of hybrid quantum-classical sensor systems.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand the basic principles of quantum sensing

CO2: Apply quantum superposition and entanglement to sensing

CO3: Analyze quantum sensor architectures

CO4: Evaluate sensitivity and error limits in quantum measurements

CO5: Design quantum sensing systems for real-world applications

Textbooks:

1. Christian L. Degen, F. Reinhard, P. Cappellaro – Quantum Sensing
2. Giovannetti, Lloyd &Maccone – Advances in Quantum Metrology
3. David Budker& Derek F. Jackson Kimball – Optical Magnetometry

Reference Books

1. Kurt Jacobs – Quantum Measurement Theory and its Applications
2. Helmut Rauch – Neutron Interferometry
3. M. O. Scully & M. S. Zubairy – Quantum Optics (Chapters on Metrology)
4. VlatkoVedral – Introduction to Quantum Information Science

Online Courses & Resources

Platform	**Course Title**
edX	Quantum Sensing & Metrology (LMU Munich)
Coursera	Quantum Optics and Sensing (University of Colorado Boulder)
MIT OpenCourseWare	Quantum Measurement and Sensing (MIT)
YouTube	Quantum Sensing Lectures
IBM Qiskit	Tutorials on Quantum Phase Estimation

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Minor

23MDINS204 QUANTUM COMMUNICATION AND SENSING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Nil

Course Objectives:

1. Simulate and analyze quantum communication protocols.
2. Implement quantum key distribution (QKD) and teleportation.
3. Perform quantum sensing simulations for precision measurements.
4. Evaluate sensor performance with noise and decoherence.
5. Gain hands-on experience with quantum simulation tools.

List of Experiments (12 Experiments)

1. Simulation of Qubits and Bloch Sphere Visualization
2. Implementation of BB84 Quantum Key Distribution Protocol
3. Simulation of B92 and E91 QKD Protocols
4. Quantum Entanglement Generation and Bell Inequality Testing
5. Quantum Teleportation Protocol using Qiskit/Cirq
6. Simulation of Quantum Repeaters and Entanglement Swapping
7. Noise and DecoherenceModeling in Quantum Communication Channels
8. Ramsey Interferometry Simulation for Quantum Sensing
9. Implementation of NV CenterMagnetometry Simulation
10. Quantum Gravimeter and Accelerometer Simulation
11. Quantum Phase Estimation for High-Precision Metrology

Platforms & Tools:

1. IBM Qiskit
2. Google Cirq
3. RigettiPyQuil
4. Quantum Inspire
5. MATLAB / Python with quantum libraries

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination.

Minor

23MDINS110 QUANTUM OPTICS PREREQUISITES FOR QUANTUM TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course introduces the fundamental principles and applications of quantum optics and photonics. It covers the classical and quantum description of light, electromagnetic field quantization, and light–matter interactions. Topics include coherence theory, quantum noise, and advanced phenomena such as photon antibunching, squeezing, and cavity-QED. The course also explores emerging quantum photonics technologies, including single-photon sources, entangled photon generation, quantum key distribution, and quantum metrology, preparing students for research and experimentation in modern quantum optics.

Course Objectives:

1. Introduce fundamentals of light-matter interaction relevant for quantum technologies.
2. Explain the quantization of electromagnetic fields.
3. Study the role of photons as quantum information carriers.
4. Explore coherent states, squeezed states, and single-photon sources.
5. Prepare for quantum sensing, communication, and photonic quantum computing applications.

UNIT I: CLASSICAL AND QUANTUM DESCRIPTION OF LIGHT **9 hours**

Review of electromagnetic waves, Maxwell‘s equations for light propagation, Plane waves, polarization, Poynting vector, Classical interference, diffraction, coherence, Blackbody radiation & Planck's hypothesis, Photoelectric effect, Photons as quantized light energy, Introduction to quantum theory of radiation.

UNIT II: QUANTIZATION OF ELECTROMAGNETIC FIELD **9 hours**

Harmonic oscillator quantization, Field quantization in free space, Photon number (Fock) states, Coherent states and classical-quantum correspondence, Vacuum fluctuations and zero-point energy, Single-mode vs multi-mode quantization, Spontaneous and stimulated emission, Quantum field operators and commutation relations.

UNIT III: LIGHT-MATTER INTERACTION **9 hours**

Two-level atom model, Absorption, stimulated emission, spontaneous emission, Einstein coefficients, Rabi oscillations, Jaynes-Cummings model, Resonant and non-resonant interaction, Cavity Quantum Electrodynamics (Cavity-QED), Atom-photon entanglement.

UNIT IV: QUANTUM COHERENCE AND QUANTUM NOISE **9 hours**

Classical vs quantum coherence, First- and second-order coherence functions, Photon antibunching, Hanbury Brown and Twiss experiment, Quantum squeezing of light, Phase-sensitive amplification, Quantum noise, shot noise, and standard quantum limit, Quantum nondemolition measurements.

UNIT V: QUANTUM PHOTONICS APPLICATIONS **9 hours**

Single-photon sources (quantum dots, NV centers, SPDC), Entangled photon pair generation, Photonic qubits and linear optical quantum computing, Quantum key distribution with photons, Photonic integrated circuits, Quantum sensors based on squeezed light, Quantum metrology using entangled photons, Designing experiments for quantum optics labs.

Course Outcomes:

On successful completion of the course, the student will be able to:

CO1: Understand quantum nature of light

CO2: Apply Maxwell‘s equations to optical fields

CO3: Analyze interaction of photons with matter

CO4: Evaluate coherence, squeezing, and quantum noise

CO5: Create models for photonic quantum systems

Textbooks:

1 Mark Fox – Quantum Optics: An Introduction

2. Rodney Loudon – The Quantum Theory of Light

3. M. O. Scully & M. S. Zubairy – Quantum Optics

Reference Books

1. Stephen Barnett – Quantum Information
2. Peter Meystre – Elements of Quantum Optics
3. Michel Le Bellac – Quantum Physics
4. D. F. Walls & G. J. Milburn – Quantum Optics

Online Courses & Resources

Platform	Course Title
MIT OpenCourseWare	Quantum Optics (MIT 8.421)
edX	Principles of Photonics (EPFL)
Coursera	Quantum Optics 1 & 2 (U. Rochester)
YouTube	Quantum Optics Lectures (Various universities)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Honors in Civil Engineering

Honors

23HDCE101 SOIL DYNAMICS AND MACHINE FOUNDATION

L	T	P	C
3	0	0	3

Pre-requisite: **23MAT101, 23MAT102, 23CE101, 23CE103**

Course Description:

This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes and elevations.

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the fundamental concepts of engineering seismology, including earthquake phenomena, seismic waves, and measuring instruments.
2. Analyze the principles of structural vibrations, degrees of freedom, and dynamic response of structures to earthquake ground motions.
3. Evaluate conceptual design strategies, seismic design principles, and methods for improving earthquake resistance in structures.
4. Apply earthquake-resistant design principles to reinforced concrete and masonry buildings using IS codes and lateral force methods.
5. Assess the role of structural walls, non-structural elements, and ductility considerations in enhancing earthquake resistance.

UNIT – I **9 hours**

Engineering Seismology: Earthquake Phenomenon - Cause of Earthquakes-Faults- Plate Tectonics-Seismic Waves- Terms Associated With Earthquakes-Magnitude/Intensity of An Earthquake-Scales-Energy Released-Earthquake Measuring Instruments Seismogram - Seismoscope, Seismograph, -Strong Ground Motions- Seismic Zones of India.

Theory of Vibrations: Elements of A Vibratory System- Degrees of Freedom-Continuous System-Lumped Mass Idealization-Oscillatory Motion-Simple Harmonic Motion-Free Vibration of Single Degree of Freedom (SDOF) System- Undamped and Damped-Critical Damping-Logarithmic Decrement-Forced Vibrations-Harmonic Excitation-Dynamic Magnification Factor-Excitation By Rigid Based Translation for SDOF System-Earthquake Ground Motion.

UNIT – II **9 hours**

Conceptual Design: Introduction-Functional Planning-Continuous Load Path-Overall form-Simplicity and Symmetry-Elongated Shapes-Stiffness and Strength-Horizontal and Vertical Members-Twisting of Buildings-Ductility-Ductility Relationships-Flexible Buildings- Framing Systems-Choice of Construction Materials-Unconfined Concrete-Confined Concrete-Masonry-Reinforcing Steel.

Introduction to Earthquake Resistant Design: Seismic Design Requirements-Regular and Irregular Configurations-Basic Assumptions-Design Earthquake Loads-Basic Load Combinations-Permissible Stresses-Seismic Methods of Analysis-Factorsin Seismic Analysis-Equivalent Lateral force Method.

UNIT – III **9 hours**

Reinforced Concrete Buildings: Principles of Earthquake Resistant Deign of RC Members- Structural Models for Frame Buildings - Seismic Methods of Analysis- Is Code Based Methods for Seismic Design - Vertical Irregularities - Plan Configuration Problems- Lateral Load Resisting Systems-Determination of Design Lateral forces as Per Is 1893 (Part-1):2016- Equivalent Lateral force Procedure- Lateral Distribution of Base Shear.

UNIT – IV **9 hours**

Masonry Buildings: Introduction- Elastic Properties of Masonry Assemblage- Categories of Masonry Buildings- Behaviour of Unreinforced and Reinforced Masonry Walls- Behavior of Walls- Box Action and Bands- Behaviour of Infill Walls- Improving Seismic Behaviour of Masonry Buildings- Load Combinations and Permissible Stresses- Seismic Design Requirements- Lateral Load Analysis of Masonry Buildings.

UNIT – V **9 hours**

Structural Walls and Non-Structural Elements: Strategies in The Location of Structural Walls- Sectional Shapes- Variations in Elevation- Cantilever Walls Without Openings – Failure Mechanism of Non-Structures- Effects of Non-Structural Elements On Structural System- Analysis of Non-Structural Elements- Prevention of Non-Structural Damage Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors Affecting Ductility- Ductile Detailing Considerations as Per Is 13920-2016 - Behaviour of Beams, Columns and Joints in RC Buildings During Earthquakes

Textbooks:

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – PankajAgarwal and Manish Shrikhande, PrenticeHall of India Pvt. Ltd

Refrence books:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly,John Wiley & Sons.
2. Eartquake Resistant Design ofBuidling structures by VinodHosur, Wiley India Pvt. Ltd.
3. Elements of Mechanical Vibration by R.N.Iyengar, I.K.International Publishing House Pvt. Ltd.
4. Masory and Timber structures including earthquake Resistant Design –AnandS.Arya, Nemchand& Bros
5. Earthquake Tips – Learning Earthquake Design and Construction, C.V.R. Murthy
6. BIS Codes: 1. IS 1893(Part-1):2016 or Latest codes;. 2. IS 13920:2016. 3. IS 4326. 4. IS 456:2000 or latest

Online Learning Resources:

https://nptel.ac.in/courses/105107204

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCE102 INDUSTRIAL WASTE AND WASTE WATER MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: 23CHE901, 23CE108

Course Objectives:

The objectives of this course are to:

1. To understand the various sources and characteristics of industrial wastewater and its impacts on natural water bodies and sewer systems.
2. To explain and differentiate primary and preliminary treatment methods for industrial effluents.
3. To illustrate advanced treatment techniques including nutrient and heavy metal removal.
4. To examine and summarize the characteristics and treatment needs of effluents from major industries like sugar, steel, petroleum, textiles, and tanneries.
5. To develop awareness of common effluent treatment plants (CETPs), their design considerations, and operational challenges.

UNIT I **9 hours**

Sources of Pollution - Physical, Chemical, Organic & Biological properties of Industrial Wastes - Difference between industrial & municipal waste waters - Sources and Flow Rates of Municipal Wastewater - Characteristics of Municipal Wastewater - Effects of industrial effluents on sewers and Natural water Bodies.

UNIT II **9 hours**

Pre & Primary Treatment - Equalization, Proportioning, Neutralization, Oil separation by Floating-Waste Reduction-Volume Reduction-Strength Reduction. Waste Treatment Methods - Nitrification and De-Nitrification-Phosphorous removal -Heavy metal removal - Membrane Separation Process - Air Stripping and Absorption Processes - Special Treatment Methods - Disposal of Treated Waste Water.

UNIT III **9 hours**

Manufacturing Process and liquid waste origin, Characteristics and Composition from Textiles, Paper and Pulp industries, Sugar Mills, Tanneries, Dairy and Oil Refineries

UNIT IV **9 hours**

Manufacturing Process and liquid waste origin, Characteristics and Composition from Steel, Pharmaceutical Plants, Petroleum Refineries, Atomic Energy Plants and other Mineral Processing Industries

UNIT V **9 hours**

Joint Treatment of Raw Industries waste water and Domestic Sewage – Common Effluent Treatment Plants (CETP) – Location, Design, Operation and Maintenance Problems – Economical aspects. Development of integrated treatment for wastewater – zero polluting industry concept – Reuse and recycle of wastewater.

Course Outcomes:

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

CO1: Identify sources and characteristics of industrial wastewaters, compare them with municipal wastewaters, and explain their effects on sewers and water bodies.
CO2: Apply suitable preliminary and primary treatment methods such as equalization, neutralization, and oil separation.
CO3: Analyse various waste treatment methods like nitrification, phosphorous and heavy metal removal, and evaluate their suitability.
CO4: Assess the composition of industrial effluents and recommend suitable treatment strategies.
CO5: Design components of CETPs and address operational and maintenance problems considering economic aspects.

Textbooks:

1. Rao, M.N. & Dutta, A.K. "Waste Water Treatment", 3rd Edition, IBH Publishers, 2020.
2. Patwardhan-" Industrial Waste Water Treatment"- PHI learning Pvt. Ltd, 2017

Reference Books:

1. Metcalf, L., and Eddy, P. Wastewater Engineering: Treatment and Reuse. 5th Edition, Tata McGraw-Hill, New Delhi, 2013.
2. Arceivala, S. J. and Asolekar, S. R. Wastewater Treatment for Pollution Control. 3rd Edition, Mc.Graw-Hill Education (India) Pvt. Ltd., New Delhi, 2006.
3. Bureau of Indian Standards for analysis of water and wastewater (IS3025)
4. Anil K. De. Environmental Chemistry, New Age International Ltd., New Delhi, 2003
5. Hammer, Mark J. Water and Wastewater Technology, Prentice Hall, New Jersey, 2001

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ce53/preview
2. https://onlinecourses.nptel.ac.in/noc21_ce25/preview

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCE201 NDT LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 23CE106

Course Objectives:

The objectives of this course are to enable the student to:

1. Understand the fundamental principles and significance of non-destructive testing (NDT) in concrete structures.
2. Apply various NDT techniques to evaluate the structural integrity and quality of concrete.
3. Analyze data from NDT methods to detect cracks, voids, rebar position, corrosion, and other defects.
4. Evaluate the durability and in-situ strength characteristics of concrete using advanced testing techniques.
5. Develop competence in interpreting NDT results for effective decision-making in structural health monitoring.

List of Experiments:

1. To assess the surface hardness and compressive strength of concrete by using Rebound Hammer Test
2. To determine the quality, uniformity, and presence of cracks or voids in concrete by Ultrasonic Pulse Velocity Test
3. To evaluate the compressive strength of hardened concrete using probe penetration by Penetration Resistance Test
4. To measure the depth of carbonation in concrete this leads to corrosion of reinforcement by Carbonation Depth Test
5. To assess the corrosion potential of reinforcing steel in concrete by Half-Cell Potential Test
6. To detect reinforcement position, diameter, and concrete cover over rebars by Rebar Locator
7. To detect subsurface features, rebar locations, and voids in concrete structures by Ground Penetrating Radar
8. To monitor crack propagation and damage activity in structural components by Acoustic Emission Technique
9. To extract cores for testing and conduct visual and microscopic analysis of concrete quality.
10. To evaluate thickness, delamination's, and voids in concrete slabs or pavements by Impact Echo Test
11. To measure strain, temperature, or crack growth in structural components using embedded optical fibers.
12. To identify surface-breaking defects in non-porous materials BY Dye Penetrant Testing

Course Outcomes:

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

CO1: Apply Rebound Hammer and Ultrasonic Pulse Velocity tests to assess surface hardness and detect internal concrete defects.
CO2: Analyze corrosion risk and carbonation depth using Half-Cell Potential and Carbonation Depth tests.
CO3: Evaluate compressive strength and integrity of concrete using Penetration Resistance and Impact Echo methods.
CO4: Detect reinforcement layout, cover, and subsurface anomalies using Rebar Locator and Ground Penetrating Radar.
CO5: Interpret results from advanced methods like Acoustic Emission and core testing for structural damage diagnosis.

Textbooks:

1. Highway Material Testing Manual, Khanna, Justo and Veera Raghavan, Nemchand Brothers.

Reference Books:

1. IS 383 :1993 “Specification for Coarse and Fine Aggregates From Natural Sources for Concrete”
2. 1S 1201 -1220 (1978) “Methods for testing tars and bituminous materials”
3. IRC SP 53 -2010 “Guidelines on use of modified bitumen”
4. MS-2 Manual for Marshalls Mix design 2002

Online Learning Resources:

https://ts-nitk.vlabs.ac.in/

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

Honors

23HDCE103 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 23CE106, 23CE107

Course Description:

This course covers practical usage of various surveying instruments for different field measurements like lengths, angles, areas, volumes and elevations.

Course Objectives:

The objectives of this course are to enable the students to:

1. Understand the causes of deterioration and distress in concrete structures and the importance of rehabilitation. (L1)
2. Familiarize with condition/damage assessment and evaluation techniques using NDT and field/lab tests. (L2)
3. Gain knowledge on the selection and application of suitable materials and techniques for concrete repair. (L2)
4. Learn various rehabilitation and retrofitting methods including case studies and demolition techniques. (L3)
5. Understand the importance of protection, maintenance, and structural health monitoring (SHM) for ensuring long-term durability. (L1)

UNIT – I **9 Hours**

Introduction: Deterioration of structures with aging, Need for rehabilitation - Deterioration of concrete structures: Causes of distress Causes of distress in concrete structures, construction and design failures, Distress in concrete due to physical and chemical deterioration. Deterioration due to water leakage, fire – detection & mitigation of the same. Visual deterioration of structures- Types of cracks, causes & characteristics of cracking in various structural components. Measurement of cracks as per IS456 - interpretation of the cause of particular type of crack.

UNIT – II **9 Hours**

Conditional/damage assessment & Evaluation of structures: Condition assessment and distress-diagnostic techniques, Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability by use of NDT equipments

UNIT – III **9 Hours**

Materials for Repair materials - Criteria for durable concrete repair, Methodology, selection of repair materials, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques . Corrosion damage of reinforced concrete - repair and prevention measures - Surface deterioration, Efflorescence, causes, prevention and protection Surface coatings and painting - Water proofing

UNIT – IV **9 Hours**

Rehabilitation methods Retrofitting, RCC Jacketing, Fibre wrapping, Building and restoration of earthquake damaged masonry structure, Method for foundation rehabilitation; Case studies - Demolition techniques : Engineered demolition techniques for Dilapidated structures – case studies.

UNIT – V **9 Hours**

Protection & maintenance of structures - Deterioration due to ageing, inadequate maintenance Facets of Maintenance, importance of Maintenance various aspects of Inspection. Corrosion mitigation techniques to protect the structure from corrosion. Long term health monitoring / Structural health monitoring (SHM)– Definition maintenance of structures and motivation for SHM, Basic components of SHM and its working mechanism.

Course Outcomes

At the end of the course, the student will be able to:

CO1: Identify the causes and types of deterioration in structures and interpret the nature of cracks using IS 456 guidelines. (L1)
CO2: Explain the procedures for condition assessment and damage evaluation using both field and lab-based NDT techniques. (L2)
CO3: Select appropriate repair materials and techniques based on the type and severity of damage in concrete structures. (L3)
CO4: Apply suitable retrofitting and rehabilitation strategies, including engineered demolition methods, with reference to case studies. (L3)
CO5: Analyze the significance of corrosion mitigation, preventive maintenance, and SHM in enhancing the service life of structures. (L4)

Textbooks:

1. B. Bhattacharjee, Concrete Structures-Repair, Rehabilitation and Retrofitting, CBS Publishers and Distributors Pvt Ltd, 2017 .
2. R. Dodge Woodson, Concrete Structures-Protection, Repair and Rehabilitation, Elsevier, 2009

Refrence books:

1. CPWD, Handbook on Repair and Rehabilitation of RCC Buildings, Govt of India Press, New Delhi, 2014.
2. Allen, Harold Roper, and Denison Campbell, Concrete Structures: Materials, Maintenance and Repair, Longman Scientific and Technical, UK, 1st Edition, 1991.
3. R. Dodge Woodson, Concrete Structures: Protection, Repair and Rehabilitation, Elsevier, 1st Edition, 2009.
4. Kenneth and Carper, Forensic Engineering, CRC Press, 1st Edition, 2000
5. W. H. Ranson, Building Failures – Diagnosis and Avoidance, E. & F.N. Spon, 1st Edition, 1981.
6. R. Holland, Appraisal and Repair of Reinforced Concrete, Thomas Telford Ltd., Edition and Year not specified

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc20_ce26/preview

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCE104 DESIGN AND DRAWING OF IRRIGATION STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: **23CE109**

Course Objectives:

1. Impart fundamental knowledge on various irrigation systems, soil moisture concepts, and canal design principles.
2. Provide an understanding of the design aspects of diversion head works and their components.
3. Introduce the functional and structural design of canal structures and cross-drainage works.
4. Develop analytical skills in assessing the design and safety of storage head works, including gravity and earth dams.
5. Explain the importance and design aspects of spillways and energy dissipation arrangements in hydraulic structures.

UNIT I **9 hours**

Irrigation Systems: Types of irrigation systems, Soil moisture, Irrigation water requirements, Irrigation efficiencies, Methods of application of irrigation water, Water logging – Causes and remedial measures - Canal Systems: Types of canals, Principles of design of stable irrigation canals, Silt theories, Tractive force theory, Design of lined canal, Design of longitudinal section.

UNIT II **9 hours**

Design of diversion head works: Types of hydraulic structures, Layout of a diversion head work, Design of vertical drop weir, Silt control in head works

UNIT III **9 hours**

Design of Canal Structures: Canal regulators, Types of canal falls, Design of Sarda type fall, Types of cross drainage works.

UNIT IV **9 hours**

Storage head works: Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam Earth dams: Types of earth dams, Causes of failure of earth dams, Seepage analysis, Seepage control, Stability analysis

UNIT V **9 hours**

Spillways and energy dissipation systems: Types of spillways, Ogee spillway, Principles of energy dissipators

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain the principles and practices of various irrigation systems, soil moisture concepts, irrigation efficiencies, and canal design methods including silt and tractive force theories.

CO2: Describe the components and layout of diversion head works and apply design principles for weirs and silt control systems.

CO3: Design canal structures such as canal regulators, Sarda-type falls, and cross-drainage works for effective water conveyance.

CO4: Analyze the structural stability and seepage characteristics of gravity dams and earth dams using appropriate design considerations.

CO5: Apply the principles of spillway hydraulics and energy dissipation mechanisms in the design of spillway systems.

Textbooks:

1. Modi, P. M., 2000, Irrigation Water Resources and Hydropower Engineering, Standard Book Publishing Company, New Delhi.
Asawa, G. L., 1996, Irrigation Engineering, New Age International Publishing Company, New Delhi

Reference Books:

1. Arora, K. L., 1996, Irrigation Water Resources Engineering, Standard Book Publishing Company, New Delhi.

2. Murthy, C. S. N., 2002, Water Resources Engineering – Principles and Practice, New Age International Publishing Company, New Delhi

3. C. Satyanarayana Murthy, Design of Minor Irrigation and Canal Structures, Wiley Eastern Ltd.,

Online Resources:

1. https://www.udemy.com/course/irrigation-structures/?couponCode=LEARNNOWPLANS

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCE202 STRUCTURAL DESIGN STUDIO LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: **23CE110**

Course Description:

This course covers practical usage of operating the ETABS and SAP2000 interface for modeling structural systems, and to evaluate the design of structural elements such as frames, water tanks, and bridges using SAP2000, and to analyze and interpret the behavior of structural models, including performance-based and nonlinear seismic analysis

Course Objectives:

1. To understand the interface, tools, and modeling environment of ETABS and SAP2000 for structural design. (L2)
2. To develop and analyze multi-storey buildings, shear walls, and frames under various loads using ETABS and SAP2000. (L3)
3. To perform structural modeling, assign loads, and interpret analysis results for real-world building and infrastructure systems. (L4)
4. To evaluate performance-based seismic behavior and nonlinear analysis techniques using advanced structural software. (L5)
5. To design and optimize structural components like water tanks and bridges using advanced modeling tools. (L6)

List of Experiments:

1. Determination of ETABS Interface and Structural Modeling Techniques
2. Analysis of a Multi-Story Building under Lateral Loads in ETABS
3. Development of Structural Analysis for a Shear Wall System in ETABS
4. Application of Performance-Based Seismic Analysis in ETABS
5. Determination of Structural Analysis of a Simple Frame using SAP2000
6. Development of a Bridge Model and Load Analysis in SAP2000
7. Analysis and Design of an Elevated Water Tank using SAP2000
8. Application of Nonlinear Analysis for a Structural System using SAP2000

List of Major Equipment

1. ETABS Software, SAP2000

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1: Understand and operate the ETABS and SAP2000 interface for modeling structural systems. (L2)

CO2: Apply ETABS for analysis of multi-story buildings and shear wall systems under lateral and gravity loads. (L3)

CO3: Analyze and interpret the behavior of structural models, including performance-based and nonlinear seismic analysis. (L4)

CO4: Evaluate the design of structural elements such as frames, water tanks, and bridges using SAP2000. (L5)

CO5: Create detailed structural models and conduct advanced simulations to support safe and economical design decisions. (L6).

Textbook

1. **"Structural Design and Drawing (Concrete and Steel)"***, N. Krishna Raju.*

Online Resources:

https://nptel.ac.in/courses/105105104

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Honors

23HDCE105 ROAD SAFETY ENGINEERING

	L	T	P	C
Pre-requisites: 23CE113	**3**	**0**	**0**	**3**

Course Description: The course provides a comprehensive understanding of traffic safety principles, focusing on accident causation, statistical analysis of crash data, and the development of effective safety management systems. It covers key aspects such as human, vehicle, and roadway factors influencing safety, methods for identifying hazardous locations, and techniques for crash investigation and analysis. The course also emphasizes road safety audits, policy frameworks, and practical mitigation measures including geometric design improvements, traffic control strategies, and urban safety interventions. By integrating analytical, engineering, and policy perspectives, the course prepares students to design and implement safer transportation systems.

Course Objectives:

1. To understand the fundamental concepts of road safety, including accident trends, causation factors, and the role of human, vehicle and roadway characteristics.
2. To develop the ability to collect, analyze, and interpret crash data using statistical and analytical methods.
3. To equip students with knowledge of road safety management systems and strategies for improving traffic safety at network and site levels.
4. To train students in conducting road safety audits and identifying hazardous locations through systematic investigation techniques.
5. To enable the design and implementation of effective mitigation measures, including engineering, enforcement, and policy-based safety interventions.

UNIT I BASICS OF ROAD SAFETY **9 hours**

Road accidents, Trends, Global and Indian level, Crash Causation, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India

UNIT II STATISTICAL INTERPRETATION AND ANALYSIS OF CRASH DATA **9 hours**

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Hot spot analysis, Case Studies.

UNIT III ROAD SAFETY MANAGEMENT SYSTEM **9 hours**

Multi-causal dynamic systems approach to safety; Crash Vs. Accident; Road safety improvement strategies; Elements of a road safety plan, Speed management, Safety data Needs; Intersection Safety, Safe vehicle design

UNIT IV ROAD SAFETY AUDITS **9 hours**

Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies

UNIT V MITIGATION MEASURES **9 hours**

Accident prevention by better design of roads, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry, and safety; Design of Forgiving roads and self-explaining roads, Effective Road Signs and Street Lighting, Safety in urban areas; Public transport and safety; Road safety policy-making, Stakeholders involvement; Road safety law.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1: Analyze the effect of user, roadway and environment characteristics on traffic safety.
CO2: Plan and design of road safety improvement programs.
CO3: Evolve safety measures using accident data.
CO4: Conduct road safety audit.
CO5: Interpret accident data using statistical analysis

Textbooks:

1. Observational Before-After Studies in Road Safety, Ezra Hauer, Pergamon Press, 1997 (Reprinted 2002).
2. Traffic Safety, Leonard Evans, Science Serving Society, 2004.
3. Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, Geetam Tiwari, and Dinesh Mohan, CRC Press, 2016, First Edition.

Reference Books:

1. The Handbook of Road Safety Measures, Rune Elvik and TrulsVaa, Elsevier, 2004
2. The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999.
3. Traffic Control and Road Accident Prevention, Popkess C.A, Chapman and Hall, 1997.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.