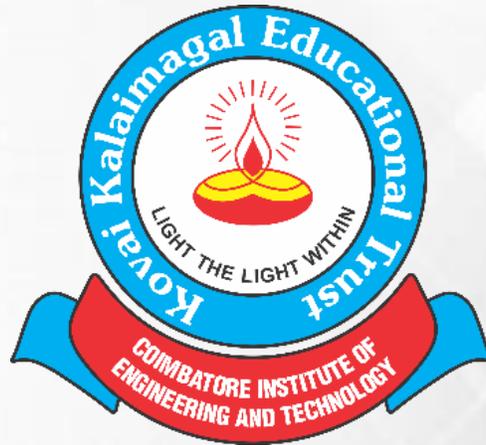




# CIET

## COIMBATORE INSTITUTE OF ENGINEERING AND TECHNOLOGY

Autonomous | Approved by AICTE | Affiliated to Anna University | Accredited by NAAC with "A" Grade



**B.E. CIVIL ENGINEERING**  
**REGULATIONS – 2023**  
**CHOICE BASED CREDIT SYSTEM**  
**CURRICULUM AND SYLLABI**

Vellimalaipattinam, Thondamuthur Via, Narasipuram, Coimbatore - 641 109



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0422-2970703

**COIMBATORE INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**(An Autonomous Institution)**

**B.E CIVIL ENGINEERING**

Regulation 2023

(Students admitted from 2023 - 2024 onwards)

**CHOICE BASED CREDIT SYSTEM**

**VISION AND MISSION OF THE DEPARTMENT**

**Vision**

To emerge as a center for excellence in Civil Engineering through continuous improvement of academic processes, industry interaction and research activities with the involvement of students.

**Mission**

- M1** To enhance the academic processes through  
Classroom learning  
Laboratory learning  
Project works  
Examinations
- M2** To encourage suitable industry interaction through  
Industrial visits  
Trainings  
Projects  
Internships  
Placement
- M3** To carve a niche in the modern world by carrying out research works those are relevant to the society.

**Programme Outcomes (POs):**

- PO1 Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- PO2 Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)



- P03 Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- P04 Conduct Investigation of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- P05 Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- P06 The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- P07 Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- P08 Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- P09 Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- P010 Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- P011 Life-Long Learning:** Recognize the need for, and have the preparation and ability for  
i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)



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### Programme Educational Objectives (PEOs)

The following Programme Educational Objectives are designed based on the department Mission

- PEO1** To develop a program that will lay a strong foundation to pursue higher studies and to play a prominent role as an employee in engineering firms or nurturing their own firms.
- PEO2** To apply state of the art knowledge and skills in areas related to Civil engineering and provide sustainable solutions to persistent problems of society.
- PEO3** To imbibe ethics, pursue lifelong learning and continuously develop managerial skills to emerge as leaders who understand and assume the roles and responsibilities of professional service.

### Program Specific Outcomes (PSOs)

- PSO1** Analyze, design, construct, maintain, and manage civil infrastructure projects, ensuring safety, quality, and sustainability standards.
- PSO2** Assess environmental impacts and adopt measures for sustainable development in civil engineering practices.
- PSO3** Utilize modern software and technologies to provide efficient solutions across various domains of Civil Engineering.

Mapping PEOs, POs & PSOs

PEOs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
PEO1	3	3	2	2	3	-	-	2	2	3	3	3	-	2
PEO2	3	3	3	3	3	3	-	-	-	2	2	3	3	3
PEO3	-	2	2	-	2	2	3	3	3	3	3	-	2	2
Average	3	2.7	2.3	2.5	2.7	2.5	3	2.5	2.5	2.7	2.7	3	2.5	2.3
3 – High, 2 – Medium, 1 – Low, - No correlation														



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SEMESTER I							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
<b>Theory</b>							
1	U23EGT01	Communicative English	3	0	0	3	HS
2	U23MAT01	Linear Algebra and Calculus	3	1	0	4	BS
3	U23PYT02	Applied Physics	3	0	0	3	BS
4	U23CST01	Problem solving and Programming in C	3	0	0	3	ES
5	U23MET02	Engineering Graphics	2	2	0	4	ES
6	U23TAT01	Heritage of Tamils	1	0	0	1	HS
<b>Practical</b>							
7	U23PYP01	Physics Laboratory	0	0	2	1	BS
8	U23CSP01	Problem solving and Programming in C Laboratory	0	0	2	1	ES
9	U23EEP01	Engineering Practices Laboratory	0	0	4	2	ES
<b>Mandatory</b>							
10	U23MTA01	Induction Programme	2	0	0	0	MC
<b>Total Periods: 28</b>			<b>17</b>	<b>3</b>	<b>8</b>	<b>22</b>	
SEMESTER II							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
<b>Theory</b>							
1	U23EGT02	Professional English	3	0	0	3	HS
2	U23MAT02	Transforms and Boundary value problems	3	1	0	4	BS
3	U23CYT02	Applied Chemistry	3	0	0	3	BS
4	U23CST02	Python Programming	3	0	0	3	ES
5	U23ECT03	Basics of Electrical, Electronics and Information Science	3	0	0	3	ES
6	U23TAT02	Tamils and Technology	1	0	0	1	HS
<b>Practical</b>							
7	U23CYP01	Chemistry Laboratory	0	0	2	1	BS
8	U23CSP02	Python Programming Laboratory	0	0	2	1	ES
9	U23MEP01	Computer Aided Drafting Laboratory	0	0	4	2	ES
<b>Total Periods: 25</b>			<b>16</b>	<b>1</b>	<b>8</b>	<b>21</b>	



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SEMESTER III							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
<b>Theory</b>							
1	U23MAT04	Statistics and Numerical Methods	3	1	0	4	BS
2	U23CET01	Construction Materials	3	0	0	3	PC
3	U23MET03	Engineering Mechanics	3	0	0	3	PC
4	U23CET02	Solid Mechanics	3	0	0	3	PC
5	U23CET03	Fluid Mechanics	3	0	0	3	PC
6	U23CET04	Surveying	3	0	0	3	PC
<b>Practical</b>							
7	U23CEP01	Solid Mechanics Laboratory	0	0	4	2	PC
8	U23CEP02	Surveying Laboratory	0	0	4	2	PC
9	U23CEP03	Building Planning and Drawing Laboratory	0	0	4	2	ES
<b>Mandatory Course</b>							
10		Mandatory Course I	2	0	0	0	MC
<b>Total Periods: 33</b>			<b>20</b>	<b>1</b>	<b>12</b>	<b>25</b>	
SEMESTER IV							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
<b>Theory</b>							
1	U23CET05	Strength of Materials	3	0	0	3	PC
2	U23CET06	Applied Hydraulics Engineering	3	0	0	3	PC
3	U23CET07	Soil Mechanics	3	1	0	4	PC
4	U23CET08	Engineering Geology	3	0	0	3	ES
5	U23CET09	Concrete Technology	3	0	0	3	PC
6		Open Elective -I	3	0	0	3	OE
<b>Practical</b>							
7	U23CEP04	Applied Hydraulics Engineering Laboratory	0	0	4	2	PC
8	U23CEP05	Soil Mechanics Laboratory	0	0	4	2	PC
<b>Mandatory Course</b>							
9		Mandatory Course II	2	0	0	0	MC
<b>Total Periods: 29</b>			<b>20</b>	<b>1</b>	<b>8</b>	<b>23</b>	

SEMESTER V							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
<b>Theory</b>							
1	U23CET10	Design of Reinforced Concrete Structural Elements	3	0	0	3	PC
2	U23CET11	Structural Analysis I	3	0	0	3	PC
3	U23CET12	Foundation Engineering	3	1	0	4	PC
4		Professional Elective -I	3	0	0	3	PE
5		Professional Elective -II	3	0	0	3	PE
6		Open Elective -II	3	0	0	3	OE
<b>Practical</b>							
7	U23CEP06	Concrete and Highway Engineering Laboratory	0	0	4	2	PC
<b>Employability Enhancement Course</b>							
8	U23CEI01	Employability Enhancement Training Program	0	0	2	1	EEC
9	U23EGS01	English Expertise and Career Moxie	0	0	2	1	EEC
<b>Total Periods: 27</b>			<b>18</b>	<b>1</b>	<b>8</b>	<b>23</b>	
SEMESTER VI							
S.No.	Course Code	Course Title	Contact Periods /			Credits	Category
			L	T	P		
<b>Theory</b>							
1	U23CET13	Design of Steel Structural Elements	3	0	0	3	PC
2	U23CET14	Structural Analysis II	3	0	0	3	PC
3	U23CET15	Water Supply and Waste Water Engineering	3	0	0	3	PC
4	U23MGT01	Total Quality Management	3	0	0	3	HS
5		Professional Elective -III	3	0	0	3	PE
6		Professional Elective -IV	3	0	0	3	PE
<b>Practical</b>							
7	U23CEP07	Computer Aided Design and Drafting Laboratory	0	0	4	2	ES
8	U23CEP08	Water and Waste Water Engineering Laboratory	0	0	4	2	PC
<b>Total Periods: 27</b>			<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>	



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SEMESTER VII							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
<b>Theory</b>							
1	U23CET16	Quantity Surveying and Estimation	3	1	0	4	PC
2	U23MGT02	Principles of Management	3	0	0	3	HS
3		Professional Elective - V	3	0	0	3	PE
4		Professional Elective - VI	3	0	0	3	PE
<b>Practical</b>							
5	U23CEP09	Computer Aided Structural Analysis Laboratory	0	0	4	2	PC
<b>Employability Enhancement Course</b>							
6	U23CEJ01	Project Work Phase I	0	0	8	4	EEC
7	U23CE001	Internship/In-plant Training	0	0	2	1	EEC
<b>Total Periods: 27</b>			<b>12</b>	<b>1</b>	<b>14</b>	<b>20</b>	
SEMESTER VIII							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
<b>Employability Enhancement Course</b>							
1	U23CEJ02	Project Work Phase II	0	0	16	8	EEC
<b>Total Periods: 16</b>			<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>	

CAT - Category; BS - Basic Science; HS - Humanities and Social Science; ES - Engineering Science; PC - Professional Core; PE - Professional Electives; OE - Open Electives; EEC - Employability Enhancement Course; MT – Mandatory Course



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SUMMARY OF CREDIT DISTRIBUTION										
CAT	Credits /Semester								Total Credits	Percentage of total credits
	I	II	III	IV	V	VI	VII	VIII		
HS	4	4	0	0	0	3	3	0	14	8.54
BS	8	8	4	0	0	0	0	0	20	12.20
ES	10	9	2	3	0	2	0	0	26	15.85
PC	0	0	19	17	12	11	6	0	65	39.63
PE	0	0	0	0	6	6	6	0	18	10.98
OE	0	0	0	3	3	0	0	0	6	3.66
EEC	0	0	0	0	2	0	5	8	15	9.15
MT	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>22</b>	<b>21</b>	<b>25</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>20</b>	<b>8</b>	<b>164</b>	<b>100.00</b>



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**PROFESSIONAL ELECTIVE COURSES – VERTICALS**

VERTICAL -1	VERTICAL -2	VERTICAL -3	VERTICAL -4	VERTICAL -5	VERTICAL -6
<b>Structures</b>	<b>Construction Techniques and Practices</b>	<b>Environmental</b>	<b>Geotechnical</b>	<b>Water Resources</b>	<b>Transportation Infrastructure</b>
Concrete Structures	Formwork Engineering	Climate Change Adaptation and Mitigation	Geo-Environmental Engineering	Participatory Water Resources Management	Airports and Harbours
Prefabricated Structures	Construction Equipment and Machinery	Air and Noise Pollution Control Engineering	Ground Improvement Techniques	Groundwater Engineering	Traffic Engineering and Management
Prestressed Concrete Structures	Construction Management and Safety	Environmental Impact Assessment	Soil Dynamics and Machine Foundations	Water Resources Systems Engineering	Urban Planning and Development
Dynamics and Earthquake Resistant Structures	Advanced Construction Techniques	Industrial Wastewater Management	Rock Mechanics	Watershed Conservation and Management	Smart Cities
Introduction to Finite Element Method	Energy Efficient Buildings	Solid and Hazardous Waste Management	Earth and Earth Retaining Structures	Integrated Water Resources Management	Intelligent Transport Systems
Repair and Rehabilitation of Structures	Sustainable Construction and Lean Construction	Environment, Health and Safety	Subsoil Investigation	Urban Water Infrastructure	Pavement Engineering
Pre-Engineered Buildings	Modern Construction Materials	Environmental Policy and Legislations	Tunneling Engineering	Water Quality and Management	Transportation Planning Process



**PROFESSIONAL ELECTIVE COURSES**

<b>VERTICAL -1 Structures</b>							
<b>S.No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Contact Periods / week</b>			<b>Credits</b>	<b>Category</b>
			<b>L</b>	<b>T</b>	<b>P</b>		
1	U23CEV01	Concrete Structures	3	0	0	3	PE
2	U23CEV02	Prefabricated Structures	3	0	0	3	PE
3	U23CEV03	Prestressed Concrete Structures	3	0	0	3	PE
4	U23CEV04	Dynamics and Earthquake Resistant Structures	3	0	0	3	PE
5	U23CEV05	Introduction to Finite Element Method	3	0	0	3	PE
6	U23CEV06	Repair and Rehabilitation of Structures	3	0	0	3	PE
7	U23CEV07	Pre-Engineered Buildings	3	0	0	3	PE

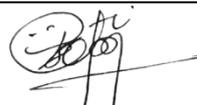
<b>VERTICAL -2 Construction Techniques and Practices</b>							
<b>S.No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Contact Periods / week</b>			<b>Credits</b>	<b>Category</b>
			<b>L</b>	<b>T</b>	<b>P</b>		
1	U23CEV08	Formwork Engineering	3	0	0	3	PE
2	U23CEV09	Construction Equipment and Machinery	3	0	0	3	PE
3	U23CEV10	Construction Management and Safety	3	0	0	3	PE
4	U23CEV11	Advanced Construction Techniques	3	0	0	3	PE
5	U23CEV12	Energy Efficient Buildings	3	0	0	3	PE
6	U23CEV13	Sustainable Construction and Lean Construction	3	0	0	3	PE
7	U23CEV14	Modern Construction Materials	3	0	0	3	PE



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<b>VERTICAL -3 Environment</b>							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
1	U23CEV15	Climate Change Adaptation and Mitigation	3	0	0	3	PE
2	U23CEV16	Air and Noise Pollution Control Engineering	3	0	0	3	PE
3	U23CEV17	Environmental Impact Assessment	3	0	0	3	PE
4	U23CEV18	Industrial Wastewater Management	3	0	0	3	PE
5	U23CEV19	Solid and Hazardous Waste Management	3	0	0	3	PE
6	U23CEV20	Environment, Health and Safety	3	0	0	3	PE
7	U23CEV21	Environmental Policy and Legislations	3	0	0	3	PE

<b>VERTICAL -4 Geotechnical</b>							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
1	U23CEV22	Geo- Environmental Engineering	3	0	0	3	PE
2	U23CEV23	Ground Improvement Techniques	3	0	0	3	PE
3	U23CEV24	Soil Dynamics and Machine Foundations	3	0	0	3	PE
4	U23CEV25	Rock Mechanics	3	0	0	3	PE
5	U23CEV26	Earth and Earth Retaining Structures	3	0	0	3	PE
6	U23CEV27	Subsoil Investigation	3	0	0	3	PE
7	U23CEV28	Tunneling Engineering	3	0	0	3	PE



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<b>VERTICAL -5 Water Resources</b>							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
1	U23CEV29	Participatory Water Resources Management	3	0	0	3	PE
2	U23CEV30	Groundwater Engineering	3	0	0	3	PE
3	U23CEV31	Water Resources Systems Engineering	3	0	0	3	PE
4	U23CEV32	Watershed Conservation and Management	3	0	0	3	PE
5	U23CEV33	Integrated Water Resources Management	3	0	0	3	PE
6	U23CEV34	Urban Water Infrastructure	3	0	0	3	PE
7	U23CEV35	Water Quality and Management	3	0	0	3	PE

<b>VERTICAL -6 Transportation Infrastructure</b>							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
1	U23CEV36	Airports and Harbours	3	0	0	3	PE
2	U23CEV37	Traffic Engineering and Management	3	0	0	3	PE
3	U23CEV38	Urban Planning and Development	3	0	0	3	PE
4	U23CEV39	Smart Cities	3	0	0	3	PE
5	U23CEV40	Intelligent Transport Systems	3	0	0	3	PE
6	U23CEV41	Pavement Engineering	3	0	0	3	PE
7	U23CEV42	Transportation Planning Process	3	0	0	3	PE

MANDATORY COURSES							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
1	U23MTA02	Essence of Indian Traditional Knowledge	2	0	0	0	MT
2	U23MTA03	Wellness Through Yoga and Ayurveda	2	0	0	0	MT
3	U23MTA04	Universal Human Values and Professional Ethics	2	0	0	0	MT
4	U23MTA05	Gender, Culture and Development	2	0	0	0	MT
5	U23MTA06	Environmental Science	2	0	0	0	MT
6	U23MTA07	Sustainable Development	2	0	0	0	MT
7	U23MTA08	Disaster Risk Reduction and Management	2	0	0	0	MT
8	U23MTA09	Vision For Humane Society	2	0	0	0	MT

INDUSTRY ORIENTED/LINKAGE COURSES							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Category
			L	T	P		
1	U23CEI01	Employability Enhancement Training Program	0	0	2	1	EEC



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<b>OPEN ELECTIVE COURSES</b> <i>(Students are encouraged to choose courses offered by other departments)</i>							
S.No.	Course Code	Course Title	Contact Periods / week			Credits	Offering Department
			L	T	P		
1.	U23OE001	Industrial Waste Management	3	0	0	3	CIVIL
2.	U23OE002	Fundamentals of Nano Science	3	0	0	3	CIVIL
3.	U23OE003	Green Buildings	3	0	0	3	CIVIL
4.	U23OE004	Corrosion Science	3	0	0	3	CIVIL
5.	U23OE005	Environment and Agriculture	3	0	0	3	CIVIL
6.	U23OE051	Programming in JAVA	3	0	0	3	CSE
7.	U23OE052	Web Frameworks	3	0	0	3	CSE
8.	U23OE053	Fundamentals of Data Structures	3	0	0	3	CSE
9.	U23OE054	Database Technologies	3	0	0	3	CSE
10.	U23OE055	Basics of Software Engineering	3	0	0	3	CSE
11.	U23OE056	Operating System Concepts	3	0	0	3	CSE
12.	U23OE057	Open-Source Software	3	0	0	3	CSE
13.	U23OE057	Virtual Reality	3	0	0	3	CSE
14.	U23OE101	Industry 5.0	3	0	0	3	ECE
15.	U23OE102	Introduction to Internet of everything	3	0	0	3	ECE
16.	U23OE103	Principles of Analog and Digital Communication	3	0	0	3	ECE
17.	U23OE104	Mobile Communication	3	0	0	3	ECE
18.	U23OE105	Introduction to Neural Network	3	0	0	3	ECE
19.	U23OE151	Basics of Electrical Engineering	3	0	0	3	EEE
20.	U23OE152	Fundamentals of Drives and Control	3	0	0	3	EEE
21.	U23OE153	Renewable Energy Systems	3	0	0	3	EEE
22.	U23OE154	Electric Vehicle Technology	3	0	0	3	EEE
23.	U23OE155	Introduction to PLC Programming	3	0	0	3	EEE
24.	U23OE201	Applied Design Thinking	3	0	0	3	MECH

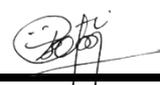
25.	U23OE202	Creativity and Innovation in Entrepreneurship	3	0	0	3	MECH
26.	U23OE203	Basics of Refrigeration and Air Conditioning	3	0	0	3	MECH
27.	U23OE204	Fundamentals of Mechanical Engineering	3	0	0	3	MECH
28.	U23OE205	Basics of Metrology and Measurements	3	0	0	3	MECH
29.	U23OE206	Testing of Materials	3	0	0	3	MECH
30.	U23OE251	Industrial Automation	3	0	0	3	MCT
31.	U23OE252	Programmable Logic Controllers	3	0	0	3	MCT
32.	U23OE253	Robotics	3	0	0	3	MCT
33.	U23OE254	Sensors and Data Acquisition Systems	3	0	0	3	MCT
34.	U23OE255	3D Printing Technology	3	0	0	3	MCT
35.	U23OE301	Introduction to computer networks	3	0	0	3	IT
36.	U23OE302	Mobile application development	3	0	0	3	IT
37.	U23OE303	Health Informatics	3	0	0	3	IT
38.	U23OE304	Information Technology essentials	3	0	0	3	IT
39.	U23OE305	cloud computing technologies	3	0	0	3	IT
40.	U23OE351	Fundamentals of Data science	3	0	0	3	AI & DS
41.	U23OE352	Fundamentals of AI	3	0	0	3	AI & DS
42.	U23OE353	Data Visualization and its Applications	3	0	0	3	AI & DS
43.	U23OE354	Fundamentals of Data Analytics	3	0	0	3	AI & DS
44.	U23OE355	Introduction to Big data	3	0	0	3	AI & DS
45.	U23OE401	Cryptography Tools and Techniques	3	0	0	3	CSE(CS)
46.	U23OE402	Network Security Essentials	3	0	0	3	CSE(CS)
47.	U23OE403	Cyber Security Fundamentals	3	0	0	3	CSE(CS)
48.	U23OE404	Web Security	3	0	0	3	CSE(CS)
49.	U23OE405	Block chain Essentials	3	0	0	3	CSE(CS)



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**Mapping of Course Outcome and Programme Outcome**

Year	Sem	Course Title	Programme Outcomes (POs)											PSOs		
			1	2	3	4	5	6	7	8	9	10	11	1	2	3
I	I	Communicative English	2	1.6	1.6	2	0.8	2	2	2.8	3	2.4	1.4	2	1.3	2.2
		Linear Algebra and Calculus	3	3	1	1	-	-	-	2	-	2	3	3	1	1
		Applied Physics	3	2.6	1.8	1.4	1.8	1.4	-	-	-	-	3	2.6	1.8	1.4
		Problem solving and Programming in C	3	2.4	2.2	2	1.6	-	-	2.5	-	2	3	2.4	2.2	2
		Engineering Graphics	3	2	2	-	2	-	-	-	3	-	2	2.2	1	2.6
		Heritage of Tamils	2	2	2.8	2	2	-	-	-	-	-	-	1.2	-	-
		Physics Laboratory	3	2.7	2.7	1	1	1	-	-	-	-	-	2.3	2.3	2.7
		Problem solving and Programming in C Laboratory	3	2.3	2.3	1.7	2.7	-	-	1.5	1	1	2.3	-	1	1
		Engineering Practices Laboratory	3	2	-	-	1	2	-	-	-	-	2	1.5	1.2	1.7
	Induction Programme															
	II	Professional English	2	1.6	1.8	1.2	2.2	1	1.2	1.8	2.8	2	2.4	2.4	1.6	2.4
		Transforms and Boundary value problems	3	3	1	1	-	-	-	2	-	-	3	2.4	1.4	2.6
		Applied Chemistry	2.8	1.5	1.6	1	-	1.8	-	-	-	-	1.3	3	1	-
		Python Programming	2	2	2.2	2.2	1.8	-	-	1	1	1	2	-	1	1
		Basics of Electrical, Electronics and Information Science	3	2.6	2.4	2	2.4	1	1	1	1.4	1.6	1.2	2	2	2.6
		Tamils and Technology	2	2	2.2	2	2	-	-	-	-	-	-	1	-	-
		Chemistry Laboratory	2.7	0.6	1.7	-	-	1.2	-	1	-	-	0.3	1.3	2.7	2
		Python Programming Laboratory	2.3	2.7	2	2	2	-	-	1	1	1	2	1.7	1.7	3
		Computer Aided Drafting Laboratory	2	3	2.3	2	1	1	1	1	1	1	1	2	1	3



<b>II</b>	<b>III</b>	Statistics and Numerical Methods	3	2.6	1.4	2	3	2	-	2	-	1	3	2.4	2	2.4
		Construction Materials	2.8	2.4	2	2.5	-	1.7	-	-	-	-	1	2.8	2.4	2
		Engineering Mechanics	3	2.4	2.3	2	2	-	-	-	-	-	1	2.6	1	1.6
		Solid Mechanics	3	3	2	3	2	3	-	-	1	-	3	3	-	-
		Fluid Mechanics	3	2.8	1.8	2	2.4	2.6	-	1	1.8	-	1.8	2.8	-	-
		Surveying	2.8	2.8	2.8	2.4	2.6	3	2.2	2.2	-	2	2	3	-	2
		Solid Mechanics Laboratory	3	3	2.7	2.7	2	-	2	-	-	-	2	3	2.3	2.7
		Surveying Laboratory	3	1.7	2.7	2	2.7	2.7	3	3	3	2	3	3	-	2
		Building Planning and Drawing Laboratory	2.7	1.7	3	-	2.3	2.7	1	2	2.3	2	1	3	2.7	2.3
	Mandatory Course I															
	<b>IV</b>	Strength of Materials	3	3	3	3	-	3	3	2	3	1	3	3	2	2.2
		Applied Hydraulics Engineering	3	2.4	2	2	2.2	1	-	-	-	-	1	3	2	2.2
		Soil Mechanics	2.7	2.7	2.3	2	-	1	1	1	1	-	2	2.3	-	2.7
		Engineering Geology	2.6	2.5	2	2	2	2.3	-	-	-	-	1	2.6	2.8	2
		Concrete Technology	2.6	2.4	2.5	3	2.4	2.4	1	-	-	-	1.4	3	2.2	2.4
		Applied Hydraulics Engineering Laboratory	3	2.7	2	2	3	2	-	-	-	-	1	3	2.3	2.7
		Soil Mechanics Laboratory	3	1.7	2.7	2	2.7	2.7	3	3	3	2	3	3	2.3	2
		Mandatory Course II														



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<b>III</b>	<b>V</b>	Design of Reinforced Concrete Structural Elements	3	2	2	-	-	-	1	-	1	-	1	3	-	-
		Structural Analysis I	3	3	1	2	-	-	1	-	1	-	2	3	-	-
		Foundation Engineering	2.8	2.8	1.8	3	-	1	1	1	1	-	2	2.2	-	2.6
		Concrete and Highway Engineering Laboratory	3	1.7	2.7	2	2.7	2.7	3	3	3	2	3	3	-	2
		Employability Enhancement Training Program	2.3	2	1.7	1.7	2.7	1.3	1	1.3	1.3	1	1	2.3	1	1.7
		English Expertise and Career Moxie	2	3	3	3	2	2	2	2	3	2	2	2.3	1.5	2.3
	<b>VI</b>	Design of Steel Structural Elements	3	2.6	2.8	1.8	-	1.2	-	1	1	1	2.2	3	1	2.8
		Structural Analysis II	3	3	3	3	-	3	1	3	2	1	1	3	-	1
		Water Supply and Waste Water Engineering	2.4	2.8	2.5	2.5	2	2.8	1	1	1.3	1.3	2.4	2	3	2
		Total Quality Management	2	1.6	2.4	2	2.2	2	1.6	2	2.2	2.4	1.6	2.4	3	2.3
		Computer Aided Design and Drafting Laboratory	2.7	1.7	2.7	2	2.3	1	-	3	2.3	1.3	1.3	2.7	1.7	2.3
		Water and Waste Water Engineering Laboratory	2.3	3	3	2	1	3	1	-	2	1.5	2	2	3	1.5



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<b>IV</b>	<b>VII</b>	Quantity Surveying and Estimation	1.6	1.8	2.4	1.2	-	2	1.6	0.4	2.2	2.4	1.6	2.4	3	2.3
		Principles of Management	3.0	2.6	3	2.8	1.3	1	1.4	1	1.4	2.6	1.4	2.6	2.3	2.4
		Computer Aided Structural Analysis Laboratory	3	2	3	1	3	-	2	-	-	-	-	3	2	3
		Project Work Phase I	2.8	2.6	2.8	2.2	2.6	1.8	1.2	2.4	2.4	2.6	2.2	2.8	2.2	2.6
		Internship/ In-plant Training	3	3	2.7	2.3	2.7	1.7	1	2	2	2.3	2.3	3	2.3	2.7
	<b>VIII</b>	Project Work Phase II	2.8	2.6	2.8	2.2	2.6	1.8	1.2	2.4	2.4	2.6	2.2	2.8	2.2	2.6

Year	Sem	Course Title	Programme Outcomes (POs)											PSOs		
			1	2	3	4	5	6	7	8	9	10	11	1	2	3
<b>Professional Elective</b>	<b>V, VI, VII</b>	Concrete Structures	3	2.8	2.8	2.4	2	2	-	-	-	1	1	2.8	2	2
		Prefabricated Structures	3	2.2	2.6	2.4	1.8	3	3	1.6	2	1	2	3	2	2
		Prestressed Concrete Structures	2	2	3	1	-	1	2	1	1	1	2	3	3	2
		Dynamics And Earthquake Resistant Structures	3	2.8	2.8	2.4	-	2	1	1	1	1	2.4	3	2.2	2
		Introduction To Finite Element Method	2.8	2.8	1.2	1.2	-	1	-	-	1	1.2	1.2	3	-	2
		Repair And Rehabilitation of Structures	2.2	2.4	2	1.6	-	2.4	1.2	0.6	0.6	1	1.2	3	2.2	2
		Pre-Engineered Buildings	2.8	2.2	1.8	0.8	1.8	1.6	0.2	0.2	0.2	0.2	1.6	2.6	1.6	1.8
		Formwork Engineering	3	2	3	1	-	-	-	-	-	-	-	2	3	1
		Construction Equipment and Machinery	3	2	3	1	-	-	-	-	-	-	-	2	3	1
		Construction Management and Safety	2	3	2	-	-	3	-	-	-	2	-	3	3	2
		Advanced Construction Techniques	2	2	3	1	-	1	-	-	-	1	1	3	2	2
		Energy Efficient	2	3	2	-	3	3	-	-	-	2	-	3	3	2



Year	Sem	Course Title	Programme Outcomes (POs)											PSOs		
			1	2	3	4	5	6	7	8	9	10	11	1	2	3
Professional Elective	V, VI, VII	Sustainable Construction and Lean Construction	3	2	3	3	-	2	-	-	-	-	-	3	2	2
		Modern Construction Materials	3	2	2	2	-	2	-	-	-	2	2	3	2	2
		Climate Change Adaptation and Mitigation	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
		Air and Noise Pollution Control Engineering	2.4	2.6	2	1	1.8	2.6	0.4	0.4	0.6	0.6	2.2	1.6	2.6	1.4
		Environmental Impact Assessment	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
		Industrial Waste Management	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
		Solid and Hazardous Waste Management	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
		Environment, Health and Safety	0.4	2.2	2	0.8	-	3	1.8	0.8	0.8	1.2	1.8	2.8	2.8	1.4
		Environmental Policy and Legislations	0.4	2.6	1.4	0.8	-	3	3	0.8	0.8	1.8	1.8	1	3	1
		Geo-Environmental Engineering	2	1	1.5	1.5	-	2.3	2	2	2	1	3	2	2	2.7
		Ground Improvement Techniques	2.3	3	2.7	2.3	-	2.7	1.7	2.3	2	1.3	3	3	3	2.7
		Soil Dynamics and Machine foundations	2.4	2.4	2.6	2.4	-	2.4	1	2	2.6	1.8	2.2	2.8	2.6	2.4
		Rock Mechanics	3	2.4	1.6	2.2	-	1.6	-	-	-	-	1.6	3	2.4	2.6
		Earth and Earth Retaining Structures	3	2.4	1.6	2.2	-	1.6	-	-	-	-	1.6	3	2.4	2.6
		Subsoil Investigation	2.4	2.6	2	2.4	2.5	2	1.5	-	-	-	1.4	2.2	2.2	1.25
		Tunneling Engineering	2.2	2.6	2	1.8	-	2.2	1.8	1.6	2.4	2.2	1.8	3	2.2	2.6
Participatory Water Resources Management	2.2	2.4	2.6	3	-	2.8	2.25	2	2	2	1.8	2.2	2.8	2.3		



Year	Sem	Course Title	Programme Outcomes (POs)											PSOs			
			1	2	3	4	5	6	7	8	9	10	11	1	2	3	
					Groundwater Engineering	2.4	2.6	2.5	2.5	2.6	2.6	2.5	2	2	2	2.4	2.4
Professional Elective	V, VI, VII	Water Resources Systems Engineering	2.4	3	2.6	2	2.8	2.6	0.6	1.6	1.8	1.2	2.2	3	2.2	2.4	
		Watershed Conservation and Management	2.6	2.4	1.2	1	-	2.6	1.4	0.6	0.6	0.6	1.6	2.6	2.8	2	
		Integrated Water Resources Management	2.4	2.4	1.4	0.8	1	2.8	2	0.2	0.4	1.2	2	2.4	3	1	
		Urban Water Infrastructure	2.6	2.2	1.8	3	-	2	3	1.3	3	2	2	3	2	2	
		Water Quality and Management	3	3	3	3	-	3	2	2	2	2	3	3	3	3	
		Airports and Harbours	1.6	1.4	2.4	1.8	-	2	2.2	2	2	2	2	2	3	2	3
		Traffic Engineering and Management	2.2	2.4	3	2	-	2.6	1.3	2	1.7	2	2	2	2.8	2.8	2
		Urban Planning and Development	2.8	2.6	2.0	1.8	-	3.0	2.2	2.0	2.6	2.0	2.2	3.0	2.8	2.2	
		Smart Cities	2.8	1.8	2.6	2	2	2	2.8	2	2.4	1.8	1.6	2.8	2.6	2.6	
		Intelligent Transport Systems	2.8	2.4	2.3	2.0	2.4	2.4	-	1.0	2.0	1.5	1.2	2.4	2.2	2.2	
		Pavement Engineering	2.8	2.6	3.0	2.0	-	2.2	-	-	-	-	1.2	2.6	2.2	1.5	
		Transportation Planning Process	3	2.6	-	-	-	2	-	-	-	-	2	3	2	1.6	



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# Semester I



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<b>U23EGT01</b>	<b>COMMUNICATIVE ENGLISH (Common to ALL branches)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To enhance learners' English Language Acquisition skills
- To facilitate learners to acquire effective technical writing skills
- To prepare learners for placement and competitive exams
- To facilitate effective English language skills for academic purposes and real-life situations

**Course Outcomes:**

Upon completion of the course, students shall have ability to

		<b>BT Level (highest level)</b>
<b>C01</b>	Demonstrate an understanding of communicative English principles, reading strategies, and basic grammar rules to communicate effectively.	<b>K2</b>
<b>C02</b>	Remember grammar rules, sentence structures, and vocabulary to convey meaning accurately in spoken and written communication.	<b>K1</b>
<b>C03</b>	Apply technical communication skills to read, write, and speak about technical topics, using appropriate vocabulary and grammatical structures.	<b>K3</b>
<b>C04</b>	Recall business communication skills to read, write, and speak effectively in professional contexts, using appropriate formats, vocabulary, and tone.	<b>K1</b>
<b>C05</b>	Comprehend and interpret information from brochures and scientific blogs and participate in team tasks and role plays, communicating effectively.	<b>K2</b>

**Course Contents**

**Unit I      COMMUNICATIVE ENGLISH** **9**

Introduction to Communicative English, **Reading:** Skimming and Scanning; Comprehensive questions (Multiple choice questions/ short questions/open-ended questions) **Speaking:** Self- introduction **Writing:** Formal and informal letters (Requisition, Complaint / Invitation /Accepting/ Declining/ Personal) Grammar: Parts of speech, Present Tense, **Vocabulary:** Synonyms/Antonyms, word formation, Prefixes /suffixes.

**Unit II      WORDS AND SENTENCES** **9**

**Reading:** Reading biographies on famous scientists and personalities/ newspaper articles/ movie reviews **Speaking:** Travelog with pictorial video /PPT **Writing:** Single line and extended definitions, Data interpretation (Pie chart, Bar chart, Table, Flow chart) **Grammar:** Modal verbs, Voices, Past Tense **Vocabulary:** Compound words, One-word substitutions.

**Unit III     TECHNICAL COMMUNICATION** **9**

**Reading:** Review on technology/gadgets, reading user manual, **Writing:** Writing Instructions; Recommendations **Speaking:** Pride activity (About hometown) **Grammar:** Cause and Effect, Prepositions, Future Tense **Vocabulary:** Phrasal Verbs, Collocations

**Unit IV     BUSINESS COMMUNICATIONS** **9**

**Reading:** Reading and understanding general and technical articles **Writing:** Report writing (Industrial visit report, Feasibility report), Checklist **Speaking:** Cultural and heritage of hometown, Dialogue writing and Telephonic conversation **Grammar:** WH questions, If conditionals **Vocabulary:** Abbreviation and Acronyms, Misspelt words.



**Unit V PROFESSIONAL ENGLISH**

**9**

**Reading:** Brochures, Scientific Blogs. **Writing:** Jumbled Sentences, Note-making **Speaking:** team task (role play) **Grammar:** Types of sentences, Possessive case **Vocabulary:** Homonyms/ Homophones.

**Total Periods 45**

**Text Books:**

1. Department of English, Anna University, "English for Engineers & Technologists", 2020, Orient Blackswan Private Ltd. Hyderabad.
2. Ramalingam N, "Grammar for all", Second edition, 2013, Himalaya Publishing House, Bengaluru.

**Reference Books:**

1. Norman Whitby, "Business Benchmark Pre-intermediate to Intermediate Personal Study Book", BEC and BULATS Edition, 2006, Cambridge University Press India Pvt Ltd, Delhi.
2. Anne Laws, "Writing Skills", 2011, Summertown Publishing, Oxford, U.K.
3. Sinha DK, "Specimen of English Prose", 2012, Orient Black Swan., Hyderabad.
4. Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", 2009, Cambridge University Press India Pvt Ltd, Delhi.
5. Raymond Murphy. "English Grammar and Use" ,4th edition, 2004, Cambridge University Press India Pvt Ltd, Delhi.

**Web URL(s):**

1. <https://www.science.org/blogs>
2. <https://www.liveworksheets.com/worksheets/en>
3. <https://www.upsconline.nic.in/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	1	-	-	-
CO3	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	3	-	1	-	-	-
CO5	-	-	-	-	-	-	-	1	3	-	1	-	-	-
Average	-	-	-	-	-	-	-	1	2.8	-	1	-	-	-
3 – High; 2 – Medium; 1– Low; - No correlation														



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**U23MAT01**

**LINEAR ALGEBRA AND CALCULUS  
(Common to ALL branches)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Pre-Requisites** : Concepts of basic matrices, differentiation and integration

**Objectives:**

To make the students

- Acquaint with the knowledge of vector space and its applications.
- Develop the use of matrix techniques for practical problems.
- Familiarize with functions of several variables.
- Understand the concepts of Gradient, Divergence and Curl through vector differentiation and integration.
- Interpret with mathematical tools needed in evaluating multiple integrals and their applications

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Apply the concepts of vectors to find the bases and dimensions.	<b>K3</b>
<b>CO2</b>	Apply the knowledge of matrices to solve the problems for respective areas of specialization.	<b>K3</b>
<b>CO3</b>	Use differentiation techniques in solving real time problems Compute gradient, curl and divergence using vector differentiation and evaluate	<b>K3</b>
<b>CO4</b>	line integral, area and volume using vector integration.	<b>K3</b>
<b>CO5</b>	Evaluate the function to get the surface area and volume using multiple integrals.	<b>K3</b>

**Course Contents**

**Unit I LINEAR ALGEBRA**

**9+3**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

**Unit II MATRICES**

**9+3**

Determinant- Cramer's rule-Eigen values and Eigen vectors of a real matrix- Properties-Cayley-Hamilton theorem (statement only)- Application-Elastic Membrane.

**Unit III FUNCTIONS OF SEVERAL VARIABLES**

**9+3**

Limits and Continuity (Geometrical interpretations) – Properties of continuous function – Partial Derivatives-Total derivatives- Jacobians - Taylor's series for two variables.

**Unit IV VECTOR CALCULUS**

**9+3**

Gradient and directional derivative – Divergence and curl - Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Volume integral - Green 's and stoke 's theorems.

**Unit V MULTIPLE INTEGRALS**

**9+3**

Double integration (Cartesian coordinates)-Region of integration-Triple integration in Cartesian coordinates- application of triple integrals.

**Total Periods 60**



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**Text Books:**

1. James Stewart., "Calculus: Early transcendentals", 7<sup>th</sup> Edition, 2015, Cengage Learning, New Delhi.
2. Kreyszig. E., "Advanced Engineering Mathematics", 10<sup>th</sup> Edition ,2016, John Wiley and Sons (Asia) Ltd, Delhi.

**Reference Books:**

1. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", 5<sup>th</sup> Edition, 2017, Narosa Publications, New Delhi.
2. Srimantha Pal and Bhunia. S.C., "Engineering Mathematics", 2015, Oxford University Press, India
3. Lay.D.C., "Linear Algebra and Its Applications", 5<sup>th</sup> Edition,2015, Pearson Education, New Delhi

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/111/104/111104137/>
2. <https://archive.nptel.ac.in/courses/111/105/111105122/>
3. <https://archive.nptel.ac.in/courses/111/104/111104137/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	-	-	-	-	-	-	2	-	2	2	-	3
CO2	3	3	-	-	-	-	-	-	2	-	2	2	-	3
CO3	3	3	1	1	-	-	-	-	2	-	2	2	1	1
CO4	3	3	1	1	-	-	-	-	2	-	2	2	1	-
CO5	3	3	1	1	-	-	-	-	2	-	2	2	1	1
Average	3	3	1	1	-	-	-	-	2	-	2	2	1	2
3 – High; 2 – Medium; 1– Low; - No correlation														



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<b>U23PYT02</b>	<b>APPLIED PHYSICS</b> <b>(Common to CIVIL, MECH and MCT)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves.
- Gain the knowledge on magnetic and super conducting properties of materials.
- The students will have knowledge on the various phase diagrams and their applications.
- Understand the concept of ceramics, composites, metallic glasses and shape memory alloys.

**Course Outcomes:**

Upon completion of the course, students would be able to

	<b>BT Level (highest level)</b>
<b>CO1</b> Apply the important concepts of mechanics.	<b>K3</b>
<b>CO2</b> Use their knowledge in electromagnetic waves.	<b>K3</b>
<b>CO3</b> Get knowledge on magnetic properties of materials, superconducting properties of materials and their applications.	<b>K3</b>
<b>CO4</b> Apply the principle to determine the phases in alloy materials.	<b>K3</b>
<b>CO5</b> Apply the concept of ceramics, composites, metallic glasses and shape memory alloys.	<b>K3</b>

**Course Contents**

**Unit I MECHANICS 9**

Basic definitions – Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Types of motion– Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy – moment of inertia– torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule – torsional pendulum.

**Unit II ELECTROMAGNETIC WAVES 9**

Basic definitions: Gauss law for electric field, Faraday’s law and Ampere’s circuit law – Maxwell’s equations – Derivation of Maxwell’s Equations – wave equation: Plane electromagnetic waves in vacuum – properties of electromagnetic waves in vacuum: speed, amplitude, phase, orientation and waves in matter – Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure.

**Unit III MAGNETIC MATERIALS AND SUPERCONDUCTIVITY 9**

Introduction – Types of magnetic materials: Dia, Para and Ferromagnetism–domain theory of Ferromagnetism –hysteresis – Ferrites and application of Ferrites. Superconductivity: Properties of Superconductor – Type I& Type II Superconductor. Application of Superconductor: Josephson junction – SQUID – Magnetic levitated Train.

**Unit IV PHASE DIAGRAMS 9**

Solid solutions – Hume Rothery’s rules – the phase rule – single component system – one component system of iron – binary phase diagrams – isomorphous systems – the tie-line rule – the lever rule – isomorphous system – eutectic phase diagram – free energy composition curve for binary systems – microstructural change during cooling.

**Unit V ADVANCED MATERIALS 9**

Ceramics – types and applications – Composites – classification, role of matrix and reinforcement, processing of fiber reinforced plastics– Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications –shape memory alloys: phases, shape memory effect, pseudo elastic effect, NiTi alloy, applications.

**Total Periods 45**



**Text Books:**

1. Kleppner D and Kolenkow R, "An Introduction to Mechanics",2017, McGraw Hill Education (Indian Edition),New Delhi.
2. Purcell E M and Morin D J, "Electricity and Magnetism",2013, Cambridge Univ.Press.United Kingdom.
3. Raghavan V, "Materials Science and Engineering: A First Course", 2015, Prentice Hall India Learning Private Limited, New Delhi.

**Reference Books:**

1. Wolfson R, "Essential University Physics". Volume 1 & 2, 2009, Pearson Education (Indian Edition), New Delhi.
2. William D. Callister J "Materials Science and Engineering", 9<sup>th</sup> edition, 2014, John Wiley and sons,Inc, New Delhi.
3. Smith, W.F., Hashemi, J. & Prakash, R, "Materials Science and Engineering" 2014, Tata McGraw Hill Education Pvt. Ltd, New Delhi.

**Web URL(s):**

1. <http://nitttrc.edu.in/nptel/courses/video/115104094/115104094.html>
2. <http://nitttrc.edu.in/nptel/courses/video/115101005/115101005.html>
3. <https://archive.nptel.ac.in/courses/113/104/113104068/>
4. <https://nptel.ac.in/courses/113105081>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	1	1	1	-	-	-	-	-	3	2	2
CO2	3	3	2	1	2	2	-	-	-	-	-	2	3	2
CO3	3	3	1	1	2	1	-	-	-	-	-	2	2	3
CO4	3	2	2	2	2	1	-	-	-	-	-	3	2	2
CO5	3	2	2	2	2	2	-	-	-	-	-	2	3	3
Average	3	2.6	1.8	1.4	1.8	1.4	-	-	-	-	3	2.6	1.8	1.4
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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**U23CST01      PROBLEM SOLVING AND PROGRAMMING IN C**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre requisites** : None

**Objectives:**

- To understand problem solving methodologies.
- To provide an overview of concepts in C language.
- To develop C programs using Arrays and Strings
- To develop modular applications in C using Functions.
- To develop skills in using Pointers. Structures, Unions and File handling.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Understand and apply problem solving techniques and basic C programming constructs.	<b>K3</b>
<b>C02</b>	Identify the appropriate conditional and looping statements for developing applications.	<b>K3</b>
<b>C03</b>	Apply Arrays and Strings concepts to store and manipulate data efficiently in programming applications.	<b>K3</b>
<b>C04</b>	Make use of Functions and Pointers to solve computational problems.	<b>K3</b>
<b>C05</b>	Develop applications in C using Structures, Unions and File processing.	<b>K3</b>

**Course Contents**

**UNIT-I      PROBLEM SOLVING FUNDAMENTALS      9**

Fundamentals of Computing – Identification of Computational Problems -Problem solving- Flow Chart, Algorithm, Pseudo code – Introduction to C – Structure of a C program- Keyword- Identifiers - Data Types – Variables - Constants – Input/output statements Operators – Type Conversion and Type casting

**UNIT-II      CONDITIONAL STATEMENTS AND LOOPING CONSTRUCTS      9**

Conditional Branching Statements: if, if-else, else-if ladder, nested-if, switch constructs - Looping constructs: for, while, do-while constructs – Nested loops - Usage of break continue, return and go to statements

**UNIT-III      ARRAYS AND STRINGS      9**

1D Array –Declaration, Initialization, 2D Array - Declaration, Initialization – Operations on Arrays- Multi-dimensional Arrays, Strings: Declaration and Initialization - String operations: length, compare, concatenate, copy

**UNIT-IV      FUNCTIONS AND POINTERS      9**

Functions: Built-in Functions, User defined functions – Function Prototypes–Command Line Arguments -Arrays and Functions – Strings and Functions- Scope of Variables – Storage classes – Recursion- Pointers: Declaration – Pointer operators – Pointer expressions -Passing Pointers to a Function – Pointers and one-dimensional arrays – Pointers and Strings - Dynamic Memory Allocation.

**UNIT-V      STRUCTURES, UNIONS AND FILE HANDLING      9**

Structure: Creating a Structure-Member initialization - Accessing Structure Members - Nested structures – Pointer and Structures – Array of structures - Self Referential Structures – typedef – Unions – Bit fields – Enumerated data types - Files- Opening and Closing a Data File, Reading and writing a data file- Pre-processor Directives

**Total Periods      45**



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**Text Books:**

1. David Riley and Kenny hunt, "Computational Thinking for the Modern problem solver", 2014, Chapman & Hall, CRC.
2. SparnkleM, "Problem solving and programming concepts", 9<sup>th</sup> edition, 2011, Pearson Education, New Delhi.
3. ReemaThareja, "Programming in C", Second Edition, 2016, Oxford University Press.
4. Herbert Schildt, "C – The Complete Reference", 2017, Tata McGraw Hill Publishing Company, New Delhi.
5. Kernighan B. W. and Ritchie D. M., "C Programming Language (ANSI C)", 2015, Prentice Hall of India Private Limited, New Delhi.

**Reference Books:**

1. Deitel and Deitel, "C How to Program", 2011, Pearson Education, New Delhi.
2. Byron S. Gottfried and Jitendar Kumar Chhabra, "Programming with C", 2011, Tata McGraw Hill Publishing Company, New Delhi.
3. PradipDey and ManasGhosh, "Programming in C", 2009, Oxford University Press, New Delhi.

**Web URL(s):**

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs40/preview](https://onlinecourses.nptel.ac.in/noc22_cs40/preview)
2. <https://www.udemy.com/topic/c-programming/>
3. <https://www.coursera.org/courses?query=c%20programming>
4. <https://alison.com/tag/c-programming>
5. <https://nptel.ac.in/courses/106105171>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	-	1	-	-	-	-	1	2	1	1	1
CO2	3	3	2	1	1	-	-	-	-	3	2	1	2	-
CO3	3	2	3	1	2	-	-	-	-	2	2	1	2	1
CO4	3	2	2	3	1	-	-	2	-	2	2	1	2	1
CO5	3	3	3	3	3	-	-	3	-	2	2	1	3	1
Average	3	2.4	2.2	2	1.6	-	-	2.5	-	2	3	2.4	2.2	2
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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<b>U23MET02</b>	<b>ENGINEERING GRAPHICS</b> <b>(Common to MECH, MCT and CIVIL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	2	0	4

**Pre-Requisites** : None

**Objectives:**

- To develop graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national BIS standards related to technical drawings.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level**  
**(highest level)**

<b>C01</b>	Recall and describe basic geometric constructions and engineering curves,	<b>K3</b>
<b>C02</b>	Describe the steps involved in projecting of lines and plane surfaces inclined to both principal planes to determine their true shapes.	<b>K3</b>
<b>C03</b>	Create orthographic projections of a simple solids with its axis inclined to one of the principal planes.	<b>K3</b>
<b>C04</b>	Analyse a sectioned cylinder to obtain the true shape of the section and develop its lateral surface.	<b>K3</b>
<b>C05</b>	Develop a freehand sketch of a complex object from its pictorial view and create its isometric projection.	<b>K3</b>

**Course Contents**

**Unit I ENGINEERING CURVES 12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

**Unit II PROJECTION OF LINES AND PLANE SURFACES 12**

Orthographic projection- principles-Principal planes -First angle projection of straight lines inclined to both the principal plane - Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both principal plane by rotating object method.

**Unit III PROJECTION OF SOLIDS 12**

Projection of simple solids like prisms, pyramids, cylinder, cube and cone when the axis is inclined to one of the principal planes by rotating object method.

**Unit IV SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple solids – Prisms, pyramids, cylinders and cones.

**Unit V FREE HAND SKETCHING AND ISOMETRIC PROJECTIONS 12**

Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects. Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and conversion of orthographic views to isometric.

**Total Periods 60**



**Text Books:**

1. Venugopal K. and Prabhu Raja V, "Engineering Graphics", 17<sup>th</sup> Edition, 2024, New Age International (P) Limited, New Delhi.
2. Natarajan K.V., "A text book of Engineering Graphics", 33<sup>rd</sup> Edition, 2023, Dhanalakshmi Publishers, Chennai.

**Reference Books:**

- 1 Bhatt N.D. and Panchal V.M, "Engineering Drawing", 55<sup>th</sup> Edition, 2025, Charotar Publishing House, Anand, Gujarat.
- 2 Gopalakrishna K. R., "Engineering Drawing", (Vol. I&II combined), 30<sup>th</sup> Edition, 2017, Subhas Stores, Bangalore.
- 3 Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", 2015, Oxford University, Press, New Delhi.

**Web URL(s):**

- 1 <https://nptel.ac.in/courses/112103019>
- 2 <https://archive.nptel.ac.in/courses/112/105/112105294/>
- 3 <https://archive.nptel.ac.in/courses/112/102/112102304/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	-	2	-	-	-	3	-	2	1	-	2
CO2	3	2	2	-	2	-	-	-	3	-	2	2	-	2
CO3	3	2	2	-	2	-	-	-	3	-	2	3	-	3
CO4	3	2	2	-	2	-	-	-	3	-	2	3	1	3
CO5	3	2	2	-	2	-	-	-	3	-	2	2	-	3
Average	3	2	2	-	2	-	-	-	3	-	3	2	2	-
3 – High; 2 – Medium; 1– Low; - No correlation														



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<b>U23TAT01</b>	<b>HERITAGE OF TAMILS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**Pre-Requisites** : None

**Objectives:**

To make the students to:

- Understand and appreciate the secular nature and ethical concepts of Sangam literature and the evolution of Tamil literature through different periods.
- Explore and analyze the traditional and modern art forms, including sculpture and folk arts, and their significance in Tamil culture and society.
- Evaluate the historical and cultural impact of Tamil heritage, including traditional sports, Agam and Puram theories, and the role of Tamil contributions in the Indian national movement and knowledge dissemination.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>C01</b>	Understand the secular nature of Sangam literature and its ethical concepts.	<b>K2</b>
<b>C02</b>	Apply knowledge of ancient and modern sculpture techniques to analyse various art forms.	<b>K3</b>
<b>C03</b>	Evaluate the role of traditional sports in Tamil society and their impact on community life.	<b>K3</b>
<b>C04</b>	Recognize the Agam and Puram theories from ancient Tamil texts.	<b>K2</b>
<b>C05</b>	Assess the historical significance of Tamil printing and its role in the dissemination of knowledge.	<b>K3</b>

**Course Contents**

**Unit I LANGUAGE AND LITERATURE 3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**Unit II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**Unit III FOLK AND MARTIAL ARTS 3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**Unit IV THINAI CONCEPT OF TAMILS 3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**Unit V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**Total Periods 15**



**Text-cum-Reference Books:**

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**Bloom’s Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	2	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	3	2	-	-	-	-	-	-	-	1	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	3	-	2	-	-	-	-	-	-	1	-	-
Average	2	2	2.75	2	2	-	-	-	-	-	2	2	2.75	2
3 - High; 2 - Medium; 1- Low; -No Correlation														



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**U23PYP01**

**PHYSICS LABORATORY**  
**(Common to ALL branches)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites :** None

**Objectives:**

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level**  
**(highest level)**

- |   |           |
|---|-----------|
| <b>CO1</b> Apply diffraction and interference principles to determine the optical properties and dimensions of materials. | <b>K3</b> |
| <b>CO2</b> Apply experimental methods to determine mechanical and thermal properties of materials.                        | <b>K3</b> |
| <b>CO3</b> Use electrical and semiconductor concepts to identify material properties and characteristics.                 | <b>K3</b> |

**List of Experiments**

1. Determination of Wavelength of Laser.
2. Determination of Particle Size and Acceptance angle of the fiber using laser.
3. Determination of thickness of a thin wire by Air wedge method.
4. Determination of wavelength of mercury spectrum – Spectrometer grating.
5. Determination of young’s modulus by Uniform bending.
6. Determination of Rigidity modulus by Torsion pendulum.
7. Determination of thermal conductivity of bad conductor.
8. Determination of bandgap of a semiconductor.
9. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.

**Total Periods      30**

**Bloom’s Taxonomy Level**

K1- Remember, K2 – Understand, K3 - Apply, K4 - Analyse, K5 - Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	1	1	1	-	-	-	-	-	2	2	3
CO2	3	3	3	1	1	1	-	-	-	-	-	3	2	2
CO3	3	3	3	1	1	1	-	-	-	-	-	2	3	3
Average	3	2.67	2.67	1	1	1	-	-	-	-	-	2.33	2.33	2.67
3 – High; 2 – Medium; 1 – Low; - No Correlation														



<b>U23CSP01</b>	<b>PROBLEM SOLVING AND PROGRAMMING IN C LABORATORY (Common to ALL branches)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites** : None

**Objectives:**

This Course aims to develop comprehensive competence in C programming by practising problem solving skills.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b> Utilize C programming constructs to develop efficient programs.	<b>K3</b>
<b>CO2</b> Develop robust programs incorporating arrays, strings, functions and pointers.	<b>K3</b>
<b>CO3</b> Design and implement structured, efficient and error-free C programs.	<b>K6</b>

**LIST OF EXPERIMENTS**

1. I/O statements, operators, expressions
2. Decision-making constructs: if-else, go to, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, multi-dimensional arrays
5. Strings: Operations
6. Functions: call, return, passing arrays to function, Passing string to functions, Recursion
7. Pointers: Pointers to Functions, Arrays and Strings, Passing parameters to functions
8. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions
9. Files: reading and writing, File pointers, File operations, Preprocessor directives
10. Mini project

**Total Periods 30**

**Reference Books:**

1. ReemaThareja, "Programming in C", Second Edition, 2016, Oxford University Press.
2. Herbert Schildt, "C – The Complete Reference", 2017, Tata McGraw Hill Publishing Company, New Delhi.
3. Kernighan B. W. and Ritchie D. M., "C Programming Language (ANSI C)", 2015, Prentice Hall of India Private Limited, New Delhi.
4. Deitel and Deitel, "C How to Program", 2011, Pearson Education, New Delhi.
5. Byron S. Gottfried and Jitendar Kumar Chhabra, "Programming with C", 2011, Tata McGraw Hill Publishing Company, New Delhi.
6. PradipDey and ManasGhosh, "Programming in C", 2009, Oxford University Press, New Delhi.



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**Web URL(s):**

1. <https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	1	2	-	-	-	-	-	2	-	1	1
CO2	3	2	3	2	3	-	-	1	0	0	2	-	1	1
CO3	3	3	3	2	3	-	-	2	1	1	3	-	1	1
Average	3	2.3	2.3	1.7	2.7	-	-	1.5	0.5	0.5	2.3	-	1	1
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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**U23EEP01**

**ENGINEERING PRACTICES LABORATORY  
(Common to CIVIL, EEE, MECH and MCT)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : None

**Objectives:**

- To gain the basic knowledge of measuring the components.
- To know about the usage of appropriate tools and equipment used in welding, plumbing and carpentry
- To impart knowledge about different types joints in welding, carpentry and plumbing.
- To understand working methodologies of lathe machine and sheet metal processes.
- To impart knowledge in electrical wiring concepts for house hold and calculations of power and energy.
- To familiarize with various electronic components and equipment.
- To learn the basic skills of soldering electronic components and wires.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Measure basic dimensions of mechanical components, Join metals using arc welding	<b>K3</b>
<b>C02</b>	Create models in sheet metal and perform basic machining operations in lathe, Use proper tools for plumbing and carpentry.	<b>K3</b>
<b>C03</b>	Make joints related to carpentry and plumbing work.	<b>K3</b>
<b>C04</b>	Carry out basic home electrical works and measure electrical quantities	<b>K2</b>
<b>C05</b>	Apply the knowledge on various electronics components and equipment	<b>K3</b>
<b>C06</b>	Elaborate on soldering practices	<b>K2</b>

**LIST OF EXPERIMENTS**

**MECHANICAL AND CIVIL ENGINEERING PRACTICES**

1. Measurement of mechanical components using Vernier Caliper and Vernier Height Gauge.
2. Measurement of diameter of mechanical components using Micrometer.
3. Sheet Metal Works: Model making – like Rectangular Tray.
4. Hands-on-exercise on Lathe machine: Facing, Simple Turning and Step Turning
5. Hands-on-exercise on Drilling Machine: Drilling of holes in a component.
6. Preparation of butt joint, lap joint and T- joint by metal arc welding.
7. Study of plumbing tools and equipment
8. Hands-on-exercises in Plumbing: Basic pipe connection using different types of joints and components required for residential and industrial buildings.
9. Hands-on-exercises in Carpentry: Wood work joints using conventional and power tools.
10. Assembling and dismantling of simple mechanical products.



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**ELECTRICAL AND ELECTRONICS ENGINEERING PRACTICES**

1. Basic switch board wiring with switch to connect three pin socket, Two Lights and Indicator Lamp.
2. Staircase wiring.
3. Measurement of Voltage, Current, Power and calibration of Single-phase Energy meter.
4. Fluorescent Lamp wiring with introduction to CFL and LED types.
5. Measurement of AC Signal parameters using CRO and Function Generator.  
(i) Measurement of DC & AC Voltage, Continuity using Digital Multimeter.
6. (ii) Measurement of Inductor and Capacitor using LCR Meter.
7. Soldering of Electronic components in PCB.
8. Study of Megger, Circuit Breakers, DC Regulated power supply and DSO.

**Total Periods            60**

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	1	2	-	-	-	-	2	2	1	1
CO2	3	2	-	-	1	2	-	-	-	-	2	2	2	2
CO3	3	2	-	-	1	2	-	-	-	-	2	2	1	1
CO4	3	2	-	-	1	2	-	-	-	-	2	1	1	2
CO5	3	2	-	-	1	2	-	-	-	-	2	1	1	2
CO6	3	2	-	-	1	2	-	-	-	-	2	1	1	2
Average	3	2	-	-	1	2	-	-	-	-	2	1.5	1.17	1.67
3 – High; 2 – Medium; 1– Low; - No correlation														



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# Semester II



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<b>U23EGT02</b>	<b>PROFESSIONAL ENGLISH (Common to ALL branches)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites :** None

**Objectives:**

- To enhance learners' English language acquisition skills
- To facilitate learners to acquire effective technical writing skills
- To prepare learners for placement and competitive exams
- To facilitate effective English language skills for academic purposes and real-life situations

**Course Outcomes:**

Upon completion of the course, students shall have ability to

**BT Level  
(highest  
level)**

<b>C01</b>	Recall and use grammatical structures proficiently to produce professional written expressions and critically compose accurate paragraphs.	<b>K1</b>
<b>C02</b>	Demonstrate product descriptions with precision and draft resumes using guided terminology.	<b>K2</b>
<b>C03</b>	Develop technical communication competencies to articulate complex ideas with precision and clarity and participate effectively in group discussions.	<b>K2</b>
<b>C04</b>	Write in formal content and comprehend letters, emails and structured essays.	<b>K1</b>
<b>C05</b>	Apply language competencies effectively for competitive examinations and professional pursuits.	<b>K3</b>

**Course Contents**

**Unit I CREATIVE THINKING** **9**

Articles – Conjunctions – Sentence Pattern - subject-verb agreement - Sentence completions- online worksheets on matching, Compare and contrast any topic in about 150 words eg. Vehicle vs - E-Vehicle, Teacher vs Robot Teachers

**Unit II PROFESSIONAL VOCABULARY** **9**

Punctuation- Expansion of Compound nouns- Idioms and Phrases- Process description, product description, Letter Format- Job application and resume writing -Online worksheets for hints development.

**Unit III TECHNICAL SKILL** **9**

Discourse Markers - Gerunds and infinitive– Relative Pronouns – Definitions of Technical Terms – Digital Transcoding – Group discussion (Do's and Don'ts)- Minutes of Meeting, online worksheet on transcoding.

**Unit IV BUSINESS COMMUNICATIONS** **9**

Clauses – Phrases – Numerical Adjectives – Complaint Letter-Filling up forms (Opening bank a/c and ticket booking) – Virtual Communication: E-Mail Writing – Essay Writing: Types of essays Opinion Essay, Discussion Essay, Direct Questions Essay, Advantage/Disadvantage Essay, Problem/Solution Essay.

**Unit V ENGLISH FOR COMPETITIVE EXAMS** **9**

TOFEL / IELTS- (LSRW) Synonyms; Vocabulary; reading comprehension of IELTS/ TOFEL; Writing exercises of IELTS/ TOFEL, Verbal Ability, Use and purpose expression, travel itinerary.

**Total Periods 45**



**Text Books:**

1. Department of English, Anna University, "English for Engineers & Technologists", 2020, Orient Blackswan Private Ltd. Hyderabad.
2. Ramalingam N, "Grammar for all", Second edition, 2013, Himalaya Publishing House, Bengaluru.

**Reference Books:**

- 1 Norman Whitby, "Business Benchmark Pre-intermediate to Intermediate Personal Study Book", BEC and BULATS Edition, 2006, Cambridge University Press India Pvt Ltd, Delhi.
- 2 Anne Laws, "Writing Skills", 2011, Summertown Publishing, Oxford, U.K.
- 3 Sinha DK, "Specimen of English Prose", 2012, Orient Black Swan., Hyderabad.
- 4 Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", 2009, Cambridge University Press India Pvt Ltd, Delhi.
- 5 Raymond Murphy. "English Grammar and Use" ,4th edition, 2004, Cambridge University Press India Pvt Ltd, Delhi.

**Web URL(s):**

- 1 <https://www.science.org/blogs>
- 2 <https://www.liveworksheets.com/worksheets/en>
- 3 <https://www.upsconline.nic.in/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping COs, POs & PSOs

COs	POs											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	3	-	1	-	-	-
CO3	-	-	-	1	-	-	-	1	3	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	3	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	1	-	-	-
Average	-	-	-	1	-	-	-	1	3	-	1	-	-	-
3 – High; 2 – Medium; 1 – Low; - No Correlation														

  
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<b>U23MAT02</b>	<b>TRANSFORMS AND BOUNDARY VALUE PROBLEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(Common to CIVIL, ECE, EEE, MECH and MCT)</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Pre-Requisites** : Linear Algebra and Calculus

**Objectives:**

To make the students

- Introduce the basic concepts of partial differential equations for solving standard types.
- Introduce Fourier series in engineering problems.
- Acquaint with Fourier transform techniques used in wide variety of situations.
- Interpret with Fourier series techniques in solving heat flow problems.
- Introduce the effective mathematical tools for the solutions of partial differential equations to model several physical processes and to develop Z transform techniques for discrete time systems.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Solve the standard partial differential equations.	<b>K3</b>
<b>CO2</b>	Solve differential equations using Fourier series analysis in engineering applications	<b>K3</b>
<b>CO3</b>	Apply the mathematical principles of transforms and partial differential equations to formulate and solve the physical problems of engineering.	<b>K3</b>
<b>CO4</b>	Apply the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow Problems and one-dimensional wave equations.	<b>K3</b>
<b>CO5</b>	Apply the mathematical tools for the solutions of partial differential equations using the Z transform techniques for discrete time systems	<b>K3</b>

**Course Contents**

**Unit I PARTIAL DIFFERENTIAL EQUATIONS** **9+3**

Solution of standard types of first order equations- Lagrange's equation- linear partial Differential equation of second and higher order with constant coefficients.

**Unit II FOURIER SERIES** **9+3**

Dirichlet's conditions- General Fourier series- Half Range Sine and Cosine series- Parseval's Identity- Harmonic Analysis.

**Unit III FOURIER TRANSFORM** **9+3**

The infinite Fourier transform pair - sine and cosine transform - properties- Parseval's identity and convolution theorem (statement only)

**Unit IV BOUNDARY VALUE PROBLEMS** **9+3**

Classification of Second order linear partial differential equations- solutions of one-dimensional wave equation-One-dimensional heat equation, steady state solution of two-dimensional heat equation, Fourier series solution in cartesian coordinates

**Unit V Z – TRANSFORMS** **9+3**

Definition and properties- Elementary Problems- Inverse Z transforms (partial fraction method) -convolution theorem (statement only)- Application of Z – Transforms in solving difference equations.

**Total Periods 60**



**Text Books:**

1. Grewal.B.S. and Grewal.J. S, “Higher Engineering Mathematics”, 44<sup>th</sup> Edition, 2018, Khanna Publishers, New Delhi.
2. Kreyszig.E, “Advanced Engineering Mathematics”, 10<sup>th</sup> Edition ,2018, John Wiley and Sons (Asia) Ltd, Delhi.

**Reference Books:**

1. Bali.N. P and Manish Goyal., “A Textbook of Engineering Mathematics”, 10<sup>th</sup> Edition, 2015, Laxmi Publications, Pvt Ltd.
2. Ramana. B.V., “Higher Engineering Mathematics”,6<sup>th</sup> edition, 2018, McGraw Hill Education Pvt Ltd, New Delhi
3. James. G., “Advanced Modern Engineering Mathematics”, 4<sup>th</sup> Edition, 2016, Pearson Education, New Delhi.

**Web URL(s):**

- 1 <https://nptel.ac.in/courses/111102129>
- 2 <https://nptel.ac.in/courses/111103021>
- 3 <https://nptel.ac.in/courses/111108144>

**Bloom’s Taxonomy Level**

K1- Remember, K2 – Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	-	3	2	-	-	-	-	-	1	3	3	1
CO2	3	3	-	3	2	-	-	-	-	-	1	3	3	2
CO3	3	3	-	3	2	-	-	-	-	-	1	3	3	1
CO4	3	3	-	3	2	-	-	-	-	-	2	2	2	-
CO5	3	3	-	2	3	-	-	-	-	-	2	3	1	1
Average	3	3	-	2.8	2.2	-	-	-	-	-	1.4	2.8	2.4	1.3
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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**U23CYT02** **APPLIED CHEMISTRY**  
**(Common to CIVIL, MECHANICAL and MCT)**

**Pre-Requisites** : None

**Objectives:**

To make the students

- Understand water quality parameters and different water treatment techniques
- Familiarise with the operating principles, working processes and applications of energy conversion and storage devices.
- Understand different types of fuels, their preparation, properties and combustion characteristics.
- Understand the basic concepts and applications of phase rule.
- Familiarize with the basic knowledge on the principles and preparatory methods of nanomaterials.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.	<b>K3</b>
<b>C02</b>	To recognize different forms of energy resources and apply them for suitable applications in energy sectors.	<b>K3</b>
<b>C03</b>	To recommend suitable fuels for engineering processes and applications.	<b>K3</b>
<b>C04</b>	To apply the knowledge of phase rule and alloys for material selection requirements.	<b>K3</b>
<b>C05</b>	To apply the basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.	<b>K3</b>

**Course Contents**

**Unit I WATER TECHNOLOGY**

**9**

Hardness of water-types -expression-units-estimation of hardness of water by EDTA-numerical problems-boiler feed water-disadvantages of hard water in boilers-boiler troubles (scale & sludge, boiler corrosion)-water treatment-zeolite process, Ion exchange process-desalination-reverse osmosis-instrumental methods for water analysis-AAS, flame emission spectroscopy and photocolourimetry.

**Unit II ENERGY SOURCES AND STORAGE DEVICES**

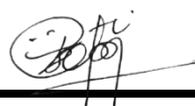
**9**

Energy sources-types-nuclear energy-nuclear fission-controlled nuclear fission-nuclear fusion-nuclear reactor power generator-breeder reactor-solar energy-solar energy conversion-wind energy-Batteries - primary (alkaline battery) - Secondary (lead storage battery, NICAD battery and lithium ion battery) - Electric vehicles - working principles -Fuel cells (H<sub>2</sub>-O<sub>2</sub> , direct methanol and solid oxide)-super capacitors.

**Unit III FUELS AND COMBUSTION**

**9**

Fuels: Introduction-Gross Calorific value- Net Calorific value- classification of fuels - coal- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - octane number - diesel oil- cetane number - natural gas- compressed natural gas (CNG)- liquefied petroleum gases (LPG)- Power alcohol and bio diesel. flue gas analysis (gas chromatography).



**Unit IV PHASE RULE AND ALLOYS**

**9**

Phase Rule: Introduction-definition of terms with examples-one component system-water system-reduced phase rule – thermal analysis and cooling curves-two component system-lead-silver system-pattinson process. Alloys: Introduction-definition-properties of alloys-significance of alloying, functions and effect of alloying elements-ferrous alloys (Nichrome and Stainless steel)-Heat treatment of steel-nonferrous alloys (Brass and Bronze).

**Unit V CHEMISTRY OF ENGINEERING MATERIALS**

**9**

Abrasives-classification-properties-Mho scale-Applications of Abrasives -Portland Cement-manufacture (wet process)-properties-setting and hardening of cement-special cement-alumina cement and water proof cement. -Nano Chemistry: Basics-distinction between molecules, nano particles and bulk materials-preparation of nano particles by sol-gel-preparation of nano wires by electro spinning-preparation of carbon nano tube by chemical vapour deposition-quantum dots-synthesis by colloidal process-Applications of nano materials.

**Total Periods 45**

**Text Books:**

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, 17<sup>th</sup> Edition, 2018, Dhanpat Rai Publishing Company (P) Ltd, New Delhi.
2. Palanna O.G, “Engineering Chemistry”, 2<sup>nd</sup> edition, 2017, McGraw Hill Education (India) Pvt. Ltd., Chennai.
3. Dara S.S, and Umare S.S, “Engineering Chemistry”, 2013, S. Chand & Company Ltd., New Delhi.

**Reference Books:**

1. Murty B. S, Shankar P, Baldev Raj, Rath B.B and James Murday, “Text book of nanoscience and nanotechnology”, 2018, Universities Press-IIM Series in Metallurgy and Materials Science., Springer Publications, US.
2. Sivasankar B, “Engineering Chemistry-Fundamentals and Applications”, 2008, Tata McGraw-Hill Publishing Company, Ltd., New Delhi.
3. Shikha Agarwal, “Engineering Chemistry” Second Edition, 2019, Cambridge University Press, New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/118/104/118104008/>
2. <https://archive.nptel.ac.in/courses/118/102/118102003/>
3. <https://archive.nptel.ac.in/courses/105/106/105106206/>

**Bloom’s Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	1	-	2	-	-	-	-	1	3	1	-
CO2	3	1	2	1	-	1	-	-	-	-	1	3	1	-
CO3	3	1	2	1	-	2	-	-	-	-	2	3	-	-
CO4	3	2	1	1	-	2	-	-	-	-	1	3	-	-
CO5	2	-	-	1	-	2	-	-	-	-	-	3	-	-
Average	2.8	1.5	1.75	1	-	1.8	-	-	-	-	1.25	3	1	-
3 – High; 2 – Medium; 1 – Low; - No Correlation														

Pre requisites : None

**Objectives:**

- To understand and apply fundamental Python programming concepts
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To know the basics of object-oriented programming concepts.
- To do input/output with files in Python.

**Course Outcomes:**

Upon completion of the course, students would be able to

		<b>BT Level (highest level)</b>
<b>C01</b>	Develop python programs using appropriate data types.	<b>K3</b>
<b>C02</b>	Utilize and manipulate Python data structures like lists, tuples, sets, and dictionaries.	<b>K3</b>
<b>C03</b>	Design and implement functions, modules, and packages for structured Python programming.	<b>K3</b>
<b>C04</b>	Articulate the Object oriented programming concepts used in Python.	<b>K3</b>
<b>C05</b>	Develop Python applications with file handling, command-line programming, and exception handling.	<b>K3</b>

**Course Contents**

<b>UNIT I</b>	<b>BASICS OF PYTHON PROGRAMMING</b>	<b>9</b>
	Introduction to Python - Python Interpreter – Data types - variables - expressions -statements- Operators and Expressions – Strings – Decision control statements	
<b>UNIT II</b>	<b>PYTHON DATA STRUCTURES</b>	<b>9</b>
	Sequence - Lists - Functional Programming – Tuples – Sets- Dictionaries	
<b>UNIT III</b>	<b>FUNCTIONS, MODULES AND PACKAGES</b>	<b>9</b>
	Functions – Definition – Call - Variable scope and Life time – Return- Lamda Functions- Recursive functions- Modules – Packages	
<b>UNIT IV</b>	<b>OBJECT ORIENTED PROGRAMMING</b>	<b>9</b>
	Object-Oriented Concepts and Terminology - Classes and objects - Attributes and Methods - Inheritance – Method overriding – Data encapsulation – Data hiding	
<b>UNIT V</b>	<b>FILES AND EXCEPTION HANDLING</b>	<b>9</b>
	File Handling - Read - Write – Command Line Programming – Exception Handling	
<b>Total Periods</b>		<b>45</b>

**Text Books:**

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, 2016, Updated for Python 3, Shroff O’Reilly Publishers.
2. ReemaThareja, “Problem solving and Programming with Python”, 2018, Oxford University.
3. Liang Y. Daniel, “Programming Using Python”, 1st Edition, 2017, Pearson Education.
4. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python”, 2011, Revised and updated for Python 3.2, Network Theory Ltd.



**Reference Books:**

1. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, 2012, CENGAGE Learning.
2. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus”, 2013, Wiley India Edition.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-Disciplinary Approach”, 2016, Pearson India Education Services Pvt. Ltd.
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, 2019, No Starch Press.

**Web URL(s):**

1. <https://nptel.ac.in/courses/106106145>
2. [https://onlinecourses.swayam2.ac.in/cec22\\_cs20/preview](https://onlinecourses.swayam2.ac.in/cec22_cs20/preview)
4. <https://nptel.ac.in/courses/106106182>
5. <https://www.udemy.com/course/python-for-complete-beginners-1/>

**Bloom’s Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	2	1	-	-	1	1	-	2	-	1	1
CO2	2	3	2	2	2	-	-	1	-	-	2	-	1	1
CO3	2	2	3	2	2	-	-	1	1	-	2	-	1	1
CO4	1	1	2	3	1	-	-	-	-	1	2	-	1	1
CO5	2	2	2	2	3	-	-	1	1	1	2	-	1	1
Average	2	2	2.2	2.2	1.8	-	-	1	1	1	2	-	1	1
3 - High; 2 - Medium; 1- Low; -No Correlation														



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<b>U23ECT03</b>	<b>BASICS OF ELECTRICAL, ELECTRONICS AND INFORMATION SCIENCE (Common to MECH, CIVIL and MCT)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**Pre-Requisites** : Mathematics and Physics

**Objectives:**

- To understand the fundamental concepts of circuit elements, electrical connections, laws and networks.
- To realize the operational behaviour of semiconductor devices.
- To impart the concepts of digital electronics.
- To know about the various types of communication systems.
- To Familiar with the concepts in Emerging fields of Information science.

**Course Outcome**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Apply KVL, KCL Voltage and current division rules on Electrical Network.	<b>K3</b>
<b>C02</b>	Compare CE Configuration of BJT and CG, CD, CS Configuration of JFET.	<b>K4</b>
<b>C03</b>	Design Combinational and Sequential Circuit for the given Specification	<b>K3</b>
<b>C04</b>	Understand the Concept of Modulation, Demodulation and learn the amplitude modulation techniques.	<b>K2</b>
<b>C05</b>	Investigate the characteristics of different network technology.	<b>K3</b>

**Course Contents**

**Unit I ELECTRIC CIRCUITS** **9**

Ohm's Law, Kirchhoff's Laws, simple problems, Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor.

**Unit II ANALOG ELECTRONICS** **9**

PN Junction Diodes, Zener Diode Characteristics and Applications, Bipolar Junction Transistor: CE Configuration, JFET- VI Characteristics and Applications, Op-amps characteristics, Inverting and Non-inverting amplifier.

**Unit III DIGITAL ELECTRONICS** **9**

Basic logic gates, Universal gates, Combinational circuit, Half- Adder, Full-Adder, Decoder, Sequential Circuit, Latches, RS Flip-flop, JK Flip-flop, D Flip-flop, T Flip-flop.

**Unit IV COMMUNICATION FUNDAMENTALS** **9**

Analog and Digital Communication: Need for Modulation, Amplitude Modulation and Frequency modulation, Basic of Pulse Amplitude Modulation, Pulse Code Modulation, Digital Modulation Techniques.

**Unit V COMPUTER AND INFORMATION TECHNOLOGY** **9**

Computer Networks: TCP/IP Model- Introduction to Microcontroller (Quantitative treatment only), Introduction to Embedded Technology- Real Time Application- Washing machine controller, Advanced Technologies- Artificial Intelligence.

**Total Periods: 45**



**Text Books**

1. Sudhakar A, Shyammohan S Pilla, "Circuits and Networks Analysis and Synthesis", 2013, Tata McGraw Hill India Pvt Limited, New Delhi.
2. Robert L Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 2013, Pearson Education, New Delhi.

**Reference Books**

1. Morris Mano M and Michael D Ciletti, "Digital Design, With an Introduction to the Verilog HDL", 2013, Pearson Education, New Delhi.
2. Wayne Tomasi, "Electronic Communication Systems", 2004, Pearson Education, New Delhi.

**Web url(s)**

- 1 <https://nptel.ac.in/courses/105103023>
- 2 <https://www.allaboutcircuits.com/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	2	1	1	1	1	1	1	-	-	2
CO2	3	3	3	2	2	1	1	1	1	1	1	-	-	3
CO3	3	3	3	2	3	1	1	1	2	2	1	-	-	3
CO4	3	2	2	2	2	1	1	1	1	2	1	-	-	2
CO5	3	2	2	2	3	1	1	1	2	2	2	2	2	3
Average	3	2.6	2.4	2	2.4	1	1	1	1.4	1.6	1.2	2	2	2.6
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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<b>U23TAT02</b>	<b>TAMILS AND TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**Pre-Requisites** : None

**Objectives:**

To make the students to:

- Understand the key technologies and techniques in weaving and ceramics during the Sangam Age, including pottery styles and decorations.
- Explore ancient design and construction methods by studying buildings and architectural styles from different historical periods in Tamil Nadu.
- Learn about manufacturing technologies like shipbuilding and metalworking, and their importance in ancient Tamil society through archaeological findings.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Understand the significance of weaving and ceramic technology during the Sangam Age, including Black and Red Ware Potteries and graffiti on potteries.	<b>K2</b>
<b>C02</b>	Apply knowledge of ancient design and construction techniques to analyze structural elements and materials used during the Sangam Age.	<b>K3</b>
<b>C03</b>	Evaluate the technological advancements in manufacturing, including shipbuilding, metallurgy, and bead making during ancient Tamil periods.	<b>K3</b>
<b>C04</b>	Recognize the agricultural and irrigation practices, including dam and pond construction, and animal husbandry methods used during the Chola period.	<b>K2</b>
<b>C05</b>	Assess the development of scientific Tamil and Tamil computing, including digitalization efforts and the establishment of Tamil virtual resources.	<b>K3</b>

**Course Contents**

**Unit I WEAVING AND CERAMIC TECHNOLOGY**

**3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**Unit II DESIGN AND CONSTRUCTION TECHNOLOGY**

**3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**Unit III MANUFACTURING TECHNOLOGY**

**3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beads - Archeological evidences - Gem stone types described in Silappathikaram.

**Unit IV AGRICULTURE AND IRRIGATION TECHNOLOGY**

**3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.



**Unit V SCIENTIFIC TAMIL & TAMIL COMPUTING**

**3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**Total Periods 15**

**Text-cum-Reference Books:**

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**Bloom’s Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	2	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	3	2	-	-	-	-	-	-	-	1	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	3	-	2	-	-	-	-	-	-	1	-	-
Average	2	2	2.2	2	2	-	-	-	-	-	-	1	-	-
3 - High; 2 - Medium; 1- Low; -No Correlation														



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**U23CYP01**

**CHEMISTRY LABORATORY  
(Common to ALL branches)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites** : None

**Objectives:**

- To make the students acquire practical skills in determination of water quality parameters through volumetric and instrumental analysis.
- To inculcate experimental skills to students to test water quality parameters, such as acidity, hardness and DO.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.
- To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

- |            |  |           |
|------------|--|-----------|
| <b>CO1</b> | Analyse the quality of water samples with respect to their hardness and DO.  | <b>K3</b> |
| <b>CO2</b> | Quantitatively analyse the impurities in solution by electroanalytical techniques.                                     | <b>K3</b> |
| <b>CO3</b> | Determine the amount of metal ions by spectroscopic techniques and molecular weight of polymers by viscometric method. | <b>K3</b> |

**List of Experiments**

1. Estimation of Total, Temporary and Permanent Hardness of Water Sample by EDTA method.
2. Determination of DO content in Water by Winkler's method.
3. Determination of strength of acids in a mixture using conductivity meter.
4. Determination of strength of acid in a base using conductivity meter.
5. Determination of strength of an acid using pH meter.
6. Estimation of iron content of the given solution using potentiometer.
7. Determination of molecular weight and degree of polymerisation of a polymer (PVA) by viscometric method
8. Estimation of Iron in a given sample by photo colorimetry

**Total Periods 30**

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	-	1	-	-	2	-	1	-	-	1	2	3	2
CO2	2	1	2	-	-	2	-	1	-	-	-	1	3	2
CO3	3	1	2	-	-	2	-	1	-	-	-	1	2	2
Average	2.7	0.6	1.7	-	-	1.2	-	1	-	-	0.3	1.3	2.7	2
3 – High; 2 – Medium; 1 – Low; - No Correlation														



Pre requisites : None

### Objectives:

This course helps to develop and implement Python programs using fundamental constructs, data structures, and advanced features like OOP and file handling.

### Course Outcomes:

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

- |   |           |
|---|-----------|
| <b>C01</b> Apply Python programming fundamentals to create programs with simple statements, expressions and control structures.       | <b>K3</b> |
| <b>C02</b> Design and implement complex programs integrating data structures, modules and exception handling for technical solutions. | <b>K4</b> |
| <b>C03</b> Develop real-time applications using advanced Python features such as functions, OOP, and file handling.                   | <b>K6</b> |

### List of Experiments

1. Python programming using simple statements and expressions
2. Conditionals and Iterative loops
3. Implementing programs using Functions.
4. Implementing programs using Strings
5. Implementing real-time/technical applications using Lists, Tuples, and Dictionaries.
6. Implementing programs using written modules and Python Standard Libraries.
7. Implementing real-time/technical applications using File handling.
8. Implementing real-time/technical applications using Exception handling.
9. Python programming using OOPs concepts.
10. Mini project.

**Total Periods: 30**

### Reference Books

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, 2016, Updated for Python 3, Shroff O'Reilly Publishers.
2. ReemaThareja, "Problem solving and programming with python", 2018, Oxford University.
3. Liang Y. Daniel, "Programming Using Python", 1<sup>st</sup> Edition, 2017, Pearson Education.
4. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python ", 2011, Revised and updated for Python 3.2, Network Theory Ltd.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", 2012, CENGAGE Learning.
6. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", 2013, Wiley India Edition.
7. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-Disciplinary Approach", 2016, Pearson India Education Services Pvt. Ltd.
8. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2<sup>nd</sup> Edition, 2019, No Starch Press.



**Web URL(s):**

1. <https://python-iitk.vlabs.ac.in/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	1	-	-	-	-	-	2	1	1	3
CO2	2	3	2	2	2	-	-	1	1	1	2	2	2	3
CO3	2	2	2	2	3	-	-	1	1	1	2	2	2	3
Average	2.3	2.7	2	2	2	-	-	1	1	1	2	1.7	1.7	3
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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<b>U23MEP01</b>	<b>COMPUTER AIDED DRAFTING LABORATORY (Common to MECH, MCT and CIVIL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : None

**Objectives:**

- To draw simple figures with title block using CAD software commands.
- To sketch curves like parabola, spiral and involute of square & circle and draw the orthographic projection of simple solids.
- To prepare orthographic projection of simple machine parts and draw a plan of residential building
- To develop skill in sketching simple steel truss and sectional views of simple solids.
- To develop skill to use software to create 2D and 3D models.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Exhibit proficiency in creating and editing a title block that includes essential text elements and projection symbols using CAD software.	<b>K3</b>
<b>CO2</b>	Create accurate front, top, and side views of simple objects from a given pictorial view, including necessary dimensions and sectional details.	<b>K3</b>
<b>CO3</b>	Develop a detailed plan of a residential building featuring designated rooms and produce an accurate drawing of a simple steel structures using CAD software.	<b>K3</b>

**List of Exercises:**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder and cone including dimensioning.
5. Drawing sectional views of prism, pyramid, cylinder and cone.
6. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
7. Drawing isometric projection of simple objects.
8. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.
9. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
10. Drawing of a simple steel truss.

**Total Periods: 60**



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**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	3	2	1	1	1	1	1	1	1	1	-	3
CO2	2	3	2	2	1	1	1	1	1	1	1	2	-	3
CO3	2	3	2	2	1	1	1	1	1	1	1	3	1	3
Average	2	3	2.3	2	1	1	1	1	1	1	1	2	0.3	3
3 – High; 2 – Medium; 1– Low; - No correlation														



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# Semester III



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<b>U23MAT04</b>	<b>STATISTICS AND NUMERICAL METHODS</b> (Common to CIVIL, MECH, MCT)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Pre-Requisites** : Basic concepts of Integration, Differentiation, Probability and Standard Distributions

**Objectives:**

- To provide the necessary basic concepts and procedures for solving numerically in engineering and technology.
- Acquaint the knowledge in testing the hypothesis for small and large samples in real life problems.
- Provide the necessary basic concepts of a design of experiments in statistics.
- Introduce the basic concepts of solving algebraic and transcendental equations using numerical techniques.
- Introduce the numerical systems of interpolation, differentiation and integration.
- Acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Apply the concept of testing of hypothesis for small and large samples in real life problems.	<b>K3</b>
<b>CO2</b>	Apply the basic concepts of classifications of design of experiments in the field of agriculture.	<b>K3</b>
<b>CO3</b>	Solve the algebraic and transcendental equations using numerical techniques for engineering applications.	<b>K3</b>
<b>CO4</b>	Apply the numerical techniques of interpolation in various intervals, differentiation and integration for engineering problems.	<b>K3</b>
<b>CO5</b>	Use the knowledge of various techniques and methods for solving first and second order ordinary differential equations.	<b>K3</b>

**Course Contents**

**Unit I TESTING OF HYPOTHESIS**

**9+3**

Tests for single and difference of means (Large and small samples) – Tests based on t, chi-square and F distribution for testing mean and variance – Contingency table (test for independence)- Goodness of fit.

**Unit II DESIGN OF EXPERIMENTS**

**9+3**

One way and two-way classifications-Completely randomized design – Randomized block design – Latin square design.

**Unit III NUMERICAL SOLUTION OF LINEAR EQUATIONS**

**9+3**

Solution of algebraic and transcendental equations - Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel.

**Unit IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION**

**9+3**

Lagrange’s and Newton’s forward and backward difference interpolation –Approximation of derivatives using interpolation polynomials – Numerical single and double integration using Trapezoidal and Simpson’s 1/3 rules.

**Unit V NUMERICAL SOLUTION OF ODE GIVEN INITIAL VALUES**

**9+3**

Single step methods: Taylor’s series method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne’s predictor corrector methods for solving first order differential equations.

**Total Periods 60**



**Text Books:**

1. Grewal.B.S and Grewal.J.S, “Numerical Methods in Engineering and Science”, 11<sup>th</sup> Edition 2013,Khanna Publishers,New Delhi.
2. Johnson. R.A, Miller.I and Freund. J, “Miller and Freund’s Probability and Statistics for Engineers”, 8<sup>th</sup> Edition, 2015, Pearson Education, Asia, Delhi.

**Reference Books:**

1. Gupta.S.C. and Kapoor. V. K, “Fundamentals of Mathematical Statistics”, 12<sup>th</sup> Edition, 2020, Sultan Chand & Sons, New Delhi.
2. Burden.R.L. and Faires.J.D, “Numerical Analysis”, 9th Edition, 2016, Cengage Learning.
3. Devore.J.L., “Probability and Statistics for Engineering and the Sciences”, 8<sup>th</sup> Edition, 2014, Cengage Learning, New Delhi

**Web URL(s):**

1. <https://nptel.ac.in/courses/111105041>
2. <https://nptel.ac.in/courses/102106051>
3. <https://nptel.ac.in/courses/111105038>

**Bloom’s Taxonomy Level**

K1- Remember, K2 – Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	1	3	2	1	-	-	-	1	1	1	1	-
CO2	1	3	1	3	2	1	-	-	-	1	-	1	1	-
CO3	2	3	-	1	2	-	-	-	-	-	1	2	1	2
CO4	3	3	-	2	3	-	-	-	-	-	-	2	2	1
CO5	3	3	-	3	3	-	-	-	-	-	-	2	2	2
Average	2.2	2.6	1	2.4	2.4	1	-	-	-	1	1	1.6	1.4	1.7
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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**U23CET01**

**CONSTRUCTION MATERIALS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To introduce students to various construction materials commonly used in civil engineering construction.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest level)**

<b>C01</b>	Apply knowledge of building materials like stones, bricks, and concrete blocks in selecting suitable materials for construction.	<b>K3</b>
<b>C02</b>	Analyze the properties and quality of cement and aggregates through standardized tests.	<b>K4</b>
<b>C03</b>	Analyze the properties of concrete ingredients and evaluate their effects on the performance of fresh and hardened concrete.	<b>K4</b>
<b>C04</b>	Identify and explain the properties and uses of various materials like timber, metals, and composites.	<b>K2</b>
<b>C05</b>	Apply knowledge of materials and techniques to select appropriate doors, windows, and painting methods for various construction applications.	<b>K3</b>

**Course Contents**

**Unit I STONES - BRICKS - CONCRETE BLOCKS 9**

Stone as building material - criteria for selection - Tests on stones - Bricks - Classification - Manufacturing of clay bricks - Tests on bricks - Compressive strength - bricks for special use - lime - preparation of lime mortar - concrete hollow blocks - Lightweight concrete blocks - Autoclaved aerated concrete (AAC) blocks - interlocking blocks - porotherm bricks.

**Unit II CEMENT - AGGREGATES 9**

Cement - Ingredients - Manufacturing process - Types and grades - Properties of cement and Cement mortar - Tests on Cement - Fineness - Soundness, Consistency - Setting time - Coarse Aggregate - Crushing strength - Impact strength - Flakiness Index - Elongation Index - Abrasion resistance - Fine aggregate - grading - Bulking.

**Unit III CONCRETE 9**

Concrete - Ingredients - Hydration - Batching plants - RMC - Properties of fresh concrete - Slump, Flow and Compaction factor - Properties of Hardened concrete - Mix Specification - Concept of mix design proportion - Self Healing Concrete - Ultra High-Performance Concrete.

**Unit IV TIMBER AND OTHER MATERIALS 9**

Timber - seasoning - Decay - Market forms - Plywood - Veneer - False ceiling materials - Laminates - Steel - Mechanical treatment - Aluminium - Uses - Market forms - Glass - Refractories - Composite Materials - FRP - poly vinyl chloride (PVC) - unplasticized poly vinyl chloride (UPVC)

**Unit V DOORS, WINDOWS AND PAINTING 9**

Doors and Windows - Types - Fixtures and Fastening - Ventilators - laminated wood products - properties - fibre board - particle boards - hard boards - A.C boards - Aluminium products - Paints and painting - Classification of paints - Painting on new and old surfaces, steel, timber and masonry wall - Defects in painting.

**Total Periods 45**



**Text Books:**

1. Varghese.P.C, "Building Materials", 2016, Second Edition PHI Learning Ltd, New Delhi.
2. Shetty.M.S, "Concrete Technology (Theory and Practice)", 2015, S Chand and Company Ltd, New Delhi.
3. G.S. Birdie, T.D. Ahuja, "A Text Book of Building Construction and Construction Materials", 2001, Dhanpatrai Publishing Company (P) Ltd, New Delhi.

**Reference Books:**

- 1 Dr.K.Elangovan, "Construction Materials", Second Edition, 2017, Lakshmi Publications, Chennai.
- 2 Dr S Seetharaman and Er M Chinnasamy, "Construction Materials", 2016, Second Edition, Anuradha Publications, Chennai.
- 3 K.Arun and Dr.R.Saravanan, "Construction Materials and Technology", 2022, First Edition, Lakshmi Publications, Chennai.

**Web URL(s):**

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2. <https://archive.nptel.ac.in/courses/105/106/105106053/>
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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	-	-	2	-	-	-	-	-	3	2	-
CO2	3	3	-	2	-	-	-	-	-	-	-	3	2	2
CO3	3	3	-	3	-	-	-	-	-	-	-	3	2	2
CO4	2	2	-	-	-	1	-	-	-	-	-	2	3	-
CO5	3	2	2	-	-	2	-	-	-	-	1	3	3	2
Average	2.8	2.4	2	2.5	-	1.7	-	-	-	-	1	2.8	2.4	2
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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<b>U23MET03</b>	<b>ENGINEERING MECHANICS (Common to MECH, MCT and CIVIL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	1	0	3

**Pre-Requisites** : None

**Objectives:**

- To make the students understand the vector and scalar representation of forces and moments and the static equilibrium of particles and rigid bodies.
- To understand the effect of friction on equilibrium, laws of motion, kinematics of motion and the interrelationship.
- To make the students understand the properties of surfaces and solids, prediction of behaviour of particles and rigid bodies under motion.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>CO1</b>	Define the basic concepts of force system	<b>K3</b>
<b>CO2</b>	Explain the resultant force, moment and geometrical properties of 2D and 3D objects using free body diagrams	<b>K3</b>
<b>CO3</b>	Calculate the centroid and centre of gravity of surfaces and objects.	<b>K4</b>
<b>CO4</b>	Calculate the displacement, velocity and acceleration of particles and objects	<b>K3</b>
<b>CO5</b>	Analyse the resistance force of particles and objects for Impending Motion	<b>K4</b>

**Course Contents**

**Unit I      BASICS AND EQUILIBRIUM OF PARTICLES      9**

Introduction-Units and Dimensions-Laws of Mechanics- Parallelogram Law of forces - principle of transmissibility Resolution and Resultant of Coplanar concurrent Forces- Equilibrium of a particle in two dimensions- Free Body Diagram- Lamis Theorem - Forces In Space-Resultant and Equilibrium of particles in space (vector approach).

**Unit II      EQUILIBRIUM OF RIGID BODIES      9**

Moment of a force -Varignon's theorem - Equivalent system of forces - Reduction of system of forces into single force and couple - Type of supports and reaction - Equilibrium of rigid bodies in two dimensions

**Unit III      PROPERTIES OF SURFACES AND SOLIDS      9**

Centroid of Common Shapes of Area-Centroid and Area Moment of Inertia of Composite Areas (Rectangle, triangle, circle, quarter and semicircle) by using Standard formula. Pappus - Guldinus Theorem only - Centre of gravity of 3D composite bodies by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

**Unit IV      DYNAMICS OF PARTICLES      9**

Displacements, Velocity and acceleration - Rectilinear motion of particles - Motion of particles under Gravity - Curvilinear motion - Motion of projectile - Newton's laws of motion- D'Alembert's Principle - Work Energy Equation- Impulse and Momentum Equation - Impact of elastic bodies- Direct central impact.

**Unit V      FRICTION AND DYNAMICS OF RIGID BODIES      9**

Types of Friction- Coulombs Law of Dry Friction - Impending motion, Angle of repose - Simple contact friction - Ladder friction. Kinematics of rigid bodies - Translation and Rotation of Rigid Bodies - General Plane motion.



**Total Periods      45**

**Text Books:**

1. Ferdinand P. Beer, Russell Johnston E., "Vector Mechanics for Engineers: Statics and Dynamics". 12<sup>th</sup> Edition, 2016, Tata McGraw-Hill International Edition, Bangalore
2. Irving H. Shames, G. Krishna Mohan Rao., "Engineering Mechanics - Statics and Dynamics", 4<sup>th</sup> Edition, 1996, Pearson Education Asia Pvt. Ltd, New Delhi.

**Reference Books:**

1. Vela Murali, "Engineering Mechanics", 2<sup>nd</sup> Edition, 2018, Oxford University Press. New Delhi.
2. Kottiswaran N, "Engineering Mechanics - Statics and Dynamics", 8<sup>th</sup> Edition, 2017, Sri Balaji Publications, Chennai.
3. Rajasekaran S and Sankara subramanian G., "Engineering Mechanics", 1<sup>st</sup> Edition, 2018, Vikas Publishing House Pvt. Ltd. New Delhi.
4. Kumar D.S., "Engineering Mechanics", 5<sup>nd</sup> Edition, 2022, S.K. Kataria & Sons Publications, New Delhi.

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2. <https://archive.nptel.ac.in/courses/112/106/112106180/>
3. <https://archive.nptel.ac.in/courses/112/103/112103108/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	1	2	-	1
CO2	3	3	2	-	-	-	-	-	-	-	1	3	-	2
CO3	3	2	2	-	-	-	-	-	-	-	1	3	-	2
CO4	3	2	2	-	2	-	-	-	-	-	1	2	-	1
CO5	3	3	3	2	-	-	-	-	-	-	1	3	1	2
Average	3	2.4	2.25	2	2	-	-	-	-	-	1	2.6	1	1.6
3 – High; 2 – Medium; 1– Low; - No correlation														



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U23CET02

**SOLID MECHANICS**

L	T	P	C
3	0	0	3

Pre-Requisites : None

**Objectives:**

- To understand the behavior of solids under different loading conditions through the study of stress, strain, beam deflection, torsion, shear, and complex stress analysis.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Use the knowledge of stress and strain to analyze and solve problems related to material behavior under different loading conditions.	<b>K3</b>
<b>C02</b>	Predict the behaviour of beams under various loading conditions.	<b>K4</b>
<b>C03</b>	Examine and predict beam deflection using appropriate methods.	<b>K4</b>
<b>C04</b>	Apply principles of torsion and shear to analyze and design structural members.	<b>K4</b>
<b>C05</b>	Interpret complex stress states using analytical and graphical methods.	<b>K4</b>

**Course Contents****Unit I TENSION, COMPRESSION AND SHEAR 9**

Introduction – Normal stress and strain – Stress and strain diagram for steel – Hooke's law – Poisson's ratio – Shear stress and strain – Deformation of axially loaded member – Elastic constants – Thermal stresses and composite bars.

**Unit II BENDING OF BEAMS 9**

Introduction – Types of beams, loads and supports – Shear force and bending moment for statically determinate beams – Theory of simple bending – Bending Stress distribution – Shear stress distribution of rectangular, circular and T section.

**Unit III DEFLECTION OF BEAMS 9**

Governing differential equation – Double Integration method – Macaulay's method – Moment area method – Conjugate beam method.

**Unit IV TORSION OF SHAFTS AND SPRINGS 9**

Introduction to Torsion – Basic assumptions – Elastic theory of torsion – Stresses and deformations in solid and hollow circular shafts – Combined bending moment and torsion of shafts – Power transmitted to shaft – Shafts in series and parallel – Closed and open coiled helical springs – Springs in series and parallel.

**Unit V PRINCIPAL STRESS AND STRAIN 9**

Principal stresses and principal planes – Maximum shear stress – Plane strain – State of stress in two dimensions – Stress on inclined planes – Maximum shear stress – Mohr's circle method.

**Total Periods 45**


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**Text Books:**

1. Er.Rajput R K, "A Textbook of Strength of Materials (Mechanics of Solids)", 2018, 6<sup>th</sup> Edition, S.Chand Publishing, New Delhi.
2. Dr.Bansal R K, "A Textbook of Strength of Materials (Mechanics of Solids)", 2024, 7<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd., New Delhi.

**Reference Books:**

1. Dr.Punmia B C, Er.Ashok Kumar Jain and Dr.Arun Kumar Jain, "SMTS – I Strength of Materials", 2013, 10<sup>th</sup> Edition, Laxmi Publications, New Delhi.
2. Singh D. K., "Strength of Materials", 2020, 4<sup>th</sup> Edition, Ane Books Pvt. Ltd, New Delhi.
3. Rattan S S, "Strength of Materials", 2017, 3<sup>rd</sup> Edition, McGraw Hill Education, New Delhi.
4. Ramamrutham S and Narayanan R, "Strength of Materials", 2020, 18<sup>th</sup> Edition, Dhanpat Rai Books, New Delhi.

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2. <https://archive.nptel.ac.in/courses/105/104/105104160/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	3	2	3	-	-	1	-	3	3	-	-
CO2	3	3	2	3	2	3	-	-	1	-	3	3	-	-
CO3	3	3	2	3	2	3	-	-	1	-	3	3	-	-
CO4	3	3	2	3	2	3	-	-	1	-	3	3	-	-
CO5	3	3	2	3	2	3	-	-	1	-	3	3	-	-
Average	3	3	2	3	2	3	-	-	1	-	3	3	-	-
3 – High, 2 – Medium, 1 – Low, - No correlation														



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U23CET03

## FLUID MECHANICS

L	T	P	C
3	0	0	3

Pre-Requisites : None

**Objectives:**

- To develop an understanding of fluid properties and the principles of fluid statics, kinematics, and dynamics, and to analyze the complexities of fluid flow problems.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Use the fundamental properties of fluids to determine pressure forces on submerged surfaces and their practical applications.	<b>K3</b>
<b>CO2</b>	Interpret fluid flow principles such as continuity, Bernoulli's equation, and flow measurement techniques to solve fluid mechanics problems.	<b>K3</b>
<b>CO3</b>	Demonstrate fluid flow in pipes, including laminar flow, energy losses, and the effects of pipe connections.	<b>K4</b>
<b>CO4</b>	Infer the characteristics of boundary layers, including separation and control methods, to optimize fluid flow behaviour.	<b>K4</b>
<b>CO5</b>	Illustrate dimensional analysis and similitude principles to solve fluid mechanics problems and design models.	<b>K3</b>

**Course Contents****Unit I PROPERTIES OF FLUID AND HYDROSTATICS**

9

Basic concepts of fluid mechanics – Fluid properties like density, specific weight, specific volume, specific gravity, viscosity, surface tension, compressibility, capillarity – Types of fluids – Total pressure and centre of pressure on submerged surfaces.

**Unit II FLUID KINEMATICS AND DYNAMICS**

9

Fluid Kinematics – Classification of fluid flows – Continuity equation– Stream line, streak line, path line – Potential function and stream function. Fluid Dynamics – Euler's equation, Bernoulli's equation and its application. Flow Measurements – Discharge measurement in pipes using Pitot tube, Venturi meter and Orifice meter.

**Unit III FLOW THROUGH PIPES**

9

Reynolds experiment - Development of Laminar flow through circular pipe (Hagen Poiseulle's equation) – Darcy-Weisbach formula– major and minor losses of flow in pipes – Pipes in series and in parallel - Equivalent pipes.

**Unit IV BOUNDARY LAYER**

9

Boundary layer – Laminar and turbulent boundary layer – Displacement, energy and momentum thickness – Separation of boundary layer –Methods of controlling boundary layer separation.

**Unit V DIMENSIONAL ANALYSIS**

9

Units and dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham Pi-theorem – Dimensionless parameters – Similitude and model studies - Distorted and undistorted models.

**Total Periods 45**


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**Text Books:**

1. Modi P.N and Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", 2013, Standard Book House, New Delhi.
2. Streeter, Victor L. Wylie, Benjamin E, "Fluid Mechanics", 2013, McGraw-Hill Ltd, Uttar Pradesh.
3. White FM, "Fluid Mechanics", 2016, Tata Mc Graw Hill, New Delhi.

**Reference Books:**

- 1 Bansal R.K, "Fluid Mechanics and Hydraulics Machines", 5<sup>th</sup> edition, 2017, Laxmi Publications Pvt. Ltd, New Delhi.
- 2 Jain AK, "Fluid Mechanics including Hydraulic Machines", 2015, Khanna Publication, New Delhi.
- 3 Subramanya K, "Fluid Mechanics including Hydraulic Machines", 2012, Tata McGraw Hill, New Delhi.
- 4 Ramamrutham S, "Fluid Mechanics and Hydraulics and Fluid Machines", 2011, DhanapatRai and Sons, New Delhi.

**Web URL(s):**

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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	PSOs														
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
CO1	3	2	1	1	2	1	-	1	1	-	1	2	-	-	
CO2	3	3	2	2	2	3	-	-	2	-	2	3	-	-	
CO3	3	3	2	2	3	3	-	-	2	-	2	3	-	-	
CO4	3	3	2	3	2	3	-	-	2	-	2	3	-	-	
CO5	3	3	2	2	3	3	-	1	2	-	2	3	-	-	
Average	3	2.8	1.8	2	2.4	2.6	-	1	1.8	-	1.8	2.8	-	-	
3 – High, 2 – Medium, 1 – Low, - No correlation															

  
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**U23CET04**

**SURVEYING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide foundational knowledge of surveying principles, methods and instruments including theodolite and modern tools to address real world civil engineering problems.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Select the angles, distances and levels using various surveying instruments	<b>K3</b>
<b>C02</b>	Discover the procedure involved in each method, emphasizing field techniques and the use of levelling instruments.	<b>K4</b>
<b>C03</b>	Choose the application of survey instruments and measuring horizontal and vertical angles.	<b>K3</b>
<b>C04</b>	Discover the procedure for establishing different types curves to align highway and railway curves.	<b>K4</b>
<b>C05</b>	Develop the concepts and principles of modern surveying to impart the knowledge.	<b>K3</b>

**Course Contents**

**Unit I MEASUREMENT OF DISTANCES AND DIRECTION 9**

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining. Methods of ranging – Well conditioned triangles – Chain traversing. Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction. Magnetic declination – Dip – Compass traversing.

**Unit II LEVELLING 9**

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments. Methods of levelling – Fly levelling – Check levelling - Procedure in levelling – Field Book - contour surveying – definition – Characteristics, methods and uses of contouring.

**Unit III THEODOLITE AND TRAVERSING 9**

Types of Theodolites - Fundamental Lines - Temporary adjustments. Measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angles. Trigonometrical levelling when base is accessible and inaccessible. Traversing: Methods of traversing - traverse computations and adjustments - Gale's traverse table - Omitted measurements.

**Unit IV TACHEOMETER SURVEYING AND CURVES 9**

Tacheometric Surveying: Principles of Tacheometry - stadia and tangential methods of Tacheometry. Curves: Types of curves and their necessity - Elements of simple curve, setting out of simple Curves - Introduction to compound curves.

**Unit V ADVANCED SURVEYING 9**

Total Station and Global Positioning System: Basic principles, classifications, applications, comparison with conventional surveying. Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations - Applications of GPS. Drone surveying and mapping - Field procedure and applications.

**Total Periods 45**



**Text Books:**

1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, "Surveying Vol. I & II", 2016, Sixteenth Edition, Lakshmi Publications Pvt Ltd, New Delhi.
2. T. P. Kanetkar and S. V. Kulkarni, "Surveying and Levelling", Parts 1 & 2, 2008, Pune Vidyarthi Griha Prakashan, Pune.

**Reference Books:**

1. R. Subramanian, "Surveying and Levelling", 2012, Second Edition, Oxford University Press, Noida, Uttar Pradesh.
2. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 2001, Seventh Edition, Mc Graw Hill, Delhi.
3. K. R. Arora, "Surveying Vol I & II", 2013, Twelfth Edition, Standard Book house, Delhi.

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2. <https://nptel.ac.in/courses/105107158>
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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	3	2	2	3	2	2	-	2	-	3	-	2
CO2	3	3	2	2	2	3	2	2	-	2	-	3	-	2
CO3	3	3	3	2	3	3	2	2	-	2	-	3	-	2
CO4	3	3	3	3	3	3	2	3	-	2	2	3	-	2
CO5	3	3	3	3	3	3	3	2	-	2	2	3	-	2
Average	2.8	2.8	2.8	2.4	2.6	3	2.2	2.2	-	2	2	3	-	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**U23CEP01**

**SOLID MECHANICS LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : None

**Objectives:**

- To understand the behavior of materials under different loading conditions such as tension, compression, torsion and bending, and to determine their impact strength and hardness

**Course Outcomes:**

On completion of the course, the student is expected to

**BT Level  
(highest  
level)**

<b>CO1</b>	Experiment with torsional strength, impact strength, hardness numbers and tensile strength of given specimens.	<b>K3</b>
<b>CO2</b>	Solve the compressive strength of brick.	<b>K3</b>
<b>CO3</b>	Solve the stiffness and deflection of open coiled and close coiled springs.	<b>K3</b>

**EXERCISES:**

- I** Tension test on steel rod
- II** Torsion test on mild steel rod
- III** Compression test on brick
- IV** Tests on open helical spring
- V** Tests on closed helical spring
- VI** Impact test on metal specimen (Izod and Charpy)
- VII** Determination of Rockwell Hardness Number
- VIII** Determination of Brinell Hardness Number
- IX** Static bending test on metal beam
- X** Double shear test on metal

**Total Periods      60**

**Text Books:**

1. "Strength of Materials Laboratory Manual", 2010, Anna University, Chennai.
2. IS 1786-2008, Specification for cold worked steel high strength deformed bars for concrete reinforcement, 2008.

**Reference Books:**

1. A.Anand Jayakumar, "Strength of Materials Lab Manual", 2012, Notion Press.
2. Dr.B.C.Punmia, Er.Ashok Kumar Jain and Dr.Arun Kumar Jain, "SMTS – I Strength of Materials", 2013, 10<sup>th</sup> Edition, Laxmi Publications, New Delhi.

**Web URL(s):**

1. <https://sm-nitk.vlabs.ac.in/Introduction.html>
2. <https://vlab.amrita.edu/?sub=77&brch=299>



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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	3	2	-	2	-	-	-	2	3	2	3
CO2	3	3	3	2	2	-	2	-	-	-	2	3	3	2
CO3	3	3	3	3	2	-	2	-	-	-	2	3	2	3
Average	3	3	2.7	2.7	2	-	2	-	-	-	2	3	2.3	2.7
3 – High, 2 – Medium, 1 – Low, - No correlation														



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U23CEP02

## SURVEYING LABORATORY

L	T	P	C
0	0	4	2

**Pre-Requisites** : Surveying

**Objectives:**

- To develop skills in measuring surveying quantities, applying appropriate methods and instruments, handling advanced equipment, and performing curve setting out.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

- |            |  |           |
|------------|--|-----------|
| <b>CO1</b> | Choose the usage of basic surveying instruments like chain/tape, compass and levelling instruments.              | <b>K3</b> |
| <b>CO2</b> | Solve to use levelling instrument for surveying operations and also theodolite for various surveying operations. | <b>K3</b> |
| <b>CO3</b> | Apply in using a total station to measure distances, angles and heights accurately.                              | <b>K3</b> |

**Course Contents****LIST OF EXPERIMENTS**

- Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset.
- Setting out works – Foundation marking.
- Compass Traversing – Measuring Bearings & arriving included angle.
- Fly levelling using Dumpy level.
- Measurements of horizontal and vertical angles (any one method).
- Determination of Tacheometric Constants.
- Heights and distances by stadia Tacheometry.
- Heights and distances by Tangential Tacheometer.
- Study of traverse using Total station.
- Determination of distance and difference in elevation between two inaccessible points using Total station.

**Total Periods**

**60**

**References:**

- T. P. Kanetkar and S. V. Kulkarni, "Surveying and Levelling", Parts 1 & 2, 2015, 24<sup>th</sup> Reprint, Vidyanthi Griha Prakashan, Pune.
- Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, "Surveying Vol. I & II", 2016, 17<sup>th</sup> Edition, Lakshmi Publications Pvt Ltd, New Delhi.
- Bannister and S. Raymond, "Surveying", 2004, 7<sup>th</sup> Edition, Volume I, Pearson Education Limited, London.

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- <https://archive.nptel.ac.in/courses/105/107/105107122/>
- <https://sl-iitr.vlabs.ac.in/>



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Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	2	2	3	3	3	3	2	3	3	-	2
CO2	3	2	3	-	3	3	3	3	3	2	-	3	-	2
CO3	3	1	2	-	3	2	-	3	-	2	3	3	-	2
Average	3	1.7	2.7	2	2.7	2.7	3	3	3	2	3	3	-	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**Coimbatore - 641 109**

<b>U23CEP03</b>	<b>BUILDING PLANNING AND DRAWING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : None

**Objectives:**

- To interpret and apply local building bye-laws and the National Building Code, demonstrate proficiency in preparing building drawings, and plan essential building elements like septic tanks and rainwater harvesting systems.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

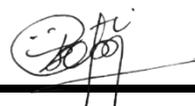
- |            |   |           |
|------------|---|-----------|
| <b>CO1</b> | Make use of the building bye-laws, plan various buildings as per the building by-laws, NBC recommendations and scheduling                 | <b>K3</b> |
| <b>CO2</b> | Develop the skills of Drawing Plans, Sections and Elevations of different buildings, and drawing building elements like doors and windows | <b>K3</b> |
| <b>CO3</b> | Plan the different building elements like Septic tank and Rain water harvesting system.   | <b>K3</b> |

**Course Contents**

**LIST OF EXPERIMENTS**

1. Objectives of building Bye laws - floor area ratio - floor space index - principles under l laying building bye laws
2. Classification of buildings - open space requirements - built up area limitations- height of buildings- wall thickness - lightening and ventilation requirements.
3. NBC Recommendations for Building drawings, study of approved building drawings and vasthu building drawings
4. Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations and Scheduling
5. Plan, Elevation and sections of a Residential Building.
6. Plan, Elevation and sections of an Industrial Building.
7. Plan, Elevation and sections of a primary health centre.
8. Panelled door and glassed door.
9. Glassed windows and panelled windows.
10. Connections of King Post truss, Queen Post truss.
11. Layout plan of rainwater recharging and harvesting system.
12. Layout plan of septic tank.

**Total Periods      60**



**References:**

1. V.B. Sikka, "A course in Civil Engineering Drawing", 7<sup>th</sup> Edition, 2015, S.K. Kataria & Sons Publishers, New Delhi.
2. D.N. Ghose, "Civil Engineering Drawing and Design", 2<sup>nd</sup> Edition, 2010, CBS Publishers & Distributors Pvt.Ltd, New Delhi.
3. National Building Code of India 2016 (NBC 2016).
4. Unni krishna Pillai and Devdas Menon, "Reinforced Concrete Design", 3<sup>rd</sup> Edition, 2017, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

**Web URL(s):**

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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	-	2	3	1	-	2	2	1	3	3	2
CO2	3	2	3	-	3	2	-	2	3	2	1	3	2	3
CO3	2	1	3	-	2	3	1	-	2	2	1	3	3	2
Average	2.7	1.7	3	-	2.3	2.7	1	2	2.3	2	1	3	2.7	2.3
3 – High, 2 – Medium, 1 – Low, - No correlation														



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# Semester IV



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**U23CET05**

**STRENGTH OF MATERIALS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Mechanics of Solids

**Objectives:**

- To analyze plane and space trusses, indeterminate beams, and columns under various loads; understand the behavior of thin and thick cylinders under pressure; and determine bending stresses and shear centers in different sections.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Determine member forces and reactions in plane trusses.	<b>K4</b>
<b>CO2</b>	Identify the concept of indeterminacy in beams used for analyzing indeterminate beams.	<b>K3</b>
<b>CO3</b>	List the failure modes and critical loads of short and long columns under various loading conditions.	<b>K4</b>
<b>CO4</b>	Determine internal pressure using Lamé's equation and various failure theories.	<b>K4</b>
<b>CO5</b>	Solve the bending stresses in beams with symmetrical and unsymmetrical cross-sections using appropriate methods.	<b>K3</b>

**Course Contents**

<b>Unit I</b>	<b>ANALYSIS OF TRUSSES</b>	<b>9</b>
Perfect, deficient and redundant trusses – Degree of redundancy – Internal and external redundancy – Methods of analysis – Methods of joints – Method of section – Method of tension coefficient – Analysis of space truss.		
<b>Unit II</b>	<b>INDETERMINATE BEAMS</b>	<b>9</b>
Analysis of propped cantilever and fixed beam – Theorem of three moments – Analysis of continuous beams – Shear force and bending moment diagrams.		
<b>Unit III</b>	<b>COLUMNS AND STRUTS</b>	<b>9</b>
Columns - Slenderness ratio - Calculation of stresses in short columns due to axial load and uni-axial and biaxial bending moments – Core of the section – Buckling load of long columns – Euler's theory – Different end conditions - Rankine's formula – Straight line formula.		
<b>Unit IV</b>	<b>THIN AND THICK CYLINDERS AND THEORIES OF ELASTIC FAILURE</b>	<b>9</b>
Thin cylinders – Circumferential stress – Longitudinal stress – Volumetric strain – Stresses in thick cylindrical shell – Stresses in compound cylinders – Failure theories – Maximum principal stress theory – Maximum shear stress theory – Maximum principal strain theory – Strain energy theory – Maximum shear strain energy theory.		
<b>Unit V</b>	<b>UNSYMMETRICAL BENDING</b>	<b>9</b>
Unsymmetrical bending of beams – Symmetrical and unsymmetrical sections – Shear centre – channel section – curved beams – Winkler Bach formula – stress concentration.		
<b>Total Periods</b>		<b>45</b>



**Text Books:**

1. Er.R.K.Rajput, "A Textbook of Strength of Materials (Mechanics of Solids)", 6<sup>th</sup> Edition, 2016, S.Chand Publishing, New Delhi.
2. Dr.R.K.Bansal, "A Textbook of Strength of Materials (Mechanics of Solids)", 7<sup>th</sup> Edition, 2024, Laxmi Publications Pvt. Ltd., New Delhi.

**Reference Books:**

1. D. K. Singh, "Strength of Materials", 2020, 4<sup>th</sup> Edition, Ane Books Pvt. Ltd, New Delhi.
2. S M A Kazimi, 'Solid Mechanics", 2017, 2<sup>nd</sup> Edition, McGraw Hill Education, Delhi.
3. Stephen Timoshenko, "Strength of Materials: Elementary Theory and Problems", 3<sup>rd</sup> Edition, 2021, D. Van Nostrand Company, Inc, New York, USA.
4. R.C.Hibbeler, "Mechanics of Materials", 10<sup>th</sup> Edition, 2022, Pearson, USA.

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2. <https://archive.nptel.ac.in/courses/112/107/112107146/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	-	1	-	-	-	-	1	3	-	2
CO2	3	3	1	2	-	1	-	-	-	-	1	3	-	2
CO3	3	3	1	2	-	1	-	-	-	-	1	3	2	2
CO4	3	3	1	2	-	1	-	-	-	-	1	3	2	2
CO5	3	3	2	2	-	1	-	-	-	-	1	3	-	3
Average	3	3	1.4	2		1					1	3	2	2.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CET06</b>	<b>APPLIED HYDRAULICS ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Fluid Mechanics

**Objectives:**

- To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow and to expose them to basic principles of working of hydraulic machineries.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Interpret flow equations to analyze different channel sections.	<b>K3</b>
<b>CO2</b>	Classify and analyze water surface profiles in gradually varied flow using numerical methods.	<b>K4</b>
<b>CO3</b>	Identify the momentum equation to rapidly varied flow and analyze hydraulic jumps and energy dissipation.	<b>K3</b>
<b>CO4</b>	Apply the principles of turbines, including specific speed and cavitation, to analyze their performance.	<b>K3</b>
<b>CO5</b>	Analyze the operation and characteristics of pumps, including centrifugal and reciprocating types.	<b>K4</b>

**Course Contents**

**Unit I UNIFORM FLOW** 9

Open channel flow: Definition, classification - Chezy's and Manning's equation - Flow through rectangular, Trapezoidal and Circular channels - Hydraulically most efficient channel section.

**Unit II GRADUALLY VARIED FLOW** 9

Dynamic equations of gradually varied flow - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method.

**Unit III RAPIDLY VARIED FLOW** 9

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation - Positive and Negative surges.

**Unit IV TURBINES** 9

Impact of Jets Turbines - Classification - Impulse turbine - Pelton wheel - Reaction turbines - Franci's turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed - Minimum Speed to start the pump.

**Unit V PUMPS** 9

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - High pressure pumps - Self priming pumps - Introduction to automatic controller in pumps.

**Total Periods** 45



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**Text Books:**

1. Chandramouli P.N, "Applied Hydraulic Engineering", 2017, Yes Dee Publishing Pvt. Ltd, Chennai.
2. Modi P.N and Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", 2019, Standard Book House New Delhi.
3. Subramanya K., "Flow in open channels", 2019, Tata McGraw Hill, New Delhi.

**Reference Books:**

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5<sup>th</sup> edition, 2018, Laxmi Publications Pvt. Ltd, New Delhi.
2. Ven Te Chow, "Open Channel Hydraulics", 2009, McGraw Hill, New York.
3. Ramamirtham S, "Fluid Mechanics and Hydraulics and Fluid Machines", 2011, Dhanapat Rai and Sons, Delhi.
4. Rajput R. K, "A Text Book of Fluid Mechanics", 2006, S. Chand & Co., New Delhi.

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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	-	2	-	-	-	-	-	-	3	2	2
CO2	3	3	-	2	2	-	-	-	-	-	-	3	2	2
CO3	3	2	-	-	2	1	-	-	-	-	-	3	2	2
CO4	3	2	2	-	2	-	-	-	-	-	-	3	2	2
CO5	3	3	2	2	3	-	-	-	-	-	1	3	2	3
Average	3	2.4	2	2	2.2	1	-	-	-	-	1	3	2	2.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**U23CET07**

**SOIL MECHANICS**

**Pre-Requisites** : Engineering Mechanics & Fluid Mechanics

**Objectives:**

- To classify soils by index properties, understand compaction and stress concepts, evaluate stress distribution and settlement, determine shear strength, and analyze slope stability with protection methods.

**Course Outcomes:**

On completion of the course, the student is expected to be able to:

**BT Level  
(highest  
level)**

<b>C01</b>	Identify the various types of soils and its properties, formulate and solve engineering problems	<b>K3</b>
<b>C02</b>	Develop the flow through soil medium and its impact of engineering solution	<b>K3</b>
<b>C03</b>	Apply the stress distribution in loaded soil medium and soil settlement due to consolidation	<b>K3</b>
<b>C04</b>	Interpret the shear strength of soils and its impact of engineering solutions to the loaded soil medium	<b>K3</b>
<b>C05</b>	Discover the stability of finite and infinite slopes and arrive at slope protection measures	<b>K4</b>

**Course Contents**

**Unit I SOIL CLASSIFICATION AND COMPACTION 9**

Nature of soil - Soil description - Particle size, shape and colour - Soil structure - Phase relationship - Index properties - Atterberg limits - Grain size distribution - BIS and Unified soil classification system. Compaction of soils - Laboratory tests - Field Compaction methods - Factors influencing compaction of soils.

**Unit II EFFECTIVE STRESS AND PERMEABILITY 9**

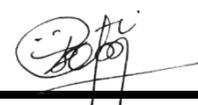
Soil water - Effective stress concepts in soils - Capillary phenomena - Darcy's law - Determination of Co-efficient of permeability - Laboratory Determination (Constant head and falling head methods) and field measurement - Pumping out test in unconfined and confined aquifer - Factors influencing permeability of soils.

**Unit III STRESS DISTRIBUTION AND SETTLEMENT 9**

Stress distribution in homogeneous and isotropic medium - Boussinesq theory - (Point load, Line load and uniformly distributed load) Use of New marks influence chart -Components of settlement - Immediate and consolidation settlement - Terzaghi's one dimensional consolidation theory - Computation of rate of settlement -  $\sqrt{t}$  and  $\log t$  methods-  $e$ - $\log p$  relationship.

**Unit IV SHEAR STRENGTH 9**

Shear strength of cohesive and cohesionless soils - Mohr-Coulomb failure theory - Measurement of shear strength - Direct shear, Triaxial compression, Unconfined compression and Vane shear tests - Pore pressure parameters.



**Unit V SLOPE STABILITY**

Stability Analysis - Infinite slopes and finite slopes - Total stress analysis for saturated clay – Friction circle method - Use of stability number – Method of slices – Fellenius method - Slope protection measures.

**Total Periods 45**

**Text Books:**

1. Murthy, V.N.S., “Soil Mechanics and Foundation Engineering”, 2015, CBS Publishers Distribution Ltd., New Delhi.
2. Gopal Ranjan and Rao, A.S.R., “Basic and Applied Soil Mechanics”, 2006, New Age Ltd. International Publisher New Delhi (India).

**Reference Books:**

1. Das, B.M., “Principles of Geotechnical Engineering”, 8th Edition, 2013, Brooks / Coles / Thompson Learning Singapore.
2. Coduto, D.P., “Geotechnical Engineering - Principles and Practices”, 2010, Prentice Hall of India Pvt.Ltd. New Delhi.
3. Punmia, B.C., “Soil Mechanics and Foundations”, 2005, Laxmi Publications Pvt. Ltd. New Delhi.

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2. <https://ocw.tudelft.nl/course-lectures/introduction-soil-mechanics-english/>
3. <https://ingeoexpert.com/en/courses-online/advanced-soil-mechanics/>

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K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	2	2	-	1	1	1	1	-	2	3	-	2
CO2	3	2	3	2	-	1	1	1	1	-	2	2	-	3
CO3	3	3	2	2	-	1	1	1	1	-	2	2	-	3
CO4	2	3	3	2	-	1	1	1	1	-	2	2	-	3
CO5	3	3	2	2	-	1	1	1	1	-	2	2	-	2
Average	2.7	2.7	2.3	2	-	1	1	1	1	-	2	2.3	-	2.7
3 – High, 2 – Medium, 1 – Low, - No correlation														



U23CET08

## ENGINEERING GEOLOGY

L	T	P	C
3	0	0	3

Pre-Requisites : None

**Objectives:**

- To equip students with foundational knowledge of earth materials, including minerals and rocks, and to enable the application of geological investigations in civil engineering projects such as roads, bridges, tunnels, and dams.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Describe the effects of weathering, landslides, and earthquakes on civil engineering works.	<b>K2</b>
<b>CO2</b>	Identify and classify rock-forming and ore minerals based on their physical properties.	<b>K3</b>
<b>CO3</b>	Identify and describe the characteristics of different rock types and their engineering applications.	<b>K2</b>
<b>CO4</b>	Apply geological principles to study structures and use geophysical methods for subsurface investigation.	<b>K3</b>
<b>CO5</b>	Apply knowledge of dam types, site requirements, and geological investigations to assess dam construction feasibility.	<b>K3</b>

**Course Contents****Unit I GENERAL AND PHYSICAL GEOLOGY 9**

Geology in civil engineering – branches and scope – understanding the internal structure. Weathering of rocks. Soils – landslides – Earthquakes and Tsunami impacts on civil engineering works.

**Unit II MINERALOGY 9**

Physical properties of minerals- Study of the following rock forming minerals – Quartz family, Felspar family, Augite, Hornblende, Biotite, Muscovite, Calcite, Garnet. Ore minerals – Haematite, Magnetite, Bauxite, Graphite, Magnetite – Clay minerals.

**Unit III PETROLOGY 9**

Classification of rocks. Igneous, Sedimentary and Metamorphic rocks. Texture, structure, engineering properties and uses of Granite – pegmatite – Dolerite – Basalt – Sandstone – Limestone – Laterite – Marble - Schist- Gneiss and Slate.

**Unit IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9**

Outcrop - Dip and strike, - Study of structure folds, faults, joints, unconformities. - Subsurface investigation on seismic and electrical methods.

**Unit V DAMS AND TUNNELS 9**

Types of dams - Requirement of dam sites - Geological investigation for a dam site – Tunnelling - Geology of the major dam sites of India.

**Total Periods 45**


**Text Books:**

1. Parbin Singh, "A Textbook of Engineering and General Geology", 2021, S. K. Kataria and Sons publications, New Delhi.
2. Chenna Kesavulu, N. "Textbook of Engineering Geology", 2018, Macmillan India Ltd, Chennai.
3. Venkat Reddy, D. "Engineering Geology", 2021, Vikas Publishing House Private Limited, New Delhi.
4. Gokhale, K.V.G.K, "Principles of Engineering Geology", 2019, B.S. Publications, Hyderabad.

**Reference Books:**

1. Krynine and Judd, "Principals of Engineering Geology and Geotechnics", 2018, Tata McGraw Hill, New Delhi.
2. Bell, F.G. "Fundamentals of Engineering Geology", 2011, B.S. Publications. Hyderabad.

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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	-	-	-	3	-	-	-	-	1	3	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	2	2	-	-	-	2	-	-	-	-	-	2	3	-
CO4	3	3	-	2	2	-	-	-	-	-	-	3	3	2
CO5	3	3	2	2	2	2	-	-	-	-	1	3	3	2
Average	2.6	2.5	2	2	2	2.3	-	-	-	-	1	2.6	2.8	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**U23CET09**

**CONCRETE TECHNOLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Construction Materials

**Objectives:**

- To understand the properties and testing methods of concrete-making materials and concrete in both fresh and hardened states, and to gain knowledge of various concrete mix design methods as per IS code provisions.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>C01</b>	Identify the various requirements of cement aggregate and water for making concrete	<b>K3</b>
<b>C02</b>	Apply admixtures to enhance the properties of concrete	<b>K3</b>
<b>C03</b>	Examine the concrete mix for various strength using IS method	<b>K4</b>
<b>C04</b>	Simplify the strength and durability parameters of concrete	<b>K4</b>
<b>C05</b>	Select the importance and application of special concrete and special concreting methods	<b>K3</b>

**Course Contents**

**Unit I      CONSTITUENT MATERIALS** **9**

Cement: Types of cement – Special cements – Tests on cement – BIS and EN Specifications. Aggregates: Classification – Characteristics affecting Concrete Properties – Tests on aggregates – Natural Sand and crushed aggregate (M-sand & P-sand) – BIS specifications. Water: General requirements – Tolerable concentrations of impurities – Quality of water for use in concrete – Use of sea water and its effects

**Unit II      CHEMICAL AND MINERAL ADMIXTURES** **9**

Chemical Admixtures: Accelerators – Retarders – Plasticizers – Super plasticizers – Water proofers – Mineral Admixtures: Fly Ash – Micro and Nano Silica – Ground Granulated Blast Furnace Slag and Metakaolin – Effects on concrete properties

**Unit III     PROPORTIONING OF CONCRETE MIX** **9**

Mix Design: Principles of Mix Proportioning – Methods of concreting – Factors in the choice of mix Properties – Physical properties of materials required for Mix Design – Quality Control – Design Mix and Nominal Mix – BIS Method of Mix Design – Mix Design Examples – ACI Procedures – Durability consideration as per IS code.

**Unit IV     PROPERTIES OF FRESH AND HARDENED CONCRETE** **9**

Fresh Concrete: Workability – Factors affecting workability – Tests – Segregation and Bleeding. Hardened Concrete: Factors affecting Strength – Curing – Methods of curing – Tests – Compressive strength – Split tensile strength – Flexural strength – Modulus of elasticity – In situ strength determination – NDT. Durability of concrete – Water absorption – Permeability – Corrosion test – Acid resistance

**Unit V      SPECIAL CONCRETE** **9**

Special Concrete: High strength concrete – High Performance concrete – Lightweight & Heavy weight concrete – Self-compacting concrete – Fibre reinforced concrete – Polymer concrete – Foam concrete – Ready mix concrete Hot & cold weather concreting – Precast concrete – Prestressed Concrete – SIFCON and Bacterial Concrete

**Total Periods** **45**



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**Text Books:**

1. Bhavikatti S S, "Concrete Technology", 2015, I.K.International Publishing House Pvt. Ltd, New Delhi.
2. Shetty M S, "Concrete Technology", 7th Edition, 2013, S.Chand and Company Limited, New Delhi.

**Reference Books:**

1. Neville A M, "Properties of Concrete", 2016, 5<sup>th</sup> edition, Pearson India, New Delhi.
2. Gambhir M L, "Concrete Technology", 2013, Tata Mc. Graw Hill Publishers, New Delhi.
3. Santhakumar A R, "Concrete Technology", 2009, Oxford University Press India, New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/102/105102012/>
2. [https://onlinecourses.nptel.ac.in/noc23\\_ce50/preview](https://onlinecourses.nptel.ac.in/noc23_ce50/preview)
3. <https://archive.nptel.ac.in/courses/105/104/105104030/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	Pos											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	2	2	-	-	-	-	1	3	2	2
CO2	2	2	3	-	3	2	-	-	-	-	1	3	2	3
CO3	3	3	2	3	3	3	-	-	-	-	2	3	2	3
CO4	3	3	2	3	2	3	-	-	-	-	2	3	2	2
CO5	2	2	3	-	2	2	1	-	-	-	1	3	3	2
Average	2.6	2.4	2.5	3	2.4	2.4	1	-	-	-	1.4	3	2.2	2.4
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEP04</b>	<b>APPLIED HYDRAULICS ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : Applied Hydraulics Engineering

**Objectives:**

- To provide hands on experience in calibration of flow meters, performance characteristics of pumps and turbines.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Apply fluid flow principles to measure discharge, pressure differences, and losses in piping systems.	<b>K3</b>
<b>CO2</b>	Analyze the performance characteristics of centrifugal, gear, submersible, and reciprocating pumps.	<b>K4</b>
<b>CO3</b>	Analyze the performance characteristics of Pelton wheel and Francis turbines, and determine the metacentric height of floating bodies.	<b>K4</b>

**Course Contents**

- Calibration of Rotameter
- Flow through Orifice meter, Venturi meter
- Bernoulli's Experiment.
- Determination of friction factor in pipes.
- Determination of minor losses.
- Characteristics of Centrifugal pumps
- Characteristics of Gear pump
- Characteristics of Submersible pump
- Characteristics of Reciprocating pump
- Characteristics of Pelton wheel turbine
- Characteristics of Francis turbine.
- Determination of metacentric height of floating bodies.

**Total Periods**                      **60**

**Text Books:**

- Dr. Madhavi Ganesan, "Hydraulic Laboratory Manual", 2015, Centre for Water Resources, Anna University, Chennai.
- Modi P.N and Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", 2013, Standard Book House, New Delhi.
- Streeter, Victor L. Wylie, Benjamin E, "Fluid Mechanics", 2013, McGraw-Hill Ltd, New Delhi.
- White FM, "Fluid Mechanics", 2016, Tata Mc Graw Hill, New Delhi.

**Reference Books:**

- Bansal R.K, "Fluid Mechanics and Hydraulics Machines", 2017, 5<sup>th</sup> edition, Laxmi Publications Pvt.Ltd, New Delhi.
- Jain AK, "Fluid Mechanics including Hydraulic Machines", 2015, Khanna Publication, New Delhi.



**Web URL(s):**

1. <https://nptel.ac.in/courses/105105203>
2. <https://eerc03-iiith.vlabs.ac.in/>
3. <https://nptel.ac.in/courses/105103096>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	2	3	-	-	-	-	-	1	3	2	2
CO2	3	3	2	2	3	-	-	-	-	-	1	3	2	3
CO3	3	3	2	2	3	2	-	-	-	-	1	3	3	3
Average	3	2.7	2	2	3	2	-	-	-	-	1	3	2.3	2.7
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**U23CEP05**

**SOIL MECHANICS LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : Soil Mechanics

**Objectives:**

- To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

**Course Outcomes:**

On completion of the course, the student is expected to

**BT Level  
(highest  
level)**

- |            |  |           |
|------------|--|-----------|
| <b>CO1</b> | Construct the tests to identify the index properties of soils.             | <b>K3</b> |
| <b>CO2</b> | Develop the insitu density and compaction characteristics.                 | <b>K3</b> |
| <b>CO3</b> | Experiment with compressibility, permeability and shear strength of soils. | <b>K3</b> |

**EXERCISES:**

1. Specific gravity of soil solids
2. Grain size distribution – Sieve analysis
3. Liquid limit and Plastic limit tests
4. Field density Test (Sand replacement method)
5. Field density Test (Core cutter method)
6. Determination of moisture – density relationship using standard proctor compaction test.
7. Permeability determination: Constant head methods
8. Permeability determination: Falling head methods
9. Direct shear test in cohesion less soil
10. Unconfined compression test in cohesive soil

**Total Periods      60**

**Text Books:**

1. Soil Engineering Laboratory Instruction Manual”, 2010, published by Engineering College Cooperative Society, Anna University, Chennai.
2. “Saibaba Reddy, E. Ramasastri, K. “Measurement of Engineering Properties of Soils”, 2008, New age International (P) limited publishers, New Delhi.

**Reference Books:**

- 1 Braja M.Das., “Soil Mechanics: Laboratory Manual”, 8<sup>th</sup> edition, 2012, Oxford University Press.
- 2 G.Venkatappa Rao and Goutham .K. Potable, “Geosynthetics Testing – A laboratory Manual”, 1<sup>st</sup> Edition 2008, Sai Master Geoenvironmental Services Pvt. Ltd.
- 3 Lambe T.W., “Soil Testing for Engineers”, 2008, John Wiley and Sons, New York.

**Web URL(s):**

- 1 [https://onlinecourses.nptel.ac.in/noc22\\_ce60/preview](https://onlinecourses.nptel.ac.in/noc22_ce60/preview)
- 2 <https://www.cedengineering.com/courses/soil-mechanics-laboratory-testing>
- 3 <https://smfe-iiith.vlabs.ac.in/>



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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	2	2	3	3	3	3	2	3	3	3	2
CO2	3	2	3	-	3	3	3	3	3	2	-	3	2	2
CO3	3	1	2	-	3	2	-	3	-	2	3	3	2	2
Average	3	1.7	2.7	2	2.7	2.7	3	3	3	2	3	3	2.3	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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# Semester V



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<b>U23CET10</b>	<b>DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Strength of Materials

**Objectives:**

- To enable students to understand RC structural behavior and apply Limit State Method as per IS codes for safe, economical design and detailing using SP-16 and SP-34.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Explain material properties and beam design as per IS code.	<b>K2</b>
<b>C02</b>	Describe the design principles for RC beams.	<b>K2</b>
<b>C03</b>	Illustrate the design methods for RC slabs, lintels, sunshades, and staircases.	<b>K3</b>
<b>C04</b>	Interpret the behaviour of RC columns	<b>K4</b>
<b>C05</b>	Classify different types of footings	<b>K4</b>

**Course Contents**

**Unit I MATERIALS FOR REINFORCED CONCRETE AND DESIGN CONCEPTS 9**

Review of basic material properties - Concept of Elastic method, ultimate load method and limit state method - Working stress method as detailed in IS code - Limit State philosophy as detailed in IS code - Analysis and design of singly and doubly reinforced beams as per Working Stress Method.

**Unit II LIMIT STATE DESIGN OF BEAMS 9**

Design of singly and doubly reinforced rectangular and flanged beams - Design of beams for bending, shear and torsion - bond and anchorage - deflection - Detailing as per SP-34.

**Unit III LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9**

Behaviour of one-way and two-way slabs - Design and detailing of one-way and two-way rectangular slabs subjected to uniformly distributed load - Design of lintel - lintel cum sunshade - Stairs - Loads on Staircase - Design of Dog-legged staircase - Detailing as per SP-34.

**Unit IV LIMIT STATE DESIGN OF COLUMNS 9**

Classification of columns - Axial, uniaxial and biaxial bending - Braced and unbraced columns - Orientation of columns in buildings - Design of columns - Use of interaction charts from SP-16 - Detailing as per SP-34.

**Unit V LIMIT STATE DESIGN OF FOOTING 9**

Design of wall footings - Design of axially and eccentrically loaded isolated square and rectangular footings - Design of combined rectangular footings - Detailing as per SP34.

**Total Periods 45**



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**Text Books:**

1. Unnikrishnan Pillai S & Devdas Menon, "Reinforced Concrete Design", 4<sup>th</sup> Edition, 2022, McGraw Hill Education (India) Private Ltd, New Delhi.
2. Karve S.R and Shah V.L. "Limit State Theory and Design of Reinforced Concrete, Structures", 9<sup>th</sup> Edition, 2023, Standard Publications, Pune.

**Reference Books:**

1. Sinha S.N., "Reinforced Concrete Design", 2017, 3<sup>rd</sup> Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Krishna Raju N., "Design of Reinforced Concrete Structures", 2019, 4<sup>th</sup> Edition, CBS Publishers & Distributors, New Delhi.
3. Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain., "Limit State Design of Reinforced Concrete", 2016, 10<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd., New Delhi.
4. IS 456:2000 Plain and Reinforced concrete Code of practice (Fourth Revision).  
SP- 16 - 2016, Design Aids for reinforced Concrete (Third Revision), Bureau of Indian Standards, New Delhi.
5. SP-34: 2016, Detailing of Reinforcement in Concrete (Second Revision), Bureau of Indian Standards New Delhi

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105104/>
2. <https://archive.nptel.ac.in/courses/105/105/105105105/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	-	-	-	1	-	1	-	1	3	-	-
CO2	3	2	2	-	-	-	1	-	1	-	1	3	-	-
CO3	3	2	2	-	-	-	1	-	1	-	1	3	-	-
CO4	3	2	2	-	-	-	1	-	1	-	1	3	-	-
CO5	3	2	2	-	-	-	1	-	1	-	1	3	-	-
Average	3	2	2	-	-	-	1	-	1	-	1	3	-	-
3 – High, 2 – Medium, 1 – Low, – No correlation														



**U23CET11**

**STRUCTURAL ANALYSIS I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Strength of Materials

**Objectives:**

- To develop the ability to analyze statically indeterminate structures using classical methods and evaluate structural response of arches and beams under moving loads.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Analyze statically indeterminate structures by strain energy method.	<b>K4</b>
<b>C02</b>	Apply the slope deflection method to analyze statically indeterminate beams.	<b>K3</b>
<b>C03</b>	Examine continuous beams and rigid jointed plane frames using moment distribution method.	<b>K4</b>
<b>C04</b>	Analyze arch structures considering settlement and temperature effects.	<b>K4</b>
<b>C05</b>	Construct influence line diagrams of statically determinate beams under various loading conditions.	<b>K3</b>

**Course Contents**

**Unit I STRAIN ENERGY METHOD 9**

Determination of Static and Kinematic Indeterminacies – Analysis of continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy).

**Unit II SLOPE DEFLECTION METHOD 9**

Application of slope deflection method - Analysis of statically indeterminate beams - Analysis of rigid jointed plane frames - Effect of settlement of supports for beams only.

**Unit III MOMENT DISTRIBUTION METHOD 9**

Stiffness and carry over factors - Analysis of continuous beams - Analysis of rigid jointed planes frames with and without sway - Effect of settlement of supports - Symmetric and skew symmetric loadings.

**Unit IV ARCHES 9**

Arches as structural forms - Examples of arch structures - Types of arches - Analysis of three hinged arches of parabolic and circular profiles - Analysis of two hinged symmetric parabolic and circular arches. Settlement and temperature effects.

**Unit V MOVING LOADS AND INFLUENCE LINES 9**

Analysis for moving loads – Influence line Diagram (ILD) – Construction of ILD for shear force and bending moment for statically determinate beams with point loads, UDL shorter than span and several point loads at a section - Equivalent UDL - Absolute maximum bending moments for two-wheel loads at a fixed distance apart.

**Total Periods 45**



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**Text Books:**

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Theory of Structures", 2017, 13<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd., New Delhi.
2. Gupta S.P and Pandit G.S, "Theory of Structures", 2017, 1<sup>st</sup> Edition, Vol. I & II", Tata McGraw Hill, New Delhi.

**Reference Books:**

1. Vaidyanathan R and Perumal P, "Structural Analysis", 2017, 4<sup>th</sup> Edition, Vol. I & II, Laxmi Publications (P) Ltd., New Delhi.
2. Bhavikatti S.S, "Structural Analysis", 2021, 5<sup>th</sup> Edition, Vol. I & II, Vikas Publishing House Pvt. Ltd., New Delhi.
3. C S Reddy, "Basic Structural Analysis", 2017, 3<sup>rd</sup> Edition, Tata Mc-Graw Hill, New Delhi.
4. L.S. Negi and R.S. Jangid, "Structural Analysis", 2004, 6<sup>th</sup> Edition, Tata McGraw Hill Publications, New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105109/>
2. <https://archive.nptel.ac.in/courses/105/105/105105166/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	1	2	-	-	1	-	1	-	2	3	-	-
CO2	3	3	1	2	-	-	1	-	1	-	2	3	-	-
CO3	3	3	1	2	-	-	1	-	1	-	2	3	-	-
CO4	3	3	1	2	-	-	1	-	1	-	2	3	-	-
CO5	3	3	1	2	-	-	1	-	1	-	2	3	-	-
Average	3	3	1	2	-	-	1	-	1	-	2	3	-	-
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**U23CET12**

**FOUNDATION ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Pre-Requisites** : Soil Mechanics

**Objectives:**

- To provide students with a comprehensive understanding of soil exploration methods, bearing capacity and settlement analysis, design principles of shallow and deep foundations, and earth pressure theories, enabling them to select and design appropriate foundation systems based on soil conditions and structural requirements.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>CO1</b>	Evaluate soil exploration methods, sampling techniques, and foundation types based on soil conditions.	<b>K3</b>
<b>CO2</b>	Assess bearing capacity and settlement of shallow foundations using codal methods and field tests, including seismic considerations.	<b>K3</b>
<b>CO3</b>	Apply codal provisions to foundation types and settlement behaviour for proportioning foundations ensuring rigid performance.	<b>K3</b>
<b>CO4</b>	Examine pile types, selection factors, and bearing capacity using static, dynamic, and field tests, including group behaviour and load test interpretation.	<b>K4</b>
<b>CO5</b>	Apply earth pressure theories, stability analysis of retaining walls, and geosynthetic solutions for soil reinforcement.	<b>K3</b>

**Course Contents**

**Unit I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9+3**

Methods of Soil Exploration - Boring - Sampling - Disturbed and undisturbed Sampling - Sampling techniques - Bore log and soil investigation report - Function and requirements of good foundation - Choice of foundation based on soil conditions.

**Unit II BEARING CAPACITY AND SETTLEMENT 9+3**

Introduction - Location and depth of foundation - Codal provisions (IS6403-1981) - Bearing capacity of shallow foundation on homogeneous deposits - Terzaghi's formula and BIS formula - Bearing capacity from in-situ tests (SPT, SCPT and plate load) - Seismic considerations in bearing capacity evaluation - Determination of settlement of foundations on granular and clay deposits - Methods of minimizing total and differential settlements.

**Unit III FOOTINGS AND RAFTS 9+3**

Types of foundation - Contact pressure and settlement distribution - Proportioning of foundations for conventional rigid behaviour - Minimum depth for rigid behaviour - Applications - Floating foundation - Codal provision.

**Unit IV PILE FOUNDATION 9+3**

Types of piles and their functions - Factors influencing the selection of pile - Carrying capacity of single pile in granular and cohesive soil - Static formula - Dynamic formulae - Capacity from in-situ tests - Negative skin friction - Group capacity by different methods - Settlement of pile groups - Interpretation of pile load test (routine test only), Under reamed piles.

**Unit V EARTH PRESSURE 9+3**

Plastic equilibrium in soils - Active and passive states - Rankine's theory - Cohesionless and cohesive soil - Coulomb's wedge theory - Earth pressure on retaining walls of simple configurations - Culmann Graphical method - Stability analysis of retaining walls - Use of geosynthetics for different applications.

**Total Periods 60**



**Text Books:**

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", 2018, CBS Publishers and Distributers Ltd., New Delhi.
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", 2006, New Age International (P) Ltd, New Delhi.

**Reference Books:**

1. Das, B.M. "Principles of Foundation Engineering", 2017, 8<sup>th</sup> edition, Thompson Asia Pvt. Ltd., Singapore.
2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", 2017, Tata McGraw Hill publishing company Ltd., New Delhi.
3. Varghese, P.C., "Foundation Engineering", 2012, Prentice Hall of India Private Limited, New Delhi.
4. Punmia, B.C., "Soil Mechanics and Foundations", 2017, Laxmi Publications Pvt.Ltd., New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/104/105104101/>
2. <https://nptel.ac.in/courses/105107158>
3. <https://nptel.ac.in/courses/105107122>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	1	3	-	1	1	1	1	-	2	3	-	3
CO2	3	3	2	3	-	1	1	1	1	-	2	2	-	2
CO3	3	3	2	3	-	1	1	1	1	-	2	2	-	2
CO4	3	3	2	3	-	1	1	1	1	-	2	2	-	3
CO5	3	3	2	3	-	1	1	1	1	-	2	2	-	3
Average	2.8	2.8	1.8	3	-	1	1	1	1	-	2	2.2	-	2.6
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEP06</b>	<b>CONCRETE AND HIGHWAY ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : Concrete Technology

**Objectives:**

- To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

**Course Outcomes:**

Upon completion of the course, students would be able to

- |            |   |           |
|------------|---|-----------|
| <b>CO1</b> | Conduct tests on fresh and hardened concrete to determine workability and strength characteristics.             | <b>K3</b> |
| <b>CO2</b> | Analyze physical and mechanical properties of aggregates through standard laboratory tests.                     | <b>K4</b> |
| <b>CO3</b> | Evaluate the suitability of bitumen and bituminous mixes using relevant test methods for pavement applications. | <b>K5</b> |

**BT Level  
(highest  
level)**

**Course Contents**

**LIST OF EXPERIMENTS**

**I. TESTS ON AGGREGATES**

1. Specific Gravity
2. Gradation of Aggregate
3. Crushing Strength
4. Abrasion Value
5. Impact Value
6. Water Absorption
7. Flakiness and Elongation Indices

**II. TESTS ON FRESH CONCRETE**

1. Slump cone test
2. Flow table
3. Compaction factor
4. Vee bee test.

**III. TESTS ON HARDENED CONCRETE**

1. Compressive Strength
2. Split Tensile Strength
2. Flexure Test

**IV. TESTS ON BITUMEN**

1. Penetration
2. Softening Point
3. Ductility

**Total Periods** **60**



**Text Books:**

1. M.S.Shetty, "Concrete Technology", 2003, S.Chand and Co., Ltd., New Delhi.
2. P.D.Kulkarni "Text book of Concrete Technology", 2007, New Age International (P) Ltd.

**References:**

1. S. K. Khanna, C.E.G. Justo, A. Veeraragavan "Highway Materials and Pavement Testing", 2009, 5<sup>th</sup> Edition, Nem Chand and Bros., Roorkee.
2. IS: 10262:2009, 2009, "Concrete Mix Proportioning – Guidelines Bureau of Indian Standards"

**Web URL(s):**

1. <https://nptel.ac.in/courses/105/106/105106176/>
2. <https://nptel.ac.in/courses/105/101/105101087/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	2	2	3	3	3	3	2	3	3	-	2
CO2	3	2	3	-	3	3	3	3	3	2	-	3	-	2
CO3	3	1	2	-	3	2	-	3	-	2	3	3	-	2
Average	3	1.7	2.7	2	2.7	2.7	3	3	3	2	3	3	-	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEI01</b>	<b>EMPLOYABILITY ENHANCEMENT TRAINING PROGRAM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites** : None

**Objectives:**

- To enhance students' employability by developing practical skills in using structural analysis software for modeling, load application, and interpreting structural behavior in civil engineering projects.

**Course Outcomes:**

Upon completion of the course, students shall have the ability to

**BT Level  
(highest level)**

<b>CO1</b>	Develop accurate digital models of structural systems using software tools.	<b>K3</b>
<b>CO2</b>	Apply various load types and boundary conditions within structural analysis software.	<b>K3</b>
<b>CO3</b>	Analyze and interpret structural analysis results to assess safety and performance.	<b>K4</b>

**Course Contents**

**1. Structural Modeling Using Software**

- i. Introduction to software interface and features
- ii. Creating models of beams, frames, and trusses
- iii. Defining materials and cross-sections

**2. Load Definition and Application**

- i. Types of loads (dead, live, wind, seismic)
- ii. Assigning loads and load combinations in the software
- iii. Defining support conditions and restraints

**3. Analysis Execution and Result Interpretation**

- i. Running structural analysis simulations
- ii. Viewing and interpreting deflections, shear forces, and bending moments
- iii. Generating reports and assessing design safety

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	1	3	1	3	1	1	2	1	1	1	1	1	3
CO2	3	2	1	1	3	2	1	1	1	1	1	3	1	1
CO3	1	3	1	3	2	1	1	1	2	1	1	3	1	1
Average	2.3	2	1.7	1.7	2.7	1.3	1	1.3	1.3	1	1	2.3	1	1.7
3 – High; 2 – Medium; 1– Low; - No correlation														



<b>U23EGS01</b>	<b>ENGLISH EXPERTISE AND CAREER MOXIE LABORATORY (Common to ALL)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites** : None

**Objectives:**

- To enable learners to develop their Professional communicative competence
- To enhance the practical understanding of the placement activity with employability skills
- To facilitate learners' soft skills

**Course Outcomes:**

Upon completion of the course, students shall have the ability to

		<b>BT Level (highest level)</b>
<b>CO1</b>	Develop effective communication skills for corporate settings, including listening, speaking, and writing.	<b>K4</b>
<b>CO2</b>	Demonstrate the ability to manage business meetings and presentations effectively, with attention to time management and documentation.	<b>K3</b>
<b>CO3</b>	Develop critical thinking, creative problem-solving skills, and self-reflection for career advancement.	<b>K6</b>

**Course Contents**

**1. Corporate Communication Skills**

1. Listening to the latest corporate meetings
2. Speaking excerpts from formal corporate meetings
3. Interview skills and biography of Founder/CEO

**2. Business Meeting and Presentation**

1. Preparing agenda and minutes of meeting
2. Oral presentations using the latest audio-visual aids
3. Observing time restrictions

**3. Time Management and Responsibility**

1. Working in pairs or groups to manage time
2. Accepting responsibility and undertaking small projects
3. Organizing and maintaining a portfolio of one's work

**4. Business Writing and Documentation**

1. Preparing digital brochures
2. Creating term planners and schedules
3. Noting key dates and events

**5. Technical Conversation and Listening**

1. Listening and completing technical conversations
2. Addressing questions on specific companies from the audience

**6. Travel and International Business**

1. Preparation for domestic and international business travel
2. Essential communication skills for global business interactions

**7. Creative Thinking and Problem-Solving**

1. Hands-on training in latest AI tools
2. Developing creative thinking skills for innovative solutions

**8. Self-Assessment and SWOT Analysis**

1. Filling up self-assessment forms
2. Conducting SWOT analyses

**9. Corporate History and Research**

1. Researching the history of reputed companies
2. Preparing biographies of founders/CEOs

**10. Portfolio Development and Career Moxie**

1. Developing a professional portfolio
2. Demonstrating career moxie for successful careers in business and communication



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**Reference Books:**

- 1 On Writing Well, William Zinsser, Harper Resource Book, 2001
- 2 Study Writing, Liz Hamp-Lyons and Ben Heasley, Cambridge University Press, 2006
- 3 Communication Skills, Sanjay kumar and pushpalata, Oxford University Press. 2011

**Web URL(s) / Websites:**

- 1 Best Academic Course Programs in Business English 2023 (academiccourses.com)
- 2 Cambridge English
- 3 TED Talks
- 4 Company Websites
- 5 AI Apps
- 6 YouTube – Documentaries

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	1	1	2	3	2	1	2	1	2
CO2	-	-	-	-	-	1	1	2	3	3	1	2	-	2
CO3	2	3	3	3	2	2	2	2	2	2	3	3	2	3
Average	1	1	1	1	1	2	2	2	3	2	2	2.3	1.5	2.3
3 – High; 2 – Medium; 1– Low; - No correlation														



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# Semester VI



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<b>U23CET13</b>	<b>DESIGN OF STEEL STRUCTURAL ELEMENTS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Structural Analysis I

**Objectives:**

- To enable students to apply IS 800:2017 in analyzing and designing steel structures and their components.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Outline various design philosophies and their applications.	<b>K2</b>
<b>C02</b>	Design procedures for connections considering different failure modes.	<b>K3</b>
<b>C03</b>	Evaluate and design tension members with considerations for shear lag and slenderness.	<b>K4</b>
<b>C04</b>	Implement design principles for compression members, ensuring stability and strength.	<b>K3</b>
<b>C05</b>	Design roof trusses, purlins, and related structural components using appropriate loads.	<b>K4</b>

**Course Contents**

**Unit I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN PHILOSOPHIES 9**

Types and properties of structural steel - Overview of IS rolled sections - Design philosophies: Limit State Design vs. Allowable Stress Design - Load considerations: Dead, live, wind, and seismic loads - Introduction to IS 800:2017 and relevant codes.

**Unit II DESIGN OF CONNECTIONS 9**

Types of connections: Bolted and welded - Design of simple and eccentric connections - Failure modes and joint efficiency - Prying action and introduction to High Strength Friction Grip (HSFG) bolts.

**Unit III DESIGN OF TENSION MEMBERS 9**

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

**Unit IV DESIGN OF COMPRESSION MEMBERS 9**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of laced and battened type columns.

**Unit V ROOF TRUSSES AND INDUSTRIAL BUILDINGS 9**

Roof trusses – Roof and side coverings – Design of purlin and elements of truss; end bearing – Design of gantry girder.

**Total Periods 45**



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**Text Books:**

1. Subramanian, N, "Design of Steel Structures", 2013, Oxford University Press, New Delhi.
2. Gambhir, M.L, "Fundamentals of Structural Steel Design", 2013, McGraw Hill Education India Pvt. Ltd.
3. Duggal, S.K, "Limit State Design of Steel Structures", 2005, Tata McGraw Hill Publishing Company.

**Reference Books:**

1. Sai Ram, K.S. "Design of Steel Structures", 2015, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
2. Shiyekar, M.R, "Limit State Design in Structural Steel", 2013, Prentice Hall of India Pvt. Ltd.
3. Bhavikatti, S.S, "Design of Steel Structures by Limit State Method as per IS:800-2007", 2009, IK International Publishing House Pvt. Ltd.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105/105/105105162/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	-	-	1	-	-	-	-	2	3	1	2
CO2	3	3	3	2	-	1	-	1	1	1	2	3	1	3
CO3	3	3	3	2	-	2	-	1	1	1	2	3	1	3
CO4	3	3	3	1	-	1	-	-	1	1	2	3	1	3
CO5	3	2	3	2	-	1	-	1	1	1	3	3	1	3
Average	3	2.6	2.8	1.4	-	1.2	-	0.6	0.8	0.8	2.2	3	1	2.8
3 – High; 2 – Medium; 1– Low; - No correlation														

  
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**U23CET14**

**STRUCTURAL ANALYSIS II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Structural Analysis I

**Objectives:**

- To apply advanced structural analysis methods including influence lines, cable and suspension bridge analysis, matrix flexibility and stiffness methods, and plastic theory to evaluate and determine forces, moments, and collapse loads in statically indeterminate beams, frames, trusses, and suspension systems.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Apply Muller-Breslau's principle to develop influence lines for support reactions, shear forces, and bending moments in beams.	<b>K3</b>
<b>C02</b>	Interpret the forces in suspension cables and bridges under various loading conditions.	<b>K2</b>
<b>C03</b>	Determine the moments using the flexibility matrix method.	<b>K4</b>
<b>C04</b>	Use the stiffness matrix method to compute moments of indeterminate structures.	<b>K3</b>
<b>C05</b>	Examine the plastic moment of indeterminate beams and frames using plastic theory and plastic hinge concepts.	<b>K4</b>

**Course Contents**

**Unit I INFLUENCE LINES FOR INDETERMINATE BEAMS** **9**

Muller Breslau's principle – Influence line for support reactions, shearing force and bending moments for indeterminate beams with degree of static indeterminacy not exceeding one.

**Unit II CABLES AND SUSPENSION BRIDGES** **9**

Components and their Functions – Analysis of cable under concentrated loads and UDL –Shape of cable under self-weight – Anchorage of suspension cables – Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

**Unit III MATRIX FLEXIBILITY METHOD** **9**

Introduction – Computation of Structure flexibility matrix – Determination of forces – Analysis of continuous beams, indeterminate frames and trusses with degree of indeterminacy not exceeding two.

**Unit IV MATRIX STIFFNESS METHOD** **9**

Introduction – equilibrium and compatibility – Analysis of continuous beams, indeterminate frames and trusses with degree of indeterminacy not exceeding two.

**Unit V PLASTIC ANALYSIS** **9**

Plastic theory – Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load – Static and kinematic methods – Upper and lower bound theorems – Plastic analysis of indeterminate beams and frames.

**Total Periods** **45**



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**Text Books:**

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Theory of Structures", 2017, 13<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd., New Delhi.
2. Vaidyanathan R and Perumal P, "Structural Analysis", 2017, 4<sup>th</sup> Edition, Vol. I & II, Laxmi Publications (P) Ltd., New Delhi.

**Reference Books:**

1. S. Rajasekaran and G. Sankarasubramanian, "Computational Structural Mechanics", 2012, 3<sup>rd</sup> Edition, Prentice-Hall of India, New Delhi.
2. Bhavikatti S.S, "Structural Analysis", 2021, 5<sup>th</sup> Edition, Vol. I & II, Vikas Publishing House Pvt. Ltd., New Delhi.
3. C S Reddy, "Basic Structural Analysis", 2017, 3<sup>rd</sup> Edition, Tata Mc-Graw Hill, New Delhi.
4. V.K. Manicka Selvam, "Elements of Matrix and Stability Analysis of Structures", 2005, 7<sup>th</sup> Edition, Khanna Publishers, Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105180/>
2. <https://archive.nptel.ac.in/courses/114/106/114106037/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	3	-	3	1	3	2	1	1	3	-	1
CO2	3	3	3	3	-	3	1	3	2	1	1	3	-	1
CO3	3	3	3	3	-	3	1	3	2	1	1	3	-	1
CO4	3	3	3	3	-	3	1	3	2	1	1	3	-	1
CO5	3	3	3	3	-	3	1	3	2	1	1	3	-	1
Average	3	3	3	3	-	3	1	3	2	1	1	3	-	1
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CET15</b>	<b>WATER SUPPLY AND WASTE WATER ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide students with a comprehensive understanding of water treatment process design and distribution systems, along with the composition, characteristics, design, treatment, and disposal methods of sewage and wastewater.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest level)**

<b>C01</b>	Explain water sources characteristics of water and principles of intake and conveyance systems.	<b>K2</b>
<b>C02</b>	Apply design criteria to compute the dimensions of water treatment units and associated processes.	<b>K3</b>
<b>C03</b>	Analyse water distribution networks and evaluate the maintenance of distribution systems, pumping stations, and house service connections.	<b>K4</b>
<b>C04</b>	Estimate sewage flow and describe the characteristics, composition of sewage and sizes of sewerage system components.	<b>K4</b>
<b>C05</b>	Demonstrate the unit operations and processes involved in sewage treatment and sludge disposal.	<b>K3</b>

**Course Contents**

**Unit I WATER SUPPLY** **9**

Water demand, Design period, Population forecasting - Surface and subsurface water resources -Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water- Intakes - types-selection of pumps.

**Unit II WATER TREATMENT** **9**

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units - Coagulation and flocculation - Clariflocculator - Pulsator clarifier - Sand filters - Disinfection - Water softening - Removal of iron and manganese - Defluoridation - Desalination process - Residue Management - Membrane systems.

**Unit III WATER STORAGE AND DISTRIBUTION** **9**

Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution networks - leak detection- pumping stations and their operations - House service connections.

**Unit IV PLANNING AND DESIGN OF SEWERAGE SYSTEM** **9**

Characteristics and composition of sewage - Sanitary sewage flow and Storm runoff estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Sewer appurtenances - Sewage pumping - Drainage in buildings-plumbing systems for drainage.

**Unit V SEWAGE TREATMENT AND DISPOSAL** **9**

Objectives - Selection of Treatment Methods. Principles, Functions - Activated Sludge Process - Trickling filters - Sequencing Batch Reactor (SBR) - UASB - Waste Stabilization Ponds - Reclamation and Reuse of sewage - sewage farming. Septic tanks and effluent disposal system - Discharge standards - Sludge digestion - drying beds - conditioning and dewatering - sludge disposal.

**Total Periods** **45**



**Text Books:**

1. Garg, S.K., "Environmental Engineering, Volume I", 2022, 35th Edition, Khanna Publishers, New Delhi.
2. Garg, S.K., "Environmental Engineering, Volume II", 2022, 42nd Edition, Khanna Publishers, New Delhi.
3. Modi, P.N., "Water Supply Engineering, Volume II", 2016, Standard Book House, New Delhi.
4. Punmia B.C., Ashok.K.Jain, and Arun.K.Jain., "Environmental Engineering, Volume II", Second edition, 2016, Laxmi Publications, Chennai.

**Reference Books:**

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Manual on Sewerage and Sewage Treatment Systems, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
3. Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata McGraw – Hill Company, New Delhi, 2017.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105105201>
2. <https://nptel.ac.in/courses/103107212>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	-	-	1	3	-	-	-	-	2	1	3	-
CO2	2	3	-	-	-	3	-	-	-	1	2	-	3	1
CO3	3	3	3	2	-	3	1	-	2	2	2	3	3	2
CO4	3	2	-	3	3	2	-	1	1	1	3	2	-	3
CO5	2	3	2	-	2	3	1	-	1	-	3	2	3	-
Average	2.4	2.8	2.5	2.5	2	2.8	1	1	1.3	1.3	2.4	2	3	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**U23MGT01**

**TOTAL QUALITY MANAGEMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To understand the fundamental principles and concepts of Total Quality Management.
- To familiarize with various tools and techniques used in quality control and improvement.
- To understand the role of leadership and employee involvement in quality improvement.
- To study various quality management systems and certifications.
- To apply quality management principles in real-life industry applications.

**Course Outcomes:**

Upon completion of the course, students would be able to

	<b>BT Level (highest level)</b>
<b>CO1</b> Explain the principles and philosophies of Total Quality Management.	<b>K2</b>
<b>CO2</b> Apply TQM tools and techniques for quality improvement in industries.	<b>K3</b>
<b>CO3</b> Analyze the role of leadership and employee involvement in quality enhancement.	<b>K4</b>
<b>CO4</b> Analyze the structure and implementation aspects of various quality standards and certification processes.	<b>K4</b>
<b>CO5</b> Analyze quality improvement plans and identify the appropriate TQM practices for effective execution	<b>K4</b>

**Course Contents**

**Unit I INTRODUCTION TO TQM**

**10**

Definition of Quality – Dimensions of Quality - TQM – Basic concepts, principles and pillars of TQM- Historical background: Contributions of Deming, Juran, Crosby Quality Planning and Quality Cost - Barriers to TQM Implementation

**Unit II TQM TOOLS AND TECHNIQUES – I**

**9**

Seven Basic Quality Tools: Check Sheet, Histogram, Pareto Chart, Cause & Effect Diagram, Control Chart, Scatter Diagram, Flow Chart - Statistical Process Control (SPC) - Process Capability Analysis - Failure Mode and Effect Analysis (FMEA) - Quality Function Deployment (QFD)

**Unit III TQM TOOLS AND TECHNIQUES – II**

**8**

Benchmarking: Types, Process and Benefits - 5S Concepts and Implementation - Kaizen Principles and Applications - Poka-Yoke – Error-proofing Methods - Total Productive Maintenance (TPM): Pillars, Metrics

**Unit IV QUALITY MANAGEMENT SYSTEMS AND STANDARDS**

**9**

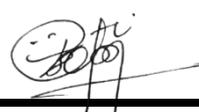
ISO 9000:2015 Standards: Clauses and Implementation - ISO 14000: Environmental Management Systems - Six Sigma: Concepts, DMAIC Process - Certifications and Accreditation: NABL, NABH - Documentation and Auditing

**Unit V STRATEGIC TQM AND CASE STUDIES**

**9**

Strategic Quality Management: Vision, Mission, Policies - Leadership and Change Management in TQM - Customer Focus and Satisfaction - Employee Involvement and Teamwork - Case Studies of TQM Implementation in Manufacturing and Service Sectors

**Total Periods 45**



**Text Books:**

1. Dale H. Besterfield, "Total Quality Management", 4<sup>th</sup> Edition, 2021, Pearson Education, New Delhi.
2. Shridhar Bhat K, "Total Quality Management – Text and Cases", Revised edition, 2<sup>nd</sup> Edition, 2020, Himalaya Publishing House, Mumbai.

**Reference Books:**

1. J.M. Juran and Frank M. Gryna, "Quality Planning and Analysis", 6<sup>th</sup> Edition, 2018, McGraw-Hill Publishing India Ltd, New Delhi.
2. Gregory H. Watson, "Strategic Benchmarking Reloaded with Six Sigma: Improving Your Company's Performance Using Global Best Practice", First Edition, 2021, Wiley India Pvt. Ltd., New Delhi.
3. Subburaj Ramasamy, "Total Quality Management", 2<sup>nd</sup> Edition, 2018, McGraw-Hill Publishing India Ltd, New Delhi.
4. James R. Evans and William M. Lindsay, "Managing for Quality and Performance Excellence", 11<sup>th</sup> Edition, 2020, Cengage Learning India Pvt. Ltd., New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/110/104/110104080/>
2. [https://onlinecourses.swayam2.ac.in/nou21\\_me04/preview](https://onlinecourses.swayam2.ac.in/nou21_me04/preview)
3. [https://onlinecourses.nptel.ac.in/noc21\\_mg72/preview](https://onlinecourses.nptel.ac.in/noc21_mg72/preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	1	1	-	1	2	2	2	2	2	1	2	-	-
CO2	2	2	3	2	3	2	1	-	2	2	2	3	3	2
CO3	-	1	2	-	2	2	1	2	3	3	1	2	-	2
CO4	2	2	3	2	2	2	2	-	2	2	2	2	-	2
CO5	2	2	3	2	3	2	2	-	2	3	2	3	3	3
Average	2	1.6	2.4	2	2.2	2	1.6	2	2.2	2.4	1.6	2.4	3	2.25
3 – High; 2 – Medium; 1– Low; - No correlation														



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<b>U23CEP07</b>	<b>COMPUTER AIDED DESIGN AND DRAFTING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : Design of RC Elements

**Objectives:**

- To acquire hands-on experience in designing and preparing structural drawings for concrete and steel structures commonly encountered in civil engineering practice, and to enhance students' capability to draw plans, elevations, and sectional views of various RCC structural elements using AutoCAD software

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Design and prepare detailed drawings for reinforced concrete structures such as retaining walls, water tanks, and T-beam bridges as per relevant codes.	<b>K3</b>
<b>C02</b>	Design and detail steel structural elements including Gantry Girders, Plate Girders, and Roof Trusses considering practical load conditions	<b>K2</b>
<b>C03</b>	Develop professional quality structural drawings using AutoCAD software for both RCC and steel structures encountered in civil engineering practice.	<b>K6</b>

**List of Drawings**

1. Design and detailing of Cantilever retaining wall
2. Design and detailing of Counterfort retaining wall
3. Design and drafting of circular RCC water tanks
4. Design and drafting of rectangular RCC water tanks
5. Design and detailing of Reinforced Concrete T Beam Bridge Deck bridges for IRC loading
6. Design and detailing of Gantry Girder
7. Design and detailing of Plate Girder Bridge
8. Design and detailing of Roof Trusses

**Total Periods**                      **60**

**Text Books:**

1. Krishnaraju. "Structural Design and Drawing", Universities Press, 2010
2. S.K.Duggal, "Limit State Design of Steel Structures", McGraw hill education (India) Private Limited, New Delhi, 2013

**Reference Books:**

1. Sinha S.N. Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., New Delhi ,2017.
2. Krishna Raju N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, NewDelhi,2017

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105039/>
2. <https://archive.nptel.ac.in/courses/105/105/105105039/>



**Bloom's Taxonomy Level**

K1- Remember (Re), K2 – understand (Un), K3- Apply (Ap), K4- Analyse (An),  
K5- Evaluate (Ev), K6 – Create (Cr)

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	2	2	1	-	-	2	1	1	3	2	2
CO2	3	2	3	2	2	1	-	-	2	1	1	3	2	2
CO3	2	1	2	-	3	-	-	3	3	2	2	2	1	3
Average	2.67	1.67	2.67	2	2.33	1	-	3	2.33	1.33	1.33	2.67	1.67	2.33
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEP08</b>	<b>WATER AND WASTE WATER ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : None

**Objectives:**

- To conduct laboratory tests on characterization of water/wastewater samples. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Understand sampling and preservation methods of water and wastewater.	<b>K2</b>
<b>C02</b>	Calibrate and standardize the equipment.	<b>K3</b>
<b>C03</b>	Analyze the physical, chemical and biological properties of water and waste water.	<b>K3</b>

**EXPERIMENTS ON ANALYSIS OF WATER SAMPLE:**

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Determination of pH in water
3. Determination of Turbidity
4. Determination of Electrical conductivity
5. Determination of Total Hardness present 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
8. Determination of Chlorides in water.

**EXPERIMENTS ON ANALYSIS OF WASTE WATER SAMPLE:**

9. Determination of Alkalinity
10. Determination of Acidity.
11. Estimation of suspended, volatile and fixed solids
12. Determination of Dissolved Oxygen

**Total Periods                      60**

**Text Books:**

1. Guideline manual: Water and Wastewater Analysis, Central Pollution control Board, Ministry of Environment & Forest, New Delhi, India
2. Experimental methods in wastewater Treatment, IWA Publishing



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**Reference Books:**

1. APHA, "Standard Methods for the Examination of Water and Waste water", 22<sup>nd</sup> Ed. Washington, 2012.
2. "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist,H. – Second Edition, VCH, Germany, 3<sup>rd</sup> Edition, 1999.
3. Methods of air sampling & analysis", James P.Lodge Jr (Editor) 3<sup>rd</sup> Edition, Lewis publishers, Inc, USA,1989.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105106119>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	-	-	1	3	-	-	-	-	2	1	3	-
CO2	2	3	-	-	-	3	-	-	-	1	2	-	3	1
CO3	3	3	3	2	-	3	1	-	2	2	2	3	3	2
Average	2.33	3	3	2	1	3	1	-	2	1.5	2	2	3	1.5
3 – High, 2 – Medium, 1 – Low, - No correlation														



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# Semester VII



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<b>U23CEV16</b>	<b>QUANTITY SURVEYING AND ESTIMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To equip students with the ability to estimate quantities of works involved in buildings, water supply, sanitary systems, road and irrigation projects, and to perform rate analysis, property valuation, and prepare detailed estimation reports.

**Course Outcomes:**

Upon completion of the course, students would be able to

	<b>BT Level (highest level)</b>
<b>CO1</b> Interpret the quantities for buildings.	<b>K2</b>
<b>CO2</b> Infer types of specifications, tender notices and types.	<b>K2</b>
<b>CO3</b> Examine the rates for various items of works	<b>K4</b>
<b>CO4</b> Develop valuation of plots and buildings	<b>K3</b>
<b>CO5</b> Outline the types of contracts and principles for report preparation	<b>K2</b>

**Course Contents**

<b>Unit I</b>	<b>QUANTITY ESTIMATION</b>	<b>11</b>
	Methods of estimation – Centre line method – Long and short wall method – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – Culverts	
<b>Unit II</b>	<b>SPECIFICATIONS AND TENDERS</b>	<b>9</b>
	Specifications – Detailed and general specifications – Constructions – Types of specifications. Tenders - Tamilnadu Tender Transparency Act - e-tender - Preparation of Tender Notice and Document	
<b>Unit III</b>	<b>RATE ANALYSIS AND COSTING</b>	<b>8</b>
	Rate for material and labour - Rate analysis for stone masonry, brick masonry, concreting, plastering and tiles laying - PWD Schedule of rates.	
<b>Unit IV</b>	<b>VALUATION</b>	<b>9</b>
	Basics of valuation - Capitalized value - Factors affecting the value of plot and building - Depreciation - Valuation of residential building - Escalation - Calculation of standard rent –Mortgage-Lease -GST Rate for Construction and Building Materials.	
<b>Unit V</b>	<b>CONTRACTS AND REPORT PERPARATION</b>	<b>8</b>
	Contracts - Types of contracts - Drafting of contract documents-Arbitration and legal requirements - Principles for report preparation – Report on estimate of residential building - Culvert - Roads - Water supply and sanitary installations.	
	<b>Total Periods</b>	<b>45</b>

**Text Books:**

1. B.N Dutta, "Estimating and Costing in Civil Engineering", 28<sup>th</sup> Revised Edition, CBS Publishers & Distributors (P) Ltd.
2. B.S.Patil, "Civil Engineering Contracts and Estimates", 2015, 7th edition, University Press.

**Reference Books:**

1. Gurcharan Singh and Jagdish Singh, "A Text Book of Estimating, Costing and Valuation", 2018, Standard Publishers Distributors, Delhi.
2. K.S.Rangawala and K.K. Rangawala, "Elements of Estimating and Costing", 2020, Charotar Publishing House, India.
3. B.S.Patil,, "Civil Engineering Contracts and Estimates", 2020, University Press.
4. D.N. Banerjee, "Principles and Practices of Valuation", 2020, 5<sup>th</sup> Edition, Eastern Law House.

**Web URL(s):**

1. <https://tcp.tn.gov.in/storage/app/document/E0XfKhBnqhlnDX0LAv6BdrpEzLuTH565I0FdrTKM.pdf>
2. <https://cleartax.in/s/land-and-building-depreciation-rate>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	1	1	-	-	2	2	2	2	2	1	2	-	-
CO2	2	2	3	2	-	2	1	-	2	2	2	3	3	2
CO3	-	1	2	-	-	2	1	2	3	3	1	2	-	2
CO4	2	2	3	2	-	2	2	-	2	2	2	2	-	2
CO5	2	2	3	2	-	2	2	-	2	3	2	3	3	3
Average	1.6	1.8	2.4	1.2	-	2	1.6	0.4	2.2	2.4	1.6	2.4	3	2.3
3 – High; 2 – Medium; 1– Low; - No correlation														



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<b>U23MGT02</b>	<b>PRINCIPLES OF MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To introduce the fundamental concepts and principles of management.
- To explore the fundamental roles and functions of management, including planning, organizing, leading, and controlling.
- To develop the ability to apply management principles to organizational scenarios.
- To build decision-making and problem-solving skills in management contexts.
- To understand ethical and social considerations in management practices.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Recall and explain the basic principles and concepts of management	<b>K1</b>
<b>CO2</b>	Describe and understand the core functions of management: planning, organizing, leading, and controlling	<b>K2</b>
<b>CO3</b>	Apply management principles to practical organizational scenarios	<b>K3</b>
<b>CO4</b>	Develop strategies to improve organizational efficiency and effectiveness	<b>K3</b>
<b>CO5</b>	Identify and address ethical challenges in management practices	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO MANAGEMENT 9**

Definition, Nature, and Importance of Management - Evolution of Management Thought - Classical Approach: Scientific Management, Administrative Theory, Bureaucratic Management - Human Relations and Behavioural Approach - Contemporary Approaches: Systems Theory, Contingency Theory - Roles and Skills of a Manager - Ethical and Social Responsibilities of Management

**Unit II PLANNING 9**

Nature and Purpose of Planning - Types of Plans: Strategic, Tactical, Operational - Planning Process - Goal Setting: SMART Goals - Decision Making: Types, Process, and Techniques Strategic Management and Planning Tools: SWOT Analysis, PEST Analysis, BCG Matrix

**Unit III ORGANIZING 9**

Organizational Structure and Design - Functional, Divisional, Matrix Structures - Authority and Responsibility - Delegation: Process, Barriers, and Principles - Decentralization vs. Centralization - Organizational Culture and Change - Coordination and Communication

**Unit IV LEADING 9**

Leadership vs. Management - Leadership Theories and Styles - Trait Theory, Behavioural Theories, Contingency Theories - Motivation Theories: Maslow's Hierarchy of Needs, Herzberg's Two-Factor Theory - Communication: Process, Types, Barriers, and Effective Communication - Team Building and Group Dynamics.

**Unit V CONTROLLING 9**

Nature and Importance of Control - Control Process - Types of Control: Feedforward, Concurrent, Feedback - Financial Controls: Budgets, Audits, Financial Statements - Non-Financial Controls: Balanced Scorecard, Benchmarking - Performance Measurement: KPIs and Metrics - Managing Information and Technology in Control

**Total Periods 45**

**Text Books:**

1. Tripathy P. C and Reddy P. N, "Principles of Management", 3<sup>rd</sup> Edition, 2021, McGraw Hill India Pvt Ltd, New Delhi.
2. Harold Koontz and Heinz Weihrich, "Essentials of Management", 10<sup>th</sup> Edition, 2020, McGraw Hill India Pvt Ltd, New Delhi.

**Reference Books:**

1. Gail Freeman - Bell and Janes Balkwill, "Management in Engineering - Principles and Practice", First Edition, 2008, Prentice Hall of India Pvt Ltd, India.
2. Stephen A. Robbins, David A. Decenzo and Mary Coulter, "Fundamentals of Management", 11<sup>th</sup> Edition, 2022, Prentice Hall, India.
3. Gupta and Meenakshi, "Principles of Management", 3<sup>rd</sup> Edition, 2021, PHI Learning Pvt. Ltd., New Delhi.

**Web URL(s):**

1. <https://nptel.ac.in/courses/110/105/110105146/>
2. [https://onlinecourses.nptel.ac.in/noc20\\_mg58/preview](https://onlinecourses.nptel.ac.in/noc20_mg58/preview)
3. <https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-mg58/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	-	2	-	2	2	1
CO2	3	3	-	2	-	-	2	-	1	2	-	3	2	3
CO3	3	3	3	3	2	-	-	-	2	3	2	2	2	2
CO4	3	2	3	3	2	-	2	2	2	3	2	3	-	3
CO5	3	3	3	3	-	2	3	3	2	3	3	3	3	3
Average	3.0	2.6	3.0	2.8	1.3	1.0	1.4	1.0	1.4	2.6	1.4	2.6	2.3	2.4
3 – High; 2 – Medium; 1- Low; - No correlation														



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<b>U23CEP09</b>	<b>COMPUTER AIDED STRUCTURAL ANALYSIS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Pre-Requisites** : None

**Objectives:**

- To develop skills in modeling, analysis, and spreadsheet-based design of structural systems and water storage structures as per IS 456, with a focus on optimization and automation.

**Course Outcomes:**

On completion of the course, the student is expected to

	<b>BT Level (highest level)</b>
<b>CO1</b> Modeling, Analysis and Design of frames and trusses.	<b>K4</b>
<b>CO2</b> Modeling, Analysis and Design of circular and rectangular water tanks.	<b>K4</b>
<b>CO3</b> Design of slab, beams, columns, and footings using spreadsheet.	<b>K6</b>

**EXERCISES:**

- I** Introduction, Need for structural analysis, Analysis of basic simply supported beams.
- II** Analysis of cantilever beams and propped cantilever beams.
- III** Analysis of continuous beams.
- IV** Analysis and design of 2D frames.
- V** Analysis and design of 3D frames.
- VI** Analysis and design of 2D trusses.
- VII** Analysis and design of rectangular - ground level, underground and elevated water tank with and without bracings.
- VIII** Analysis and design of circular- ground level, underground and elevated water tank with and without bracings.
- IX** Design of structural elements like slab, and beams using spreadsheet.
- X** Design of structural elements like columns and footings using spreadsheet.

**Total Periods      60**



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**Text Books:**

1. K.U. Muthu, A. Ilango, M. Vijian and R. Gopalan, "Computer Aided Design of Structures", I.K. International Publishing House, 2005
2. W. McGuire, R.H. Gallagher and R.D. Ziemian, "Matrix Structural Analysis", Wiley, 2000.

**Reference Books:**

1. R.V. Dukkupati, "Finite Element Analysis", New Age International, 2006.
2. R.C. Hibbeler, "Structural Analysis", Pearson Education, 2017.

**Web URL(s):**

1. <https://bit.ly/temple-structural-analysis>
2. <https://bit.ly/rcc-slab-tool>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	1	3	-	-	-	-	-	-	3	-	3
CO2	3	2	3	1	3	-	2	-	-	-	-	3	2	3
CO3	3	2	3	1	3	-	-	-	-	-	-	3	-	3
Average	3	2	3	1	3	-	2	-	-	-	-	3	2	3
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEJ01</b>	<b>PROJECT WORK PHASE I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>

**Pre-Requisites** :

**Objectives:**

- To enhance students' design capabilities by engaging them in a comprehensive design problem from any civil engineering discipline such as structural design, wastewater treatment, foundation systems, or traffic engineering carried out individually or in small groups, culminating in a detailed report comprising design data, calculations, specifications, and complete working drawings.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Identify and define a real-world civil engineering design problem within a specific domain such as structures, transportation, water resources, or geotechnics.	<b>K3</b>
<b>CO2</b>	Collect, interpret, and utilize relevant design data in accordance with applicable codes, standards, and site conditions.	<b>K4</b>
<b>CO3</b>	Develop and execute appropriate design methodologies to arrive at safe, functional, and efficient solutions.	<b>K5</b>
<b>CO4</b>	Prepare detailed design calculations, technical specifications, and engineering drawings using manual and digital tools.	<b>K6</b>
<b>CO5</b>	Collaborate effectively in teams to document and present a comprehensive design report, demonstrating clarity, accuracy, and professionalism.	<b>K6</b>

**EVALUATION PROCEDURE**

The method of evaluation will be as follows:

<b>Continuous Internal Assessment</b>	
<b>Description</b>	<b>Marks</b>
Review I	20
Review II	20
Review III	20
<b>End Semester Examinations</b>	
<b>Description</b>	<b>Marks</b>
Internal Examiner	20
External	20
<b>Total</b>	<b>100</b>

**Total Periods 60**



**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	2	1	1	2	2	2	2	3	2	2
CO2	3	3	3	2	3	2	1	2	2	2	3	3	3	3
CO3	3	3	3	3	3	2	1	2	2	3	2	3	2	3
CO4	3	2	3	2	3	2	1	3	3	3	2	3	2	3
CO5	2	2	3	2	2	2	2	3	3	3	2	2	2	2
Average	2.8	2.6	2.8	2.2	2.6	1.8	1.2	2.4	2.4	2.6	2.2	2.8	2.2	2.6
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEO01</b>	<b>INTERNSHIP/IN-PLANT TRAINING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Pre-Requisites :**

**Objectives:**

- To enhance students' knowledge of professional engineering practices by providing industrial training focused on the latest technological developments, fostering practical problem-solving skills, and imparting hands-on experience through involvement in real-time industrial projects.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

- |  |           |
|--|-----------|
| <b>CO1</b> Bridge the gap between academic learning and industrial requirements by applying acquired knowledge to real-time engineering problems under professional supervision. | <b>K3</b> |
| <b>CO2</b> Engage in multidisciplinary industrial projects, demonstrating problem-solving abilities, teamwork, and adaptability to industrial culture and practices.             | <b>K4</b> |
| <b>CO3</b> Contribute to research and development activities in specialized areas, enhancing understanding of complex engineering systems and solutions.                         | <b>K5</b> |

**STRATEGY:**

The students individually undertake training in reputed civil engineering companies for a maximum period of four weeks. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated based on the presentation during the viva voce examination.

**EVALUATION PROCEDURE:**

The method of evaluation will be as follows:

1.	Industrial training certificate & report	40 Marks
2.	Presentation	40 Marks
3.	Viva-voce	20 Marks

**Total Periods 15**

  
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Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	2	1	1	2	2	2	2	3	2	2
CO2	3	3	3	2	3	2	1	2	2	2	3	3	3	3
CO3	3	3	3	3	3	2	1	2	2	3	2	3	2	3
Average	3	3	2.7	2.3	2.7	1.7	1	2	2	2.3	2.3	3	2.3	2.7
3 - High, 2 - Medium, 1 - Low, - No correlation														



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# Semester VIII



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<b>U23CEJ02</b>	<b>PROJECT WORK PHASE II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>

**Pre-Requisites** :

**Objectives:**

- To enable students to undertake an investigative study in the field of Civil Engineering—whether theoretical, practical, or a combination of both - by developing literature review skills and demonstrating expertise in a selected area of specialization.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Identify and define a research problem in a specific area of Civil Engineering.	<b>K3</b>
<b>C02</b>	Conduct a comprehensive literature review to understand existing research and identify gaps.	<b>K4</b>
<b>C03</b>	Formulate research objectives and develop a suitable methodology for investigation.	<b>K5</b>
<b>C04</b>	Execute theoretical, experimental, or computational investigations to generate meaningful results.	<b>K5</b>
<b>C05</b>	Demonstrate expertise in the chosen area through systematic documentation and effective presentation of findings.	<b>K6</b>

**EVALUATION PROCEDURE**

It will be assigned by the Department for maximum of four students in a group, under the guidance of a supervisor. During this period the students shall receive directions from the Supervisor for the progress of the Project Work.

The students shall give periodical presentations of the progress made in the Project Work. Each student shall finally produce a comprehensive report. This final report shall be typewritten form as specified in the guidelines.

The Project Work shall be carried out in any of the Civil Engineering areas such as Construction Engineering, Structural Engineering, Environmental Engineering, Water Resources Engineering, Transportation Engineering, Geo Technical Engineering and Remote sensing.

The Project Work includes:

- Review and finalization of the Approach to the Problem
- Preparing an Action Plan for conducting the investigation, including team work
- Detailed Analysis/ Modelling /Simulation/Design/Problem Solving/Experiment as needed
- Final development of product/process, testing, results, conclusions and future directions
- Preparing a paper for Conference presentation/Publication in Journals, if possible
- Preparing a Dissertation in the standard format for being evaluated by the Supervisor
- Final Seminar Presentation before a Departmental Committee



The method of evaluation will be as follows:

Continuous Internal Assessment	
Description	Marks
Review I	20
Review II	20
Review III	20
End Semester Examinations	
Description	Marks
Internal Examiner	20
External	20
Total	100

Total Periods 120

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	2	1	1	2	2	2	2	3	2	2
CO2	3	3	3	2	3	2	1	2	2	2	3	3	3	3
CO3	3	3	3	3	3	2	1	2	2	3	2	3	2	3
CO4	3	2	3	2	3	2	1	3	3	3	2	3	2	3
CO5	2	2	3	2	2	2	2	3	3	3	2	2	2	2
Average	2.8	2.6	2.8	2.2	2.6	1.8	1.2	2.4	2.4	2.6	2.2	2.8	2.2	2.6
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV01</b>	<b>CONCRETE STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : Design of Reinforced Concrete Structural Elements

**Objectives:**

- To provide students with a strong foundation in reinforced concrete design by introducing key structural engineering concepts, enhancing practical understanding of design implementation, and applying scientific and technological principles in accordance with the limit state method for building design.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Examine the design of counterfort and cantilever retaining walls	<b>K4</b>
<b>CO2</b>	Determine the moments in underground and overhead R.C water tanks	<b>K3</b>
<b>CO3</b>	Compute the moment for various types of slabs using yield line theory	<b>K3</b>
<b>CO4</b>	Estimate the moments in flat slabs	<b>K4</b>
<b>CO5</b>	Explain the concepts of pre-stressing for structural elements	<b>K2</b>

**Course Contents**

**Unit I FOOTING AND RETAINING WALL** **9**

Design of Eccentrically loaded Footings for columns – Combined Rectangular Footing. Design of Cantilever and counterfort retaining wall.

**Unit II WATER TANK** **9**

Design of rectangular and circular water tanks- resting on ground- below ground level- overhead water tank (As per IS 3370 (Part I-III))

**Unit III YIELD LINE THEORY** **9**

Assumptions – Characteristics of yield line – Determination of collapse load/ plastic moment – Application of virtual work method – square, rectangular, circular and triangular slabs – Design problems

**Unit IV FLAT SLAB** **9**

Elements of Flat slab – Types – design methods, IS code recommendations – Reinforcement details.

**Unit V INTRODUCTION TO PRESTRESS** **9**

Introduction – Materials – IS Codes – Methods and systems of prestressing – Analysis for Stresses and Losses – Application

**Total Periods** **45**



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**Text Books:**

1. Varghese, P., "Advanced Reinforced Concrete Design", 2012, Prentice Hall of India, Pvt. Ltd., New Delhi.
2. Gambhir.M.L., "Design of Reinforced Concrete structures", 2024, Prentice Hall of India Private limited, New Delhi.

**Reference Books:**

1. Subramanian, N. "Design of Reinforced Concrete Structures", 2013, Oxford University Press, New Delhi.
2. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "RCC Designs Reinforced Concrete Structures", 2012, Laxmi Publications Pvt. Ltd., New Delhi.
3. I.C. Syal and A.K. Goel, "Reinforced Concrete Structures", 2012, S. Chand and Company Ltd, New Delhi.
4. Krishnaraju, "Prestressed concrete", 2016, Prentice Hall of India, Pvt. Ltd., New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105105/>
2. <https://archive.nptel.ac.in/courses/105/105/105105104/>
3. [https://onlinecourses.nptel.ac.in/noc22\\_ce65/preview](https://onlinecourses.nptel.ac.in/noc22_ce65/preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 - understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 - Create

Mapping COs, POs & PSOs

COs	Pos											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	2	-	2	-	-	-	1	-	3	2	-
CO2	3	3	3	2	-	2	-	-	-	1	-	3	2	-
CO3	3	3	3	3	2	2	-	-	-	1	1	3	2	2
CO4	3	3	3	3	2	2	-	-	-	1	1	3	2	2
CO5	3	2	2	2	2	2	-	-	-	-	1	2	2	2
Average	3	2.8	2.8	2.4	2	2	-	-	-	1	1	2.8	2	2
3 - High, 2 - Medium, 1 - Low, - No correlation														



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<b>U23CEV02</b>	<b>PREFABRICATED STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To apply fundamental concepts and design principles of prefabrication, structural components, joints, and connections, incorporating considerations for abnormal loads and progressive collapse to optimize structural performance and safety.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Infer the principles, production, transportation, and erection in prefabrication.	<b>K2</b>
<b>CO2</b>	Identify prefabricated components and systems to optimize performance and efficiency in construction projects.	<b>K3</b>
<b>CO3</b>	Explain the design principles in prefabricated structures.	<b>K3</b>
<b>CO4</b>	Describe types of joints and connections in structural members, including their design and detailing.	<b>K2</b>
<b>CO5</b>	Interpret the effects of abnormal loads and methods to prevent progressive collapse through case studies.	<b>K2</b>

**Course Contents**

**Unit I INTRODUCTION TO PREFABRICATION 9**

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standardization – Loads and load combinations– Materials – Production – Transportation – Erection.

**Unit II PREFABRICATED COMPONENTS AND SYSTEMS 9**

Behaviour and types of structural components – roof and floor slabs – Walls panels – Shear walls – Beams - Columns – skeletal system – portal frame system – Large panel systems – block system.

**Unit III DESIGN PRINCIPLES 9**

Design philosophy – Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation – Demountable precast concrete systems – Design for stripping, stacking, transportation and erection of elements.

**Unit IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS 9**

Types of Joints – based on action of forces – compression joints – shear joints – tension joints – based on function - construction joints, contraction joints, expansion joints. Design of expansion joints – Dimensions and detailing – Types of sealants – Types of structural connections – Beam to Column – Column to Column – Beam to Beam – Column to foundation.

**Unit V DESIGN FOR ABNORMAL LOADS 9**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., – Importance of avoidance of progressive collapse – case study.

**Total Periods 45**



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**Text Books:**

1. K.I.M. Elliott, "Precast concrete structures", 2010, 2<sup>nd</sup> Edition, CRC Press, New York.
2. Dr.R.Anuradha and Dr.K.Ramadevi, "Prefabricated Structures", 2017, 1<sup>st</sup> Edition, VSRD Academic Publishing, India.

**Reference Books:**

1. Ramachandra Murthy S., "Design and Construction of Precast Concrete Structures", 2017, 1<sup>st</sup> Edition, Dipti Press OPC Private Limited - Chennai.
2. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift "Precast Concrete Structures", 2019, 2<sup>nd</sup> Edition, Wiley-VCH, Germany.
3. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
4. IS 15916:2010 - Building design and erection using prefabricated concrete - Code of practice.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105106117/>
2. <https://mrbstructure.in/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	1	-	-	-	-	1	3	2	-
CO2	3	3	3	-	-	2	-	-	-	-	2	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	2	3	2	-
CO4	3	2	2	-	-	-	-	-	-	-	1	3	-	-
CO5	3	2	2	2	-	3	2	-	-	-	2	2	3	-
Average	3	2.8	2	0.4	-	1.2	0.4	-	-	-	1.6	2.8	2	-
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CET04</b>	<b>PRESTRESSED CONCRETE STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To understand the methods and types of prestressing and to enable the students to design prestressed concrete structural elements and systems

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Describe the basic principles, materials, methods, and anchorage systems used in prestressed concrete	<b>K2</b>
<b>CO2</b>	Interpret stresses in prestressed concrete sections using stress, strength, and load balancing concepts	<b>K2</b>
<b>CO3</b>	Evaluate the performance of prestressed concrete members in terms of flexure, shear, and serviceability requirements	<b>K4</b>
<b>CO4</b>	Predict deflections and anchorage zone stresses in pre- and post-tensioned beams using standard methods.	<b>K2</b>
<b>CO5</b>	Demonstrate the principles of prestressing in the design of miscellaneous structures such as tanks, sleepers, and tension members.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION – THEORY AND BEHAVIOUR 9**

Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post-tensioned and pre-tensioned members.

**Unit II DESIGN FOR FLEXURE AND SHEAR 9**

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343:2012 code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343:2012 :2012 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343:2012 code.

**Unit III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9**

Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343:2012 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams- design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

**Unit IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9**

Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

**Unit V MISCELANEOUS STRUCTURES 9**

Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

**Total Periods 45**

**Text Books:**

1. Krishna Raju N., "Prestressed concrete", 5<sup>th</sup> Edition, Tata McGraw Hill Company, New Delhi, 2012.
2. Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2014

**Reference Books:**

1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017.
3. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH,2017
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/106/105106118/>
2. <https://www.concrete.org/topicsinconcrete/topicdetail.aspx?search=prestressed%20concrete>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	1	-	1	2	1	1	1	2	3	1	1
CO2	3	2	3	1	-	1	2	1	1	1	2	3	3	2
CO3	3	2	3	1	-	1	2	1	1	1	2	3	3	2
CO4	2	2	3	1	-	1	2	1	1	1	2	3	2	2
CO5	2	2	3	1	-	1	2	1	1	1	2	3	3	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV04</b>	<b>DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Formulate equations of motion and evaluate natural frequencies and vibration modes for single and multi-degree of freedom dynamic systems.	<b>K3</b>
<b>CO2</b>	Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.	<b>K2</b>
<b>CO3</b>	Identify the behaviour of various types of structures under earthquake.	<b>K2</b>
<b>CO4</b>	Determine the forces in a structure due to earthquake.	<b>K3</b>
<b>CO5</b>	Examine the structural principles involved in earthquake-resistant design.	<b>K4</b>

**Course Contents**

**Unit I INTRODUCTION TO DYNAMICS 9**

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D’Alembert’s Principles - Formulation of equation of motion for SDOF system and MDOF system – Evaluation of natural frequencies and modes - Effect of damping.

**Unit II SEISMOLOGY 9**

Elements of Engineering Seismology – Seismic hazard - Earthquake phenomenon – Seismotectonic – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction – Liquefaction of soil - Seismic zone map – Response spectra.

**Unit III EARTHQUAKE EFFECTS ON STRUCTURES 9**

Inertia force on structures – load transfer path – Effect of architectural features on behaviour of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete - Pinching Effect – Bouchinger Effects - Energy dissipation - P-delta effect - storey drift - Behaviour of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – typical failures - Causes of damage -- Lessons learnt from past earthquakes.

**Unit IV EARTHQUAKE LOAD ANALYSIS 9**

Design spectra – Codal provision – Different methods of earthquake analysis -- Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis.

**Unit V EARTHQUAKE RESISTANT DESIGN 9**

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

**Total Periods 45**

**Text Books:**

1. Mario Paz, "Structural Dynamics: Theory and Computations", 2004, 2<sup>nd</sup> Edition, CBS publisher, New Delhi.
2. R W Clough, and Joseph Penzien, "Dynamics of Structures", 2015, 2<sup>nd</sup> Edition, McGraw Hill Education, New Delhi.

**Reference Books:**

1. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", 2011, 2<sup>nd</sup> Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Anil K. Chopra, "Dynamics of structures – Theory and applications to Earthquake Engineering", 2023, 6<sup>th</sup> Edition, Pearson, New Delhi.
3. IS 1893: 2016, "Criteria for Earthquake Resistant Design of Structures", Part 1, General Provisions and Buildings, 6<sup>th</sup> Revision, December 2016.
4. IS 13920: 2016, "Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice", 1<sup>st</sup> Revision, July 2016.
5. IS 4326: 2013, "Earthquake Resistant Design and Construction of Buildings – Code of Practice", 3<sup>rd</sup> Revision, August 2013.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/104/105104189/>
2. <https://archive.nptel.ac.in/courses/105/101/105101004/>
3. <https://www.nicee.org/EQTips.php>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	2	-	1	1	1	1	1	2	3	1	2
CO2	3	2	2	2	-	1	1	1	1	1	2	3	2	2
CO3	3	3	3	3	-	3	1	1	1	1	2	3	3	2
CO4	3	3	3	2	-	2	1	1	1	1	3	3	2	2
CO5	3	3	3	3	-	3	1	1	1	1	3	3	3	2
Average	3	2.8	2.8	2.4	-	2	1	1	1	1	2.4	3	2.2	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV05</b>	<b>INTRODUCTION TO FINITE ELEMENT METHOD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To develop a thorough understanding of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in Civil Engineering.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Explain the basic concepts, shape functions and methods of discretization in finite element method.	<b>K2</b>
<b>C02</b>	Evaluate approximate methods to analyze structural systems	<b>K3</b>
<b>C03</b>	Interpret the plane stress and plane strain problems using finite element formulations.	<b>K2</b>
<b>C04</b>	Compute joint displacements and member forces in two-dimensional trusses.	<b>K3</b>
<b>C05</b>	Calculate two-dimensional beam elements and rigid plane frames using the direct stiffness method.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION 9**

General description - Basic element shapes - Discretization process - Node numbering - Mesh generation - Steps involved in finite element method - Application of finite element method - Advantages and disadvantages of finite element method.

**Unit II APPROXIMATE METHODS OF ANALYSIS 9**

Energy principles - Variational methods - Rayleigh Ritz method - Method of collocation - Subdomain method - Galerkin Method - Least squares approach.

**Unit III PLANE STRESS AND PLANE STRAIN PROBLEMS 9**

Basic concepts of plane stress and plane strain - derivation of stiffness matrix for constant - strain, linear strain triangular elements - rectangular elements - Iso-parametric elements - Lagrange and Serendipity elements - static condensation - axisymmetric elements.

**Unit IV ANALYSIS OF TRUSSES 9**

Stiffness matrix for an axial element - Direct stiffness approach - Element assembly into global stiffness matrix -two dimensional trusses - displacement of joints - forces in the members.

**Unit V ANALYSIS OF BEAMS AND FRAMES 9**

Beam stiffness - Direct stiffness approach - Element assembly into global stiffness matrix - solution for beam problems - Two-Dimensional beam element - rigid plane frames.

**Total Periods 45**



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**Text Books:**

1. J N Reddy, "An Introduction to Finite Element Method", 2019, 4<sup>th</sup> Edition, McGraw Hill, New Delhi.
2. Daryl L. Logan, "Finite Element Method", 2012, 5<sup>th</sup> Edition, Cengage Learning India Private Limited, India.

**Reference Books:**

1. Singiresu S. Rao, "The Finite Element Method in Engineering", 2010, 5<sup>th</sup> Edition, Butterworth - Heinemann, India.
2. C S Krishnamoorthy, "Finite Element Analysis", 2019, 2<sup>nd</sup> Edition, Tata McGraw Hill, New Delhi.
3. S Rajasekaran, "Finite Element Analysis in Engineering Design", 2006, 2<sup>nd</sup> Edition, S.Chand and Company, India.
4. Larry J. Segerlind, "Applied Finite Element Analysis", 2012, 2<sup>nd</sup> Edition, John Wiley and Sons, New York.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105041/>
2. <https://archive.nptel.ac.in/courses/105/106/105106051/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	1	-	1	-	-	1	1	1	3	-	2
CO2	2	3	2	1	-	1	-	-	1	1	1	3	-	2
CO3	3	3	1	2	-	1	-	-	1	2	2	3	-	2
CO4	3	3	1	1	-	1	-	-	1	1	1	3	-	2
CO5	3	3	1	1	-	1	-	-	1	1	1	3	-	2
Average	2.8	2.8	1.2	1.2	-	1	-	-	1	1.2	1.2	3	-	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV06</b>	<b>REPAIR AND REHABILITATION OF STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide comprehensive knowledge on the causes of structural deterioration, condition assessment techniques, and the materials and methods used for repair, rehabilitation, strengthening, retrofitting, maintenance, and demolition of structures.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Identify the causes and mechanisms of structural deterioration.	<b>K2</b>
<b>CO2</b>	Classify and explain techniques for structural condition assessment.	<b>K2</b>
<b>CO3</b>	Use appropriate repair materials and techniques for different structural deficiencies.	<b>K3</b>
<b>CO4</b>	Illustrate methods for strengthening and retrofitting of structural elements.	<b>K3</b>
<b>CO5</b>	Explain suitable repair and maintenance strategies.	<b>K3</b>

**Course Contents**

<b>Unit I</b>	<b>INTRODUCTION TO MAINTENANCE AND REPAIR STRATEGIES</b>	<b>9</b>
	Maintenance strategies - Types of deterioration - Causes of distress - Inspection methods - Condition assessment - Preventive and corrective maintenance - Classification of repair works.	
<b>Unit II</b>	<b>STRENGTH AND DURABILITY OF CONCRETE</b>	<b>9</b>
	Concrete durability - Strength affecting factors - Types of cracks - Crack causes and identification - Corrosion of reinforcement - Chemical attacks - Material and construction defects.	
<b>Unit III</b>	<b>REPAIR MATERIALS AND TECHNIQUES</b>	<b>9</b>
	Repair materials - Polymer modified mortars - Epoxy and resins - Grouts and sealants - Surface preparation - Crack injection - Stitching - Guniting - Shotcreting - Jacketing methods.	
<b>Unit IV</b>	<b>STRENGTHENING AND RETROFITTING METHODS</b>	<b>9</b>
	Strengthening techniques - Column and beam retrofitting - FRP composites - RCC and steel jacketing - Underpinning - Seismic retrofitting - Shoring methods.	
<b>Unit V</b>	<b>MAINTENANCE AND DEMOLITION TECHNIQUES</b>	<b>9</b>
	Maintenance planning - Monitoring techniques - Demolition methods - Manual and mechanical demolition - Controlled blasting - Safety measures - Rehabilitation case studies.	
	<b>Total Periods</b>	<b>45</b>



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**Text Books:**

1. Vidivelli B., Rehabilitation of Concrete Structures, 2009, Standard Publishers, New Delhi, India.
2. Woodson, R.D., Concrete Structures: Protection, Repair and Rehabilitation, 2012, Butterworth-Heinemann, Oxford, UK.

**Reference Books:**

1. Varghese, P.C., "Maintenance, Repair and Rehabilitation of Structures", 2014, PHI Learning, New Delhi, India.
2. Ravishankar, K., Krishnamoorthy, T.S., "Structural Health Monitoring and Rehabilitation", 2004, Allied Publishers, New Delhi, India.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105105162>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	1	-	-	3	2	-	-	-	1	3	2	1
CO2	2	2	1	2	-	2	1	-	-	-	1	3	2	2
CO3	3	2	3	1	-	2	1	1	1	2	1	3	2	3
CO4	2	2	3	2	-	2	1	1	1	2	1	3	2	2
CO5	2	3	2	3	-	3	1	1	1	1	2	3	3	2
Average	2.2	2.4	2	1.6	-	2.4	1.2	0.6	0.6	1	1.2	3	2.2	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV07</b>	<b>PRE-ENGINEERED BUILDINGS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide a comprehensive understanding of Pre-Engineered Buildings (PEBs), including their fundamentals, structural systems, design methodologies, code applications, and construction techniques, while developing practical skills through software tools, case studies, and detailing practices.

<b>Course Outcomes:</b>		<b>BT Level (highest level)</b>
On completion of the course, the students will be able to		
CO1	Explain the concepts, advantages, limitations, and applications of Pre-Engineered Buildings.	<b>K2</b>
CO2	Identify and describe the primary and secondary structural components of PEB systems.	<b>K2</b>
CO3	Analyse loads and connections based on Indian standards applicable to PEB structures.	<b>K3</b>
CO4	Design basic elements of PEBs including rafters, columns, purlins, girts, and bracings.	<b>K4</b>
CO5	Utilize modern structural software tools to model, detail, and assess performance of PEBs.	<b>K3</b>

**Course Contents**

<b>Unit I</b>	<b>INTRODUCTION TO PRE-ENGINEERED BUILDINGS</b>	<b>9</b>
Definition and origin of PEB systems – Evolution of steel construction – Comparison with conventional steel buildings – Advantages: cost-efficiency, speed, modularity – Limitations and challenges – Application domains: industrial sheds, logistics hubs, institutional buildings, commercial centers – Relevance to green and sustainable construction practices.		
<b>Unit II</b>	<b>COMPONENTS AND STRUCTURAL SYSTEM OF PEBS</b>	<b>9</b>
Primary structural members: rigid frames, rafters, tapered columns – Secondary members: purlins, girts, eave struts – Roofing and wall cladding materials: metal sheets, sandwich panels – Bracing systems: portal, diagonal, cross-bracing – Integration of accessories: skylights, mezzanines, canopies, ventilators, doors, louvers, and windows – Role of diaphragm action.		
<b>Unit III</b>	<b>LOAD CONSIDERATIONS AND CONNECTION DETAILING</b>	<b>9</b>
Types of loads as per IS 875 (Parts 1–5): dead, live, wind, snow, temperature – Seismic loads (IS 1893: Part 1) – Load combinations and analysis methods – Load paths and structural behaviour – Preliminary sizing – Connection types: bolted (bearing/friction), welded – Detailing for moment and shear connections – Tolerances and deflection limits – Fatigue and corrosion considerations.		
<b>Unit IV</b>	<b>DESIGN OF STRUCTURAL ELEMENTS</b>	<b>9</b>
Design of portal frames (rafters and columns) as per IS 800:2007 (Limit State Method) – Cold-formed sections for secondary members: purlins and girts (IS 801) – Base plate and anchor bolt design – Bracing systems for lateral stability – Design checks: strength, stability, and serviceability – Introduction to software-assisted design workflow.		
<b>Unit V</b>	<b>CONSTRUCTION METHODS AND SOFTWARE APPLICATIONS</b>	<b>9</b>
Fabrication process: shop drawings, cutting, welding, surface treatment – Transportation and lifting techniques – Site erection procedures and quality control – Sequence of assembly and safety measures – Use of software tools: STAAD Pro, Tekla Structures, MBS – Modelling, load application, connection detailing, BOM generation – Case studies: comparative evaluation of built PEBs vs conventional structures.		

**Total Periods** **45**

**Text Books:**

1. S.K. Duggal, Design of Steel Structures, 2008, 3<sup>rd</sup> Edition, McGraw Hill Education.
2. N. Subramanian, Design of Steel Structures: Theory and Practice, 2011, Oxford University Press.

**Reference Books:**

1. Ramchandra & Virendra Gehlot, Design of Steel Structures (Vol. 1), 2016, Scientific Publishers.
2. Bureau of Indian Standards, IS 800:2007 – General Construction in Steel – Code of Practice.
3. Bureau of Indian Standards, IS 875 (Parts 1 to 5): Code of Practice for Design Loads.
4. Bureau of Indian Standards, IS 1893 (Part 1): Criteria for Earthquake Resistant Design of Structures.

**Web URL(s):**

1. [https://onlinecourses.nptel.ac.in/noc21\\_ce40/preview](https://onlinecourses.nptel.ac.in/noc21_ce40/preview)
2. [https://onlinecourses.nptel.ac.in/noc25\\_ce65/preview](https://onlinecourses.nptel.ac.in/noc25_ce65/preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	-	1	2	1	-	-	-	1	2	2	1
CO2	3	2	1	-	1	1	-	-	-	-	1	3	1	1
CO3	3	3	2	1	2	2	-	-	-	-	1	3	2	2
CO4	3	2	3	1	2	2	-	-	-	-	2	3	2	2
CO5	2	2	2	2	3	1	-	1	1	1	3	2	1	3
Average	2.8	2.2	1.8	0.8	1.8	1.6	0.2	0.2	0.2	0.2	1.6	2.6	1.6	1.8
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV08</b>	<b>FORMWORK ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide an understanding of formwork engineering, including types, materials, design principles, special systems, and construction issues through case studies.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Solve basic problems related to formwork design and construction.	<b>K3</b>
<b>CO2</b>	Identify the different types of formwork systems and materials commonly used in construction projects.	<b>K3</b>
<b>CO3</b>	Evaluate design requirements for formwork based on structural configurations, loads, and construction methods.	<b>K4</b>
<b>CO4</b>	Examine the challenges and requirements of formwork for special structures like bridges, shells, domes, and towers.	<b>K3</b>
<b>CO5</b>	Evaluate formwork failures through case studies with respect to construction impact and safety practices.	<b>K4</b>

**Course Contents**

**Unit I INTRODUCTION TO FORM WORK 9**

Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork.

**Unit II FORMWORK MATERIALS ASSESORIES 9**

Formwork Materials, Accessories and consumables – Application of tools, Reconstituted wood - Steel – Aluminium Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants - Formwork hours - Labour Requirement. Hardware and fasteners - Nails in Plywood.

**Unit III FORMWORK DESIGN 9**

Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.

**Unit IV FORMWORK FOR SPECIAL STRUCTURES 9**

Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

**Unit V CASE STUDIES 9**

Formwork failures: Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry.

**Total Periods 45**



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**Text Books:**

1. Robert L. Peurifoy and Garold D. Oberlender, "Formwork for Concrete Structures", 2011, 4<sup>th</sup> Edition, McGraw-Hill Education, New York.
2. Kumar Neeraj Jha, "Formwork for Concrete Structures", 2023, 2<sup>nd</sup> Edition, McGraw Hill Education, New Delhi.

**Reference Books:**

1. C.K.Austin, "Formwork for Concrete", 1978, 3<sup>rd</sup> Edition, George Godwin Limited, London.
2. M.K.Hurd, "Formwork for Concrete", 2005, 7<sup>th</sup> Edition, American Concrete Institute, U.S.A.
3. Michael P. Hurst, "Formwork", 1983, 1<sup>st</sup> Edition, Construction Press, London and New York.
4. Christopher Souder, "Temporary Structure Design", 2015, 2<sup>nd</sup> Edition, John Wiley & Sons, New Jersey.
5. IS 14687: 1999(R2005), "Falsework for Concrete Structures - Guidelines," Bureau of Indian Standards.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/104/105104030/>
2. <https://archive.nptel.ac.in/courses/105/105/105105105/>
3. <https://lntedutech.com/formwork-engineering/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO2	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO3	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO4	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO5	3	2	3	1	-	-	-	-	-	-	-	2	3	1
Average	3	2	3	1	-	-	-	-	-	-	-	2	3	1
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV09</b>	<b>CONSTRUCTION EQUIPMENT AND MACHINERY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To expose the students in the field of construction equipment and machineries knowledge in carrying out engineering tasks.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Develop knowledge on planning of equipment and selection of equipment	<b>K3</b>
<b>C02</b>	Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment	<b>K4</b>
<b>C03</b>	Develop the knowledge on special construction equipment	<b>K3</b>
<b>C04</b>	Use the knowledge on asphalt and concrete plants	<b>K3</b>
<b>C05</b>	Choose appropriate material handling equipment for construction activities.	<b>K3</b>

**Course Contents**

<b>Unit I</b>	<b>CONSTRUCTION EQUIPMENTS</b>	<b>9</b>
	Identification - Planning of equipment - Selection of equipment - Equipment management in projects - Maintenance management - Equipment cost - Operating cost - Cost control of equipment - Depreciation analysis - Replacement analysis.	
<b>Unit II</b>	<b>EQUIPMENT FOR EARTHWORK</b>	<b>9</b>
	Fundamentals of earthwork operations - Earth moving operations - Types of earthwork equipment - Tractors, motor graders, scrapers, front end waders - Dozer, excavators, rippers, loaders, trucks and hauling equipment, compacting equipment, finishing equipment	
<b>Unit III</b>	<b>OTHER CONSTRUCTION EQUIPMENT</b>	<b>9</b>
	Equipment for dredging, trenching, drag line and clamshells, tunnelling - Jacking equipment - Equipment for drilling and blasting - Pile driving equipment - Erection equipment - Crane, mobile crane - Types of pumps used in construction - Equipment for dewatering, grouting and demolition.	
<b>Unit IV</b>	<b>ASPHALT AND CONCRETE PLANTS</b>	<b>9</b>
	Aggregate production - Different crushers - Feeders - Screening equipment - Handling equipment - Batching and mixing equipment - Ready mix concrete equipment, concrete pumping equipment - Asphalt plant - Asphalt pavers - Asphalt compacting equipment.	
<b>Unit V</b>	<b>MATERIALS HANDLING EQUIPMENT</b>	<b>9</b>
	Forklifts and related equipment - Portable material bins - Material handling conveyors - Material handling cranes - Industrial trucks - Aerial transporting equipment.	
	<b>Total Periods</b>	<b>45</b>



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**Text Books:**

1. Peurifoy, R.L., Schexnayder, C., Schmitt, R.L. and Aviad Shapira., "Construction Planning, Equipment and Methods", 2018, 9<sup>th</sup> Edition, McGraw Hill, Singapore.
2. Douglas D. Gransberg, Calin M. Popescu, Richard Ryan, "Construction Equipment and Management for Engineers, Estimators and Owners, 2006, 1<sup>st</sup> Edition, Taylor and Francis Publishers, New York.

**Reference Books:**

1. S.V.Deodhar, "Construction Equipment and Job Planning", 2020, 4<sup>th</sup> Edition, Khanna Publishers, New Delhi.
2. S.P.Arora and S.P.Bindra, "Building Construction, Planning Techniques and Method of Construction", 2018, 3<sup>rd</sup> Edition, Dhanpat Rai Publications Pvt. Ltd, New Delhi.
3. S.C.Sharma, "Construction Equipment and Management", 2019, 1<sup>st</sup> Edition, Khanna Publishers, New Delhi.
4. Dr.Mahesh Varma, "Construction Equipment and its Planning and Application", 2003, 2<sup>nd</sup> Edition, Metro-politan Book Company, New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/103/105103206/>
2. <https://lntcmb.com/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO2	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO3	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO4	3	2	3	1	-	-	-	-	-	-	-	2	3	1
CO5	3	2	3	1	-	-	-	-	-	-	-	2	3	1
Average	3	2	3	1	-	-	-	-	-	-	-	2	3	1
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV10</b>	<b>CONSTRUCTION MANAGEMENT AND SAFETY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To study and understand the concept of planning, scheduling, cost and quality control, safety during construction.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Identify project stages and essential services involved in construction activities.	<b>K2</b>
<b>CO2</b>	Use scheduling techniques for planning construction projects.	<b>K3</b>
<b>CO3</b>	Evaluate cost control methods, monitoring techniques, and quality control	<b>K4</b>
<b>CO4</b>	Identify hazards and its remedial measures in the construction industry	<b>K3</b>
<b>CO5</b>	Review safety measures in handling construction equipment.	<b>K2</b>

**Course Contents**

**Unit I FUNDAMENTALS OF CONSTRUCTION PROJECT MANAGEMENT 9**

Introduction of construction Project Management Construction -Scope -Construction Project- Characteristics Project development and Life Cycle Construction Project -Management Practice Roles and Functions- Responsibility of Construction Managers and Major causes of Project failure.

**Unit II PLANNING AND ORGANIZING CONSTRUCTION PROJECT 9**

Construction Project organization -Planning Project work- Scope and integration Processes -Defining Project Activities- Scheduling Project- CPM- PERT- Precedence Network Analysis Planning and organizing project- resources such as manpower material equipment Time and cost for construction site.

**Unit III COST CONTROL MONITORING AND ACCOUNTING 9**

Cost Control Problem -Project Budget Forecasting for Activity -Cost Control Financial Accounting Systems - Cost Accounts -Control of Project Cash Flows Schedule -Control Schedule - Budget Updates Relating Cost and Schedule Information -Total Quality Control.

**Unit IV CONSTRUCTION SAFETY 9**

Quality and Safety Concerns in Construction -Organizing for Quality and Safety Work and Material Specifications- Importance of Safety during project construction Accidents and their Causes- General precaution to hazardous atmosphere and materials- Safety facilities at construction sites -Training to project staff and operation staff -Emergency rescue equipment Costs of Construction -Injuries Legal Implications.

**Unit V SAFETY MEASURES IN HANDLING CONSTRUCTION EQUIPMENTS 9**

General requirements of safety in concrete construction Handling of Concrete forms and shoring Safety measures for hoisting and erection of prefabricated elements OSHA Occupational Safety and Healthy Administration for Prestressing Operations Risk Assessment for erecting RC & Steel members Electrical safety in construction site.

**Total Periods 45**



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**Text Books:**

1. Dr. S. Seetharaman, "Construction Engineering & Management", Umesh Publications, New Delhi
2. P. S. Gahlot, B. M. Dhir, "Engineering Construction Planning and Management", 2018, New Age International, New Delhi.

**Reference Books:**

1. Peurifoy, R.L., Schexnayder, C.J., Shapira, A., and Schmitt, R., "Construction Planning, Equipment, and Methods", 2020, 9<sup>th</sup> Edition, McGraw Hill Education, New York.
2. Sharma S.C. "Construction Equipment and Management", 2019, Khanna Publishers, New Delhi.
3. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", 2019, 1<sup>st</sup> Edition, Tata McGraw Hill Publishing Company, New Delhi.

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1. <https://archive.nptel.ac.in/courses/105/104/105104161/>
2. <https://archive.nptel.ac.in/courses/105/102/105102206/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	2	1	-	-	-	-	-	-	2	-	3	-	2
CO3	-	3	3	-	-	-	-	-	-	2	-	3	2	2
CO4	-	3	2	-	-	3	-	-	-	-	-	2	3	-
CO5	-	-	2	-	-	3	-	-	-	-	-	2	3	3
Average	2	3	2	-	-	3	-	-	-	2	-	3	3	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV11</b>	<b>ADVANCED CONSTRUCTION TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to	
<b>CO1</b> Understand the modern construction techniques used in the sub structure construction.	<b>K2</b>
<b>CO2</b> Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings	<b>K2</b>
<b>CO3</b> Understand the concepts used in the construction of special structures	<b>K3</b>
<b>CO4</b> Knowledge on Various strengthening and repair methods for different cases.	<b>K3</b>
<b>CO5</b> Identify the suitable demolition technique for demolishing a building.	<b>K4</b>

**Course Contents**

**Unit I SUB STRUCTURE CONSTRUCTION 9**

Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

**Unit II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9**

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ pre stressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures

**Unit III CONSTRUCTION OF SPECIAL STRUCTURES 9**

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

**Unit IV REHABILITATION AND STRENGTHENING TECHNIQUES 9**

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.



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**Unit V DEMOLITION**

**9**

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

**Total Periods 45**

**Text Books:**

1. Jerry Irvine, Advanced Construction Techniques, CA Rocket, 1984
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.

**Reference Books:**

1. Emmons, P. H., "Concrete Repair and Maintenance Illustrated: Problem Analysis; Repair Strategy; Techniques", 1992, Illustrated edition, Wiley (Reprinted by Galgotia Publications Pvt. Ltd., New Delhi).
2. Brown, R. W., "Practical Foundation Engineering Handbook", 2000, 2nd Edition, McGraw-Hill, New York.
3. Sarkar, S. K. & Saraswati, S., "Construction Technology", 2008, Illustrated edition, Oxford University Press, New Delhi.

**Web URL(s):**

1. [https://swayam.gov.in/nd1\\_noc24\\_ce104/Preview](https://swayam.gov.in/nd1_noc24_ce104/Preview)
2. [https://swayam.gov.in/nd2\\_noc21\\_ce21/Preview](https://swayam.gov.in/nd2_noc21_ce21/Preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	1	-	-	-	1	-	-	-	-	1	3	-	2
CO2	2	1	2	-	-	1	-	-	-	-	1	3	-	2
CO3	2	2	2	1	-	1	-	-	-	1	1	3	1	2
CO4	2	2	3	1	-	1	-	-	-	1	1	3	2	2
CO5	2	2	3	-	-	2	-	-	-	1	1	2	2	1
Average	2	2	3	1	-	1	-	-	-	1	1	3	2	2
3 – High, 2 – Medium, 1 – Low, - No correlation														

<b>U23CEV12</b>	<b>ENERGY EFFICIENT BUILDINGS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide an understanding of the concept of energy consumption in buildings and design an energy efficient building

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>CO1</b>	Understand environmental energy supplies on buildings	<b>K2</b>
<b>CO2</b>	Explain the passives solar heating, cooling system	<b>K2</b>
<b>CO3</b>	Discuss the various aspects of day-lighting and electrical lighting in a building	<b>K3</b>
<b>CO4</b>	Predict and design building ventilation and heat control for indoor comfort	<b>K3</b>
<b>CO5</b>	Use simulation programs of buildings to perform energy calculations	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION 9**

Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.

**Unit II PASSIVE SOLAR HEATING AND COOLING 9**

General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds– Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odour removal.

**Unit III DAYLIGHTING AND ELECTRICAL LIGHTING 9**

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – 130 Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.

**Unit IV HEAT CONTROL AND VENTILATION 9**

Hourly Solar radiation – Heat insulation – Terminology - Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation – Calculation of probable indoor wind speed.

**Unit V DESIGN FOR CLIMATIC ZONES 9**

Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification.

**Total Periods 45**

**Text Books:**

1. Bureau of Energy Efficiency, "Energy Conservation Building Code", 2018, New Delhi.
2. Bureau of Indian Standards, "Handbook on Functional Requirements of Buildings – Part 1 to 4, SP: 41 (S&T)", 1995, New Delhi.

**Reference Books:**

- 1 Krigger, J., and Dorsi, C., "Residential Energy: Cost Savings and Comfort for Existing Buildings", 2009, Saturn Resource Management.
- 2 Brown, G.Z., and DeKay, M., "Sun, Wind and Light - Architectural Design Strategies", 2014, 3<sup>rd</sup> Edition, John Wiley and Sons Inc.
- 3 Majumdar, M. (Ed), "Energy-Efficient Buildings in India", 2009, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources.

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2. <https://drmcet.digimat.in/nptel/courses/video/105102175/L37.html>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	2	1	-	3	-	-	-	-	2	-	3	-	2
CO3	-	3	3	-	2	-	-	-	-	2	-	3	2	2
CO4	-	3	2	-	-	3	-	-	-	-	-	2	3	-
CO5	-	-	2	-	3	3	-	-	-	-	-	2	3	3
Average	2	3	2	-	3	3	-	-	-	2	-	3	3	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV13</b>	<b>SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Describe the various sustainable materials used in construction.	<b>K2</b>
<b>CO2</b>	Explain the method of estimating the amount of energy required for building.	<b>K2</b>
<b>CO3</b>	Describe the features of LEED, TERI and GRIHA ratings of buildings.	<b>K2</b>
<b>CO4</b>	Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity	<b>K3</b>
<b>CO5</b>	Apply lean tools & techniques to achieve sustainability in construction projects.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9**

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability

**Unit II ENERGY CALCULATIONS 9**

Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use.

**Unit III GREEN BUILDINGS 9**

Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighbouring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building.

**Unit IV CORE CONCEPTS IN LEAN 9**

Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

**Unit V LEAN CONSTRUCTION TOOLS AND TECHNIQUES 9**

Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping– 5S , Collaborative Planning System (CPS)/ Last Planner™ System (LPS) – Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Site

**Total Periods 45**

**Text Books:**

1. Charles J. Kibert, "Sustainable Construction: Green Building Design & Delivery", 2016, 4<sup>th</sup> Edition, Wiley Publishers.
2. Steve Goodhew, "Sustainable Construction Process", 2016, Wiley Blackwell, UK.

**Reference Books:**

1. Craig A. Langston & Grace K.C. Ding, "Sustainable Practices in the Built Environment", 2011, Butterworth-Heinemann Publishers.
2. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., "Lean Construction Tools and Techniques", 2002.
3. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., "Site Implementation and Assessment of Lean Construction Techniques", 2005, Lean Construction Journal.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105/102/1051021952>
2. <https://nptel.ac.in/courses/105/106/105106213>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	2	-	-	-	-	-	3	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	-	2
CO3	3	2	-	-	-	2	-	-	-	-	-	3	2	-
CO4	-	-	2	2	-	-	-	-	-	-	-	3	-	2
CO5	-	-	3	3	-	2	-	-	-	-	-	3	2	3
Average	3	2	3	3	-	2	-	-	-	-	-	3	2	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV14</b>	<b>MODERN CONSTRUCTION MATERIALS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non-weathering materials, and smart materials.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to	
<b>CO1</b> Understand material science fundamental	<b>K2</b>
<b>CO2</b> Infer material properties	<b>K2</b>
<b>CO3</b> Apply knowledge to construction materials	<b>K3</b>
<b>CO4</b> Utilize advanced materials	<b>K3</b>
<b>CO5</b> Select appropriate materials for projects	<b>K4</b>

**Course Contents**

**Unit I SPECIAL CONCRETES 9**

Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

**Unit II METALS 9**

Types of Steels – Manufacturing process of steel – Advantages of new alloy steels – Properties and advantages of aluminium and its products – Types of Coatings & Coatings to reinforcement – Applications of Coatings.

**Unit III COMPOSITES 9**

Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FRP.

**Unit IV OTHER MATERIALS 9**

Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its uses – Types of Flooring and Facade Materials and its application, concrete admixtures and construction chemicals.

**Unit V SMART AND INTELLIGENT MATERIALS 9**

Types & Differences between Smart and Intelligent Materials – Special features – Case studies showing the applications of smart & Intelligent Materials.

**Total Periods 45**

**Text Books:**

- Ganapathy, C., Modern Construction Materials, 2015, Eswar Press.
- Ashby, M.F. and Jones, D.R.H.H., Engineering Materials 1: An Introduction to Properties, Applications and Designs, 2005, Elsevier Publications.

**Reference Books:**

- 1 American Concrete Institute, "Design and Construction of Externally Bonded Fiber-Reinforced Polymer (FRP) Systems for Strengthening Concrete Structures – Guide", 2023, ACI PRC-440.2-23, American Concrete Institute, Farmington Hills, MI.
- 2 Pierre-Claude Aïtcin, "High Performance Concrete", 2020, 1st Edition, CRC Press, Boca Raton, FL.
- 3 M.S. Shetty & A.K. Jain, "Concrete Technology: Theory and Practice", 2019, 8th Edition, S. Chand Publishing, New Delhi.

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1. <https://nptel.ac.in/courses/105106053/>
- 2 <https://archive.nptel.ac.in/courses/video/105106053/L02.html>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-	1
CO2	3	3	-	2	-	-	-	-	-	-	2	3	-	1
CO3	3	2	2	-	-	1	-	-	-	-	1	3	2	2
CO4	3	2	2	2	-	2	-	-	-	1	2	3	2	3
CO5	3	3	2	-	-	3	-	-	-	2	2	3	3	3
Average	3	2	2	2	-	2	-	-	-	2	2	3	2	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV15</b>	<b>CLIMATE CHANGE ADAPTATION AND MITIGATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide foundational knowledge of the Earth's climate system and its natural and anthropogenic drivers; to understand the impacts of climate change and evaluate adaptation and mitigation strategies; and to explore clean technologies and renewable energy solutions for promoting sustainable development.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest level)**

<b>CO1</b>	Outline the climatic system and the factors influencing the climatic changes.	<b>K2</b>
<b>CO2</b>	Choose the uncertainty and impact of climatic changes.	<b>K3</b>
<b>CO3</b>	Implement climate change mitigation and adaptation projects using alternate fuels and renewable energy.	<b>K3</b>
<b>CO4</b>	Use in-depth knowledge on climate models.	<b>K3</b>
<b>CO5</b>	Identify clean technologies for sustainable growth.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO WEATHER AND CLIMATE 9**

Atmosphere – weather and climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global Ocean circulation – El Nino and its effect - Carbon cycle.

**Unit II OBSERVATION OF CLIMATE CHANGE 9**

Observed changes and its causes-- Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large-Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India.

**Unit III IMPACTS OF CLIMATE CHANGE 9**

Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas.

**Unit IV CLIMATE CHANGE MITIGATION MEASURES 9**

IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration.

**Unit V CLEAN TECHNOLOGY AND RENEWABLE ENERGY 9**

Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic- Alternate Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels.

**Total Periods 45**



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**Text Books:**

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", 2007, Cambridge University Press India Private Limited, New Delhi.
2. Jan C. van Dam, "Impacts of Climate Change and Climate Variability on Hydrological Regimes", 2009, Cambridge University Press, New Delhi.
3. IPCC Report Technical paper VI – Climate change and Water, 2008.
4. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., "Climate Change and Water", 2008, Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva.

**Reference Books:**

- 1 Climate change 2014: Impacts, Adaptation and Vulnerability, IPCC 5.
- 2 Climate change 2013: The Physical Science basis, IPCC.
- 3 Thomas E, Lovejoy and Lee Hannah "Climate Change and Biodiversity", 2005, TERI Publishers, Mumbai.
- 4 Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", 2003, Cambridge University Press, New Delhi.
- 5 IPCC fourth assessment report - Working Group II Report, "Impacts, Adaptation and Vulnerability", 2007.

**Web URL(s):**

1. [www.environment.org/explore-topics/climate-change/what.we.do/climate-adaptation](http://www.environment.org/explore-topics/climate-change/what.we.do/climate-adaptation)
2. <https://nptel.ac.in/courses/106106465>
3. [www.environment.gov.au/climate-change/adaptation](http://www.environment.gov.au/climate-change/adaptation)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	-	-	1	3	-	-	-	-	2	1	3	-
CO2	2	3	-	-	-	3	-	-	-	1	2	-	3	1
CO3	3	3	3	2	-	3	1	-	2	2	2	3	3	2
CO4	3	2	-	3	3	2	-	1	1	1	3	2	-	3
CO5	2	3	2	-	2	3	1	-	1	-	3	2	3	-
Average	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV16</b>	<b>AIR AND NOISE POLLUTION CONTROL ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To cultivate a deep understanding and interest in air and noise pollution, including their adverse effects on environmental components, and to impart knowledge on the sources, impacts, and control techniques of these pollutants

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest level)**

<b>C01</b>	Show the air quality and effects of air pollutants.	<b>K2</b>
<b>C02</b>	Discover various types and sources of air pollution.	<b>K4</b>
<b>C03</b>	Analyse the dispersion of air pollutants and their modelling.	<b>K4</b>
<b>C04</b>	Identify the principles and design of control of particulate pollutants.	<b>K3</b>
<b>C05</b>	Choose the sources, effects and control of vehicular, indoor air and noise pollution.	<b>K3</b>

**Course Contents**

**Unit I AIR QUALITY AND EFFECTS OF AIR POLLUTANTS 9**

Air quality standards – Meteorology and air pollution – Atmospheric stability and inversions – Mixing height and plume behaviour – Effects of air pollution on human beings, vegetation, animals, materials and climate.

**Unit II SOURCES AND CLASSIFICATION 9**

Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants: Chemical, Instrumental and biological methods.

**Unit III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING 9**

Sampling and measurement of particulate and gaseous pollutants: Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence- Dispersion of air pollutants- Air Quality Modelling.

**Unit IV AIR POLLUTION CONTROL MEASURES 9**

Control methods: source correction techniques and control equipment's - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers - Control of gaseous emissions - Absorption - Adsorption and combustion devices (Theory and working of equipment's only)

**Unit V CONCEPTS OF NOISE AND NOISE CONTROL STRATEGIES 9**

Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of noise and sound absorbent.

**Total Periods 45**



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**Text Books:**

1. C. S. Rao, "Environmental Pollution Control Engineering", 2006, Wiley Eastern Limited, New Delhi.
2. M. N. Rao, H. V. N. Rao, "Air pollution", 2017, Tata McGraw Hill Pvt Ltd, New Delhi.
3. Dr. Y. Anjaneyulu, "Air Pollution and Control Technologies", 2019, Allied publishers Private Limited, Mumbai.

**Reference Books:**

1. Anjaneyulu, D., "Air Pollution Control Technologies", 2002, Allied Publishers, Mumbai.
2. Noel De Nevers, "Air pollution control Engineering", 2000, McGraw Hill International Edition, New Delhi.

**Web URL(s):**

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2. <https://archive.nptel.ac.in/courses/112/104/112104227/>
3. <https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce22/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	1	-	1	3	-	-	-	-	2	1	3	-
CO2	2	3	2	-	-	3	1	-	-	1	2	-	3	1
CO3	3	3	2	3	3	2	-	1	1	1	3	2	2	3
CO4	3	2	3	2	3	2	-	1	1	1	2	3	2	3
CO5	2	3	2	-	2	3	1	-	1	-	2	2	3	-
Average	2.4	2.6	2	1	1.8	2.6	0.4	0.4	0.6	0.6	2.2	1.6	2.6	1.4
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV17</b>	<b>ENVIRONMENTAL IMPACT ASSESSMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide students with a thorough understanding of Environmental Impact Assessment (EIA) and enable them to formulate effective Environmental Management Plans using interdisciplinary knowledge.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	carry out scoping and screening of developmental projects for environmental and social assessments	<b>K2</b>
<b>CO2</b>	explain different methodologies for environmental impact prediction and assessment	<b>K3</b>
<b>CO3</b>	asses socio-economic investigation of the environment in a project	<b>K3</b>
<b>CO4</b>	plan environmental impact assessments and environmental management plans.	<b>K3</b>
<b>CO5</b>	knowledge to prepare environmental impact assessment reports for various projects	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO EIA 9**

Historical development of Environmental Impact Assessment (EIA). Environmental Clearance- EIA in project cycle. legal and regulatory aspects in India – types and limitations of EIA –EIA process screening – scoping - terms of reference in EIA – public hearing in EIA- EIA consultant accreditation.

**Unit II IMPACT IDENTIFICATION AND PREDICTION 9**

Matrices – networks – checklists – cost benefit analysis – expert systems in EIA. prediction tools for EIA – mathematical modelling for impact prediction – assessment of impacts – air – water – soil – noise – biological -- cumulative impact assessment.

**Unit III SOCIO-ECONOMIC IMPACT ASSESSMENT 9**

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts.

**Unit IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN 9**

Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings.

**Unit V CASE STUDIES 9**

Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects.

**Total Periods 45**



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**Text Books:**

1. L.W. Canter, "Environmental Impact Assessment", 1996, 2<sup>nd</sup> Edition, McGraw Hill, New York.
2. D.P. Lawrence, "Environmental Impact Assessment – Practical Solutions to Recurrent Problems", 2003, Wiley-Interscience, New Jersey.
3. Y. Anjaneyulu, "Environmental Impact Assessment Methodologies", 2002, B.S. Publications, Hyderabad.

**Reference Books:**

1. S. K. Shukla and P. R. Srivastava, "Concepts in Environmental Impact Analysis", 1992, Commonwealth Publishers, New Delhi.
2. John G. Rao and David C. Hooten (Eds.), "Environmental Impact Analysis Handbook", 1990, McGraw Hill Book Company.
3. World Bank, "Source Book on Environmental Impact Assessment (EIA)".
4. K. V. Raghavan and A. Khan, "Methodologies in Hazard Identification and Risk Assessment", 1990, Manual by CLRI.
5. Kolluru Rao, Steven Bartell, R. Pitblado, and Stricoff, "Risk Assessment and Management Handbook", 1996, McGraw Hill Inc., New York.

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1. <https://archive.nptel.ac.in/courses/124/107/124107160/>
2. <https://archive.nptel.ac.in/courses/120/108/120108004/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	-	-	1	3	-	-	-	-	2	1	3	-
CO2	2	3	-	-	-	3	-	-	-	1	2	-	3	1
CO3	3	3	3	2	-	3	1	-	2	2	2	3	3	2
CO4	3	2	-	3	3	2	-	1	1	1	3	2	-	3
CO5	2	3	2	-	2	3	1	-	1	-	3	2	3	-
Average	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV18</b>	<b>INDUSTRIAL WASTEWATER MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide knowledge of industrial wastewater characteristics, treatment, and reuse, and develop skills to apply pollution prevention and design solutions through case studies.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
On completion of the course, the students will be able to	
<b>C01</b> Summarize the characteristics of industrial wastewater and its environmental impacts.	<b>K2</b>
<b>C02</b> Interpret pollution prevention and waste minimization techniques.	<b>K3</b>
<b>C03</b> Design appropriate treatment processes for various industrial effluents.	<b>K4</b>
<b>C04</b> Assess strategies for wastewater reuse and residuals management.	<b>K4</b>
<b>C05</b> Apply theoretical knowledge to practical industrial wastewater management scenarios.	<b>K3</b>

**Course Contents**

<b>Unit I INTRODUCTION TO INDUSTRIAL WASTEWATER</b>	<b>9</b>
Industrial activities and their environmental impacts - Water usage in industries - Sources and types of industrial wastewater - Pollutant characteristics and origins - Regulatory requirements and standards - Industrial waste survey and monitoring techniques - Toxicity assessments and bioassay tests	
<b>Unit II POLLUTION PREVENTION AND WASTE MINIMIZATION</b>	<b>9</b>
Concepts of pollution prevention vs. control - Waste management hierarchy - Source reduction techniques - Periodic waste minimization assessments - Evaluation of pollution prevention options - Cost-benefit analysis and pay-back period calculations - Implementation of pollution prevention programs	
<b>Unit III INDUSTRIAL WASTEWATER TREATMENT</b>	<b>9</b>
Flow and load equalization - Solids separation techniques - Removal of fats, oils, and grease - Neutralization and pH control - Removal of inorganic constituents: precipitation, heavy metal removal, nutrient removal - Advanced treatment methods: ion exchange, adsorption, membrane filtration, advanced oxidation processes - Biological treatment processes	
<b>Unit IV WASTEWATER REUSE AND RESIDUALS MANAGEMENT</b>	<b>9</b>
Individual and common effluent treatment plants - Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for wastewater reuse - Disposal methods for treated effluents - Residuals management: sludge quantification, thickening, digestion, dewatering, and disposal - Management of reverse osmosis rejects.	
<b>Unit V CASE STUDIES OF SPECIFIC INDUSTRIES</b>	<b>9</b>
Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Sugar and Distilleries	
<b>Total Periods</b>	<b>45</b>

**Text Books:**

1. Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton, and H. David Stensel, "Wastewater Engineering: Treatment and Reuse", 2017, 4th Edition, McGraw-Hill.
2. Soli J. Arceivala and Shyam R. Asolekar, "Wastewater Treatment for Pollution Control and Reuse", 2007, 3rd Edition, Tata McGraw-Hill.

**Reference Books:**

- 1 Wesley Eckenfelder W., "Industrial Water Pollution Control", 2000, 2nd Edition, McGraw-Hill.
- 2 Nelson Leonard Nemerow, "Industrial Waste Treatment, Elsevier", 2007.
- 3 Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo, and Constantine Yapijakis, "Handbook of Industrial and Hazardous Waste Treatment", 2004, 2nd Edition, CRC Press.
- 4 Paul L. Bishop, "Pollution Prevention: Fundamentals and Practice", 2000, McGraw-Hill.

**Web URL(s):**

1. [https://onlinecourses.nptel.ac.in/noc24\\_ce53/preview](https://onlinecourses.nptel.ac.in/noc24_ce53/preview)
2. [https://onlinecourses.nptel.ac.in/noc24\\_ce105/preview](https://onlinecourses.nptel.ac.in/noc24_ce105/preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	-	-	1	3	-	-	-	-	2	1	3	-
CO2	2	3	-	-	-	3	-	-	-	1	2	-	3	1
CO3	3	3	3	2	-	3	1	-	2	2	2	3	3	2
CO4	3	2	-	3	3	2	-	1	1	1	3	2	-	3
CO5	2	3	2	-	2	3	1	-	1	-	3	2	3	-
Average	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV19</b>	<b>SOLID AND HAZARDOUS WASTE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- This course aims to provide students with a fundamental understanding of the sources, characteristics, and impacts of solid and hazardous wastes. It equips them with the skills to evaluate minimization strategies and design appropriate treatment and disposal systems.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Outline the characteristics of solid and hazardous wastes and their environmental impacts.	<b>K2</b>
<b>CO2</b>	Apply the waste minimization and resource recovery techniques	<b>K3</b>
<b>CO3</b>	Design appropriate treatment and disposal processes for various solid and hazardous wastes.	<b>K4</b>
<b>CO4</b>	Assess strategies for waste management in compliance with regulatory frameworks.	<b>K4</b>
<b>CO5</b>	Apply theoretical knowledge to practical waste management scenarios	<b>K3</b>

**Course Contents**

**Unit I WASTE SOURCES & REGULATIONS 9**

Definitions and classifications of solid and hazardous wastes - Sources and characteristics of municipal solid waste (MSW) and hazardous waste - Waste generation rates and composition - Environmental and health impacts of improper waste management -Regulatory frameworks and policies governing waste management.

**Unit II WASTE COLLECTION, TRANSPORT AND STORAGE 9**

On-site handling and storage methods - Collection systems: methods, equipment, and route optimization - Transfer stations: design and operation - Transportation methods and logistics - Occupational health and safety in waste handling.

**Unit III SOLID WASTE TREATMENT PROCESS 9**

Physical, chemical, and biological processing techniques - Composting: aerobic and anaerobic methods - Incineration and energy recovery - Mechanical-biological treatment (MBT) - Material recovery facilities (MRFs) and recycling processes

**Unit IV HAZARDOUS WASTE MANAGEMENT 9**

Classification of hazardous wastes - Hazardous waste generation and minimization strategies- Treatment technologies: physical, chemical, thermal, and biological methods - Stabilization and solidification processes - Secure landfilling and containment systems - Transportation and storage regulations for hazardous wastes.

**Unit V WASTE DISPOSAL AND SITE REMEDIATION 9**

Landfill design and operation for solid and hazardous wastes - Leachate and gas management systems - Closure and post-closure care of landfills - Site assessment and remediation techniques for contaminated sites - Bioremediation and phytoremediation methods - Case studies on successful waste management and remediation projects

**Total Periods 45**

**Text Books:**

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management", 2015, 1<sup>st</sup> Edition, Mc-Graw Hill India, First edition, New York.
2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", 2010, Mc-Graw Hill International edition, New York.
3. Rao M.N, Razia Sultana, Sri Harsha Kota, "Solid and hazardous waste management – Science and Engineering", 2016, Butterworth-Heinemann, New York.

**Reference Books:**

1. CPHEEO, "Manual on Municipal Solid waste management, Vol I, II and III", 2016, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi.
2. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, "Solid Waste Engineering – A Global perspective", 3rd Edition, 2017, Cengage Learning, USA.
3. Gary C. Young, "Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons", 2010, Wiley publications, Canada.
4. Cherry P M, "Solid and Hazardous Waste Management", 2018, CBS publishers and distributors Private limited, New Delhi.

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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	-	-	1	3	-	-	-	-	2	1	3	-
CO2	2	3	-	-	-	3	-	-	-	1	2	-	3	1
CO3	3	3	3	2	-	3	1	-	2	2	2	3	3	2
CO4	3	2	-	3	3	2	-	1	1	1	3	2	-	3
CO5	2	3	2	-	2	3	1	-	1	-	3	2	3	-
Average	2.4	2.8	1	1	1	2.8	0.4	0.2	0.8	0.8	2.4	1.6	2.4	1.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV20</b>	<b>ENVIRONMENT, HEALTH AND SAFETY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- This course introduces the fundamental principles of environmental health and safety, focusing on the identification and evaluation of various hazards. It enables students to analyze their impacts and apply appropriate regulatory frameworks and mitigation strategies.

**Course Outcomes:**

On completion of the course, the students will be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Outline the needs for EHS in industries and related Indian regulations	<b>K2</b>
<b>CO2</b>	Assess the various types of Health hazards, effect, assessment and control methods	<b>K3</b>
<b>CO3</b>	Identify the various safety systems in working environments	<b>K3</b>
<b>CO4</b>	Select the methodology for preparation of Emergency Plans and Accident investigation	<b>K3</b>
<b>CO5</b>	Analyze the EHS Management System and its elements	<b>K4</b>

**Course Contents**

**Unit I INTRODUCTION 9**

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

**Unit II OCCUPATIONAL HEALTH AND HYGIENE 9**

Definition of occupational health and hygiene - Categories of health hazards - Exposure pathways and human responses-Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria

**Unit III WORKPLACE SAFETY AND SAFETY SYSTEMS 9**

Features of Satisfactory and Safe design of work premises - good housekeeping - lighting and color, Ventilation and Heat Control, Noise, Chemical and Radiation Safety - Electrical Safety - Fire Safety - Safety at Construction sites, ETP - Machine guarding - Process Safety, Working at different levels

**Unit IV HAZARDS AND RISK MANAGEMENT 9**

Safety appraisal - Job Safety Analysis-Control techniques - plant safety inspection - Accident investigation - Analysis and Reporting - Hazard and Risk Management Techniques -Onsite and Offsite emergency Plans. Employee Participation- Education and Training- Case Studies

**Unit V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 9**

Concept of Environmental Health and Safety Management - Elements of Environmental Health and Safety Management Policy and implementation and review - ISO 45001-Strucure and Clauses-Case Studies

**Total Periods 45**



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**Text Books:**

1. "Industrial Health and Safety Acts and Amendments", 2020 by Ministry of Labour and Employment, Government of India.
2. Dr.K.U.Mistry, "Fundamentals of Industrial Safety and Health", 2012, Siddharth Prakashan, New Delhi.
3. Goetsch, D. L., "Occupational Safety and Health for Technologists, Engineers, and Managers", 8th edition, 2018, Pearson, ISBN: 978-0134695815, Bangalore.

**Reference Books:**

1. Bill Taylor, "Effective Environmental, Health, and Safety Management Using the Team Approach", 2005, Culinary and Hospitality Industry Publications Services.
2. Brian Gallant, "The Facility Manager's Guide to Environmental Health and Safety", 2007, Government Institutes, Maryland, USA.
3. Nicholas P. Cheremisinoff and Madelyn L. Graffia, "Environmental and Health and Safety Management", 1995, William Andrew publishers, New York.

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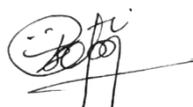
1. <https://archive.nptel.ac.in/courses/114/106/114106017/>
2. <https://nptel.ac.in/courses/120108004>
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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	2	-	-	-	3	3	-	-	-	-	2	3	1
CO2	1	3	2	-	-	3	-	-	-	1	2	3	3	2
CO3	-	2	3	-	-	3	-	-	-	-	2	3	2	-
CO4	1	2	2	2	-	3	3	2	2	2	2	3	3	2
CO5	-	2	3	2	-	3	3	2	2	3	3	3	3	2
Average	0.4	2.2	2	0.8	-	3	1.8	0.8	0.8	1.2	1.8	2.8	2.8	1.4
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV21</b>	<b>ENVIRONMENTAL POLICY AND LEGISLATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To introduce the principles and evolution of environmental legislation and enable students to analyze and apply legal frameworks for managing environmental issues in engineering practice.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
On completion of the course, the students will be able to	
<b>CO1</b> Identify major environmental laws and their relevance to civil engineering.	<b>K2</b>
<b>CO2</b> Interpret environmental legislation and assess project implications.	<b>K3</b>
<b>CO3</b> Apply laws to ensure compliance and sustainable development.	<b>K3</b>
<b>CO4</b> Analyze case studies on legislation effectiveness.	<b>K4</b>
<b>CO5</b> Develop strategies to integrate legal requirements into management systems.	<b>K4</b>

**Course Contents**

**Unit I INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS 9**

Evolution and significance of environmental laws - Constitutional provisions related to the environment in India - Principles of environmental law: Polluter Pays Principle, Precautionary Principle, Sustainable Development. Role of judiciary in environmental protection - international environmental agreements and their influence on Indian legislation.

**Unit II INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION 9**

Indian Environmental Policy 2006 Administrative machinery for pollution control Common Law & Criminal Law Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems. Environmental Laws in India - The Environment (Protection) Act, 1986, The Air (Prevention and Control of Pollution) Act, 1981, The Water (Prevention and Control of Pollution) Act, 1974, The Wildlife (Protection) Act, 1972, The Forest (Conservation) Act, 1980, The Biological Diversity Act, 2002.

**Unit III REMEDIES FOR ENVIRONMENTAL POLLUTION 9**

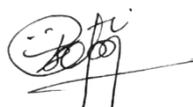
Common Law Remedies/Remedies under Law of Tort – Penal Remedies – Indian Penal Code and Code of Criminal Procedure – Remedies under Constitutional Law – Writs – Public Interest Litigation - Public Liability Insurance Act, 1991 – The National Green Tribunal Act 2010

**Unit IV INSTITUTIONAL FRAMEWORK AND ENFORCEMENT MECHANISMS 9**

Central and State Pollution Control Boards: Structure and functions - National Green Tribunal: Composition, powers, and functions - Role of NGOs and public interest litigation in environmental protection - Environmental auditing and reporting - Challenges in enforcement and compliance.

**Unit V CONTEMPORARY ISSUES AND CASE STUDIES 9**

Polluter Pay Principle, Precautionary Principle, Public Trust Doctrine. Landmark Judgments - Olium gas leakage case, Citizen Welfare Forum v. Union of India, (1996) 5SCC 647) Ganga Pollution case (1988) I SCC) S. Jagannath v. UOI (1997) SCC867) Vellore Citizens welfare forum case M.C. Mehta V. Kamalnath (1997) I SCC 388)



**Total Periods 45**

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**Text Books:**

1. Leela Krishnan, P, "Environmental Law in India", 5th edition, 2022, LexisNexis. ISBN: 978-9351438215, New York.
2. Divan, S., & Rosencranz, A., "Environmental Law and Policy in India", 3rd edition, 2021, Oxford University Press. ISBN: 978-0190122453, Uttar Pradesh.

**Reference Books:**

1. Shanthakumar S., "Environmental Law – An Introduction", 2004, Butterworths, New York.
2. Shyam Divan & Armin Rosencranz., "Environmental Law and Policy in India", 3rd edition, 2021, Oxford University Press, Uttar Pradesh.
3. Bharucha, E., "Textbook of Environmental Studies for Undergraduate Courses", 3rd edition, 2019, Universities Press, Hyderabad.

**Web URL(s):**

1. [https://onlinecourses.nptel.ac.in/noc20\\_hs34/preview](https://onlinecourses.nptel.ac.in/noc20_hs34/preview)
2. <https://www.classcentral.com/course/swayam-environmental-law-25349>
3. [https://en.wikipedia.org/wiki/Indian\\_environmental\\_law](https://en.wikipedia.org/wiki/Indian_environmental_law)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	2	-	-	-	3	3	-	2	-	-	1	3	-
CO2	-	3	-	-	-	3	3	1	-	2	-	-	3	1
CO3	1	3	2	-	-	3	3	-	2	2	3	-	3	2
CO4	-	3	2	2	-	3	3	1	-	2	3	2	3	2
CO5	-	2	3	2	-	3	3	2	-	3	3	3	3	-
Average	0.4	2.6	1.4	0.8	-	3	3	0.8	0.8	1.8	1.8	1	3	1
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV22</b>	<b>GEOENVIRONMENTAL ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide knowledge on geotechnical problems related to soil contamination, safe waste disposal, and soil remediation techniques for environmental protection.

**Course Outcomes:**

On completion of this course, the student is expected to be able to:

**BT Level  
(highest  
level)**

<b>C01</b>	Outline the various causes and consequences of waste interaction with soil and their modification.	<b>K2</b>
<b>C02</b>	Choose the various mechanism of transport of contaminants into the subsurface and characterization of contaminated sites and their risk analysis.	<b>K3</b>
<b>C03</b>	Identify the decontaminate the site so as to reuse the site for human settlement	<b>K3</b>
<b>C04</b>	Evaluate various waste containment processes and their effectiveness for the safe disposal of waste.	<b>K4</b>
<b>C05</b>	Examine on how to convert the waste into a resource material through soil waste stabilization techniques with or without chemical stabilization.	<b>K3</b>

**Course Contents**

**Unit I SOIL – WASTE INTERACTION 9**

Role of Geo-environmental Engineering – sources, generation and classification of wastes – causes and consequences of soil pollution – case studies in soil failure -factors influencing soil pollutant interaction – modification of index, chemical and engineering properties – physical and physiochemical mechanisms.

**Unit II CONTAMINANT TRANSPORT AND SITE CHARACTERISATION 9**

Transport of contaminant in subsurface – advection, diffusion, dispersion – chemical process – biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, Volatization, biodegradation – characterization of contaminated sites – soil and rock data – hydrological and chemical data – analysis and evaluation.

**Unit III WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES 9**

In-situ containment – vertical and horizontal barrier – surface cover – ground water pumping system on subsurface drain – soil remediation – Soil Vapour extraction, soil waste stabilization, solidification of soils, electrokinetic remediation, soil heating, vitrification, bio remediation, Phyto-remediation – ground water remediation – pump and treat, In-situ flushing, permeable reacting barrier, In-situ air sparging.

**Unit IV LANDFILLS AND SURFACE IMPOUNDMENTS 9**

system – Source and characteristics of waste - site selection for landfills – components of landfills – liner soil, geomembrane, geosynthetic clay, geo-composite liner system – leachate collection – final cover design – monitoring landfill - Environmental laws and regulations.

**Unit V STABILISATION OF WASTE 9**

Evaluation of waste materials – fly ash, municipal sludge, plastics, scrap tire, blast furnace slag, construction waste, wood waste and their physical, chemical and biological characteristics – potential reuse – utilization of waste and soil stabilization.

**Total Periods 45**

**Text Books:**

1. Hari D. Sharma and Krishna R.Reddy, "Geo-Environmental Engineering", 2004, John Wiley and Sons, INC, USA.
2. Daniel B.E, "Geotechnical Practice for waste disposal", 1993, Chapman & Hall, London.

**Reference Books:**

1. Westlake, K., "Landfill Waste pollution and Control", 1995, Albion Publishing Ltd., England.
2. Lagrega, M.d., Buckingham, P.L., and Evans, J.C., "Hazardous Waste Management", 1994, McGraw Hill, Inc. Singapore.
3. Wentz, C.A., "Hazardous Waste Management", 1989, McGraw Hill, Singapore.

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1. <https://archive.nptel.ac.in/courses/105/103/105103025/>
2. <https://www.geoengineer.org/education/geoenvironmental-engineering>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	1	1	1	-	2	-	-	-	1	3	2	2	3
CO2	3	1	-	-	-	2	-	2	-	-	3	2	2	3
CO3	2	1	2	2	-	3	2	-	-	1	3	2	2	2
CO4	1	3	3	2	-	2	2	2	2	-	3	3	2	3
CO5	2	2	3	3	-	2	2	3	2	1	3	1	2	2
Average	2.0	1.0	1.5	1.5	-	2.3	2	2	2	1	3	2.0	2.0	2.7
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV23</b>	<b>GROUND IMPROVEMENT TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To expose students to common soil problems and evaluation methods, teach techniques for improving difficult soils, and cover design approaches for implementing ground improvement methods.

**Course Outcomes:**

On completion of this course, the student is expected to be able to:

		<b>BT Level (highest level)</b>
<b>CO1</b>	Identify various problems associated with soil deposits and selection of ground improvement methods	<b>K3</b>
<b>CO2</b>	Discover the dewatering techniques and design for simple cases as per needs and specifications.	<b>K4</b>
<b>CO3</b>	Develop the concept involved for in-situ treatment of cohesive and cohesionless soils and design for simple cases	<b>K3</b>
<b>CO4</b>	Select the concept of earth reinforcement and its applications and design for simple cases in various engineering structure	<b>K3</b>
<b>CO5</b>	List the soil grouting and stabilization techniques	<b>K4</b>

**Course Contents**

**Unit I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 9**

Geotechnical problems in alluvial, lateritic and black cotton soils - Role of ground improvement in foundation engineering - Methods of ground improvement - Selection of suitable ground improvement techniques based on soil conditions.

**Unit II DEWATERING 9**

Dewatering Techniques - Well points - Vacuum and electroosmotic methods - Seepage analysis for two-dimensional flow for fully and partially penetrated slots in homogeneous deposits - Design for simple cases.

**Unit III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 9**

Insitu densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime Piles-Installation techniques - Simple design - Relative merits of above methods and their limitations.

**Unit IV EARTH REINFORCEMENT 9**

Concept of reinforcement - Types of reinforcement material - Reinforced earth wall - Mechanism - Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

**Unit V GROUTING TECHNIQUES AND SOIL STABILIZATION 9**

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring - Stabilization with cement, lime, chemicals and industrial wastes - Stabilization of expansive soil.

**Total Periods 45**

**Text Books:**

1. Bikash Chandra Chattopadhyay and Joyanta Maity, "Ground Improvement Techniques", 2017, PHI Learning Pvt. Ltd.
2. Purushothama Raj. P, "Ground Improvement Techniques", 2005, Firewall Media.

**Reference Books:**

1. Han, J., "Principles and Practice of Ground Improvement", 2015, John Wiley and Sons, New Jersey, Canada.
2. Moseley, M.P., "Ground Improvement", 2004, Blackie Academic and Professional, Chapman and Hall, Glasgow.
3. Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", 1994, McGraw Hill.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105210/>
2. <https://www.iadc-dredging.com/subject/techniques/ground-improvement/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	3	-	3	3	3	3	2	3	3	3	2
CO2	2	3	3	2	-	2	1	2	2	1	3	3	3	3
CO3	2	3	3	2	-	3	1	2	1	1	3	3	3	3
CO4	2	3	3	1	-	2	1	2	1	1	3	3	3	3
CO5	2	3	2	2	-	2	1	2	1	1	3	3	3	3
Average	2.3	3	2.7	2.3	-	2.7	1.7	2.3	2	1.3	3	3	3	2.7
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV24</b>	<b>SOIL DYNAMICS AND MACHINE FOUNDATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide fundamental knowledge of soil dynamics, machine foundation design, vibration isolation, and mitigation of soil-structure interaction from machinery vibrations.

**Course Outcomes:**

On completion of the course, the students will be able to

		<b>BT Level (highest level)</b>
CO1	Explain the basic principles of soil dynamics and machine foundations.	<b>K2</b>
CO2	Identify the dynamic properties of soils and evaluate their effect on foundation behaviour.	<b>K2</b>
CO3	Examine the effect of dynamic loading on soil and its response in foundation design.	<b>K3</b>
CO4	Design machine foundations considering dynamic effects and soil-structure interaction.	<b>K3</b>
CO5	Identify vibration isolation techniques for machine foundations.	<b>K2</b>

**Course Contents**

**Unit I INTRODUCTION TO SOIL DYNAMICS 9**

Basic concepts of soil dynamics – Soil as a three-phase system – Types of dynamic loads – Dynamic properties of soil – Shear modulus, damping, and their frequency dependence – Measurement of dynamic properties of soils.

**Unit II DYNAMIC RESPONSE OF SOIL 9**

Wave propagation in soils – Elastic waves in soil – Seismic waves and their behaviour in soil – Response of soil to vertical, horizontal, and rotational dynamic loading – Dynamic settlement and soil liquefaction – Case studies of soil response.

**Unit III MACHINE FOUNDATIONS – FUNDAMENTALS 9**

Types of machine foundations – Vibrations of rigid bodies and flexible bodies – Dynamic load distribution in machine foundations – Amplification of vibrations in foundations – Resonance and its effects – Methods for analysis of machine foundations.

**Unit IV DESIGN OF MACHINE FOUNDATIONS 9**

Design criteria for machine foundations – Methods of design: Westergaard's and Newmark's methods – Design of foundations for different types of machines (reciprocating, impact, rotating) – Soil-structure interaction in machine foundations.

**Unit V VIBRATION ISOLATION AND CASE STUDIES 9**

Vibration isolation: Theory and principles – Vibration isolation materials and techniques – Case studies of machine foundation design and soil-structure interaction – Modern techniques in design and installation of machine foundations.

**Total Periods 45**



**Text Books:**

1. Prakash, S., Puri, V.K. Soil Dynamics and Machine Foundations, 2012, McGraw-Hill Education.
2. Kameswara Rao, A. Soil Dynamics and Foundation Vibration, 2014, Wiley-India.

**Reference Books:**

1. Das, B.M. Principles of Foundation Engineering, 2017, 8<sup>th</sup> Edition, Cengage Learning.
2. Vijayvergia, R., Sinha, D., & Awasthi, V. Fundamentals of Soil Dynamics and Machine Foundations, 2016, Oxford University Press.
3. Burland, J.B., and Brooker, E.W. Vibrations in Soils: Theory and Practice, 1989, John Wiley & Sons.

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2. <https://www.coursera.org/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	2	-	3	1	2	2	1	2	3	2	2
CO2	2	3	2	2	-	2	1	2	2	1	3	3	2	2
CO3	3	2	3	3	-	2	1	2	3	2	2	3	3	2
CO4	2	3	3	3	-	2	1	2	3	3	2	3	3	3
CO5	2	2	3	2	-	3	1	2	3	2	2	2	3	3
Average	2.4	2.4	2.6	2.4	-	2.4	1	2	2.6	1.8	2.2	2.8	2.6	2.4
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV25</b>	<b>ROCK MECHANICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To introduce rock mechanics principles and enable students to assess rock behavior and apply classification systems in the design of foundations, tunnels, slopes, and other rock structures.

**Course Outcomes:**

On completion of the course, the students will be able to

	<b>BT Level (highest level)</b>
CO1 Classify rocks and evaluate their engineering properties.	<b>K2</b>
CO2 Determine strength and failure criteria through laboratory and field testing.	<b>K2</b>
CO3 Examine in-situ stresses and understand their implications.	<b>K3</b>
CO4 Use principles of rock mechanics in design of structures.	<b>K3</b>
CO5 Recommend appropriate rock reinforcement and stabilization measures.	<b>K3</b>

**Course Contents**

**Unit I CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 9**

Geological classification of rocks – Physical and mechanical properties – Laboratory determination of index properties – Porosity, permeability, durability, specific gravity, water absorption – Rock Quality Designation (RQD) – Rock Mass Rating (RMR) – Geological Strength Index (GSI) – Classification of rock masses and their significance.

**Unit II STRENGTH AND FAILURE CRITERIA OF ROCKS 9**

Rock strength under compression, tension and shear – Stress-strain behavior – Failure modes – Laboratory and field testing methods – Triaxial test, Brazilian test, Point load test – Mohr-Coulomb and Hoek-Brown failure criteria – Deformability of rocks – Modulus of elasticity and Poisson's ratio.

**Unit III IN-SITU STRESS AND MEASUREMENT TECHNIQUES 9**

Concept of in-situ stress – Factors influencing in-situ stresses – Determination of in-situ stresses: Overcoring, Hydraulic fracturing, Flat jack methods – Stress distribution around tunnels and openings – Influence of joints and discontinuities.

**Unit IV ROCK STABILITY AND CIVIL ENGINEERING APPLICATIONS 9**

Design principles for underground openings – Stability of rock slopes – Foundations on rock masses – Stress distribution beneath loaded areas – Blast-induced vibrations – Case studies on tunnels, slopes and dams in rock.

**Unit V ROCK REINFORCEMENT AND SUPPORT SYSTEMS 9**

Rock bolting techniques – Types of rock bolts – Shotcreting – Grouting – Anchors – Rock reinforcement design – Load transfer mechanism – Support reaction curves – Instrumentation in rock engineering – Field applications and case studies.

**Total Periods 45**



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**Text Books:**

1. Goodman, R.E., Introduction to Rock Mechanics, 2nd Edition, 1989, John Wiley & Sons.
2. Ramamurthy, T., Engineering in Rocks for Slopes, Foundations and Tunnels, 3rd Edition, 2014, PHI Learning Pvt. Ltd., New Delhi.

**Reference Books:**

1. Brady, B.H.G., and Brown, E.T., Rock Mechanics for Underground Mining, 3<sup>rd</sup> Edition, 2006, Springer.
2. Hoek, E. and Bray, J.W., Rock Slope Engineering, 4<sup>th</sup> Edition, 2004, CRC Press.
3. Brown, E.T., Rock Characterization, Testing and Monitoring, 1991, Pergamon Press.

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**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	2	-	1	-	-	-	-	1	3	2	2
CO2	3	3	-	3	-	1	-	-	-	-	1	3	2	3
CO3	3	3	2	2	-	2	-	-	-	-	2	3	2	2
CO4	3	2	3	2	-	2	-	-	-	-	2	3	3	3
CO5	3	2	3	2	-	2	-	-	-	-	2	3	3	3
Average	3	2.4	1.6	2.2	-	1.6	-	-	-	-	1.6	3	2.4	2.6
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV26</b>	<b>EARTH AND EARTH RETAINING STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To enable students to analyse and design rigid and flexible earth retaining structures, slurry-supported trenches, and deep excavations.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to	
<b>CO1</b> Examine the earth pressure on retaining structures using classical theories	<b>K3</b>
<b>CO2</b> Interpret engineering principles and earth pressure theories to design rigid retaining structures	<b>K2</b>
<b>CO3</b> Use the knowledge of engineering and earth pressure to analyse and design flexible earth retaining walls	<b>K2</b>
<b>CO4</b> Infer lateral earth pressure conditions around excavations to design braced cuts, slurry-supported excavations and underground utility systems	<b>K3</b>
<b>CO5</b> Discuss the function of slurry in excavation support and perform stability analysis considering realistic slurry support geometries.	<b>K2</b>

**Course Contents**

<b>Unit I</b>	<b>EARTH PRESSURE THEORIES</b>	<b>9</b>
Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann’s method) – Active and passive cases – Earth pressure due to external loads.		
<b>Unit II</b>	<b>COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES</b>	<b>9</b>
Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.		
<b>Unit III</b>	<b>SHEET PILE WALLS</b>	<b>9</b>
Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.		
<b>Unit IV</b>	<b>SUPPORTED EXCAVATIONS</b>	<b>9</b>
Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.		
<b>Unit V</b>	<b>SLURRY SUPPORTED EXCAVATION</b>	<b>9</b>
Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm walls-bored pile walls-contiguous pile wall-secant piles-stability analysis.		

**Total Periods** **45**



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**Text Books:**

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations: Basic Geotechnics", 6th Edition, 2002, Prentice Hall
2. Rowe, R.K., "Geotechnical and Geoenvironmental Engineering Handbook", 2001, Kluwer Academic Publishers
3. Budhu, M., "Soil Mechanics and Foundations", 2007, John Wiley & Sons, Inc.

**Reference Books:**

1. Clayton, C.R.I., Militisky, J. and Woods, R.I., "Earth Pressure and Earth-Retaining Structures", 2<sup>nd</sup> Edition, 1993, Survey University Press.
2. Das, B.M., "Principles of Geotechnical Engineering", 4<sup>th</sup> Edition, 1998, The PWS Series in Civil Engineering.
3. Winterkorn, H.F. and Fang, H.Y., "Foundation Engineering Handbook", 2000, Galgotia Booksources.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105185/>
2. <https://archive.nptel.ac.in/courses/105/105/105105039/>
3. [https://onlinecourses.nptel.ac.in/noc21\\_ce06/preview](https://onlinecourses.nptel.ac.in/noc21_ce06/preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	3	2	2	3	2	2	-	2	-	3	-	2
CO2	3	3	2	2	2	3	2	2	-	2	-	3	-	2
CO3	3	3	3	2	3	3	2	2	-	2	-	3	-	2
CO4	3	3	3	3	3	3	2	3	-	2	2	3	-	2
CO5	3	3	3	3	3	3	3	2	-	2	2	3	-	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV27</b>	<b>SUBSOIL INVESTIGATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide fundamental knowledge of soil exploration and investigation methods, develop skills in sampling and field test data interpretation, familiarize students with laboratory, in-situ, and geophysical testing procedures, and enable preparation of geotechnical investigation reports for civil engineering projects.

**Course Outcomes:**

Upon completion of the course, students would be able to

		<b>BT Level (highest level)</b>
<b>C01</b>	Understand the principles, planning, and methods of subsoil exploration	<b>K2</b>
<b>C02</b>	Use techniques for soil sampling and classify soil based on field and lab data	<b>K3</b>
<b>C03</b>	Infer results from in-situ tests to determine soil properties	<b>K4</b>
<b>C04</b>	Evaluate and interpret laboratory and geophysical test data for engineering applications	<b>K5</b>
<b>C05</b>	Prepare comprehensive subsoil investigation reports for infrastructure development projects	<b>K6</b>

**Course Contents**

**Unit I INTRODUCTION TO SUBSOIL EXPLORATION 9**

Objectives and necessity of subsoil investigation - Site reconnaissance and planning for investigation - Methods of exploration: Open excavation, trial pits, auger boring, rotary drilling, wash boring - Depth and spacing of boreholes - Preparation and interpretation of bore logs

**Unit II SOIL SAMPLING AND IDENTIFICATION 9**

Types of soil samples: disturbed vs undisturbed - Sampling techniques: split spoon sampler, Shelby tube sampler, piston sampler - Standard procedures for sample handling, preservation, and transportation - Field identification of soils: visual-manual procedures - Index properties and classification using field data

**Unit III IN-SITU TESTING TECHNIQUES 9**

Standard Penetration Test (SPT): procedure, corrections, significance - Dynamic Cone Penetration Test (DCPT) and Static Cone Penetration Test (SCPT) - Vane Shear Test: field procedure and application - Plate Load Test: procedure, interpretation of results, limitations

**Unit IV GEOPHYSICAL METHODS OF SUBSURFACE EXPLORATION 9**

Introduction to geophysical exploration and its relevance - Seismic methods: seismic refraction principles, field procedures, data interpretation - Electrical resistivity methods: Wenner and Schlumberger configurations - Comparison of geophysical and conventional methods - Applications in detecting bedrock, voids, and groundwater

**Unit V DATA INTERPRETATION AND REPORTING 9**

Compilation of field and laboratory test data - Interpretation of data for bearing capacity and settlement analysis - Preparation of geotechnical investigation reports - Recommendations for foundation design - Case studies: subsoil investigation for buildings, bridges, and pavements

**Total Periods 45**



**Text Books:**

1. B.C. Punmia, "Soil Mechanics and Foundations", 2017, Laxmi Publications.
2. Gopal Ranjan and A.S.R. Rao, "Basic and Applied Soil Mechanics", 2016, New Age International.
3. Braja M. Das, "Principles of Geotechnical Engineering", 2015, Cengage Learning.

**Reference Books:**

1. Arora K.R., "Soil Mechanics and Foundation Engineering", 2016, Standard Publishers.
2. Bowles J.E., "Foundation Analysis and Design", 2011, McGraw Hill.
3. IS Codes: IS 1892, IS 2131, IS 9640, IS 4968, IS 6403, IS 1498.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105103097>
2. <https://www.geotechdata.info>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	-	2	-	2	2	-	-	-	1	2	1	-
CO2	3	3	2	2	2	-	-	-	-	-	1	2	2	1
CO3	2	3	2	3	3	-	-	-	-	-	1	3	2	1
CO4	2	2	2	3	3	2	1	-	-	-	1	2	3	1
CO5	2	2	2	2	2	2	1.5	-	-	-	3	2	3	2
Average	2.4	2.6	2	2.4	2.5	2	1.5	-	-	-	1.4	2.2	2.2	1.25
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV28</b>	<b>TUNNELING ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To provide an understanding of tunnel classification, applications, and construction methods for various ground conditions, along with design principles, support systems, safety aspects, and modern trends through real-life case studies.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
On completion of the course, the students will be able to	
CO1 Describe the types, components, and significance of tunnels in civil infrastructure.	<b>K2</b>
CO2 Explain various tunneling methods and determine suitable methods for different conditions.	<b>K2</b>
CO3 Identify and apply support systems and ground improvement techniques in tunnel construction.	<b>K3</b>
CO4 Apply safety, ventilation, and lighting provisions for tunnel operations.	<b>K3</b>
CO5 Illustrate case studies and recent developments in tunnel construction.	<b>K3</b>

**Course Contents**

<b>Unit I INTRODUCTION TO TUNNELING</b>	<b>9</b>
Definition – Necessity – Scope and classification of tunnels – Alignment – Shape and size – Advantages and limitations – Tunnel surveying – Selection of site – Geotechnical investigations for tunneling – Basic terminology.	
<b>Unit II TUNNELING METHODS</b>	<b>9</b>
Selection of tunneling methods – Tunneling in soft ground: cut-and-cover, shield tunneling, fore-poling – Tunneling in hard rock: drill and blast method – Tunnel Boring Machines (TBM) – New Austrian Tunneling Method (NATM) – Sequential Excavation Method (SEM) – Comparison of methods.	
<b>Unit III DESIGN AND SUPPORT SYSTEMS</b>	<b>9</b>
Tunnel design considerations: alignment, cross-sectional shape, geological influences – Temporary and permanent support systems: rock bolts, shotcrete, steel ribs, concrete lining – Ground improvement techniques: grouting, dewatering, ground freezing – Instrumentation and monitoring.	
<b>Unit IV SAFETY, LIGHTING AND VENTILATION IN TUNNELS</b>	<b>9</b>
Safety hazards: ground collapse, gas, water ingress – Safety devices – Tunnel ventilation: natural and mechanical systems – Ventilation during construction and operation – Lighting systems in tunnels – Emergency procedures and fire protection.	
<b>Unit V CASE STUDIES AND MODERN DEVELOPMENTS</b>	<b>9</b>
Case studies of notable tunnel projects (road, rail, metro, hydro) – Challenges and mitigation – Innovations in equipment and construction practices – Environmental and sustainability considerations – Advances in digital monitoring and automation in tunneling.	



**Total Periods 45**

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**Text Books:**

1. R.S. Sinha, "Tunneling Engineering", 2014, Khanna Publishers, New Delhi.
2. Bickel, J.O., and Kuesel, T.R., "Tunnel Engineering Handbook", 2011, Springer.

**Reference Books:**

1. O' Reilly, M.P., and New, B.M., "Tunneling and Ground Movement", 2010, CIRIA.
2. Basu, D.N., and Bhattacharya, S., "Underground Excavations in Rock", 2013, Taylor & Francis.
3. Harris, K., and Baker, R., "Modern Tunnel Design", 2012, Thomas Telford.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105/105/105105212/>
2. <https://www.asce.org/education-and-events/explore-education/on-demand-courses/introduction-to-tunnel-design-and-construction>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	1	1	-	1	1	1	2	1	1	3	2	2
CO2	2	3	2	1	-	2	1	1	2	2	2	3	2	3
CO3	3	3	3	2	-	3	2	2	3	3	2	3	2	3
CO4	2	2	2	3	-	3	2	2	2	3	2	3	2	3
CO5	2	3	2	2	-	2	3	2	3	2	2	3	3	2
<b>Average</b>	2.2	2.6	2	1.8	-	2.2	1.8	1.6	2.4	2.2	1.8	3	2.2	2.6
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV29</b>	<b>PARTICIPATORY WATER RESOURCE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To help students understand regional and global practices of participatory irrigation water management and gain insight into paradigm shifts in stakeholder involvement.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Select the fundamental concepts and terms which are to be applied and understood all through the study.	<b>K3</b>
<b>CO2</b>	Develop the participatory ideology with its rudiments under the light of both national and international illustrative cases.	<b>K3</b>
<b>CO3</b>	Show the roles of different players as stakeholders with the ground reality of the underlying issues in farm community.	<b>K2</b>
<b>CO4</b>	Identify as how reforms can help build up institutional and irrigation agencies	<b>K3</b>
<b>CO5</b>	Choose an overarching understanding of recommendation for improved irrigation management	<b>K3</b>

**Course Contents**

**Unit I FUNDAMENTALS OF SOCIOLOGY AND PARTICIPATORY APPROACH 9**

Basic Sociological concepts and Definitions - Objectives – Perspectives- Social stratification – Sociological understanding - Irrigation as a Sociotechnical Process - paradigm shift and Participatory approach.

**Unit II UNDERSTANDING FARMERS PARTICIPATION 9**

Need of farmers participation –Benefits of farmers participation – Comparisons of cost and benefit. Water User Association -- Membership - Kinds of participation – National and International Experiences - Activities on Water towards Organization and Structure - Context of participation-factors in the environment.

**Unit III ROLE OF STAKEHOLDERS AND THE UNDERLYING ISSUES 9**

Introduction to geophysical methods – Electrical resistivity methods – Wenner and Schlumberger methods of groundwater exploration – Seismic Reflection and Refraction Methods – Remote sensing techniques for groundwater exploration – Well logging and types - Collector wells and Infiltration galleries.

**Unit IV IMPROVING AGENCY RELATIONS AND INSTITUTIONAL REFORMS 9**

Supporting farmer organization and participation -Decision Making- Leadership and responsibilities - Development strategy – Channels for implementation -- Equity and Equality- Agency Incentives- Technical co-operation – Special roles – Agency Roles- Institutional Reforms

**Unit V POLICY CONSIDERATIONS AND EMERGING CHALLENGES 9**

Water Policy-Irrigation Governance-Building from Below-Non-political Associations-Bureaucratic Reorientation- Policy options and Alternatives and Sustainability.

**Total Periods 45**



**Text Books:**

1. Desai A.R., "Rural Sociology in India", 1969, Popular Prakashan, Bombay.
2. Michael C.M., "Putting people first, Sociology variables in Rural Development", 1985, Oxford University press, London.
3. Uphoff. N., "Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management", 1986, New West - View press, Boulder and London.
4. Chambers R., "Managing Canal Irrigation", 1998, Oxford IBM publishing Co. Pvt. Ltd., New Delhi.

**Reference Books:**

1. Sivasubramaniam K, "Water Management", 2009, SIMRES Publication, Chennai.
2. <http://mowr.gov.in/writereaddata/mainlinkFile/File421.pdf>
3. Korten F.F and Robert Y. Siy, Jr. "Transforming a Bureaucracy – The experience of the Philippines National Irrigation Administration", 1989, Ateneo De Manila University Press, Manila.

**Web URL(s):**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ce45/preview](https://onlinecourses.nptel.ac.in/noc22_ce45/preview)
2. <https://archive.nptel.ac.in/courses/105/105/105105110/>
3. <https://archive.nptel.ac.in/courses/105/101/105101215/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	2	-	-	3	2	-	-	-	1	2	3	-
CO2	2	3	3	-	-	3	2	2	2	1	1	2	3	-
CO3	3	2	2	3	-	2	-	-	-	-	2	3	2	3
CO4	2	2	3	-	-	3	2	2	2	2	2	2	3	2
CO5	2	2	3	-	-	3	3	2	2	3	3	2	3	2
Average	2.2	2.4	2.6	3	-	2.8	2.25	2	2	2	1.8	2.2	2.8	2.3
3 – High, 2 – Medium, 1 – Low, - No correlation														



<b>U23CEV30</b>	<b>GROUND WATER ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To prepare students for successful careers in hydrology and water resources engineering by developing their ability to analyze and apply data and technical concepts in groundwater engineering, including groundwater quality, aquifer behavior, well solutions, and sustainable resource management.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Choose the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers	<b>K3</b>
<b>C02</b>	Use the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics out conservation measures in a watershed	<b>K3</b>
<b>C03</b>	Explain the concept of groundwater model development and data base management for groundwater management	<b>K5</b>
<b>C04</b>	Develop the importance of artificial recharge and groundwater quality concepts	<b>K3</b>
<b>C05</b>	Apply the creative and innovative technique on conservation of groundwater	<b>K3</b>

**Course Contents**

**Unit I HYDROGEOLOGICAL PARAMETERS 9**

Introduction – water bearing Properties of Rock – Type of aquifers – Aquifer properties – Permeability, specific yield, transmissivity and storage coefficient – methods of Estimation – Ground water table fluctuation and its interpretations – ground water development and Potential in India – GEC norms

**Unit II WELL HYDRAULICS 9**

Objectives of Ground water hydraulics – Darcy’s Law – Ground water equation – steady state flow – Dupuit Forchheimer assumption – unsteady state flow – thesis method – Jacob method – Slug tests – Image well theory – Partial penetrations of wells.

**Unit III GROUNDWATER MANAGEMENT 9**

Need for management model- Database for groundwater management – ground water balance study – Introduction to mathematical model – Conjunctive use – Collector well and infiltration gallery.

**Unit IV GROUNDWATER QUALITY 9**

Groundwater chemistry – origin, movement and quality – water quality standards – health and aesthetic aspects of water quality – Saline intrusion – Environmental concern and regulatory requirements

**Unit V GROUNDWATER CONSERVATION 9**

Artificial recharge techniques – Remediation of Saline Intrusion – Groundwater management studies – protection zone delineation, Contamination source inventory, remediation schemes - Ground water Pollution and legislation.

**Total Periods 45**



**Text Books:**

1. Raghunath H.M., "Ground Water Hydrology", 2010, New Age International (P) Limited, New Delhi.
2. Todd D.K., "Ground Water Hydrology", 2000, John Wiley and Sons, New York.

**Reference Books:**

1. Fitts R Charles, "Groundwater Science", 2002, Elsevier, Academic Press.
2. Ramakrishnan, S, "Ground Water", K.J. Graph Arts, 1998, Chennai.
3. Chahar BR, "Groundwater hydrology", 2015, McGraw Hill Education (India) Pvt Ltd, New Delhi.
4. Rastogi A.K, "Numerical Groundwater Hydrology", 2011.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/101/105101214/>
2. <https://archive.nptel.ac.in/courses/105/105/105105042/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	2	2	-	-	-	-	2	3	2	2
CO2	3	3	2	2	3	3	-	-	-	-	2	3	3	2
CO3	2	3	2	3	3	2	-	2	2	2	3	2	3	3
CO4	2	2	3	-	2	3	3	-	-	-	2	2	3	2
CO5	2	3	3	-	3	3	2	-	-	2	3	2	3	2
Average	2.4	2.6	2.5	2.5	2.6	2.6	2.5	2	2	2	2.4	2.4	2.8	2.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV31</b>	<b>WATER RESOURCES SYSTEMS ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To understand the components and functions of water resources systems, apply hydrologic and hydraulic modeling techniques for system analysis, use optimization and simulation methods for efficient allocation and operation, and explore the principles of Integrated Water Resources Management (IWRM) for sustainable planning.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
On completion of the course, the students will be able to	
CO1 Explain the structure and function of water resource systems.	<b>K2</b>
CO2 Demonstrate methods for formulating and solving water resource allocation problems.	<b>K3</b>
CO3 Apply hydrologic and hydraulic techniques to analyze water resource system behaviour.	<b>K3</b>
CO4 Interpret interactions among system components in water resource planning models.	<b>K2</b>
CO5 Apply the principles of IWRM and sustainability to real-world water resource planning scenarios.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO WATER RESOURCES SYSTEMS 9**

Definition and scope of water resources systems engineering – Components of water resource systems: surface water, groundwater, reservoirs, and conveyance systems – System approach to water resource planning and management – Objectives and constraints in water resource systems – Economic, environmental, and social considerations.

**Unit II HYDROLOGIC AND HYDRAULIC MODELING 9**

Hydrologic cycle and its components – Rainfall–runoff modelling techniques – Flood frequency analysis and risk assessment – Groundwater flow modelling – Hydraulic modelling of water distribution and drainage systems.

**Unit III OPTIMIZATION TECHNIQUES IN WATER RESOURCES 9**

Introduction to optimization in water resource systems – Linear programming: formulation and applications – Dynamic programming: principles and applications – Basics of non-linear and integer programming – Case studies on optimization in water resources planning.

**Unit IV SIMULATION AND SYSTEM ANALYSIS 9**

Role of simulation in water resources planning – Simulation models for reservoir operation and river basin management – Integration of simulation and optimization models – Sensitivity analysis – Handling uncertainty in water resources modelling – Software tools for simulation.

**Unit V INTEGRATED WATER RESOURCES MANAGEMENT 9**

Principles and concept of Integrated Water Resources Management (IWRM) – Stakeholder involvement and policy frameworks – Water quality and environmental sustainability – Impact of climate change on water resources – Sustainable Development Goals (SDGs) related to water resource planning and management.

**Total Periods 45**



**Text Books:**

1. Vedula, S. and Mujumdar, P.P. Water Resources Systems, 2005, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1st Edition.
2. Loucks, D.P., van Beek, E., Water Resource Systems Planning and Management: An Introduction to Methods, Models and Applications, 2017, Springer.

**Reference Books:**

1. Mays, L.W., Water Resources Engineering, 2010, Wiley India Pvt. Ltd., 2<sup>nd</sup> Edition.
2. Jain, S.K., and Singh, V.P., Water Resources Systems Planning and Management, 2003, Elsevier.
3. Chatterjee, D. and Kanwar, P., Water Resources Engineering, 2018, Narosa Publishing House.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105108075>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
<b>CO1</b>	2	3	2	2	2	2	-	1	1	1	2	3	2	2
<b>CO2</b>	2	3	3	2	3	3	1	2	2	1	2	3	2	3
<b>CO3</b>	3	3	3	2	3	3	1	2	2	1	2	3	2	3
<b>CO4</b>	2	3	2	2	3	2	-	1	1	1	2	3	2	2
<b>CO5</b>	3	3	3	2	3	3	1	2	3	2	3	3	3	2
<b>Average</b>	2.4	3	2.6	2	2.8	2.6	0.6	1.6	1.8	1.2	2.2	3	2.2	2.4
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV32</b>	<b>WATERSHED CONSERVATION AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To comprehend the principles and importance of watershed management, analyze hydrological processes and soil erosion mechanisms, design suitable control measures and watershed structures, and integrate socio-economic and ecological aspects into effective watershed planning.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
On completion of the course, the students will be able to	
CO1 Describe the fundamentals and significance of watershed management.	<b>K2</b>
CO2 Interpret hydrological data to evaluate watershed behavior.	<b>K2</b>
CO3 Identify causes and effects of soil erosion and suggest appropriate conservation practices.	<b>K3</b>
CO4 Apply technical knowledge to select suitable watershed structures based on site conditions	<b>K3</b>
CO5 Illustrate the key components of integrated watershed management including socio-economic considerations.	<b>K3</b>

**Course Contents**

<b>Unit I INTRODUCTION TO WATERSHED MANAGEMENT</b>	<b>9</b>
Definition, scope and objectives of watershed management – Importance in sustainable development – Watershed characteristics – Delineation and classification of watersheds – Factors affecting watershed behaviour – Watershed problems in India – Watershed management programmes and policies.	
<b>Unit II HYDROLOGICAL ASPECTS OF WATERSHEDS</b>	<b>9</b>
Hydrologic cycle – Precipitation, infiltration, evaporation, and runoff – Estimation of runoff – Rainfall-runoff models – Streamflow measurement – Hydrograph analysis – Groundwater recharge – Application of hydrological data in watershed planning – Use of GIS and remote sensing in hydrology.	
<b>Unit III SOIL EROSION AND CONSERVATION MEASURES</b>	<b>9</b>
Types of soil erosion – Factors affecting erosion – Estimation of soil loss using Universal Soil Loss Equation (USLE) – Soil conservation methods: agronomic and mechanical – Contour bunding, bench terracing, check dams, grassed waterways – Gully control structures – Vegetative measures for erosion control.	
<b>Unit IV WATERSHED STRUCTURES AND MANAGEMENT PRACTICES</b>	<b>9</b>
Land capability classification – Rainwater harvesting techniques: percolation tanks, farm ponds, recharge pits – Design and construction of water harvesting structures – Water budgeting – Agroforestry and silvopasture systems – Livelihood options and productivity enhancement – Case studies of successful watershed projects.	
<b>Unit V INTEGRATED WATERSHED MANAGEMENT AND POLICY</b>	<b>9</b>
Concept of integrated watershed development – Participatory watershed management – Role of Panchayats and NGOs – Institutional framework and policies in India – Monitoring and evaluation of watershed projects – Watershed impact assessment – Climate change and watershed resilience – Future trends and challenges	

**Total Periods 45**



**Text Books:**

1. Murthy, J.V.S., Watershed Management, 2013, New Age International, 3<sup>rd</sup> Edition.
2. Das, G., Hydrology and Soil Conservation Engineering, 2011, PHI Learning, 2<sup>nd</sup> Edition.

**Reference Books:**

1. Suresh, R., Soil and Water Conservation Engineering, 2012, Standard Publishers, 6<sup>th</sup> Edition.
2. Tideman, E.M., Watershed Management, 2005, Omega Scientific Publishers.
3. Babu, R.S., Watershed Management, 2005, ICAR.

**Web URL(s):**

1. <https://nptel.ac.in/courses/105105210>
2. <https://www.iirs.gov.in>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	2	2	-	-	-	1	2	3	1
CO2	3	3	-	2	-	2	1	-	-	-	1	2	2	2
CO3	2	3	1	1	-	3	1	-	-	-	1	3	3	2
CO4	3	2	3	1	-	3	1	1	1	1	2	3	3	3
CO5	2	2	2	1	-	3	2	2	2	2	3	3	3	2
Average	2.6	2.4	1.2	1	-	2.6	1.4	0.6	0.6	0.6	1.6	2.6	2.8	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV33</b>	<b>INTEGRATED WATER RESOURCES MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To introduce the principles and frameworks of Integrated Water Resources Management (IWRM), explore socio-economic, environmental, and institutional influences, analyze challenges such as climate change and pollution, examine relevant policies and case studies, and apply IWRM concepts to real-world scenarios.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
On completion of the course, the students will be able to	
CO1 Explain the fundamental concepts, objectives, and evolution of IWRM.	<b>K2</b>
CO2 Interpret the socio-economic and institutional factors affecting water resource management.	<b>K2</b>
CO3 Use IWRM principles to assess and propose solutions for emerging water management issues.	<b>K3</b>
CO4 Analyse national and international policies and legal frameworks governing water resources.	<b>K3</b>
CO5 Evaluate case studies to understand the practical implementation of IWRM strategies.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO INTEGRATED WATER RESOURCES MANAGEMENT 9**

Definition, principles, and scope of IWRM – Evolution and importance – Objectives of IWRM – Stakeholder participation – Systems approach in water resource planning – Water governance and decentralization.

**Unit II SOCIO-ECONOMIC AND INSTITUTIONAL ASPECTS 9**

Role of institutions in water management – Inter-sectoral coordination – Social equity and gender issues – Water economics: pricing, subsidies, demand management – Public-Private Partnerships – Role of NGOs and community-based organizations.

**Unit III CHALLENGES IN WATER RESOURCE MANAGEMENT 9**

Climate change and its impact on water availability – Water pollution and urbanization – Integrated watershed and aquifer management – Flood and drought management – Ecosystem approach and sustainability – SDGs and water.

**Unit IV LEGAL AND POLICY FRAMEWORKS 9**

National Water Policy – State water policies – Water laws and legal institutions in India – International water treaties and transboundary river basins – Rights-based approaches and equity issues – Institutional reforms in the water sector.

**Unit V CASE STUDIES AND APPLICATIONS 9**

Successful IWRM case studies (India and abroad) – River basin management: Ganga, Cauvery, Mekong, Nile – Role of remote sensing and GIS in IWRM – Participatory rural appraisal techniques – Role of data and decision-support systems – Future trends and innovations.

**Total Periods 45**



**Text Books:**

1. Mollinga, P. et al., "Integrated Water Resources Management: Water in South Asia", Volume I, 2006, Sage Publications.
2. Sithamparanathan, Rangasamy, A., and Arunachalam, N., "Ecosystem Principles and Sustainable Agriculture", 1999, Scitech Publications (India) Pvt. Ltd., Chennai.

**Reference Books:**

1. Cech, Thomas V., Principles of Water Resources: History, Development, Management, and Policy, 2003, John Wiley and Sons Inc., New York.
2. Murthy, J.V.S., Watershed Management in India, 1995, Wiley Eastern Ltd., New York.
3. Dalte, S.J.C., Soil Conservation and Land Management, 1986, International Book Distribution, India.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/108/105108081/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	2	2	-	-	-	2	2	3	-
CO2	2	3	-	-	-	3	2	-	-	-	2	2	3	-
CO3	3	3	2	-	2	3	1	-	-	2	2	3	3	2
CO4	2	2	2	2	1	3	3	-	-	2	2	2	3	1
CO5	2	2	3	2	2	3	2	1	2	2	2	3	3	2
Average	2.4	2.4	1.4	0.8	1	2.8	2	0.2	0.4	1.2	2	2.4	3	1
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV05</b>	<b>URBAN WATER INFRASTRUCTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To understand the structure and function of urban ecosystems, analyze the urban hydrological cycle and human impacts, design and manage stormwater systems, apply strategies for water conservation and reuse, and evaluate challenges and best practices in urban water governance.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Explain various functional elements of urban ecosystem.	<b>K2</b>
<b>CO2</b>	Calculate urban runoff, compute supply and demand of water, draw hydrograph.	<b>K3</b>
<b>CO3</b>	Compare advantages of newer techniques of green infrastructure and illustrate benefits.	<b>K4</b>
<b>CO4</b>	Analyze the operational and maintenance challenges in urban water systems.	<b>K4</b>
<b>CO5</b>	Recommend context-specific best management practices for urban water systems in India.	<b>K4</b>

**Course Contents**

**Unit I URBAN ECOSYSTEM 9**

Cities as Ecological system – hybrid ecosystem – Resilience in urban ecosystem. Human components of Ecosystem – Urban pattern and Ecosystem function. Population and Community dynamics, functions of Urban Ecosystem.

**Unit II URBAN HYDROLOGY 9**

The urban hydrological cycle – Function – Human induced changes in urban watershed – Hydrological calculation – Runoff – Infiltration – hydrograph.

**Unit III URBAN STORM WATERMANAGEMENT 9**

Design of Drainage System – Roadway Drainage Analysis – Types of inlet – inlet design – Design of storm drain - Storm water management regulations - structural storm management systems – Newer trends in storm water management (Green infrastructure) – installation – operation and maintenance.

**Unit IV WATER CONSERVATION AND REUSE 9**

Trends in supply and demand – indoor conservation – outdoor conservation – water reuse – Rainwater harvesting – public education.

**Unit V WATER GOVERNANCE 9**

Challenges in water sector - Institutional setting, Supply Management, Demand Management, Waste water management – Private sector participation, urban service delivery, customer satisfaction, financial resource management – case studies of best practices in cities across the world.

**Total Periods 45**



**Text Books:**

1. Anand Chiplunkar, K Seetharam, and CheonKheong, "Good Practices in urban water management", 2012, ADB, National University, Singapore.
2. Mohammad Karamouz, Ali Moridi, and Sara Nazif, "Urban Water Engineering and Management", 2010, 1<sup>st</sup> Edition, CRC Press.

**Reference Books:**

1. Monzur A. Imteaz, "Urban Water Resources", 2019, 1<sup>st</sup> Edition, CRC Press.
2. Hormoz Pazwash, "Urban storm water management", 2016, 2<sup>nd</sup> Edition, CRC Press.
3. Larry W. Mays, "Urban Stormwater Management Tools", 2004, McGraw-Hill Companies.
4. Jonathan Parkinson, and Ole Mark, "Urban Stormwater Management in Developing Countries", 2005, IWA Publishing.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105214/>
2. <https://archive.nptel.ac.in/courses/105/106/105106051/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	-	-	-	3	1	3	-	-	-	-	-
CO2	3	3	3	-	-	-	3	1	3	-	-	3	-	-
CO3	3	3	2	-	-	-	3	-	3	-	-	3	-	2
CO4	2	2	2	3	-	2	3	-	3	2	2	3	2	-
CO5	2	1	1	3	-	2	3	2	3	2	2	3	2	2
Average	2.6	2.2	1.8	3	-	2	3	1.3	3	2	2	3	2	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV34</b>	<b>WATER QUALITY AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To understand the fundamentals of mathematical models and their importance in water quality modelling, and to impart the skills to use water quality modelling software for surface and groundwater quality modelling.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to	
<b>CO1</b> Explain the principles and importance of water quality modelling.	<b>K2</b>
<b>CO2</b> Summarize the pollutant transport phenomena in both surface and groundwater systems.	<b>K2</b>
<b>CO3</b> Demonstrate surface water quality modelling to predict the water quality of rivers, lakes and estuaries.	<b>K3</b>
<b>CO4</b> Estimate the transport of contaminants in groundwater systems.	<b>K3</b>
<b>CO5</b> Illustrate numerical modelling techniques for forecasting water quality in surface and subsurface waters.	<b>K3</b>

**Course Contents**

**Unit I MODELLING INSIGHTS 9**

Engineers and Mathematical models – Water quality models – historical development – different types of models – steps in model development – importance of model building – calibration and verification of models – finite element, finite difference and finite volume methods.

**Unit II POLLUTION TRANSPORT 9**

Transport phenomena – advection, diffusion, dispersion- contamination transport in surface and subsurface water – Simple transport models – steady state and time variable solutions – conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport.

**Unit III SURFACE WATER QUALITY MODELLING 9**

Water quality modelling of streams, lakes and estuaries – water quality – model sensitivity – assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD –Streeter Phelp’s model for point and distributed sources – Modified Streeter Phelp’s equations.

**Unit IV GROUNDWATER QUALITY MODELLING 9**

Groundwater flow and mass transport of solutes – groundwater quality modelling using numerical methods – Parameters, Input-output stresses, Initial and Boundary conditions – degradation of organic compounds in subsurface – Model calibration: steady state and unsteady state – sensitivity analysis – Model validation – seawater intrusion – basic concepts and modelling.

**Unit V WATER QUALITY MANAGEMENT MODELS 9**

Exposure to surface water and groundwater quality modelling software’s – MIKE 21, WASP, QUAL2E and MODFLOW – demonstration – case studies – Modeling multilayer groundwater flow system – Artificial recharge feasibility through modeling – Groundwater contamination, restoration and management.

**Total Periods 45**



**Text Books:**

1. Steven C. Chapra, "Surface Water-Quality Modelling", 2008, 2<sup>nd</sup> Edition, Waveland Press Publisher.
2. Zhen-Gang Ji, "Hydrodynamics and Water Quality: Modelling Rivers, Lakes, and Estuaries", 2018, 2<sup>nd</sup> Edition, John Wiley & Sons.

**Reference Books:**

1. Marcello Benedini, and George Tsakiris, "Water Quality Modelling for Rivers and Streams", 2013, Springer Publisher.
2. Jacob Bear, and Alexander H. D. Cheng, "Modeling Groundwater Flow and Contaminant Transport", 2010, 1<sup>st</sup> Edition, Springer Publisher.
3. Ne-Zheng Sun, and Alexander Sun, "Mathematical Modelling of Groundwater Pollution", 2012, Springer Publisher.

**Web URL(s):**

1. <https://pure.iiasa.ac.at/id/eprint/2144/1/XB-83-112.pdf>
2. <https://www.science.gov/topicpages/w/wasp%2Bwater-quality%2Bmodel>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	Pos											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	-	-	3	-	-	-	-	-	-	2	-	-	2
CO3	-	-	3	2	-	2	2	-	-	2	-	-	-	3
CO4	-	2	3	3	-	3	2	-	2	2	-	-	3	-
CO5	-	3	2	-	-	3	-	2	-	2	3	3	2	-
Average	3	3	3	3	-	3	2	2	2	2	3	3	3	3
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV36</b>	<b>AIRPORTS AND HARBOURS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To expose students to the design principles of airports, understand the components and functions of harbours and docks, and learn about breakwater construction methods and navigational lights.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
On completion of the course, the students will be able to	
<b>C01</b> Outline on the planning and site selection of airport planning and design.	<b>K2</b>
<b>C02</b> Use the knowledge on design of various Airport components	<b>K3</b>
<b>C03</b> Analyze and design the elements for orientation of runways and passenger facility systems.	<b>K3</b>
<b>C04</b> Identify the various features in Harbours and Ports, their construction, coastal protection works	<b>K3</b>
<b>C05</b> Implement knowledge on various Environmental Regulations and Acts	<b>K3</b>

**Course Contents**

<b>Unit I AIRPORT PLANNING</b>	<b>9</b>
Air transport characteristics - airport classification – ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area.	
<b>Unit II AIRPORT COMPONENTS</b>	<b>9</b>
Airport Classification, Planning of Airfield Components – Runway, Taxiway, Apron, Hangar-Passenger Terminals- Geometric design of runway and taxiways-Runway pavement Design-Difference between Highway and airport pavements- Introduction to various design methods-Airport drainage.	
<b>Unit III AIRPORT DESIGN</b>	<b>9</b>
Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Runway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings- Air Traffic Control Tower- Instrumental Landing.	
<b>Unit IV SEAPORTS COMPONENTS AND CONSTRUCTION</b>	<b>9</b>
Definition of Basic Terms: Harbor, Port, Satellite Port, Docks- Dry and Floating Dock, Waves and Tides – Planning and Design of Harbors: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins Floating Landing Stage – Navigational Aids-Inland Water Transport.	
<b>Unit V SEAPORT REGULATIONS AND EIA</b>	<b>9</b>
Wave action on Coastal Structures and Shore Protection and Reclamation – Coastal Regulation Zone, 2011-EIA – methods of impact analysis and its process.	
<b>Total Periods</b>	<b>45</b>



**Text Books:**

1. Khanna.S.K and Arora.M.G, "Airport planning and design", 2006, Chand and bros, Uttarakhand.
2. Vazirani.V.N and Chandola.S.P, "Transportation and Engineering", 2005, Vol.2, Khanna publishers, New Delhi.
3. Subramanian K.P, "Highways, Railways, Airport and Harbour Engineering", 2010, Scitech Publications, Chennai.

**Reference Books:**

1. Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", 1996, McGraw Hill, New York.
2. Richard De Neuffille and Amedeo Odoni, "Airport Systems Planning and Design", 2003, McGraw Hill, New York.
3. Venkatramaiah. C, "Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels", 2015, Universities Press (India) Private Limited, Hyderabad.
4. Mundrey J S, "Railway Track Engineering", 2013, McGraw Hill Education (India) Private Ltd, New Delhi.

**Web URL(s):**

1. <https://nptel.ac.in/courses/114106025>
2. <https://archive.nptel.ac.in/courses/105/107/105107123/>
3. <https://nptel.ac.in/courses/105105107>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	1	2	1	-	2	2	2	2	2	2	3	2	3
CO2	2	2	3	2	-	2	2	2	2	2	2	3	2	3
CO3	2	2	3	2	-	2	2	2	2	2	2	3	2	3
CO4	1	1	2	3	-	2	2	2	2	2	2	3	2	3
CO5	1	1	2	1	-	2	3	2	2	2	2	3	2	3
Average	1.6	1.4	2.4	1.8	-	2	2.2	2	2	2	2	3	2	3
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV37</b>	<b>TRAFFIC ENGINEERING AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To give an overview of traffic engineering, various surveys to be conducted, traffic regulation, management and traffic safety.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Use the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards	<b>K3</b>
<b>CO2</b>	Infer the principles of traffic flow characteristics and their relationships	<b>K2</b>
<b>CO3</b>	Choose the various traffic management measures in addressing the demand pricing and ITS applications.	<b>K3</b>
<b>CO4</b>	Develop the various types of control and regulatory measures to meet an efficient traffic network.	<b>K3</b>
<b>CO5</b>	List the various type of facilities and plan for Non-Motorised Transport	<b>K4</b>

**Course Contents**

**Unit I      TRAFFIC SURVEYS AND ANALYSES      9**

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed-spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

**Unit II      TRAFFIC FLOW AND ROADWAY CAPACITY      9**

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed Flow-Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value-Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

**Unit III      COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES      9**

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self- Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

**Unit IV      DESIGN OF ROAD INTERSECTIONS      9**

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.



**Unit V DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS**

9

**Parking:** Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; **Pedestrians:** Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; **Cycle Tracks:** Principles of design, Design criteria, Design standards for Rural Expressways.

**Total Periods 45**

**Text Books:**

1. Kadiyali. L.R., “Traffic Engineering and Transport Planning”, 2019, Khanna Publishers, Delhi.
2. Khanna.K and Justo C.E.G. and Veeraragavan, “A Highway Engineering”, 2014, 10<sup>th</sup> Edition, Nem Chand Bros., Roorkee.
3. Srinivasa Kumar, “Introduction to Traffic Engineering”, 2018, Universities Press, Hyderabad.
4. Partha Chakroborty and Animesh Das, “Principles of Transportation Engineering”, 2011, PHI Learning Pvt. Ltd., Delhi.

**Reference Books:**

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. Institute of Transportation Engineers, “Transportation and Traffic Engineering Hand Book”, 2009, 6<sup>th</sup> Edition.
3. Papacosta.P.S and Prevedouros.P.D, “Transportation Engineering and Planning”, 2015, 3<sup>rd</sup> Edition, Prentice Hall, New Jersey.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/101/105101008/>
2. <https://archive.nptel.ac.in/courses/105/105/105105215/>

**Bloom’s Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	-	2	-	2	-	-	1	-	2	3	3	2
CO2	2	3	-	-	-	2	-	-	-	-	2	2	2	-
CO3	2	2	3	-	-	3	1	-	-	-	2	3	3	2
CO4	2	2	3	-	-	3	1	2	2	2	2	3	3	2
CO5	2	2	3	-	-	3	2	2	2	2	2	3	3	2
Average	2.2	2.4	3	2	-	2.6	1.3	2	1.7	2	2	2.8	2.8	2
3 – High, 2 – Medium, 1 – Low, - No correlation														



<b>U23CEV38</b>	<b>URBAN PLANNING AND DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

<b>Course Outcomes:</b>		<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to		
<b>CO1</b>	Understand the basic issues and meaning of terminologies in urban planning	<b>K2</b>
<b>CO2</b>	Understand the different types of theories of urban planning and city development	<b>K2</b>
<b>CO3</b>	Understand the different types of plan, their strategies and their preparation process.	<b>K2</b>
<b>CO4</b>	Comprehend the planning standards, evaluate the constraints and the financial mechanism	<b>K4</b>
<b>CO5</b>	Knowledge on various town and country planning acts and their functions.	<b>K2</b>

**Course Contents**

<b>Unit I</b>	<b>INTRODUCTION</b>	<b>7</b>
Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas –Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)		
<b>Unit II</b>	<b>PLANNING PROCESS AND THEORIES</b>	<b>10</b>
Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radburn Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept		
<b>Unit III</b>	<b>DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION</b>	<b>10</b>
Types of plans – Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town- Development Plan, urban nodes, Smart City Plan -Scope and Content of Regional Plan (RP), Master Plan (MP), and the Detailed Development Plan (DDP), Methodologies for the preparation of the RP, MP, and the DDP – Case Studies.		
<b>Unit IV</b>	<b>PLAN IMPLEMENTATION</b>	<b>10</b>
Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation		
<b>Unit V</b>	<b>URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS</b>	<b>8</b>
Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.		

**Total Periods** **45**



**Text Books:**

1. Goel, S.L, "Urban Development and Management", 2002, Deep and Deep publications, New Delhi.
2. George Chadwick, "A Systems view of planning", 1978, Pergamon press, Oxford
3. Singh V.B, "Revitalised Urban Administration in India", 2001, Kalpaz publication, Delhi.

**Reference Books:**

1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai
2. Thooyavan, K.R., "Human Settlements – A Planning Guide to Beginners", 2005, M.A Publications, Chennai.
3. Urban & Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, Vol I & II, Jan 2015, Govt of India, Ministry of Urban Development

**Web URL(s):**

1. <http://.moud.gov.in>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	-	-	3	2	2	3	-	2	3	2	2
CO2	3	2	1	1	-	3	2	2	3	1	2	3	3	2
CO3	3	3	3	2	-	3	2	2	2	2	2	3	3	2
CO4	2	3	3	3	-	3	2	2	3	3	3	3	3	3
CO5	3	3	2	1	-	3	3	2	2	2	2	3	3	2
Average	2.8	2.6	2.0	1.8	-	3.0	2.2	2.0	2.6	2.0	2.2	3.0	2.8	2.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**U23CEV39**

**SMART CITIES**

L	T	P	C
3	0	0	3

**Pre-Requisites** : None

**Objectives:**

- To create awareness about codes of practice for smart and sustainable cities, understand the concept and challenges of smart cities, and conduct feasibility studies for infrastructure planning.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Understand the basics of Urbanisation and the role of smart cities.	<b>K2</b>
<b>CO2</b>	Gain knowledge on implementation of smart physical infrastructure.	<b>K3</b>
<b>CO3</b>	Understand the role of smart planning for sustainable development.	<b>K2</b>
<b>CO4</b>	Comprehend the knowledge of Technologies in Smart City planning	<b>K3</b>
<b>CO5</b>	Reviewing the case studies of smart city projects.	<b>K4</b>

**Course Contents**

<b>Unit I</b>	<b>INTRODUCTION</b>	<b>6</b>
Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges - Smart infrastructures for city- Smart Cities Mission		
<b>Unit II</b>	<b>SMART PHYSICAL INFRASTRUCTURE</b>	<b>12</b>
Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc.,		
<b>Unit III</b>	<b>SUSTAINABILITY AND SMART PLANNING</b>	<b>10</b>
Relationship Between Sustainability and Smart planning - Place making project guidelines Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services.		
<b>Unit IV</b>	<b>APPLICATION OF TECHNOLOGIES IN SMART CITIES</b>	<b>8</b>
Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities.		
<b>Unit V</b>	<b>SMART CITIES PROJECT MANAGEMENT</b>	<b>9</b>
Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling; Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies		
<b>Total Periods</b>		<b>45</b>



**Text Books:**

1. P Sharma, "Sustainable Smart cities in India, Challenges and Future Perspectives", Springer Link, 2017

**Reference Books:**

1. Sameer Sharma, "Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018.
2. Binti Singh, Manoj Parmar, "Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India, 2019
3. Jo Beall (1997); "A city for all: valuing differences and working with diversity"; Zed books limited, London (ISBN: 1- 85649-477-2).
4. Mission statement & guidelines on Smart City Scheme". Government of India - Ministry of Urban Development

**Web URL(s):**

1. <https://smartcities.gov.in/guidelines#block-habikon-content>
2. <https://smartnet.niua.org/learn/library>
3. [http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines \(1\).pdf](http://smartcities.gov.in/upload/uploadfiles/files/Smart%20City%20Guidelines%20(1).pdf)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	1	2	1	3	2	3	1	1	2	1	3	3	2
CO2	3	3	3	2	1	3	3	2	3	1	1	3	3	3
CO3	3	1	3	2	1	1	3	3	2	2	2	3	2	3
CO4	3	2	2	2	3	2	3	2	3	1	2	3	2	2
CO5	2	2	3	3	2	2	2	2	3	3	2	2	3	3
Average	2.8	1.8	2.6	2	2	2	2.8	2	2.4	1.8	1.6	2.8	2.6	2.6
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23CEV40</b>	<b>INTELLIGENT TRANSPORT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To learn the fundamentals of Intelligent Transportation Systems (ITS), explore its functional areas, and gain an overview of ITS implementation in developing countries.

**Course Outcomes:**

Upon completion of the course, students would be able to

Course Outcome	Description	BT Level (highest level)
<b>CO1</b>	Understand the fundamentals of ITS and its benefits.	<b>K2</b>
<b>CO2</b>	Gain knowledge on data collection using sensors and its applications.	<b>K2</b>
<b>CO3</b>	Acquainted with the knowledge of ITS in Traffic	<b>K2</b>
<b>CO4</b>	Application of ITS in-Transportation Planning	<b>K3</b>
<b>CO5</b>	Able to gain knowledge on application of ITS in Logistics	<b>K2</b>

**Course Contents**

<b>Unit I</b>	<b>INTRODUCTION TO ITS</b>	<b>7</b>
Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS Deployment - Benefits of ITS- Overview of application of ITS in Transportation Planning		
<b>Unit II</b>	<b>DATA COLLECTION THROUGH ITS</b>	<b>9</b>
Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT)		
<b>Unit III</b>	<b>ITS IN TRAFFIC MANAGEMENT</b>	<b>10</b>
ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections		
<b>Unit IV</b>	<b>ITS IN TRANSPORTATION PLANNING</b>	<b>10</b>
ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing; Transportation network operations – public transportation applications- Weight –in Motion		
<b>Unit V</b>	<b>ITS APPLICATION IN LOGISTICS</b>	<b>9</b>
Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce		
<b>Total Periods</b>		<b>45</b>



**Text Books:**

1. R. Srinivasa Kumar, "Intelligent Transportation Systems", 2022, Universities Press P Ltd, Telangana
2. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application", Springer Verlog, New York

**Reference Books:**

1. Intelligent Transport Systems, "Intelligent Transportation Primer", 2001, Washington, US.
2. Korth, Henry F. and Silberschatz, Abraham, "Data Base System Concepts", 1992, McGraw Hill.
3. Turban, E., "Decision Support and Expert Systems Management Support Systems", 1998, Maxwell Macmillan.
4. Chen, Kan Paul and Miles, John, "ITS Handbook 2000: Recommendations for World Road Association (PIARC)".
5. Indian Roads Congress (IRC), "Specifications: Guidelines and Special Publications on Traffic Planning and Management".

**Web URL(s):**

1. <https://nptel.ac.in/courses/105105204>
2. [https://www.civil.iitb.ac.in/tvm/nptel/591\\_ITS\\_1/web/web.html](https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html)

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	2	2	-	-	-	-	1	2	2	1
CO2	3	2	-	-	3	2	-	-	-	-	1	2	2	3
CO3	3	3	2	-	3	3	-	-	-	-	1	3	2	2
CO4	3	3	3	2	2	3	-	1	2	2	2	3	3	2
CO5	2	2	2	-	2	2	-	-	-	1	1	2	2	3
Average	2.8	2.4	2.3	2.0	2.4	2.4	-	1.0	2.0	1.5	1.2	2.4	2.2	2.2
3 – High, 2 – Medium, 1 – Low, - No correlation														



**U23CEV41**

**PAVEMENT ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To equip students with knowledge of IRC guidelines for designing rigid and flexible pavements and enable them to assess road quality and serviceability conditions.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Get knowledge about types of rigid and flexible pavements.	<b>K2</b>
<b>CO2</b>	Design of rigid pavements.	<b>K3</b>
<b>CO3</b>	Design of flexible pavements.	<b>K3</b>
<b>CO4</b>	Determine the causes of distress in rigid and flexible pavements.	<b>K4</b>
<b>CO5</b>	Understand stabilization of pavements, testing and field control.	<b>K2</b>

**Course Contents**

**Unit I PAVEMENT MATERIALS AND SUBGRADE ANALYSIS 8**

Introduction – Pavement as layered structure – Pavement types -rigid and flexible-Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

**Unit II DESIGN OF FLEXIBLE PAVEMENTS 10**

Flexible pavement design – Advantages and disadvantages -Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

**Unit III DESIGN OF RIGID PAVEMENTS 9**

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India

**Unit IV PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE 10**

Construction Techniques practice of flexible and concrete pavement Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

**Unit V STABILIZATION OF PAVEMENTS 8**

Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads.

**Total Periods 45**



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**Text Books:**

1. Khanna, S.K. and Justo C.E.G. and Veeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition, 2014.
2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 2015

**Reference Books:**

1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", 2000, John Wiley.
2. Guidelines for the Design of Flexible Pavements, IRC-37-2012, The Indian roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-2018, The Indian Road Congress, New Delhi.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/107/105107219/>
2. <https://nptel.ac.in/courses/105104098>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	2	-	-	-	-	1	3	2	-
CO2	3	3	3	-	-	2	-	-	-	-	1	3	2	1
CO3	3	3	3	-	-	2	-	-	-	-	1	3	2	1
CO4	3	3	-	2	-	2	-	-	-	-	2	2	3	2
CO5	2	2	-	-	-	3	-	-	-	-	1	2	2	2
Average	2.8	2.6	3.0	2.0	-	2.2	-	-	-	-	1.2	2.6	2.2	1.5



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<b>U23CEV42</b>	<b>TRANSPORTATION PLANNING PROCESS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To impart knowledge in the rudiments and stages in Transportation Planning Process

**Course Outcomes:**

Upon completion of the course, students would be able to

		<b>BT Level (highest level)</b>
<b>CO1</b>	Understand the principles of the transportation planning process and methods of data collection.	<b>K2</b>
<b>CO2</b>	Acquainted with the trip production, trip attraction models and calibration.	<b>K3</b>
<b>CO3</b>	Acquainted with the trip production, trip attraction models and calibration.	<b>K3</b>
<b>CO4</b>	Able to understand trip distribution models and its application.	<b>K3</b>
<b>CO5</b>	Gain knowledge on the mode choice behaviour and mode split models	<b>K2</b>

**Course Contents**

**Unit I TRANSPORTATION PLANNING PROCESS 8**

Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones - internal and external; Various Transportation Surveys for the collection of data - methodology, analyses of data and presentation of results.

**Unit II TRIP GENERATION STAGE 9**

Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.

**Unit III TRIP DISTRIBUTION STAGE 10**

Definition and objective; Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.

**Unit IV MODAL SPLIT STAGE 9**

Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model.

**Unit V TRAFFIC ASSIGNMENT STAGE 9**

Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees

**Total Periods 45**



**Text Books:**

1. Kadiyali. L.R., "Traffic Engineering and Transport Planning", 2019, Khanna Publishers, Delhi.
2. C.S. Papacostas and P.D. Prevedouros, "Transportation Engineering and Planning", 2009, Prentice Hall of India Pvt. Ltd.
3. Michael J.Bruton, "Introduction to Transportation Planning", 1995, Hutchinson, London.

**Reference Books:**

1. J D Ortuzar and L G Willumnsen. "Modeling Transport", 2011, John Wiley and Sons, New York.
2. C. JotinKhisty, Kent Lall, "Transportation Engineering: An Introduction", 1998, Prentice Hall.
3. Juan de Dios Ort zar and Luis G. Willumsen, "Modelling Transport", 2001, John Wiley & Sons.
4. James H.Banks, "Introduction to Transportation Engineering", 2010, Tata McGraw Hill Education Pvt Ltd.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/105/105105208/>
2. <https://archive.nptel.ac.in/courses/124/105/124105016/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	2	-	-	-	-	2	3	2	1
CO2	3	3	-	-	-	2	-	-	-	-	2	3	2	2
CO3	3	3	-	-	-	2	-	-	-	-	2	3	2	2
CO4	3	3	-	-	-	2	-	-	-	-	2	3	2	2
CO5	3	2	-	-	-	2	-	-	-	-	2	3	2	1
Average	3	2.6	-	-	-	2	-	-	-	-	2	3	2	1.6
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**R2023 - Mandatory Courses Lists**

<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>
U23MTA02	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	IKS
U23MTA03	WELLNESS THROUGH YOGA AND AYURVEDA	IKS
U23MTA04	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	UHV
U23MTA05	GENDER, CULTURE AND DEVELOPMENT	Gender Sensitization
U23MTA06	ENVIRONMENTAL SCIENCE	EVS
U23MTA07	SUSTAINABLE DEVELOPMENT	SDG
U23MTA08	DISASTER RISK REDUCTION AND MANAGEMENT	SDG
U23MTA09	VISION FOR HUMANE SOCIETY	IKS



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<b>U23MTA02</b>	<b>ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites :** None

**Objectives:**

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

**Course Outcomes:**  
Upon completion of the course, students would be able to

	<b>BT Level (highest level)</b>
<b>CO1</b> Explain the scope and characteristics of traditional knowledge and differentiate it from indigenous and Western knowledge.	<b>K2</b>
<b>CO2</b> Assess the importance of protecting traditional knowledge and analyze the role of governments in this process.	<b>K3</b>
<b>CO3</b> Summarize key laws related to traditional knowledge and evaluate their impact on its protection.	<b>K3</b>
<b>CO4</b> Describe protection systems for traditional knowledge and evaluate patents and non-IPR mechanisms.	<b>K3</b>
<b>CO5</b> Examine the role of traditional knowledge in various sectors and discuss its significance for sustainability and food security.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO TRADITIONAL KNOWLEDGE 8**

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

**Unit II PROTECTION OF TRADITIONAL KNOWLEDGE 4**

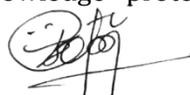
The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

**Unit III LEGAL FRAMEWORK AND TRADITIONAL KNOWLEDGE 7**

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

**Unit IV TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY 5**

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge.



**Unit V TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS****6**

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Food security of the country and protection of TK.

**Total Periods 30****Text Books:**

1. Jha, Amit, "Traditional Knowledge System in India", 2009.
2. Mohanta, Basanta Kumar and Singh, Vipin Kumar, "Traditional Knowledge System and Technology in India", 2012, Pratibha Prakashan.

**Reference Books:**

1. Jha, Amit, "Traditional Knowledge System in India", 2002, Atlantic Publishers.
2. Kapoor, Kapil and Danino, Michel, "Knowledge Traditions and Practices of India".
3. Tempelman, Erik, Shercliff, Hugh, and Ninaber van Eyben, Bruno, "Manufacturing and Design: Understanding the Principles of How Things Are Made", 2014, Elsevier.

**Web URL(s):**

1. <http://nptel.ac.in/courses/121106003/>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO2	-	2	-	-	-	3	3	-	-	-	2	2	-	-
CO3	-	2	-	-	-	3	-	2	-	-	-	-	-	-
CO4	-	2	-	-	-	3	-	2	-	-	-	-	-	-
CO5	-	2	-	-	-	-	3	2	-	-	3	-	-	-
Average	3	2	-	-	-	3	3	2	-	-	2.7	2.5	-	-
3 – High; 2 – Medium; 1 – Low; - No Correlation														



<b>U23MTA03</b>	<b>WELLNESS THROUGH YOGA AND AYURVEDA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites** : None

**Objectives:**

- To enjoy life happily with fun filled new style activities that help to maintain health
- To adapt a few lifestyle changes that will prevent many health disorders
- To be cool and handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>CO1</b>	Define health and describe its various dimensions, emphasizing the importance of maintaining overall health.	<b>K2</b>
<b>CO2</b>	Explain the role of diet in health maintenance, including the components of a balanced diet and their benefits.	<b>K2</b>
<b>CO3</b>	Summarize the preventive aspects of AYUSH systems and evaluate their role in maintaining health through different prevention levels.	<b>K3</b>
<b>CO4</b>	Describe the importance of emotional health, analyze stress management techniques, and explain the impact of sleep and immunity on mental wellness.	<b>K3</b>
<b>CO5</b>	Analyze the benefits of different types of yoga and evaluate how to choose appropriate yogasanas based on individual needs and health conditions.	<b>K3</b>

**Course Contents**

**Unit I HEALTH AND ITS IMPORTANCE** **6**

**Health:** Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health,

**Unit II DIET** **6**

**Role of diet in maintaining health** - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight,

**Balanced Diet and its 7 Components** - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.



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**Unit III      ROLE OF AYURVEDA IN MAINTAINING HEALTH**

**6**

**AYUSH systems and their role in maintaining health** - preventive aspect of AYUSH - AYUSH as a soft therapy.

**Prevention of illness with our traditional system of medicine**-Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

**Unit IV      MENTAL WELLNESS**

**8**

**Emotional health** - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances.

**Stress management** - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.

**Sleep** - Sleep and its importance for mental wellness - Sleep and digestion. Immunity - Types and importance - Ways to develop immunity.

**Unit V      YOGA**

**4**

**Definition and importance of yoga** - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders.

**Total Periods      30**

**Text Books:**

1. Martin, Ashley, "Nutrition and Dietetics", White Word Publications, New York, NY 10001, USA.
2. Elliott, Jennifer, "An Introduction to Sustainable Development", 4<sup>th</sup> Ed., 2012, Routledge, London.

**Reference Books:**

- 1 Zeidner, Moshe, Matthews, Gerald, and Roberts, Richard D., "What We Know About Emotional Intelligence: How It Affects Learning, Work, Relationships, and Our Mental Health".
- 2 Neff, Kristin., and Germer, Christopher, "The Mindful Self-Compassion Workbook", The Guilford Press, A Division of Guilford Publications, New York.

**Web URL(s):**

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/>
2. <https://www.legit.ng/1163909-classes-food-examples-functions.html>
3. <https://www.cdc.gov/nutrition/php/resources/healthy-eating-benefits-for-adults.html>
4. <https://yogamedicine.com/guide-types-yoga-styles/>
5. <https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/food-additives>
6. <https://nutritionsource.hsph.harvard.edu/healthy-weight/>
7. <https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda>



**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	3	3	-	-	-	-	3	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	1
CO3	3	2	3	-	-	3	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	3	-	-	-	-	-	2	-	-
CO5	3	2	-	-	-	3	-	-	-	-	3	-	-	-
Average	3	2	3	-	-	3	3	-	-	-	3	2.75	-	1
3 – High; 2 – Medium; 1 – Low; - No Correlation														



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<b>U23MTA04</b>	<b>UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites** : None

**Objectives:**

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
- To help students initiate a process of dialog within themselves to know what they really want to be in their life and profession
- To help students understand the meaning of happiness and prosperity for a human being.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to	
<b>CO1</b> Define value education and describe its importance and basic guidelines, including self-exploration as a method for value development.	<b>K2</b>
<b>CO2</b> Explain the concept of harmony between the Self and the Body, and analyze the needs of both to achieve personal balance.	<b>K3</b>
<b>CO3</b> Analyze the role of family in human values and relationships, and evaluate the principles for achieving harmony in family, society, and nature.	<b>K3</b>
<b>CO4</b> Explain the basics of ethical human conduct, analyze defects in ethical behavior, and evaluate holistic and universal approaches to ethical conduct.	<b>K3</b>
<b>CO5</b> Apply ethical frameworks and principles to create sustainable and ethically sound engineering practices and solutions.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO VALUE EDUCATION** **6**

Value Education- Definition, Concept and Need, The Content and Process of Value Education, Basic Guidelines for Value Education. Self exploration as a means of Value Education.

**Unit II HARMONY IN THE HUMAN BEING** **6**

Human Being is more than just the Body. Harmony of the Self ('I') with the Body. Understanding Myself as Co-existence of the Self and the Body. Understanding Needs of the Self and the needs of the Body.



**Unit III HARMONY IN THE FAMILY AND SOCIETY AND HARMONY IN THE NATURE 7**

Family as a basic unit of Human Interaction and Values in Relationships. The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour.

**Unit IV SOCIAL ETHICS 5**

The Basics for Ethical Human Conduct. Defects in Ethical Human Conduct. Holistic Alternative and Universal Order. Universal Human Order and Ethical Conduct.

**Unit V PROFESSIONAL ETHICS 6**

Value based Life and Profession. Professional Ethics and Right Understanding. Competence in Professional Ethics. Issues in Professional Ethics – The Current Scenario.

**Total Periods 30**

**Text Books:**

1. Tripathi, A.N., "Human Values", 2004, New Age Intl. Publishers, New Delhi.
2. Bajpai, B. L., "Indian Ethos and Modern Management", 2004, New Royal Book Co., Lucknow. Reprinted 2008
3. Gaur, R.R., Sangal, R., and Bagaria, G.P., "A Foundation Course in Value Education", 2009, Excel Books, New Delhi.

**Reference Books:**

- 1 Gaur, R.R., Sangal, R., and Bagaria, G.P., "Teachers Manual", 2009, Excel Books.
- 2 Sharma, I.C., "Ethical Philosophy of India", Nagin & Co., Julundhar.
- 3 Govindrajran, M., Natrajan, S., and Senthil Kumar, V.S., "Engineering Ethics (including Human Values)", Eastern Economy Edition, Prentice Hall of India Ltd.

**Web URL(s):**

1. <https://www.uhv.org.in/uhv-ii>
2. [https://fdp-si.aicte-india.org/8dayUHV\\_download.php](https://fdp-si.aicte-india.org/8dayUHV_download.php)

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	3	3	3	-	-	3	3	1	1
CO2	-	2	-	-	-	3	3	3	-	-	3	3	1	-
CO3	-	-	2	-	-	3	3	3	-	-	3	2	-	-
CO4	-	2	3	-	-	3	3	3	-	-	3	1	-	-
CO5	2	3	3	3	3	3	3	3	-	3	3	1	-	-
Average	2	2.3	2.7	3	3	3	3	3	-	3	3	2	1	1

3 – High; 2 – Medium; 1 – Low; - No Correlation

<b>U23MTA05</b>	<b>GENDER, CULTURE AND DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites** : None

**Objectives:**

- To build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination
- To analyze current events aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>CO1</b>	Apply core concepts, historical evolution, and key theories of gender studies to analyze societal structures and practices.	<b>K3</b>
<b>CO2</b>	Apply principles of gender equality and employment laws to address gender dynamics, issues, and violence in the workplace.	<b>K3</b>
<b>CO3</b>	Understand basic concepts and approaches to studying culture from gender perspectives, including the role of media and performance.	<b>K2</b>
<b>CO4</b>	Understand the relationship of gender with development, including key indices and measures such as the Gender Development Index and Gender Empowerment Measure.	<b>K2</b>
<b>CO5</b>	Apply government policies, initiatives, and emerging strategies to enhance gender equality and reduce disparities in economic opportunities in India.	<b>K3</b>

**Course Contents**

**Unit I FOUNDATIONS OF GENDER STUDIES 8**

Gender : Core Concepts of Gender/Evolution in Gender Studies, Patriarchy: Power, Structure and Practices, Masculinity/Femininity: An Overview, Understanding Sexuality: Conceptual Underpinnings, Inclusion, Exclusion, Discrimination: Caste, Class, Ethnicity, Waves of Feminism and Gender Theories.

**Unit II GENDER DYNAMICS IN THE WORKPLACE 5**

Gendering Work, Gender and Employment, Gender Issues in Work and Labour Market, Gender- Based Violence, Gender Equality and Women’s Protection: Law and Legislation in India

**Unit III GENDER AND CULTURAL PERSPECTIVES 5**

Culture: Gender Perspectives, Basic concepts and approaches to the study of culture: Gender perspectives, Interrogating Culture: Gender, caste and class.



**Unit IV GENDER AND DEVELOPMENT 6**

Introduction, Relationship of Gender with Development, Role of Gender in Development, Gender Empowerment and Development, Gender Development Index, Gender Empowerment Measure.

**Unit V GENDER AND DEVELOPMENT IN INDIA 6**

Government Policies and Initiatives for promoting gender equality, Role of women in the Indian economy, Gender disparities in economic opportunities, Women in Indian politics.

**Total Periods 30**

**Text Books:**

1. Seth, M., "Women and Development: The Indian Experience", 2001, Sage Publications, New Delhi.
2. Uberoi, P., "Freedom and Destiny: Gender, Family, and Popular Culture in India", 2006, Oxford University Press, New Delhi.
3. Nathan, Hippu Salk Kristle, "Gender-Based Indicators in Human Development: Correcting for 'Missing Women'", 2008, Indira Gandhi Institute of Development Research, Mumbai.

**Reference Books:**

- 1 Seth, Mira, "Women and Development: The Indian Experience", 2001, Sage Publications, New Delhi.
- 2 Mathu, A., "Gender and Development in India: The Indian Scenario", 2008, Gyan Publishing House.
- 3 Spary, C., "Gender, Development, and the State in India", 2019, Routledge.

**Web URL(s):**

1. <https://nptel.ac.in/courses/109103122>
2. <https://archive.nptel.ac.in/courses/109/107/109107139/>
3. [https://onlinecourses.swayam2.ac.in/arp19\\_ap54/preview](https://onlinecourses.swayam2.ac.in/arp19_ap54/preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	3	-	-	3	3	3	-	-	-	3	-	-
CO2	-	3	3	-	-	3	3	3	-	-	-	3	-	-
CO3	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO4	-	-	3	-	-	3	3	3	-	-	-	3	-	-
CO5	-	3	3	-	-	3	3	3	-	-	-	3	-	-
Average	-	3	3	-	-	3	3	3	-	-	-	3	-	-
3 - High; 2 - Medium; 1- Low; -No Correlation														



<b>U23MTA06</b>	<b>ENVIRONMENTAL SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites :** None

**Objectives:**

- To study the integrated themes and biodiversity, natural resources, pollution control and

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to	
<b>CO1</b> Study the Environment, Ecosystem and Biodiversity by learning the structures and functions.	<b>K2</b>
<b>CO2</b> Apply the case studies with present scenario on the effects of resource use on forests, water, minerals, and food by preparing a report that identifies the specific impacts and proposes practical solutions.	<b>K3</b>
<b>CO3</b> Measure water and air quality parameters and assess pollution levels by conducting field tests and interpreting the results in a written analysis.	<b>K2</b>
<b>CO4</b> Evaluate the role of NGOs and community initiatives in solving environmental issues by participating in a local environmental project and documenting the process and outcomes in a presentation.	<b>K5</b>
<b>CO5</b> Identify and describe the different types and limitations of EIA by reviewing and summarizing an actual EIA report for a local development project, highlighting its strengths and weaknesses.	<b>K3</b>

**Course Contents**

**Unit I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 6**

Definition – scope of environment – concept of an ecosystem - structure and function of an ecosystem – ecological succession processes – Types. Biodiversity – definition: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity.

**Unit II NATURAL RESOURCES 6**

Forest resources: Use and benefits – Causes and effects. Water resources: Purpose and benefits, Socio economic impacts – Case studies. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: Food security, effects of modern agriculture on soil and water resources, Problems with Fertilizers and pesticides. Energy resources - Case studies.

**Unit III ENVIRONMENTAL POLLUTION 6**

Water pollution: Forms and sources of water pollution – water quality parameters – physical, chemical and biological parameters. Air pollution: Sources and classification, effects of air pollution – case study. Marine pollution: Causes and effects - Thermal pollution: Nuclear hazards – Case study.

**Unit IV SOCIAL ISSUES AND THE ENVIRONMENTAL LEGISLATION 6**

Sustainability – Ecological foot print – Urban energy crisis – Renewable energy. Water conservation – Rainwater harvesting. Role of non-governmental organization. Greenhouse effect - Global warming and climate change. Pollution control boards and acts in India.



**Unit V ENVIRONMENT IMPACT ASSESSMENT**

**6**

Environmental impact analysis (EIA) – Legal and Regulatory aspects in India – Types and limitations of EIA – Issues in EIA – Case studies of EIA of developmental projects.

**Total Periods 30**

**Text Books:**

1. Joseph, Benny, "Environmental Science and Engineering", 2006, Tata McGraw Hill Publishing Company, New Delhi.
2. Masters, Gilbert M. and Ela, Wendell P., "Introduction to Environmental Engineering and Science", 3rd Ed., 2015, Pearson Education India, Noida, Uttar Pradesh.
3. Peavy, Howard S., Rowe, Donald R., and Tchobanoglous, George, "Environmental Engineering", 2017, McGraw Hill Education, New Delhi.
4. Cunningham, W.P., Cooper, T.H., Gorhani, E., and Hepworth, M.T., "Environmental Encyclopedia", 2001, Jaico Publishing House, Mumbai.

**Reference Books:**

1. Kaul, S.N. and Ashutosh Gautam, "Principles of Environmental Studies", 2002, Daya Publishing house, New Delhi.
2. Anjaneyalu, Y., "Introduction to Environmental Science", 2004, BS Publications, Hyderabad, Andhra Pradesh.
3. Swarajya Lakshmi, G, Prabhu Prasadini, P, Ramesh Thatikunta and VNLV Tayaru, "Environmental Science a Practical Manual", 2010, BS publications, Hyderabad.

**Web URL(s):**

1. [https://onlinecourses.nptel.ac.in/noc23\\_ge17/preview](https://onlinecourses.nptel.ac.in/noc23_ge17/preview)
2. [https://onlinecourses.nptel.ac.in/noc23\\_hs155/preview](https://onlinecourses.nptel.ac.in/noc23_hs155/preview)
3. <https://nptel.ac.in/courses/103107084>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	3	-	-	-	2	3	1	-
CO2	2	3	3	-	-	-	3	-	-	2	-	3	2	-
CO3	3	3	-	3	-	-	3	-	-	-	-	2	2	-
CO4	-	-	-	-	-	3	3	-	3	3	-	-	3	-
CO5	-	3	-	-	-	-	3	-	-	-	-	2	-	-
Average	-	2.75	3	3	-	3	3	-	3	2.5	2	2.5	2	-

3 - High; 2 - Medium; 1- Low; -No Correlation

<b>U23MTA07</b>	<b>SUSTAINABLE DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites :** None

**Objectives:**

- To introduce students to the concept and principles of sustainable development.
- To analyze the environmental, social, and economic challenges facing sustainable development.
- To explore strategies for promoting sustainability in various sectors.
- To encourage critical thinking and problem-solving skills in addressing sustainability issues.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>CO1</b>	Define sustainable development and describe the differences between economic growth and sustainable development, including the transition from MDGs to SDGs.	<b>K2</b>
<b>CO2</b>	Explain the economic, socio-political, and ecological aspects of sustainability and analyze strategies for achieving sustainability in each aspect	<b>K2</b>
<b>CO3</b>	Analyze the roles of society, environment, culture, and economy in sustainable development and evaluate various initiatives and policies.	<b>K3</b>
<b>CO4</b>	Explain major challenges like climate change and resource management, and analyze adaptation and mitigation strategies.	<b>K3</b>
<b>CO5</b>	Describe the SDGs, analyze implementation challenges, and evaluate strategies for development, financing, and governance.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO SUSTAINABLE DEVELOPMENT 6**

Introduction to Sustainable Development - Economic Growth and Progress - Environmental Threats. Business as Usual Versus Sustainable Development, From the MDGs to the SDGs: Agenda 2030.

**Unit II ASPECTS OF SUSTAINABILITY DEVELOPMENT 6**

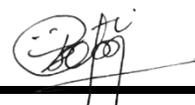
Introduction to Sustainability Development, Economic Aspects- Meaning, Ways of Achieving Economic Sustainability. Socio Political Aspects – Meaning, Ways of Achieving Socio Political Sustainability. Ecological (Environmental) Aspects – Meaning, Ways of Achieving Ecological Sustainability.

**Unit III DIMENSIONS TO SUSTAINABLE DEVELOPMENT 6**

Society, environment, culture and economy; current challenges – natural, political, socio-economic imbalance. Sustainable development initiatives and policies of various countries: global, regional, national, local; needs of present and future generation – political, economic, environmental.

**Unit IV CHALLENGES TO SUSTAINABLE DEVELOPMENT 6**

Agriculture, Population & Food Security, Public Health and Nutrition, Education, Natural Resources (Forests, Energy, Water), Climate Change, Introduction to the science of climate change, Climate change and natural resources system, Human dimensions of climate change, Adaptation and Mitigation



**Unit V PROPOSAL FOR SUSTAINABLE DEVELOPMENT GOALS**

**6**

The Sustainable Development Goals, Structure and Content of the SDGs, Challenges in Implementing the SDGs, Goal-Based Development, Financing for Sustainable Development, Principles of Good Governance – Green Technology.

**Total Periods**

**30**

**Text Books:**

1. Franco, I.B. and Tracey, J., "Community capacity-building for sustainable development: Effectively striving towards achieving local community sustainability targets", 2019, International Journal of Sustainability in Higher Education.
2. Elliott, Jennifer, "An Introduction to Sustainable Development", 4th Edition, 2012, Routledge, London.
3. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable development", 2012.
4. Sachs, J. D, "The Age of Sustainable Development", 2015, Columbia University Press, New York.

**Reference Books:**

- 1 Soubbotina, Tatyana P., "Beyond Economic Growth: An Introduction to Sustainable Development", 2004, WBI Learning Resources Series, Washington DC, World Bank.
- 2 Kerr, Julie, "Introduction to Energy and Climate: Developing a Sustainable Environment", 2017, CRC Press.
- 3 Nhamo, Godwell, and Mjimba, Vuyo, "Sustainable Development Goals and Institutions of Higher Education", 2020, Springer.

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2. [https://onlinecourses.nptel.ac.in/noc22\\_hs61/preview](https://onlinecourses.nptel.ac.in/noc22_hs61/preview)

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create  
Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	3	3	-	-	-	2	2	-	-
CO2	-	3	-	-	-	3	3	-	-	-	-	1	-	-
CO3	-	3	3	-	-	3	3	-	-	-	-	1	-	-
CO4	-	-	3	-	-	3	3	-	-	-	3	2	-	-
CO5	-	2	3	-	-	3	3	-	-	3	-	1	-	-
Average	-	2.7	3	-	-	3	3	-	-	3	2.5	1.4	-	-

3 - High; 2 - Medium; 1- Low; -No Correlation



<b>U23MTA08</b>	<b>DISASTER RISK REDUCTION AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites:** None

**Objectives:**

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
- To acquaint with the skills for planning and organizing disaster response

<b>Course Outcomes:</b>	<b>BT Level (highest level)</b>
Upon completion of the course, students would be able to	
<b>CO1</b> Explain the concepts of Disaster, Vulnerability and Disaster Risk reduction.	<b>K2</b>
<b>CO2</b> Identify the Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction.	<b>K3</b>
<b>CO3</b> Develop disaster response skills by adopting relevant tools and technology	<b>K3</b>
<b>CO4</b> Build awareness of institutional processes for Disaster response in the country.	<b>K3</b>
<b>CO5</b> Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity.	<b>K3</b>

**Course Contents**

**Unit I HAZARDS, VULNERABILITY AND DISASTER RISKS 6**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks. Natural, Human induced, Climate change induced. Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters – Structural collapse, Industrial accidents, oil spills – Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.

**Unit II DISASTER RISK REDUCTION (DRR) 6**

Sendai Framework for Disaster Risk Reduction, Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR. Structural – non-structural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders.

**Unit III DISASTER MANAGEMENT 6**

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction – Disaster Risk Management and post disaster management – Compensation and Insurance. Disaster Management Act (2005) and Policy.

**Unit IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT 6**

Early warning systems - Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness – Role of GIS and Information Technology Components in Preparedness.



**Unit V DISASTER MANAGEMENT: CASE STUDIES**

**6**

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters – Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies. Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies

**Total Periods 30**

**Text Books:**

1. Taimpo, “Disaster Management and Preparedness”, 2016, CRC Publications, Florida, USA.
2. Singh R, “Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami”, 2017, Horizon Press Publications, Norfolk, United Kingdom.
3. Singhal J.P. “Disaster Management”, 2010, Laxmi Publications, Chennai.
4. Tushar Bhattacharya, “Disaster Science and Management”, 2012, McGraw Hill India Education Pvt. Ltd, New Delhi.

**Reference Books:**

- 1 Govt. of India: Disaster Management Act, 2005, Government of India, New Delhi.
- 2 Government of India, “National Disaster Management Policy”, 2009.
- 3 Shaw R, “Community based Disaster risk reduction”, 2016, Oxford University Press, England, United Kingdom.

**Web URL(s):**

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2. <https://ssp.nidm.gov.in/enrol/index.php?id=147>

**Bloom’s Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	3	-	3	2	-	-	-	-	3	2	-
CO2	-	-	-	3	-	3	2	-	-	-	-	3	1	-
CO3	3	-	-	3	3	3	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	1	1	-
CO5	3	-	-	3	-	3	2	-	-	-	2	1	2	-
Average	3.0	-	-	3.0	3.0	3.0	2.0	-	-	-	2.0	2.2	1.5	-
3 - High; 2 - Medium; 1- Low; -No Correlation														



<b>U23MTA09</b>	<b>VISION FOR HUMANE SOCIETY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Pre-Requisites** : None

**Objectives:**

- To help the students to understand the importance and types of relationship with expressions.
- To develop the competence to think about the conceptual framework of undivided society as well as universal human order.
- To help the students to develop the exposure for transition from current state to the undivided society and universal human order.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Analyse the significance of feelings in ensuring justice in human-human relationships	<b>K3</b>
<b>CO2</b>	Formulate a conceptual framework of humane society based on relationship and harmony	<b>K2</b>
<b>CO3</b>	Evaluate the fulfilment in relationships in their personal and professional life with the understanding of established and expressed values.	<b>K3</b>
<b>CO4</b>	Develop the competence to work as a team based on relationship in different dimensions of life and society.	<b>K3</b>
<b>CO5</b>	Formulate the steps of transition from current state to humane society (the undivided society and universal human order).	<b>K4</b>

**Course Contents**

**Unit I INTRODUCTION TO THE COURSE 7**

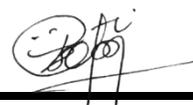
Basic aspiration of a Human Being and program for its fulfilment, Need for family and relationship for a Human Being, Human-Human relationship and role of work in its fulfilment, Comprehensive Human Goal, Need for Undivided Society, Need for Universal Human Order.

**Unit II UNDERSTANDING HUMAN-HUMAN RELATIONSHIP & ITS FULFILMENT 6**

Recognition of Human-Human Relationship, Recognition of feelings in relationship, Established Values and Expressed Values in Relationship, interrelatedness of feelings and their fulfilment, Expression of feelings.

**Unit III JUSTICE FROM FAMILY TO WORLD FAMILY ORDER 6**

Undivided Society as continuity and expanse of Justice in behaviour – family to world family order, continuity of culture and civilization, Universal Order on the basis of Undivided Society, Conceptual Framework for Universal human order.



**Unit IV PROGRAM FOR ENSURING UNDIVIDED SOCIETY AND UNIVERSAL HUMAN ORDER 4**

Education –Sanskar, Health –Sanyam, Production-work, Exchange – storage, Justice-preservation.

**Unit V HUMAN TRADITION 7**

Scope and Steps of Universal Human Order, Human Tradition (Ex. Family order to world family order), Steps for transition from the current state, Possibilities of participation of students in this direction, Present efforts in this direction, Sum up.

**Total Periods 30**

**Text Books:**

1. Gaur, R. R., Sangal, R., and Bagaria, G. P., "A Foundation Course in Human Values and Professional Ethics", 2010, Excel Books, New Delhi.
2. Gandhi, M. K., "Hind Swaraj: Indian Home Rule", 2014, Sarva Seva Sangh Prakashan.
3. Holborn, Martin, and Langley, Peter, "Sociology: Themes and Perspectives", 8th Ed., 2014, HarperCollins; originally published 1980.

**Reference Books:**

- 1 Dhar, P. L., and Gaur, R. R., "Science & Humanism – Towards a Unified Worldview", 1990, Commonwealth Publishers, New Delhi.
- 2 Nagraj, A., "Manav Vyavahar Darshan", Divya Path Sansthan, Amarkantak, India.
- 3 Kumarappa, J. C., "Economy of Permanence – A Quest for Social Order Based on Non-Violence", 2010, Sarva-Seva-Sangh-Prakashan, Varanasi, India.

**Web URL(s):**

1. <https://www.nec.com/en/global/about/vision/overview.html>
2. <https://www.who.int/publications/i/item/9789241516570>

**Bloom's Taxonomy Level**

K1- Remember, K2 – Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6 – Create

**Mapping COs, POs & PSOs**

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	3	2	2	-	-	-	-	-	-
CO2	-	-	-	-	-	3	2	2	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	3	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	3	3	-	-	-	-
CO5	-	-	-	-	-	3	2	2	-	-	-	-	-	-
Average	-	-	-	-	-	3	2	2	3	3	-	-	-	-
3 - High; 2 - Medium; 1- Low; -No Correlation														



<b>U23OE001</b>	<b>INDUSTRIAL WASTE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- Evaluate industrial wastewater characteristics, treatment methods, and pollution prevention strategies, including sludge and hazardous waste management, to achieve sustainable industrial effluent management and zero liquid discharge.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>C01</b>	Explain the significance of industrial pollution prevention in today life.	<b>K2</b>
<b>C02</b>	Identify the processes involved in industrial wastewater treatment processes like physical, chemical and biological.	<b>K3</b>
<b>C03</b>	Apply the concept of zero effluent discharge and quality requirements for disposal of effluent on land and water bodies.	<b>K3</b>
<b>C04</b>	Discover the methods for managing sludge and hazardous wastes generated from industrial processes.	<b>K4</b>
<b>C05</b>	Examine the customized wastewater treatment processes tailored to the needs of selected industries.	<b>K4</b>

**Course Contents**

**Unit I INDUSTRIAL POLLUTION PREVENTION 9**

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters – Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – 3R technique - Cost benefit analysis – Pay back period.

**Unit II INDUSTRIAL WASTEWATER TREATMENT 9**

Physico-Chemical Treatment Processes – Aerobic and Anaerobic Biological Treatment – Advanced oxidation and Tertiary Treatment processes for removal of dissolved organics and inorganics– Ozonation, photocatalysis, Evaporation and membrane Technologies.

**Unit III ZERO LIQUID DISCHARGE 9**

Individual and Common Effluent Treatment Plants – Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse – Industrial reuse, Disposal on water and land.

**Unit IV SLUDGE AND HAZARDOUS WASTE MANAGEMENT 9**

Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills – Hazardous waste management – e-waste management.



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**Unit V CASE STUDIES**

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries- Textiles- Pulp and Paper – Metal finishing – Sugar and Distilleries.

**Total Periods 45**

**Text Books:**

1. S.P.Mahajan, "Pollution Control in Process Industries", 2017, 26<sup>th</sup> Edition, Tata McGraw Hill Publishing Co., New Delhi.
2. S.C.Bhatia, "Handbook of Industrial Pollution and Control", 2002, 1<sup>st</sup> Edition, Volume I, CBS Publishers, New Delhi.

**Reference Books:**

1. W.Wesley Eckenfelder, "Industrial Water Pollution Control", 2000, 3rd Edition, Mc-Graw Hill, the University of Michigan.
2. Frank Woodard, "Industrial Waste Treatment Handbook", 2001, 1<sup>st</sup> Edition, Butterworth-Heinemann Ltd, New Delhi.
3. Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo, Constantine Yapijakis, "Handbook of Industrial and Hazardous Wastes Treatment", 2004, 2<sup>nd</sup> Edition, CRC Press, Boca Raton.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/105/103/105103205/>
2. <https://youtu.be/QRsqHKIpNss>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	-	-	-	-	-	3	-	-	1	3	2	2	-
CO2	-	3	2	2	-	-	3	3	2	2	3	-	2	-
CO3	2	3	3	-	-	-	-	3	2	2	3	-	2	-
CO4	2	-	3	-	2	-	3	3	-	2	3	-	2	-
CO5	2	3	2	3	-	-	3	3	1	1	3	3	2	-
Average	2.25	3	3	2.5	2	-	3	3	1.6	1.6	3	2.5	2	-
3 – High, 2 – Medium, 1 – Low, - No correlation														



**U23OE002**

**FUNDAMENTALS OF NANO SCIENCE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- To impart fundamental knowledge of nanoscience and technology, covering various methods of nanomaterial preparation, types of nanomaterials, their characterization techniques, and diverse fields of application.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest  
level)**

<b>CO1</b>	Interpret the basic knowledge on Nano science technology	<b>K2</b>
<b>CO2</b>	Choose the different types of Nano materials preparation.	<b>K3</b>
<b>CO3</b>	Identify the facts on different types of Nano materials.	<b>K3</b>
<b>CO4</b>	Develop the knowledge on various characterization techniques of Nano materials.	<b>K3</b>
<b>CO5</b>	Plan the facts on the application of Nano materials in different fields.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION 9**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**Unit II GENERAL METHODS OF PREPARATION 9**

Need of farmers participation –Benefits of farmers participation – Comparisons of cost and benefit. Water User Association -- Membership - Kinds of participation – National and International Experiences - Activities on Water towards Organization and Structure - Context of participation-factors in the environment.

**Unit III NANOMATERIALS 9**

Nanoforms of Carbon – Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides - ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays - functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**Unit IV CHARACTERIZATION TECHNIQUES 9**

X-ray diffraction technique, Scanning Electron Microscopy – environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**Unit V APPLICATIONS 9**

Nano InfoTech: Information storage- Nano computer, molecular switch, super chip, nano crystal, Nano biotechnology: nano probes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bio imaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products – In Photostat, printing, solar cell, battery

**Total Periods 45**



**Text Books:**

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, 1998, Institute of Physics Publishing, Bristol and Philadelphia.
2. N John Dinardo, “Nanoscale Charecterisation of Surfaces & Interfaces”, 2000, 2<sup>nd</sup> edition, Weinheim Cambridge, Wiley-VCH.

**Reference Books:**

1. G Timp, “Nanotechnology” 1999, AIP press/Springer.
2. Akhlesh Lakhtakia. “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”,2007, Prentice-Hall of India (P) Ltd, New Delhi.

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2. <https://nptel.ac.in/courses/118/104/118104008/>
3. <https://archive.nptel.ac.in/courses/113/106/113106093/>

**Bloom’s Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	1	-	2	2	2	2
CO2	3	2	2	-	2	-	-	-	-	-	2	2	2	3
CO3	3	2	2	-	2	-	-	-	-	-	2	2	2	3
CO4	3	2	2	3	3	-	-	-	-	-	2	2	2	3
CO5	2	2	3	2	2	2	2	1	1	2	3	2	3	3
Average	2.8	2	2.3	2.5	2.3	2	2	1	1	2	2.2	2	2.2	2.8
3 – High, 2 – Medium, 1 – Low, - No correlation														



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U23OE003

## GREEN BUILDINGS

L	T	P	C
3	0	0	3

Pre-Requisites : None

**Objectives:**

- Learn the principles of planning and orientation of buildings.
- Environmental implications of natural and building materials along with green cover
- Acquire knowledge on various aspects of green buildings

**Course Outcomes:**

Upon completion of the course, students would be able to

BT Level  
(highest  
level)

<b>C01</b>	Apply the principles of building planning, its bylaws and provide facilities for rainwater harvesting	<b>K3</b>
<b>C02</b>	Discover the Environmental implications of buildings energy	<b>K4</b>
<b>C03</b>	Relate safety to Green Technology and understand the concepts of green buildings	<b>K2</b>
<b>C04</b>	Plan the rating systems of GRIHA, IGBC and LEED	<b>K3</b>
<b>C05</b>	Make use of Renewable Energy Sources	<b>K3</b>

**Course Contents****Unit I PLANNING OF BUILDINGS 9**

Principles of planning, Relevant building bylaws, site selection for buildings, orientation of buildings, common errors in planning, Provision of rain water harvesting.

**Unit II BUILDING-ENERGY-IMPLICATIONS 9**

Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Green cover and built environment.

**Unit III GREEN BUILDING TECHNOLOGIES 9**

Introduction- Necessity - Concept of Green building. Principles of green building – Site selection criteria for Green Buildings – Usage of low energy materials – Effective cooling and heating systems – Effective electrical systems – Effective water conservation systems.

**Unit IV CERTIFICATION SYSTEMS 9**

Certification systems- Green Rating for Integrated Habitat Assessment (GRIHA), Indian Green Building Council (IGBC) and Leadership in Energy and Environmental Design (LEED), case studies.

**Unit V GREEN BUILDING DESIGN 9**

Introduction - Reduction in Energy Demand - Onsite Sources and Sinks - Maximise System Efficiency - Steps to Reduce Energy Demand and Use Onsite Sources - Use of Renewable Energy Sources.

**Total Periods 45**


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**Text Books:**

1. Kumara Swamy N.Kameswara Rao A, "Building Planning And Drawing", 2023, 9<sup>th</sup> Edition, Charotar Publishing House Pvt. Ltd, India.
2. Shahane, V. S, "Planning and Designing Building", 2004, Poona, Allies Book Stall.

**Reference Books:**

1. Michael Bauer, Peter Mosle and Michael Schwarz, "Green Building – Guidebook for Sustainable Architecture", 2010, Springer.
2. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison "Green Building Handbook", 2002, 1<sup>st</sup> Edition, Volume I, Routledge Publisher.
3. Kent Peterson, "Standard for the design for High Performance Green Buildings", 2009.

**Web URL(s):**

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2. <https://onlinelibrary.wiley.com/doi/10.1002/9781119792079.ch15>

**Bloom's Taxonomy Level**

K1- Remember, K2 – understand, K3- Apply, K4- Analyse, K5- Evaluate, K6 – Create

Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	-	1	1	-	2	1	1	-	2	1	3	2	3
CO2	3	1	3	2	1	2	-	1	1	1	2	3	2	3
CO3	2	2	3	1	1	1	-	-	-	3	1	3	3	3
CO4	3	1	3	2	2	1	1	1	1	3	2	3	3	3
CO5	3	1	2	2	2	2	1	-	1	3	2	3	3	3
Average	2.3	1.5	2.3	1.3	1	1.7	1	1	1	2	1	3	2.3	3
3 – High, 2 – Medium, 1 – Low, - No correlation														



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<b>U23OE003</b>	<b>CORROSION SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Pre-Requisites** : None

**Objectives:**

- Analyze the principles, types, mechanisms, rate estimation, and control methods of corrosion to effectively prevent and manage material degradation in industrial applications.

**Course Outcomes:**

Upon completion of the course, students would be able to

**BT Level  
(highest level)**

<b>CO1</b>	Explain the fundamentals of corrosion, including its spontaneity, rate units, and prevention methods.	<b>K2</b>
<b>CO2</b>	Identify and describe various types of corrosion and their effects on metals.	<b>K2</b>
<b>CO3</b>	Analyze the mechanisms of corrosion affecting different metal surfaces.	<b>K4</b>
<b>CO4</b>	Estimate corrosion rates by applying electrochemical and non-destructive testing techniques."	<b>K3</b>
<b>CO5</b>	Use corrosion control techniques including cathodic protection and protective coatings.	<b>K3</b>

**Course Contents**

**Unit I INTRODUCTION TO CORROSION 9**

Importance of corrosion – spontaneity of corrosion – units of corrosion rate (mdd and mpy) – direct and indirect damage by corrosion – importance of corrosion – prevention in industries – Pilling Bedworth ratio and its significance – passivation – area relationship in both active and passive states of metals – Pourbaix diagrams of Mg, Al and Fe and their advantages and disadvantages.

**Unit II TYPES OF CORROSION 9**

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion – Catastrophic oxidation corrosion.

**Unit III MECHANISM OF CORROSION 9**

Hydrogen embrittlement – corrosion fatigue – filiform corrosion – fretting damage and microbes induced corrosion. Corrosion mechanism on steel, iron, zinc and copper metal surfaces.

**Unit IV CORROSION RATE AND ITS ESTIMATION 9**

Rate of corrosion – Factors affecting corrosion – Electrochemical methods of polarization: Tafel extrapolation polarization and linear polarization – Weight loss method – testing for intergranular susceptibility and stress corrosion. Non - destructive testing methods: Visual testing – liquid penetrant testing – magnetic particle testing and eddy current testing.

**Unit V CORROSION CONTROL METHODS 9**

Fundamentals of cathodic protection – types of cathodic protection (sacrificial anodic and impressed current cathodic protection). Stray current corrosion, problems and its prevention. Protective coatings: Metal coatings: Hot dipping (galvanizing, tinning and metal cladding) – natural inhibitors. Selection of suitable design for corrosion control.

**Total Periods 45**



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**Text Books:**

1. Mouafak A. Zaher, "Introduction to Corrosion Engineering", 2016, Create space Independent Publishing Platform.
2. E. McCafferty, "Introduction to Corrosion Science", 2010, Springer, New York.

**Reference Books:**

1. R.Winston Revie and Herbert H. Uhlig, "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 2008, 4<sup>th</sup> Edition, John Wiley & Science, New York.
2. Mars G. Fontana, "Corrosion Engineering", 2017, 3<sup>rd</sup> Edition, Tata McGraw Hill, India.
3. David E.J. Talbot, James D.R. Talbot, "Corrosion Science and Technology", 2018, 3<sup>rd</sup> Edition, CRC Press, Boca Raton.

**Web URL(s):**

1. <https://nptel.ac.in/courses/113108051/>
2. <http://corrosion-doctors.org/Corrosion-History/Eight.html>
3. <https://youtu.be/t8ycmWZ0gis>

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Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	2	2	2	-	-	-	2	3	2	-
CO2	3	3	1	2	-	2	2	-	-	-	2	3	2	-
CO3	3	3	2	3	2	-	2	-	-	-	2	3	2	-
CO4	3	2	2	3	3	-	-	-	-	-	2	3	2	-
CO5	3	3	3	3	2	3	3	-	-	-	2	3	2	-
Average	3	2.8	2	2.6	1.8			-	-	-	2	3	2	-
3 – High, 2 – Medium, 1 – Low, - No correlation														



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**Text Books:**

1. M.Lakshmi Narasaiah, "Environment and Agriculture", 2006, Discovery Pub. House.
2. Arvind Kumar, "Environment and Agriculture", 2005, ABH Publications, New Delhi.

**Reference Books:**

- 1 T.C. Byerly, "Environment and Agriculture", 2006, United States. Dept. of Agriculture. Economic Research Service.
- 2 Robert D. Havener, Steven A. Breth, "Environment and Agriculture: rethinking development issues for the 21st century: proceedings of a symposium", 1994, Winrock International Institute for Agricultural Development.

**Web URL(s):**

1. <https://archive.nptel.ac.in/courses/126/105/126105010/>
2. <https://archive.nptel.ac.in/courses/126/103/126103022/>
3. [https://youtu.be/VwE\\_KsI8sa4](https://youtu.be/VwE_KsI8sa4)

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Mapping COs, POs & PSOs

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO2	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO3	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO4	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO5	3	2	3	1	2	-	-	-	-	-	-	2	3	1
Average	3	2	3	1	2	0	0	0	0	0	0	2	3	1
3 – High, 2 – Medium, 1 – Low, - No correlation														



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