KPR Institute of Engineering and Technology

Learn Beyond (Autonomous, NAAC "A")

Avinashi Road, Arasur, Coimbatore.

To Work. Certified MAR 2022 - MAR 2023 INDIA

B.E. – Civil Engineering
Curriculum and Syllabi
Regulation – 2021(Revised)

Vision and Mission of the Institute

Vision

To become a premier institute of academic excellence by imparting technical, intellectu... professional skills to students for meeting the diverse needs of the industry, society, the nation and the world at large.

Mission

- ❖ Commitment to offer value-based education and enhancement of practical skills
- ❖ Continuous assessment of teaching and learning processes through scholarly activities
- ❖ Enriching research and innovation activities in collaboration with industry and institutes of repute
- ❖ Ensuring the academic processes to uphold culture, ethics and social responsibility

II. Vision and Mission of the Department

Vision

To develop competent Civil Engineers to create infrastructure with technology in demand that leads to nation building

Mission

The Mission of the Department is to

- ❖ Provide holistic education to students to enhance technical knowledge and skills
- ❖ Indoctrinate augmented contents to meet the requirements of stakeholders
- ❖ Promote research and consultancy activities in collaboration with industries
- ❖ Foster ethical and moral values with leadership qualities

III. Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) of the Civil Engineering (CE) represent major accomplishments that the graduates are expected to achieve after three to five years of graduation.

PEO1: Graduates will attain adequate knowledge in the core areas of Civil Engineering with good communication and presentation skills and excel in their chosen profession

PEO2: Graduates will become successful Civil Engineers by applying their technical and managerial skills and disseminate the knowledge with confidence in various disciplines of Civil Engineering as a responsible citizen

PEO3: Graduates will initiate an active programme for life long professional achievement and expertise through continuous development

IV. Program Outcomes (POs)

Graduates of Civil Engineering will be able to

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

PO 2 Problem analysis: Identify, formulate, review research literature, and analyze complex civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3 Design/ development of solutions: Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate

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consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex civil engineering activities with an understanding of the limitations.

PO 6 The engineer and society: Apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

V. Program Specific Outcomes (PSOs)

Graduates of Civil Engineering will be able to

PSO 1: Design, construct and provide sustainable solutions through consultancy service.

PSO 2: Execute projects, prepare reports and practice professional licensure.

VI. PEO/PO Mapping

Following three levels of correlation should be used:

1: Low

2: Medium

3: High

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	2	2	2	2	2	3	3	2
PEO2	3	3	3	3	3	2	1	2	2	3	3	3
PEO3	3	3	3	3	3	2	2	2	1	3	3	3

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VI. MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES

Year	SEM	Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I Year	SEM I	Heritage of Tamils	-	-	-	-	-	-	✓	✓	-	✓	-	✓	-	-
		Calculus and Differential Equations	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
		English for Technologists	-	-	-	-	-	-	-	-	-	✓	-	✓	-	✓
		Engineering Physics	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-
		Engineering Chemistry	✓	✓	-	-	-	-	✓	-	✓		-	✓	✓	✓
		Problem solving and C Programming	✓	✓	✓	✓	-	✓	-	✓	✓	✓	-	✓	-	-
		Engineering Graphics	✓	✓	✓	-	✓	-	-	✓	-	✓	-	✓	-	-
		Engineering Studio	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-	✓	-	-
	SEM II	Tamils and Technology	-	-	-	-	-	-	✓	✓	-	✓	-	✓	-	-
		Laplace Transforms and Complex Variables	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
		Basic Mechanical and Electrical Engineering	✓	✓	-	-	-	✓	-	-	-	-	✓	✓	-	-
		Engineering Mechanics	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	✓	-
		Building Materials	✓	✓	-	-	-	✓	-	-	-	-	-	✓	-	✓
		Materials Science	✓	✓	-	-	-	✓	-	-	-	-	-	✓	-	-
		Personality Enhancement	-	-	-	-	-	-	-	✓	✓	✓		✓	-	✓
		Python Programming	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	-	-

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II Year	SEM III	Fourier Analysis and Boundary value problems	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	
		Concrete Technology	✓	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	✓
		Fluid Mechanics	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-
		Strength of Materials I	✓	✓	✓	✓	-	-	-	-	✓	✓	-	-	✓	✓
		Engineering Survey	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓	✓
		Concrete Laboratory	✓	✓	✓	✓	-	✓	-	✓	✓	✓	-	✓	✓	✓
		Computer Aided Drafting Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Design Studio I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
	SEM IV	Numerical Techniques	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
		Strength of Materials II	✓	✓	✓	✓	-	✓	-	-	-	✓	-	-	✓	✓
		Applied Hydraulics and Hydraulic Machinery	✓	✓	✓	-	-	-	✓	-	-	✓	-	✓	✓	-
		Soil Mechanics	✓	✓	✓	✓	✓	-	✓	-	✓	✓	-	-	✓	✓
		Highway Engineering	✓	✓	✓	-	-	✓	-	✓	✓	-	-	-	✓	✓
		Hydraulic Engineering Laboratory	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓	✓	-
		Survey Camp	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓
		Soft Skills I	-	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
		Design Studio II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
III Year	SEM V	Design of Reinforced Concrete Structures	✓	✓	✓	-	-	✓	-	✓	-	✓	-	✓	✓	✓

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		Structural Analysis I	✓	✓	✓	-	-	-	✓	-	-	✓	-	✓	✓	✓
		Environmental Engineering I	✓	-	✓	-	✓	✓	✓	✓	-	✓	✓	✓	-	✓
		Soft Skills - II	-	-	-	-	-	-	-	-	✓	✓	-	-	-	-
		Proto Studio I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
	SEM VI	Environmental Engineering II	✓	✓	✓	-	✓	✓	✓	✓	-	✓	-	✓	-	✓
		Structural Analysis II	✓	✓	✓	-	-	✓	-	-	-	✓	-	✓	✓	✓
		Design of Steel Structures	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	✓
		Environmental Engineering Laboratory	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	-	✓
		Computer Aided Analysis and Design Laboratory	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓	✓
		Soft Skills III	-	-	-	-	-	-	-	✓	✓	✓	-	✓	✓	-
		Proto Studio II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
IV Year	SEM VII	Construction Project Management	✓	✓	-	-	✓	✓	-	✓	✓	✓	✓	✓	-	✓
		Estimation and Quantity Surveying	✓	✓	✓	-	-	-	-	-	✓	✓	-	✓	✓	✓
		Project work Phase - I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEM VIII	Project work Phase - II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PE Vertical I		Structural Dynamics and Earthquake Engineering	✓	✓	✓	-	-	✓	-	✓	-	-	-	✓	✓	✓
		Prestressed Concrete Structures	✓	✓	✓	-	-	✓	-	✓	-	-	-	✓	✓	✓
		Prefabricated Structures	✓	✓	✓	-	-	✓	-	✓	-	-	-	✓	✓	✓

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	Repair and Rehabilitation of Structures	✓	✓	✓	-	-	✓	-	-	-	-	-	✓	✓	✓
	Structural Design and Drawing	✓	✓	✓	-	-	✓	-	✓	-	-	-	✓	✓	✓
	Steel Concrete Composite Structures	✓	✓	✓	-	-	✓	-	✓	-	-	-	✓	✓	✓
PE Vertical II	Air Pollution and Management	✓	✓	-	-	-	✓	✓	✓	-	-	✓	✓	-	-
	Industrial Waste Water Engineering	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	-	-	✓
	Municipal Solid Waste Management	✓	-	-	-	✓	✓	✓	✓	-	-	✓	✓	✓	✓
	Environmental Impact Analysis	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	-	✓	-
	Hydrology	✓	✓	✓	-	-	✓	✓	✓	-	-	-	-	✓	-
	Irrigation Engineering	✓	✓	✓	-	-	✓	✓	✓	-	-	-	✓	-	-
	Ground water Engineering	✓	✓	-	-	-	✓	✓	✓	-	-	✓	-	-	-
PE Vertical III	Construction Techniques, Equipment and Practices	✓	-	-	-	✓	✓	-	✓	-	-	✓	✓	✓	✓
	Construction Planning & Scheduling	-	✓	-	-	-	✓	✓	-	✓	✓	✓	✓	✓	✓
	Safety Engineering	✓		✓	✓	-	✓	✓	✓	✓		✓	✓	✓	✓
	Quality Control and Assurance	-	✓	✓	✓	-	-	✓	-	-	✓	✓	-	-	✓
	Building Services	✓	-	✓	-	✓	✓	✓	✓	-	-	✓	✓	-	✓
	Sustainable & Lean Construction	✓	✓	✓	-	-	✓	-	✓	-	-	✓	✓	✓	✓
	Formwork Engineering	✓	✓	✓	-	✓	-	✓	-	-	✓	-	-	-	-
PE Vertical IV	Urban Planning and Management	✓	✓	✓	-	✓	✓	-	-	-	-	-	-	✓	-
	Railways, Airports and Harbor Engineering	✓	✓	✓	-	-	✓	✓	-	-	-	-	-	✓	-

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	Traffic Engineering and Management	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-
	Smart Cities	✓	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-
	Metro Engineering	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	-
	Pavement Engineering	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	✓
PE Vertical VI	Foundation Engineering	✓	✓	✓	✓	-	-	-	-	✓	-	-	✓	✓	✓
	Ground Improvement techniques	✓	✓	✓	✓	-	-	✓	-	-	-	-	-	✓	-
	Geo Environmental Engineering	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-
	Tunnelling Engineering	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-	✓
	Soil dynamics and Machine Foundation	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	✓
	Engineering Geology	✓	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓
PE Vertical VII	AI in Civil Engineering	✓	✓	✓	✓	✓	-	-	-	-	✓	-	-	-	✓
	Energy Efficient Building	✓	✓	-	✓	-	✓	✓	✓	-	-	✓	✓	✓	✓
	Building Information Modelling	-	-	-	-	✓	-	-	-	✓	✓	✓	-	✓	-
	Principles of Architecture	-	✓	✓	-	-	-	✓	✓	-	-	-	-	✓	-
	Disaster Mitigation & Management	✓	✓	✓	-	-	✓	✓	-	✓	✓	-	-	✓	✓
	GIS & Remote Sensing	✓	✓	-	-	✓	-	-	-	-	✓	-	✓	✓	✓
	Finance for Engineers	✓	✓	✓	✓	✓	-	-	✓	-	-	✓	✓	-	✓

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B.E. CIVIL ENGINEERING

REGULATIONS – 2021 (Revised)

For the students admitted in 2022

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR I - VIII SEMESTERS

SEMESTER I

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21GEG01	Heritage of Tamils	HSMC	1	0	0	0	1
2	U21MA101	Calculus and Differential Equations	BSC	3	1	0	0	4
	THEORY COURSE WITH LABORATORY COMPONENT							
3	U21EN101	English for Technologists	HSMC	1	0	2	0	2
4	U21PH101	Engineering Physics	BSC	2	0	2	0	3
5	U21CY101	Engineering Chemistry	BSC	2	0	2	0	3
6	U21CSG01	Problem solving and C Programming	ESC	2	0	2	0	3
	LABORATORY COURSES							
7	U21MEG01	Engineering Graphics	ESC	0	0	4	0	2
8	U21ECG03	Engineering Studio	ESC	0	0	4	0	2
	MANDATORY NON CREDIT COURSES							
9	U21MYC01	Induction program	MNC	Three Weeks				
			TOTAL	11	1	16	0	20

SEMESTER II

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21GEG02	Tamils and Technology	HSMC	1	0	0	0	1
2	U21MA201	Laplace Transforms and Complex Variables	BSC	3	1	0	0	4
3	U21MEG03	Basic Mechanical and Electrical Engineering	ESC	3	0	0	0	3
4	U21CE201	Engineering Mechanics	ESC	3	1	0	0	4
5	U21CE202	Building Materials	ESC	3	0	0	0	3
6	U21PH201	Materials Science	BSC	2	0	0	0	2
	THEORY COURSE WITH LABORATORY COMPONENT							
7	U21EN201	Personality Enhancement	HSMC	1	0	2	0	2
8	U21CSG02	Python Programming	ESC	2	0	2	0	3
	MANDATORY NON CREDIT COURSES							
9	U21MYC02	Environmental Sciences	MNC	(1)	0	0	0	0
			TOTAL	18	2	4	0	22

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SEMESTER III

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MA303	Fourier Analysis and Boundary value problems	BSC	3	1	0	0	4
2	U21CE301	Concrete Technology	PCC	3	0	0	0	3
3	U21CE302	Fluid Mechanics	PCC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
4	U21CE303	Strength of Materials I	PCC	3	0	2	0	4
5	U21CE304	Engineering Survey	PCC	3	0	2	0	4
	LABORATORY COURSE WITH PROJECT COMPONENT							
7	U21CE305	Concrete Laboratory	PCC	0	0	4	2	3
8	U21CE307	Computer Aided Drafting Laboratory	ESC	0	0	2	2	2
	LABORATORY COURSES							
9	U21CE308	Design Studio I	EEC	0	0	0	2	1
	MANDATORY NON CREDIT COURSES							
10	U21MYC03	Essence of Indian Traditional Knowledge	MNC	(1)	0	0	0	0
			TOTAL	15	1	10	6	24

SEMESTER IV

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MA401	Numerical Techniques	BSC	3	0	0	0	3
2	U21CE401	Strength of Materials II	PCC	3	0	0	0	3
3	U21CE402	Applied Hydraulics and Hydraulic Machinery	PCC	3	0	0	0	3
4		Open Elective - I	OEC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
5	U21CE403	Soil Mechanics	PCC	3	0	2	0	4
6	U21CE404	Highway Engineering	PCC	3	0	2	0	4
	LABORATORY COURSES							
7	U21CE405	Hydraulic Engineering Laboratory	PCC	0	0	4	0	2
8	U21CE406	Survey Camp **	PCC	2 Weeks				1
9	U21SSG01	Soft Skills I	HSMC	0	0	2	0	1
10	U21CE407	Design Studio II	EEC	0	0	0	2	1
	MANDATORY NON CREDIT COURSES							
11	U21MYC04	Indian Constitution	MNC	(1)	0	0	0	0
			TOTAL	18	0	10	2	25

**Two Weeks during III semester vacation

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SEMESTER V

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21CE501	Design of Reinforced Concrete Structures	PCC	3	1	0	0	4
2	U21CE502	Structural Analysis I	PCC	3	1	0	0	4
3	U21CE503	Environmental Engineering I	PCC	3	0	0	0	3
4		Professional Elective - I	PEC	3	0	0	0	3
5		Professional Elective - II	PEC	3	0	0	0	3
6		Open Elective - II	OEC	3	0	0	0	3
	LABORATORY COURSES							
7	U21SSG02	Soft Skills - II	HSMC	0	0	2	0	1
8	U21CE505	Proto Studio I	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSES								
9	U21MYC05	Cyber Security Essentials	MNC	(1)	0	0	0	0
			TOTAL	18	2	2	2	22

SEMESTER VI

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21CE601	Environmental Engineering II	PCC	3	0	0	0	3
2	U21CE602	Structural Analysis II	PCC	3	0	0	0	3
3		Professional Elective - III	PEC	3	0	0	0	3
4		Professional Elective - IV	PEC	3	0	0	0	3
5		Open Elective - III	OEC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
6	U21CE603	Design of Steel Structures	PCC	3	0	2	0	4
	LABORATORY COURSE WITH PROJECT COMPONENT							
7	U21CE604	Environmental Engineering Laboratory	PCC	0	0	2	2	2
LABORATORY COURSES								
8	U21CE605	Computer Aided Analysis and Design Laboratory	ESC	0	0	4	0	2
9	U21SSG03	Soft Skills III	HSMC	0	0	2	0	1
10	U21CE606	Proto Studio II	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSES								
11	U21MYC06	Introduction to UN SDG's: An integrated approach	MNC	(1)	0	0	0	0
			TOTAL	18	0	10	4	25

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SEMESTER VII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21CE701	Construction Project Management	HSM	3	0	0	0	3
2	U21CE702	Estimation and Quantity Surveying	PCC	3	0	0	0	3
3		Professional Elective – V	PEC	3	0	0	0	3
4		Professional Elective - VI	PEC	3	0	0	0	3
5		Open Elective - IV	OEC	3	0	0	0	3
	LABORATORY COURSES							
6	U21CE703	Project work Phase - I	EEC	0	0	0	4	2
			TOTAL	15	0	0	4	17

SEMESTER VIII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CE802	Project work Phase - II	EEC	0	0	0	16	08
			TOTAL	0	0	0	16	08

INDUSTRIAL TRAINING / INTERNSHIP

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CEI01	Industrial Training / Internship *	EEC	0	0	0	0	2
			TOTAL	0	0	0	0	2

***Four Weeks during any semester vacation from III to VI Semester**

NCC CREDIT COURSES

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21NCC01	National Cadet Corps I	-	1	0	2	0	2
2	U21NCC02	National Cadet Corps II	-	1	0	2	0	2
3	U21NCC03	National Cadet Corps III	-	1	0	2	0	2
4	U21NCC04	National Cadet Corps IV	-	2	0	2	0	3
5	U21NCC05	National Cadet Corps V	-	1	0	2	0	2
6	U21NCC06	National Cadet Corps VI	-	2	0	2	0	3
			TOTAL	8	-	12	-	14

NCC Credit Course (Level 1 – Level 6) are offered for NCC students only. The grades earned by the students will be recorded in the mark sheet, however the same shall not be considered for the computation of CGPA.

TOTAL CREDITS: 165

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PROFESSIONAL ELECTIVES COURSES: VERTICALS

Vertical I STRUCTURAL ENGINEERING	Vertical II ENVIRONMENTAL & WATER RESOURCE ENGINEERING	Vertical III CONSTRUCTION MANAGEMENT	Vertical IV INFRASTRUCTURE ENGINEERING	Vertical V GEO TECHNICAL ENGINEERING	Vertical VI DIVERSIFIED COURSES	Vertical VII COMPREHENSIVE COURSES
Structural Dynamics and Earthquake Engineering	Air Pollution and Management	Construction Techniques, Equipment and Practices	Urban Planning and Management	Foundation Engineering	AI in Civil Engineering	Comprehension I
Prestressed Concrete Structures	Industrial Waste Water Engineering	Construction Planning and Scheduling	Railways, Airports and Harbour Engineering	Ground Improvement techniques	Energy Efficient Building	Comprehension II
Prefabricated Structures	Municipal Solid Waste Management	Safety Engineering	Traffic Engineering and Management	Geo Environmental Engineering	Building Information Modelling	
Repair and Rehabilitation of Structures	Environmental Impact Analysis	Quality Control and Assurance	Smart Cities	Tunnelling Engineering	Principles of Architecture	
Structural Design and Drawing	Hydrology	Building Services	Metro Engineering	Soil dynamics and Machine Foundation	Disaster Mitigation and Management	
Steel Concrete Composite Structures	Irrigation Engineering	Sustainable and Lean Construction	Pavement Engineering	Engineering Geology	GIS and Remote Sensing	
	Ground water Engineering	Formwork Engineering			Finance for Engineers	

HONOURS WITH SPECIALIZATION IN INFRASTRUCTURE ENGINEERING (Vertical IV)
Infrastructure Planning and Engineering
Remote Sensing and GIS forInfrastructure Planning
Project Management forInfrastructure Development
EIA For Infrastructure Projects
Infrastructure Financing
Experiential Project

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Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VII. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester III to VII.

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I STRUCTURAL ENGINEERING

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U21CEP01	Structural Dynamics and Earthquake Engineering	PEC	3	0	0	3
2	U21CEP02	PrestressedConcrete Structures	PEC	3	0	0	3
3	U21CEP03	Prefabricated Structures	PEC	3	0	0	3
4	U21CEP04	Repair and Rehabilitation of Structures	PEC	3	0	0	3
5	U21CEP05	Structural Design and Drawing	PEC	3	0	0	3
6	U21CEP06	Steel Concrete Composite Structures	PEC	3	0	0	3

VERTICAL II ENVIRONMENTAL & WATER RESOURCE ENGINEERING

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U21CEP07	Air Pollution and Management	PEC	3	0	0	3
2	U21CEP08	Industrial Waste Water Engineering	PEC	3	0	0	3
3	U21CEP09	Municipal Solid Waste Management	PEC	3	0	0	3
4	U21CEP10	Environmental Impact Analysis	PEC	3	0	0	3
5	U21CEP11	Hydrology	PEC	3	0	0	3
6	U21CEP12	Irrigation Engineering	PEC	3	0	0	3
7	U21CEP13	Ground water Engineering	PEC	3	0	0	3

VERTICAL III CONSTRUCTION MANAGEMENT

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U21CEP14	Construction Techniques, Equipment and Practices	PEC	3	0	0	3
2	U21CEP15	Construction Planning and Scheduling	PEC	3	0	0	3
3	U21CEP16	Safety Engineering	PEC	3	0	0	3
4	U21CEP17	Quality Control and Assurance	PEC	3	0	0	3
5	U21CEP18	Building Services	PEC	3	0	0	3
6	U21CEP19	Sustainable and Lean Construction	PEC	3	0	0	3
7	U21CEP20	Formwork Engineering	PEC	3	0	0	3

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VERTICAL IV INFRASTRUCTURE ENGINEERING

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U21CEP21	Urban Planning and Management	PEC	3	0	0	3
2	U21CEP22	Railways, Airports and Harbour Engineering	PEC	3	0	0	3
3	U21CEP23	Traffic Engineering and Management	PEC	3	0	0	3
4	U21CEP24	Smart Cities	PEC	3	0	0	3
5	U21CEP25	Metro Engineering	PEC	3	0	0	3
6	U21CEP26	Pavement Engineering	PEC	3	0	0	3
HONOURS WITH SPECIALIZATION IN INFRASTRUCTURE ENGINEERING							
7	U21CEP42	Infrastructure Planning and Engineering	PEC	3	0	0	3
8	U21CEP43	Remote Sensing and GIS for Infrastructure Planning	PEC	3	0	0	3
9	U21CEP44	Project Management for Infrastructure Development	PEC	3	0	0	3
10	U21CEP45	EIA For Infrastructure Projects	PEC	3	0	0	3
11	U21CEP46	Infrastructure Financing	PEC	3	0	0	3
12	U21CEP47	Experiential Project	PEC	3	0	0	3

VERTICAL V GEO TECHNICAL ENGINEERING

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U21CEP27	Foundation Engineering	PEC	3	0	0	3
2	U21CEP28	Ground Improvement techniques	PEC	3	0	0	3
3	U21CEP29	Geo Environmental Engineering	PEC	3	0	0	3
4	U21CEP30	Tunnelling Engineering	PEC	3	0	0	3
5	U21CEP31	Soil dynamics and Machine Foundation	PEC	3	0	0	3
6	U21CEP32	Engineering Geology	PEC	3	0	0	3

VERTICAL VI DIVERSIFIED COURSES

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U21CEP33	AI in Civil Engineering	PEC	3	0	0	3
2	U21CEP34	Energy Efficient Building	PEC	3	0	0	3
3	U21CEP35	Building Information Modelling	PEC	3	0	0	3
4	U21CEP36	Principles of Architecture	PEC	3	0	0	3
5	U21CEP37	Disaster Mitigation and Management	PEC	3	0	0	3
6	U21CEP38	GIS and Remote Sensing	PEC	3	0	0	3
7	U21CEP39	Finance for Engineers	PEC	3	0	0	3

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VERTICAL VII COMPREHENSIVE COURSES

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U21CEP40	Comprehension I	PEC	3	0	0	3
2	U21CEP41	Comprehension II	PEC	3	0	0	3

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OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are notsimilar to any other course contents/title under other course categories).

OPEN ELECTIVES – I (SEMESTER: IV)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CEX01	Environmental & Social Impact Assessment	OEC	3	0	0	0	3
2	U21CEX02	Integrated Water Resource Management	OEC	3	0	0	0	3

OPEN ELECTIVES – II (SEMESTER: V)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CEX03	Remote Sensing and GIS	OEC	3	0	0	0	3
2	U21CEX04	Waste Management	OEC	3	0	0	0	3

OPEN ELECTIVES – III (SEMESTER: VI)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CEX05	Environment & Agriculture	OEC	3	0	0	0	3
2	U21CEX08	E - Waste Management	OEC	3	0	0	0	3

OPEN ELECTIVES – IV (SEMESTER: VII)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CEX06	Green Buildings	OEC	3	0	0	0	3
2	U21CEX07	Disaster Management	OEC	3	0	0	0	3

MICRO SPECIALIZATION IN WATER AND WATER TREATMENT

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MCG01	Sustainable Water Management: Principles and Practices	MSC	2	0	2	0	3
2	U21MCG02	Water Treatment Essentials: Principles andPractices	MSC	2	0	2	0	3
3	U21MCG03	Plumbing – Theory and Practice	MSC	2	0	2	0	3
4	U21MCG04	Experiential Project	MSC	0	0	0	6	3

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Scheme of Credit distribution – Summary

S.No	Stream	Credits/Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences including Management (HSM)	3	3		1	1	1	3		12
2.	Basic Science Courses (BSC)	10	6	4	3					23
3.	Engineering Science Courses (ESC)	7	13	2			2			24
4.	Professional Core Courses (PCC)			17	16	12	11	4		60
5.	Professional Elective Courses (PEC)					6	6	6		18
6.	Open Elective Courses (OEC)				3	3	3	3		12
7.	Employability Enhancement Courses (EEC)		1	1	1	1		2	8	14
8.	Industrial Training/ Internship								2	2
9.	Mandatory Non-Credit Course (MNC)									
Total		20	23	24	24	23	23	18	10	165

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SEMESTER I

		Category: HSMC				
U21GEG01	HERITAGE OF TAMILS (Common to all programs)	L	T	P	J	C
		1	0	0	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

Upon completion of the course, the student will be able to

- To learn the extensive literature of classical tamil
- To review the fine arts heritage of tamil culture
- To realize the contribution of tamils in Indian freedom struggle

COURSE OUTCOMES:

CO1: Understand the extensive literature of Tamil and its classical nature (Understand)

CO2: Understand the heritage of sculpture, painting and musical instruments of ancient people (Understand)

CO3: Review on folk and martial arts of tamil people (Understand)

CO4: Realization of thinai concepts, trade and victory of Chozha dynasty (Understand)

CO5: Understand the contribution of tamils in Indian freedom struggle, Self-esteem movement and siddha medicine (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

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

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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, Leatherpuppetry, 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

Contact Periods:

Lecture: 15 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 15 Periods

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9. 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)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

EVALUATION PATTERN:

Continuous Internal Assessment	Total
	100

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SEMESTER I

		Category: HSMC				
U21GEG01	தமிழர் மரபு (அனைத்து துறைகளுக்கும் பொதுவனது)	L	T	P	J	C
		1	0	0	0	1

முன்கூட்டிய துறைசார் அறிவு: தேவையில்லை

பாடத்தின் நோக்கங்கள்:

- தமிழ் மொழியின் இலக்கியச் செறிவைக் கற்றுணர்தல்
- தமிழர் பண்பாட்டின் நுண்கலைகள் பற்றிய ஒரு மீள்பார்வை
- இந்திய தேசிய இயக்கத்தில் தமிழர்களின் பங்கினை அறிதல்

பாடம் கற்றதின் விளைவுகள்:

CO1: தமிழ் மொழியின் செந்தன்மை மற்றும் இலக்கியங்கள் குறித்த தெரிதல் (புரிதல்)
CO2: தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்த தெளிவு (புரிதல்)
CO3: தமிழர்களின் நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த அறிமுகம் (புரிதல்)
CO4: தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள் (புரிதல்)
CO5: இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்துவம் பற்றிய புரிதல் (புரிதல்)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)					3: Substantial (High)			

பாடத்திட்டங்கள்:

அலகு I மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக்குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள் – தமிழகத்தில் சமண, பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம் – ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும்

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பாரதிதாசன் ஆகியோரின் பங்களிப்பு

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரி முனையில் திருவள்ளுவர் சிலை – இசைக்கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக, பொருளாதார வாழ்வில் கோவில்களின் பங்கு

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்க காலத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும், துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிற பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு

Contact Periods:

Lecture: 15 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 15 Periods

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)

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9. 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)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

மதிப்பீட்டு முறை:

தொடர்ச்சியான உள் மதிப்பீடு	மொத்தம்
	100

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SEMESTER I

U21MA101	CALCULUS AND DIFFERENTIAL EQUATIONS (Common to AD, BM, CE, CH, CS, CS(AIML), EC, IT, ME, MI)	Category: BSC				
		L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of matrices and calculus which will enable them to model and analyze physical phenomena involving continuous change
- To understand the methodologies involved in solving problems related to fundamental principles of calculus
- To develop confidence to model mathematical pattern and give appropriate solutions

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the knowledge of matrices with the concepts of eigenvalues to study their problems in core areas (Apply)

CO2: Apply the basic techniques and theorems of functions of several variables in other areas of mathematics (Apply)

CO3: Analyze the triple integrals techniques over a region in two dimensional and three dimensional geometry (Apply)

CO4: Apply basic concepts of integration to evaluate line, surface and volume integrals (Apply)

CO5: Solve basic application problems described by second and higher order linear differential equations with constant coefficients (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I MATRICES **9 + 3**

Eigenvalues and eigenvectors – Properties (without proof) – Cayley Hamilton theorem (without proof) – Diagonalization using orthogonal transformation – Applications

UNIT II FUNCTIONS OF SEVERAL VARIABLES **9 + 3**

Partial derivatives – Total derivative – Jacobians – Taylor's series expansion – Extreme values of

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functions of two variables – Lagrange multipliers method

UNIT III MULTIPLE INTEGRALS **9 + 3**

Double integrals – Change of order of integration – Triple integrals – Applications in area and volume

UNIT IV LINE AND SURFACE INTEGRALS **9 + 3**

Line integrals – Surface integrals – Green's theorem in a plane – Gauss divergence theorem – Stokes' theorem (excluding proofs)

UNIT V ORDINARY DIFFERENTIAL EQUATIONS **9 + 3**

Second and higher order linear differential equations with constant coefficients – Variable coefficients – Euler Cauchy equation – Legendre's equation – Method of variation of parameters – Applications

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley India Pvt Ltd, New Delhi, 2018.
2. Grewal B S, "Higher Engineering Mathematics", 44th edition, Khanna Publishers, New Delhi, 2017.

REFERENCES:

1. Bali N P and Dr Manish Goyal, "A text book of Engineering Mathematics", 12th edition, Laxmi Publications, 2016.
2. Thomas G B and Finney R L, "Calculus and Analytic Geometry", 14th edition, Pearson Education India, 2018.
3. Maurice D Weir, Joel Hass and Christopher Heil, "Thomas Calculus", 14th edition, Pearson Education, India, 2018.
4. James Stewart, "Calculus: Early Transcendental", 7th edition, Cengage Learning, New Delhi, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER I

		Category: HSMC				
U21EN101	ENGLISH FOR TECHNOLOGISTS (Common to AD, BM, CH, CE, CS, CS(AIML), EE, EC, ME, MI, IT)	L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To infer and interpret the meaning of Technical, Business, Social and Academic contexts.
- To enhance the listening skills and facilitate effective pronunciation.
- To make effective presentation and conversation in technical and professional environment.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Comprehend language and learn strategies for error-free communication (Understand)

CO2: Improve speaking skills in academic and social contexts (Apply)

CO3: Enhance both reading and writing skills to excel in professional career (Analyse)

CO4: Evaluate different perspectives on a topic (Analyse)

CO5: Develop listening skills to understand complex business communication in a variety of global English accents through Personality Development (Understand)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	1	-	2
CO4	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO5	-	-	-	-	-	-	-	2	-	3	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I SUBJECTIVE INTROSPECTION 9

Module:1 Vocabulary Building

Activity: Word Puzzles, Snappy words, Word Sleuthing

Module:2 Introducing and Sharing Information

Activity: Get to know oneself, Introducing Peer Members

Module:3 Opinion Paragraph

Activity: Note making, analyzing and writing a review

UNIT II CAREER ENHANCEMENT 9

Module:4 Reading Comprehension

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Activity: Reading Newspaper articles/Blogs, Sentence completion

Module:5E-mail Communication

Activity: Drafting personal and professional emails

Module:6 Career Profiling

Activity: Resume Writing & Digital Profiling

UNIT III LANGUAGE ADEPTNESS 9

Module:7 Rewriting passages

Activity: Conversion of voices & Rephrasing Articles

Module:8 Enhancing Pronunciation skills

Activity: Listening to short technical Reels and reproducing it

Module:9 Making Conversations

Activity: Role play & Narrating Incidents

UNIT IV TECHNICAL WRITING 9

Module:10 Spotting Errors

Activity: Proof reading, Rewriting sentences

Module:11 Data interpretation

Activity: Interpretation of Graphics/Charts/Graphs

Module:12 Expository Writing

Activity: Picture inference, Captions for Posters& Products

UNIT V LANGUAGE UPSKILLING 9

Module:13 Listening for Specific Information

Activity: TED talks/Announcement/Documentaries

Module:14 Presentation

Activity: Extempore & Persuasive Speech

Module:15 Team Communication

Activity: Team building activities, Group Discussion

LIST OF EXERCISES

1. Introducing oneself
2. Role play
3. Listening to short technical Reels
4. Listening to TED Talks/ Announcements/ Documentaries
5. Presentation
6. Group Discussion

Contact Periods:

Lecture: 15 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods

Total: 45 Periods

TEXT BOOKS:

1. Ashraf Rizvi, "Effective Technical Communication", 2nd edition, Mc Graw – Hill. India 2017.
2. Rod Ellis, "English for Engineers & Technologists", Vol. II: (English for Engineers and Technologist: A Skills Approach). 2nd edition, Orient Black Swan, 1990.

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REFERENCES:

1. Raymond Murphy, "Intermediate English Grammar", 2nd edition, Cambridge University Press, 2009.
2. Thomas L Means, "English and Communication for Colleges", 4th edition, Cengage 2017.
3. Using English: "A Coursebook for Undergraduate Engineers and Technologists", 1st edition, Orient Black Swan, 2017.

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">Assessment I
(Theory)
(100 Marks)</td><td colspan="2">Assessment II
(Practical)
(100 Marks)</td><td rowspan="2">Practical Examinations

(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>*Individual Assignment / Seminar / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)</td><td>Test</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>50</td></tr>
<tr><td colspan="4">50</td><td>50</td></tr>
<tr><td colspan="5">Total: 100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER I

U21PH101	ENGINEERING PHYSICS (Common to all branches)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental principles of laser and fibre optics with their applications
- To acquire the knowledge of ultrasonic waves, thermal conductivity and properties of liquids
- To understand the concepts of crystals

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Demonstrate the types of laser for various industrial and medical applications (Understand)

CO2: Apply the concepts of fibre optics in engineering (Understand)

CO3: Understand the production methods of ultrasonic waves and uses in engineering and medicine (Understand)

CO4: Apply the concepts of thermal conductivity in hybrid vehicles and viscosity of liquids in engineering applications (Understand)

CO5: Explain the basic concepts of crystals and its growth techniques (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I LASER 6

Laser characteristics – Spontaneous and stimulated emission – Pumping methods – CO_2 laser – Semiconductor laser – Material Processing – Selective laser Sintering – Hologram – Medical applications (Ophthalmology)

UNIT II FIBER OPTICS 6

Total internal reflection – Numerical aperture and acceptance angle – Classification of optical fibers
(Materials, modes and refractive index profile) – Fiber optical communication system –

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Displacement and temperature sensor – Medical Endoscopy

UNIT III ULTRASONICS 6

Properties of ultrasonic waves – Piezoelecrtic generator – Acoustic grating – Applications of ultrasonics in industry– SONAR – NDT – Ultrasonic scanning methods – Fetal heart movement

UNIT IV THERMAL PHYSICS AND PROPERTIES OF FLUIDS 6

Modes of heat transfer – Thermal conductivity – Lee's disc method – Solar thermal power generation – Hybrid vehicles – Microwave oven – Surface tension and coefficient of viscosity – Poiseuille's flow experiment

UNIT V CRYSTAL PHYSICS 6

Unit cell – Bravais lattices – SC, BCC, FCC structures – Miller indices – d spacing in cubic lattice – Crystal growth from melt: Bridgeman Technique – Silicon ingots from Czochralski method – Silicon wafers from ingots and its applications.

LIST OF EXPERIMENTS

1. Determination of the wavelength of a given laser source
2. Determination of acceptance angle and numerical aperture of an optical fibre
3. Determination of velocity of sound and compressibility of a liquid using Ultrasonic interferometer
4. Determination of thermal conductivity of a bad conductor using Lee's disc method
5. Determination of viscosity of the given liquid using Poiseuille's flow method

Contact Periods:

Lecture: 30 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods

Total: 60 Periods

TEXT BOOKS:

1. Bhattacharya D K and Poonam Tandon, "Engineering Physics", 2nd edition, Oxford University Press, Chennai, 2017
2. Marikani A, "Engineering Physics", 3rd edition, PHI publishers, Chennai, 2021

REFERENCES:

1. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", 2nd edition, Pearson India Education Services Private Limited, Chennai, 2018
2. Avadhanulu M N, Kshirsagar P G and Arun Murthy TVS, "A Text book of Engineering Physics", 2nd Edition, S Chand Publishing, New delhi, 2018
3. Thyagaran K, Ajoy Ghatak, "Lasers – Fundamantals and Applications", 2nd edition, Laxmi Publications Pvt Limited, New delhi, 2019
4. https://nptel.ac.in/downloads/104104085/
5. https://nptel.ac.in/courses/122107035/8/

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (Examinations will be conducted for 100 Marks)**	**Practical Examinations (Examinations will be conducted for 100 Marks)**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test		
40	60	75	25		
25		25		25	25
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER I

U21CY101	ENGINEERING CHEMISTRY (Common to all branches)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To inculcate the fundamentals of water technology and electrochemistry
- To gain basic knowledge of corrosion of metals and alloys
- To acquire knowledge about the properties of fuels and applications of polymers

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the principles of water technology in treatment of industrial and domestic water and estimate the various constituents of industrial water (Apply)

CO2: Describe the principles and applications of electro chemical cells, fuel cells and solar cells (Understand)

CO3: Outline the different types of corrosion processes and preventive methods adopted in industries (Understand)

CO4: Explain the analysis and calorific value of different types of fuels (Understand)

CO5: Classify the polymers and their engineering applications (Understand)

CO-PO MAPPING:

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	2	-	1	-	-	1	-	-
CO2	3	1	-	-	-	-	2	-	1	-	-	1	-	-
CO3	3	1	-	-	-	-	2	-	1	-	-	1	-	-
CO4	3	1	-	-	-	-	2	-	1	-	-	1	1	1
CO5	3	1	-	-	-	-	2	-	1	-	-	1	-	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)						3: Substantial (High)			

SYLLABUS:

UNIT I CHARACTERISTICS OF WATER AND ITS TREATMENT 6

Characteristics of water – Hardness – Types, Dissolved oxygen, Total dissolved solids, Disadvantages due to hard water in industries – (Scale, Sludge, Priming, Foaming and Caustic embrittlement), Water softening methods – Lime-soda, Zeolite, Ion exchange processes and reverse Osmosis and their applications. Specifications of domestic water (ICMR and WHO).

Water treatment for municipal supply – Sedimentation with coagulant – Sand Filtration – Chlorination, Disinfection methods – UV treatment, Ozonolysis, Electro dialysis

UNIT II ELECTROCHEMISTRY AND ENERGY STORAGE SYSTEMS 6

Introduction, Electrodes – (Calomel electrode), Electrochemical series and its applications, Brief

introduction to conventional primary and secondary batteries – (Pb acid, Lithium)

Fuel cells – Polymer membrane fuel cells, Solid-oxide fuel cells – Working principles, advantages, applications. Solar cells – Dye sensitized solar cells – Working principles, characteristics and applications

UNIT III CORROSION AND ITS CONTROL 6

Types – Dry – Chemical corrosion and Wet – Galvanic and differential aeration (Pitting, Crevice, pipeline) – Factors influencing rate of corrosion – Corrosion control methods – Sacrificial anode and impressed current method – Protective coating – Electroplating – Ni plating.

Alloys – Ferrous (stainless steel), Heat treatment – Non-ferrous alloys (Brass -Dutch metal, German Silver) – Composition, properties and uses

UNIT IV FUELS AND COMBUSTION 6

Fuels- Solid fuel: Coal - Analysis of coal (Proximate analysis only) – Liquid fuel – Manufacture of synthetic petrol (Bergius process) – Octane number, cetane number, Knocking in engines- Anti-knocking agents, Gasoline additives, Gaseous fuel: Compressed natural gas (CNG) – Liquefied petroleum gases (LPG) – Composition only.

Calorific value – Higher and lower calorific values – Flue gas analysis (ORSAT method). Measurement of calorific value using bomb calorimeter, Three-way catalytic converter – Selective catalytic reduction of NO_X

UNIT V POLYMERS 6

Introduction – Monomer, dimers, functionality, degree of polymerisation, transition glass temperature Classification of polymers, Difference between thermoplastics and thermosetting plastics, Engineering application of plastics - ABS, PVC, PTFE and Bakelite.

Types of compounding of plastics – Moulding, Injection moulding, Extrusion moulding, Compression moulding

Conducting polymers – Polypyrrole, Polyacetylene, Polyaniline – Structure and applications, Composites – FRP – Properties and applications

LIST OF EXPERIMENTS

1. Determination of total, permanent and temporary hardness of a given sample water by EDTA method
2. Estimation of ferrous ion by potentiometric titration
3. Estimation of Copper in Brass by EDTA method
4. Determination of percentage of moisture, volatile, ash and carbon content in a given sample of coal.
5. Determination of molecular weight and degree of polymerization of an oil sample by viscosity measurement (Ostwald's viscometer).
6. Determination of chloride content in the water sample
7. Determination of strength of HCl by pH metric method

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. Jain P C and Monika Jain, "Engineering Chemistry", 16th edition, Dhanpat Rai Publishing Company, Pvt. Ltd., New Delhi, 2015
2. Vairam S, Kalyani P and Suba Ramesh, "Engineering Chemistry", 2nd edition, Wiley India Pvt. Ltd, New Delhi, 2014

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", 2nd edition, Scientific International Pvt. Ltd, New Delhi, 2014
2. Prasanta Rath, "Engineering Chemistry", 1st edition, Cengage Learning India, Pvt. Ltd, Delhi, 2015

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3. Shikha Agarwal, "Engineering Chemistry, Fundamentals and Applications", 1st edition, Cambridge University Press, 2015
4. https://nptel.ac.in/courses/113/104/113104008/

EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		25	25
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER I

U21CSG01	PROBLEM SOLVING AND C PROGRAMMING (Common to all branches)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide exposure to problem-solving through programming
- To develop computational thinking perspective of one's own discipline
- To write, compile and debug programs using C language

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Formulate the algorithmic solutions for a given computational problem (Understand)

CO2: Describe modularization, structures and pointers in C language (Understand)

CO3: Design and implement algorithms for a given problem using C control structures (Apply)

CO4: Apply the C programming constructs for searching and sorting techniques (Apply)

CO5: Solve real time problems using suitable non-primitive data structures in C (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	-	-	-	1	2	2	-	3	-	-
CO2	2	1	1	2	-	-	-	1	2	2	-	2	-	-
CO3	3	2	2	2	-	2	-	1	2	2	-	2	-	-
CO4	3	2	2	2	-	-	-	1	2	2	-	2	-	-
CO5	3	2	2	2	-	-	-	1	2	2	-	2	-	-
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)					3: Substantial (High)						

SYLLABUS:

UNIT I COMPUTATIONAL THINKING 6

Computational Thinking – Modern Computer – Information based Problem solving – Real world information and Computable Data – Data types and data encoding – Number Systems – Introduction to programming languages – Basics of C programming – variables– Data types – keywords – C program structure – Simple programs in C

UNIT II ALGORITHMIC APPROACH 6

Logic – Boolean Logic – Applications of Propositional logic – Problem Definition – Logical Reasoning and Algorithmic thinking – Pseudo code and Flow chart – Constituents of algorithms – Sequence, Selection and Repetition – Problem understanding and analysis – Control structures in C – Algorithm design and implementation using control structures

UNIT III SEARCHING, SORTING, AND MODULARIZATION 6

Data Organization – Arrays – Introduction to Searching and Sorting – Linear Search, Binary Search

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– Basic sorting techniques – Two-dimensional arrays – Matrix manipulation – Modularization – Functions – Function prototype – Function definition – Function call – Built-in functions (string functions and math functions) – Recursion

UNIT IV STRUCTURES AND POINTERS 6

Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program – Sorting of names – Parameter passing – Pass by value – Pass by reference – Structure – Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Unions

UNIT V FILES 6

Files – Types of file processing – Sequential access – Random access – Sequential access file – Example Program – Finding average of numbers stored in sequential access file – Random access file – Example Program – Transaction processing using random access files – Command line arguments

LIST OF EXPERIMENTS

A. Lab Programs

1. Using IO Statements, get higher secondary marks of a student. Calculate and display the medical and engineering cut-off marks. [Assume the calculation formula]
2. Develop a C program to emulate the operations of an ATM using control structures. Authentication, Deposit, Withdrawal, and Balance check and pin change operations are to be supported.
3. Develop a calculator to perform the operations including addition, subtraction, multiplication, division and square of a number.
4. Given different prices of a vegetable which is varying through the day (from morning to evening), find out the best buy price and sell price for the maximum profit. Eg. For the prices [33, 35, 28, 36, 39, 25, 22, 31], best buy is at 28 and best sell is at 39.
5. Collect height and weight of 4 of your friends and calculate their body mass index. Use 2 dimensional array to store the values.
6. Weights of 10 students of your class who are standing in a line is given in a random order. Find out if there is a heavy person whose weight is the sum of previous two persons.
7. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
8. From a given paragraph perform the following using built-in functions:
   a) Find the total number of words.
   b) Capitalize the first word of each sentence.
9. Solve Towers of Hanoi using recursion.
10. Develop an expense manager which reads date, product, price and product category. The program should display the total expense amount based on product category or date as per user's selection. Use structures.
11. Develop a banking application to store details of accounts in a file. Count the number of account holders based on a search condition such as - whose balance is less than the minimum balance.

B. Mini Project (SAMPLE)

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Create a Railway Reservation system with the following modules of Booking,

- Availability checking
- Cancellation
- Prepare chart

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. David D. Railey and Kenny A.Hunt , "Computational Thinking for.Modern problem Solver", 1st Edition, CRC Press, 2014
2. Brian W. Kernighan and Dennis Ritchie, " The C Programming Language" , 2nd Edition, Pearson, 2015

REFERENCES:

1. Paolo Ferragina and Fabrizio Luccio, "Computational Thinking First Algorithms", Then Code" ,1st Edition,Springer International Publishing, 2018
2. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016
3. Paul Deitel and Harvey Deitel, "C How to Program", 7th Edition, Pearson Publication
4. Juneja, B. L and Anita Seth, "Programming in C",1st Edition, Cengage Learning India Pvt. Ltd., 2011
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th colspan="2">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I
(Theory)
(100 Marks)</th><th colspan="2">Assessment II
(Practical)
(100 Marks)</th><th rowspan="2">Theory Examinations
(Examinations will be conducted for 100 Marks)</th><th rowspan="2">Practical Examinations
(Examinations will be conducted for 100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record
(Rubrics Based Assessments)</td><td>Test</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td><td></td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>25</td><td>25</td></tr>
<tr><td colspan="4">50</td><td colspan="2">50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER I

U21MEG01	ENGINEERING GRAPHICS	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To expose the standards and conventions followed in preparation of engineering drawings
- To develop graphic skills for communication of concepts, ideas and engineering drawings
- To expose on 2D & 3D drawings and its projections

COURSE OUTCOME:

Upon completion of the course, the student will be able to

CO1: Sketch the curves and orthographic projections of points as per BIS conventions (Apply)

CO2: Illustrate the orthographic projections of straight lines and plane surfaces (Apply)

CO3: Sketch the orthographic projections of solids, lateral surfaces of frustums, truncated solids and its development (Apply)

CO4: Develop the lateral surfaces of simple solids (Apply)

CO5: Interpret the orthographic and isometric views of simple components (Apply)

CO PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	3	-	-	1	-	2	-	1	-	-
CO2	3	2	2	-	3	-	-	-	-	2	-	1	-	-
CO3	3	2	2	-	3	-	-	-	-	3	-	1	-	-
CO4	3	2	2	-	3	-	-	-	-	3	-	1	-	-
CO5	3	2	2	-	3	-	-	-	-	3	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

BASICS OF ENGINEERING DRAWING AND CAD (Not for examination)

Introduction – Drawing instruments and its uses – Sheet layout – BIS conventions – Lines – Lettering and dimensioning practices – Lines – Co – Ordinate points – Axes – Poly lines – Square – Rectangle – Polygons – Splines – Circles – Ellipse – Text – Move – Copy – Off – Set – Mirror – Rotate – Trim – Extend – Break – Chamfer – Fillet – Curves – Constraints viz. agency – Parallelism – Inclination and perpendicularity

UNIT I CONICS, SPECIAL CURVES AND PROJECTION OF POINTS 12

Construction of parabola – Ellipse and hyperbola using eccentricity method – Construction of involutes for squares and circles – Construction of Tangent and normal to the above curves – Introduction – Method of projection – Planes of projection – Reference line and notations

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Orthographic Projection of points – Points in all four quadrants

UNIT II PROJECTION OF STRAIGHT LINES AND SURFACES 12

Projection of straight lines – Lines inclined to HP / VP plane – Inclined to both HP and VP planes (straight lines are assumed to be in first quadrant only) – Projection of planes – Projection of square – Rectangle – Pentagon – Hexagon and circular plane – Inclined to both the plane by change of position method

UNIT III PROJECTION OF SOLIDS 12

Introduction – Projection of solids – Prisms – Pyramids – Cylinders and cones with axis inclined to both the planes (Solids resting on HP only)

UNIT IV DEVELOPMENT OF LATERAL SURFACES OF SOLIDS 12

Introduction – Cutting plane – Sectional views of right regular solids resting with base on HP – Prisms – Pyramids – Cylinder and cone – True shapes of the sections – Development of lateral surfaces of right regular prisms – pyramids – Cylinders – Cones resting with base on HP only – Development of the frustums and truncations

UNIT V ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS 12

Orthographic projection – Simple machine components using free hand sketching – Isometric projection – Simple Solid exercises and combination of solids

Contact Periods:

Lecture: - Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total: 60 Periods

TEXT BOOKS:

1. ND Bhat & VM Panchal, "Engineering Drawing", Charotar Publishing House, Gujarat, 51st edition, 2013.
2. Venugopal K. and Prabhu Raja V, "Engineering Graphics", New Age International (P) Limited, 6th edition 2019.

REFERENCE BOOKS:

1. Natrajan K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 21st edition 2017.
2. Sam Tickoo, AutoCAD 2013 for Engineers and Designers, Dream tech Press, 1st edition 2013.
3. M.H.Annaiah & Rajashekar Patil, Computer Aided Engineering Drawing, New Age International Publishers,4th edition,2012.
4. Basant Aggarwal, Engineering Drawing, Tata Mc Graw Hill Education Private Limited, 1st edition, 2010.
5. D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, New Delhi, Revised edition.,2010.

EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test	
75	25	
100		100
60		40
100		

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SEMESTER I

U21ECG03	ENGINEERING STUDIO (Common to all Programmes)	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To enable the students understand the functioning of simple to complex devices and systems
- To help the students design and build simple applications on their own
- To create an immersive environment in the engineering lab

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand basics of electronics (Understand)

CO2: Use basic electronic components and Arduino for prototyping (Apply)

CO3: Create simple real time use cases (Create)

CO-PO MAPPING:

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	2	-	-	-	1	-	-	1	-	-
CO2	3	3	3	3	2	2	1	1	2	-	-	1	-	-
CO3	3	3	3	3	3	2	3	3	3	-	-	3	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

LIST OF EXPERIMENTS

Basics of Electronics

1. Breadboard Basics – LED glowing, Ohm's Law
   Series and Parallel Circuits
2. Controlling the circuit response using Potentiometer
   Capacitor Charging and Discharging
3. Water level Indicator using transistor
   Touch sensor using transistor
4. Automatic night light- (LDR –transistor) circuit
   Fire alarm Circuit
5. IR Sensor-Obstacle detecting circuit
   Doorbell using 555 Timer circuit
6. LED Chaser circuit using Counter IC
   Shadow detector using IC741
7. Regulated output using Regulator IC
   Logic gate Realization

Basics of IoT (With Arduino)

1. Basics of ARDUINO and IoT
   Working with LEDs
2. Working with digital switch
   Adjusting voltage using potentiometer

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KPRIET
Learn Beyond

3. Measuring the presence / absence of light using LDR
   Finding the distance of an object using ultrasonic sensor
4. Finding the Temperature and Humidity in the surroundings
   Detecting the motion of human using PIR
5. Working with Servo motor
   Establish communication using Bluetooth

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total 60 Periods

EVALUATION PATTERN:

Continuous Internal Assessments
Evaluation of course workbook, Tasks **(Rubrics based)**
100

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SEMESTER II

		Category: HSMC				
		L	T	P	J	C
U21GEG02	தமிழரும் தொழில்நுட்பமும் (அனைத்து துறைகளுக்கும் பொதுவனது)	1	0	0	0	1

முன்கூட்டிய துறைசார் அறிவு: தேவையில்லை

பாடத்தின் நோக்கங்கள்:

- தமிழர்களின் சங்ககால நெசவு, பானை வனைதல் மற்றும் கட்டட தொழில்நுட்பம் குறித்து அறிதல்
- தமிழர்களின் சங்ககால வேளாண்மை, நீர்ப்பாசனம் மற்றும் உற்பத்தி முறைகள் குறித்த கற்றல்
- நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிதல்

பாடம் கற்றதின் விளைவுகள்:

CO1: சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானை வனைதல் தொழில்நுட்பம் குறித்த கற்றுணர்தல் (புரிதல்)
CO2: சங்ககாலத் தமிழர்களின் கட்டட தொழில்நுட்பம், கட்டுமானப் பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்த அறிவு (புரிதல்)
CO3: சங்ககாலத் தமிழர்களின் உலோகத்தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு (புரிதல்)
CO4: சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு (புரிதல்)
CO5: நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்துதலும் (கற்றலை பயன்படுத்துதல்)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)					3: Substantial (High)			

பாடத்திட்டங்கள்:

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்

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அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்க காலத்தில் வீட்டுப் பொருட்களின் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும் கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல் – மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாடு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை

அலகு III உற்பத்தித் தொழில்நுட்பம் 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருகுதல், எக்கு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்

அலகு V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் – தமிழ் மின்நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்

Contact Periods:

Lecture: 15 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 15 Periods

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies

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7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9. 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)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

மதிப்பீட்டு முறை:

தொடர்ச்சியான உள் மதிப்பீடு	மொத்தம்
	100

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KPRIET
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SEMESTER II

U21MA201	LAPLACE TRANSFORMS AND COMPLEX VARIABLES (Common to CE, EE, CH, ME, MI)	Category: BSC				
		L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the mathematical aspects of conversion time domain to frequency domain using Laplace transform and Inverse Laplace transform vice versa
- To use the concepts of complex analysis, in the study of heat flow, fluid dynamics and electrostatics
- To understand the concepts of singularities in the various domains of engineering fields

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the concepts of Laplace transform in core engineering applications (Apply)

CO2: Apply the concepts of inverse Laplace transform with their properties in engineering field (Apply)

CO3: Analyze the complex functions and their mapping in certain complex planes (Understand)

CO4: Evaluate complex contour integrals directly and use the Cauchy integral theorem in its various versions (Understand)

CO5: Compute the residues of a function at given points or singularities and use the residue theorem to evaluate a contour integral (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I LAPLACE TRANSFORM **9 + 3**

Laplace transform – Conditions for existence – Transform of elementary functions – Standard properties (statement only) – Transforms of unit step function – Impulse function – Periodic function – Initial and final value theorems – Convolution theorem(without proof)

UNIT II INVERSE LAPLACE TRANSFORM **9 + 3**

Inverse Laplace transform – Standard properties (statement only) – Second order linear differential equations with constant coefficients

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UNIT III COMPLEX DIFFERENTIATION 9 + 3

Analytic functions: Cauchy-Riemann equations (Cartesian form) and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Construction of analytic functions – Bilinear transformations

UNIT IV COMPLEX INTEGRATION 9 + 3

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula

UNIT V SINGULARITIES AND RESIDUES 9 + 3

Taylor's and Laurent's series expansions – Singular points – Classification of singularities – Residues – Cauchy's residue theorem

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley India Pvt Ltd, New Delhi, 2018.
2. Grewal B S, "Higher Engineering Mathematics", 44th edition, Khanna Publishers, New Delhi, 2017.

REFERENCES:

1. Bali N P and Dr Manish Goyal, "A text book of Engineering Mathematics", 12th edition, Laxmi Publications, 2016.
2. Thomas G B and Finney R L, "Calculus and Analytic Geometry", 14th edition, Pearson Education India, 2018.
3. James Stewart, "Calculus: Early Transcendental", 7th edition, Cengage Learning, New Delhi, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESETR II

U21MEG03	BASICS OF MECHANICAL AND ELECTRICAL ENGINEERING (for B.E Civil Engineering)	Category: ESC				
		L	T	P	L	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To familiarize with basic mechanical elements, cycle and power plants
- To understand the concepts of safety and Industrial principles
- To know different types of DC and AC motors

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Recognize various mechanical elements and list out the applications and functions (Understand)

CO2: Understand the working of power plants, machinery and IC Engines (Understand)

CO3: Recall various safety requirements and software required for mechanical engineering (Understand)

CO4: Acquire the knowledge of operating principles, characteristics, starting, and speed control methods of DC motors (Understand)

CO5: Explain the operating principles of AC motor and characteristics, starting methods of Induction motor (Understand)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	1	-	-	-	-	1	1	-	-
CO2	3	2	-	-	-	1	-	-	-	-	1	1	-	-
CO3	3	2	-	-	-	1	-	-	-	-	1	1	-	-
CO4	3	2	-	-	-	1	-	-	-	-	1	1	-	-
CO5	3	2	-	-	-	1	-	-	-	-	1	1	-	-
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)			3: Substantial (High)								

SYLLABUS:

UNIT I BASIC MECHANICAL ELEMENTS 9

Basic Concepts and demonstration: Bearings Gears – Belt drives Chain drives – Cable drives – Chain block – Conveyers – Shafts – Keys – Spline shafts – Springs – Fasteners – Screws – Bolts – nuts and their specifications – Fundamental Hydraulics and Pneumatics – Valves and Cylinders – FRL units

UNIT II MECHANICAL CYCLES, POWER PLANTS AND IC ENGINES 9

Rankine Cycle – Refrigeration and Air conditioning – VARG and VCRC systems – Power Plants – Steam – Gas – Diesel – Hydroelectric and Nuclear Power plants – Turbines and Pumps – Classification and functions IC Engines – SI and CI engines – Two stroke and four stroke Engines

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UNIT III INDUSTRIAL ENGINEERING 9

Introduction to safety engineering – Evolution of Safety – Improvements Required – Safety Organization – Safety Functions – Workplace Operations Requiring Safety – Safety Benefits – Software In Mechanical Industry – Introduction to Modelling and Analysis software – Basic Concepts and Application of IoT to Industrial processes

UNIT IV DC MOTOR 9

DC motor Construction – Principle of operation – Types – Torque equation – Characteristics and applications – Starters for DC motor – Two point – Three point – Speed control – Armature and field control (Qualitative Analysis only)

UNIT V TRANSFORMER AND AC MOTOR 9

Single phase transformer – Three phase Induction motor – Construction – Principle of operation – characteristics – And applications – Starters – DOL – Star – Delta

Contact Periods:

Lecture: 45 Periods Tutorial: Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Basant Agarwal and C.M. Agarwal," Basics of Mechanical Engineering", Wiley India Pvt. Ltd New Delhi, 3rd edition, 2018.
2. Rajput R.K, "Electrical Machines", Laxmi Publications, 6th edition, 2016.

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 3rd edition, 2010
2. Venugopal K. and Prabhu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 5th edition, 2010.
3. S.K. Bhattacharya, "Electrical Machines", McGraw–Hill Education, New Delhi, 4th edition, 2017.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER II

U21CE201	ENGINEERING MECHANICS	Category: ESC				
		L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge of static equilibrium of particles and rigid bodies
- To comprehend the effect of friction on equilibrium
- To understand the laws of motion, kinematics of motion and their interrelationship

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the fundamental concepts in determining the effect of forces acting on a particle (Apply)

CO2: Analyze different types of rigid bodies and calculate the moment use of various principles in the determination of effect of forces in a rigid body (Apply)

CO3: Understand the concepts of frictions and application of statics (Apply)

CO4: Compute centroid and second moment of area for different sections (Apply)

CO5: Apply the principles of kinematics and kinetics in solving problems in dynamics (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	1	-	-	-	-	-	-	1	2	-
CO3	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	1	-	-	-	-	-	-	-	-	-	1	-
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)			3: Substantial (High)								

SYLLABUS:

UNIT I STATICS OF PARTICLES 9

Introduction – Laws of Mechanics, Parallelogram and triangular Laws of forces – Coplanar Forces Resolution and Composition of forces – Free body diagram – Equilibrium of a particle – Lami's theorem – Equilibrium of a particle in space

UNIT II STATICS OF RIGID BODIES 9

Principle of transmissibility – Moment of force about a point – Varignon's theorem – Moment of a couple – Equivalent couple – Moment of force about an axis – Coplanar non–concurrent forces acting on rigid bodies – Resultant and equilibrium – Resolution of a given force into force couple system – Equilibrium in three dimensions – Reactions and supports

UNIT III FRICTION AND APPLICATION OF STATICS 9

Friction–Frictional forces–Laws of coulomb's friction–simple contact friction–Ladder fiction–Belt

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friction–Rolling resistance

UNIT IV PROPERTIES OF SURFACE AND SOLIDS 9

Determination of areas and volumes–Pappus Guldinus theorem–Radius of gyration–First moment of area and centroid of sections–Rectangle, Circle ,triangle from integration– T section, I section, Angle section, Hollow section–Second and product moments of plane area–Rectangle, Circle from integration–T section, I section, Hollow section and Angle section–Parallel axis and Perpendicular axis theorem–Polar moment of inertia

UNIT V DYNAMICS OF PARTICLES 9

Kinematics: Displacement, velocity and acceleration and their relationship–Relative motion–Rectilinear motion– Projectile motion

Kinetics: Newton's law, D'Alemberts Principle–Principle of work Energy equation of particles–Impulse and momentum–Impact of Elastic bodies

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. N.H.Dubey., "Engineering Mechanics–Statics and Dynamics", 6th edition, Tata Mc Graw Hill Private Ltd.NewDelhi 2013
2. Palanisamy M.S. and Nagan.S ."Engineering Mechanics – Statics and Dynamics", 1St edition, Tata Mc Graw Hill Private Ltd. New Delhi 2011

REFERENCES:

1. Bansal R.K., "Engineering Mechanics", 9th edition, Lakshmi Publications Private Ltd, New Delhi 2017
2. Beer F.P and Johnson Jr.E.R, "Vector Mechanics for Engineers–Statics and Dynamics", 6th edition, Mc Graw Hill International Edition 2010
3. Hibbler R C., "Engineering Mechanics", Vol.1 Statics, Vol.2 Dynamics, 4th edition, Pearson Education Asia Pvt Ltd.2010
4. Rajasekaran S and Sankarasubramanian G, "Engineering Mechanics–Statics and Dynamics", 7th edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided based on the nature of the courses

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SEMESTER II

U21CE202	BUILDING MATERIALS	Category: ESC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the knowledge on properties of stones, bricks and concrete blocks
- To understand the types and characteristics of cement and aggregates
- To identify the properties of modern materials used in concrete

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the properties of stones, bricks and concrete blocks (Understand)

CO2: Identify the ingredients to be used in manufacture of concrete along with its properties (Apply)

CO3: Interpret various timber and other materials to be used in construction (Understand)

CO4: Classify the different types of building finishes (Understand)

CO5: Choose the appropriate modern materials available in construction industry (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1	-	2
CO2	3	2	-	-	-	2	-	-	-	-	-	2	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	-	-	-	-	-	2	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

SYLLABUS:

UNIT I STONES – BRICKS – CONCRETE BLOCKS 9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Concrete blocks – Lightweight concrete blocks

UNIT II CEMENT – AGGREGATE 9

Cement – Ingredients – Manufacturing process – Types and Grades – Tests on cement – Fine Aggregate – River sand and M-Sand – Coarse aggregate – Natural and Manufacturing Aggregate – Test on aggregate (Fine and Coarse Aggregate)

UNIT III TIMBER AND OTHER MATERIALS 9

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermocol – Panels of laminates –

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Steel – Aluminum and Other Metallic Materials – Composition – Aluminum composite panel – Market forms

UNIT IV BUILDING FINISHES 9

Plastering – types – cement mortar plastering – Paints – types of paints – interiors– exteriors– paints for special use; weather shield – water proof paint –Varnishes –Distempers– Bitumen – Plastic classification – Properties – Uses

UNIT V MODERN MATERIALS 9

Glass – Ceramics – Fibre glass reinforced plastic–Composite materials – Types – Applications of laminar composites – Fibre textiles– Geomembranes and Geotextiles for earth reinforcement

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total: 45 Periods

TEXT BOOKS:

1. Varghese.P.C, "Building Materials", 3rd Edition, PHI Learning Pvt. Ltd, New Delhi, 2015
2. Rajput. R.K., "Engineering Materials", 1st edition, S.Chand and Company Ltd., 2008

REFERENCES:

1. Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2013
2. Duggal.S.K., "Building Materials", 4th Edition, New Age International, 2012
3. Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", 3rd Edition, Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012
4. Rangwala, "Engineering materials", 6th Edition Charotar Publishers, 2015
5. Jagadish.K.S, "Alternative Building Materials Technology", 1st edition, New Age International, 2007.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided based on the nature of the courses

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SEMESTER II

U21PH201	MATERIALS SCIENCE (Common to all branches except BME)	Category: BSC				
		L	T	P	J	C
		2	0	0	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To gain the knowledge of conducting and semiconducting materials
- To understand the concepts of magnetic, dielectric and optical properties of materials
- To enhance the knowledge of new engineering materials

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Demonstrate the electrical characteristics of conducting materials (Understand)

CO2: Interpret the properties and types of semiconducting materials (Understand)

CO3: Compare various types of magnetic materials for engineering applications (Understand)

CO4: Explain the fundamental concepts of dielectric and optical materials (Understand)

CO5: Examine new engineering materials for industrial applications (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO4	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO5	3	2	-	-	-	1	-	-	-	-	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I CONDUCTING MATERIALS 6

Classical free electron theory – Expression for electrical conductivity and thermal conductivity – Wiedemann - Franz law – Drawbacks – Fermi distribution function – Density of energy states in metals

UNIT II SEMICONDUCTING MATERIALS 6

Intrinsic and Extrinsic semiconductor – Carrier concentration in n-type semiconductor – P-type semiconductor(qualitative) – Applications of semiconductors – Solar cell – LED – Hall effect and its experimental determination

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UNIT III MAGNETIC MATERIALS 6

Origin of magnetism – Dia, para and ferro magnetic materials – Domain theory – Soft and hard magnetic materials – Magnetic bubble memories – GMR sensor

UNIT IV DIELECTRIC AND OPTICAL MATERIALS 6

Dielectrics – Types of polarisation – Electronic polarisation – Dielectric breakdown – Ferroelectrics – Applications of dielectrics – Classification of optical materials – Nonlinear optics – Applications

UNIT V NEW ENGINEERNG MATERIALS AND CHARACTERIZATION TECHNIQUES 6

SMA – SiC – GaN – Rheological materials – Nanomaterials – Synthesis (Ball milling and CVD) – Quantum dot, quantum wire and quantum well(qualitative) – Characterisation techniques – Powder XRD(qualitative) – SEM

Contact Periods:

Lecture: 30 Periods Tutorial: - Periods Practical: - Periods Project: - Periods

Total: 30 Periods

TEXT BOOKS:

1. Wahab M A, "Solid State Physics: Structure and Properties of Materials", 3rd edition, Narosa Publishing House, Chennai, 2018
2. Marikani A, "Materials Science", 1st edition, PHI publishers, Chennai, 2017

REFERENCES:

1. Pillai S O "Solid State Physics", 9th edition, New Age International Publishers, New Delhi, 2020
2. Bangwei Zhang, "Physical Fundamentals of Nanomaterials", Chemical Industry Press, China, 2018
3. Joginder Singh Galsin, "Solid State Physics – An Introduction to Theory", Academic Press, India, 2019
4. https://nptel.ac.in/courses/108/108/108108122/
5. https://nptel.ac.in/courses/113/105/113105081/

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided based on the nature of the courses

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SEMESTER II

U21EN201	PERSONALITY ENHANCEMENT (Common to AD, BM, CH , CE, CS, CS(AIML),EE,EC,ME,MI,IT)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop of personality traits that contributes in the professional environment
- To create a basic awareness about the significance of soft skills in professional and interpersonal communications
- To enhance the level of self-confidence that helps to excel in the leadership skills

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Nurture a deep understanding of personality development and interpersonal relationship for overall self-development (Understand)

CO2: Communicate proficiently in high-end interviews and in all social situations (Understand)

CO3: Synthesize complex concepts and present them in speech and writing (Analyse)

CO4: Negotiate and lead teams towards success (Understand)

CO5: Present ideas in an effective manner using web tools (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	-	-	-	-	-	-	-	1	2	3	-	1	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	-	-	1
CO4	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO5	-	-	-	-	-	-	-	1	-	3	-	-	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I LEXICAL REASONING 9

Module:1 Establishing Associations

Activity: Verbal Analogy, Logical Reasoning

Module:2 Lateral Thinking

Activity: Reasoning and Assertions

Module:3 Sentence Completion

Activity: Cloze Test, Single Word Substitutes

UNIT II SOCIAL CORRESPONDENCE 9

Module:4 Etiquettes

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Activity: Brain storming & performing in actions

Module:5 Introspection

Activity: SWOT Analysis, Goal Setting

Module:6 Co-verbal Gesture

Activity: Body Language, Non verbal cues

UNIT III ART OF NETWORKING 9

Module:7 Addressing a Multitude

Activity: Welcome address, Vote of Thanks, Public Speaking

Module:8Persuasive Communication

Activity: Making Technical Presentation

Module:9 Career Oriented Communication

Activity: Face to face Conversation, Mock Interview

UNIT IV CRITICAL THINKING 9

Module:10 Organizing ideas

Activity: Mind Mapping

Module:11 Problem Solving Skills

Activity: Conflict management, Case Study

Module:12 Critical Review

Activity: Book/ Movie Review, Comparative Analysis

UNIT V CONTENT WRITING 9

Module:13 Reports

Activity: Writing Event Report, Project Report

Module:14 Writing for Digital platform

Activity: Writing Posts, Blogs

Module:15 Developing Content

Activity: Product Description, Writing Proposals

LIST OF EXERCISES

1.Listening to Inspirational Speech

2.Listening to Product Description

3.Book/Movie Review

4.Presentation

5.Mock Interview

6.Public Speaking

Contact Periods:

Lecture: 15 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods

Total: 45 Periods

TEXT BOOKS:

1. Meenakshi Raman & Sangeetha Sharma. "Professional English: for AKTU",1st edition, Oxford University Press. 2018.
2. Barun. K.Mitra. "Personality Development and Soft Skills", OUP India. 2nd edition, 2016.

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REFERENCES:

1. Mathew Allen. "Smart Thinking: Skills for Critical Understanding and Writing", 2nd edition, OUP India, 2016.
2. Means, Thomas L, "English and Communication for Colleges", 4th edition, Cengage 2017
3. Using English: "A Coursebook for Undergraduate Engineers and Technologists", 1st edition, Orient Black Swan, 2017

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">Assessment I
(Theory)
(100 Marks)</td><td colspan="2">Assessment II
(Practical)
(100 Marks)</td><td rowspan="2">Practical Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>*Individual Assignment / Seminar / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)</td><td>Test</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>50</td></tr>
<tr><td colspan="4">50</td><td>50</td></tr>
<tr><td colspan="5">Total: 100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER II

U21CSG02	PYTHON PROGRAMMING (Common to All Branches)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand syntax and semantics of python programming
- To implement programs using python data structures
- To gain expertise in using python libraries for solving real time problems

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Describe the basic operations of tokens in python (Understand)

CO2: Demonstrate the programs using control statements (Apply)

CO3: Develop programs using python data structures (Apply)

CO4: Implement the exceptions in file-handling concepts (Apply)

CO5: Apply the python libraries in real-world problems (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	-	-	-	1	2	2	-	2	-	-
CO2	2	1	1	2	-	-	-	1	2	2	-	2	-	-
CO3	3	2	2	2	-	-	-	1	2	2	-	2	-	-
CO4	3	2	2	2	-	-	-	1	2	2	-	2	-	-
CO5	3	2	2	2	1	-	-	1	2	2	-	2	-	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I LANGUAGE BASICS 6

Python interpreter and interactive mode – Tokens – Data types – Numbers and math functions – Input and Output operations – Comments – Reserved words – Indentation – Operators and expressions – Precedence and associativity – Type conversion – Debugging – Common errors in Python

UNIT II CONTROL STATEMENTS, FUNCTIONS, AND MODULES 6

Selection – Conditional branching statements – if – if-else – Nested-if – if-elif-else statements – Iterative statements – while – for loop – break – continue and pass statements – Functions – Function Definition and Function call – Variable scope and Lifetime – Return statement – Lambda functions or Anonymous functions – Recursion – Modules and Packages

UNIT III PYTHON DATA STRUCTURES 6

Strings – Slicing – Immutability – Built-in string methods and functions – Concatenating – Appending and Multiplying strings – String modules – List – Creation – Accessing values – Slicing – List methods

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– In-built functions for Lists – Tuples – Creation – Operations on tuples – Traversing – Indexing and Slicing – Tuple assignment – In-built functions for tuples – Sets – Creation – Operations – Dictionaries – operations and methods

UNIT IV EXCEPTION AND FILE HANDLING 6

Exceptions – Errors and Exceptions – Handling exception – Built-in and User-defined exceptions – Files – Types – Operations – Open – Read – Write – Close

UNIT V NUMPY and PANDAS 6

Numpy – Introduction – Computations using NumPy functions – Computation on Arrays – Aggregation – Indexing and Sorting – Pandas – Introduction and Basic Pandas Concepts – Data frames – Data Handling

LIST OF EXPERIMENTS

1. Programs on selection and Iteration operations.
2. Get an integer input from a user. If the number is odd, then find the factorial of a number and find the number of digits in the factorial of the number. If the number is even, then check the given number is palindrome or not.
3. Strings and its operations.
4. Given two strings, PRINT (YES or NO) whether the second string can be obtained from the first by deletion of none, one or more characters.
5. List and its operations.
6. Programs for positive and negative indexing.
7. Program to check if the given list is in Ascending order or Not.
8. Tuples and its operations.
9. Python program to convert a tuple to a string.
10. Python program to reverse a tuple.
11. Sets and its operations.
12. Python program to check if a set is a subset of another set.
13. Dictionaries and its operations.
14. Python program to iterate over dictionaries using for loops.
15. Computations using NumPy functions.
16. NumPy program to convert a list of numeric value into a one-dimensional NumPy array.
17. NumPy program to convert a list and tuple into arrays.
18. Data manipulations using Pandas.
19. Program to convert a NumPy array and series to data frames.
20. Program to add, subtract, multiple and divide two Pandas Series.
21. Program to retrieve and manipulate data using dataframes.

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. Reema Thareja, "Python programming: Using problem solving approach", 1st Edition, Oxford Press, 2017
2. William McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, Shroff/O'Reilly Publication, 2017

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", 2nd Edition, McGrawHill Education, 2018
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach",1st Edition, Pearson India Education Services Pvt. Ltd., 2016
4. https://python-iitk.vlabs.ac.in/List%20of%20experiments.html

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5. http://greenteapress.com/wp/think-python/

EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		25	25
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER III

		Category: BSC				
U21MA303	FOURIER ANALYSIS AND BOUNDARY VALUE PROBLEMS (Common to CE, EE, ME, MI)	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of partial differential equations and its solutions
- To understand the concept of Fourier series and Fourier transform techniques in the field of engineering
- To understand the mathematical aspects that contribute to the solution of one and two dimensional PDEs

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the fundamental concepts of partial differential equations to solve real life practical applications (Apply)

CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications and digital signal processing (Apply)

CO3: Analyze the spectral characteristics of signals using Fourier transforms to find the discrete/continuous function arising in signals (Apply)

CO4: Apply Fourier series to solve an initial–boundary value problem for one dimensional wave and heat equation (Apply)

CO5: Apply Fourier series to solve an initial–boundary value for two dimensional heat equations (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Solution methods for second order homogeneous equations with constant coefficients

UNIT II FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series –

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Parseval's identity – Harmonic analysis

UNIT III FOURIER TRANSFORM **9 + 3**

Fourier transform pair – Fourier sine and cosine transforms – Properties (without proof) – Transforms of simple functions – Convolution theorem – Parseval's identity

UNIT IV ONE DIMENSIONAL BOUNDARY VALUE PROBLEMS **9 + 3**

Fourier series solution – Vibration of strings – One dimensional wave equation – One dimensional heat flow equation (unsteady state)

UNIT V TWO DIMENSIONAL BOUNDARY VALUE PROBLEMS **9 + 3**

Fourier series solution – Two dimensional (steady state) heat flow equations(Cartesian form only) separation of variables

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics",10th edition Wiley India Pvt Ltd, New Delhi, 2018.
2. Grewal B. S, "Higher Engineering Mathematics", 44th edition, Khanna Publishers, 2017.

REFERENCES:

1. Bali N.P and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications; 12th edition, 2016.
2. Wylie C. R. and Barrett L. C, "Advanced Engineering Mathematics", 6th edition, Tata McGraw-Hill, New Delhi, 2016.
3. Narayanan S, Manicavachagom Pillay T. K. and Ramanaiah G, "Advanced Mathematics for Engineering Students", Vol. II & III, 2nd edition, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="2">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I
(100 Marks)</th><th colspan="2">Assessment II
(100 Marks)</th></tr>
<tr><td>*Individual Assignment / Seminar / MCQ</td><td>Written Test</td><td>Individual Assignment / Seminar / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER III

		Category: PCC				
		L	T	P	J	C
U21CE301	CONCRETE TECHNOLOGY	3	0	0	0	3

PRE–REQUISITES:

- U21CE202: Building Materials

COURSE OBJECTIVES:

- To learn the characteristics on various concrete making materials as per IS codal provisions and to understand their properties
- To explore various methods of mix design for concrete
- To study the properties of fresh and hardened concrete

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the various requirements of cement, aggregate and water for making concrete (Understand)

CO2: Choose admixtures to enhance the properties of concrete (Understand)

CO3: Design the concrete mix for various strength using IS & ACI methods (Apply)

CO4: Evaluate the strength and durability parameters of concrete (Apply)

CO5: Identify the importance and application of special concrete (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	-	-	-	-	-	-	-	-	2	2
CO2	3	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	3	1	-	2	-	-	-	-	-	-	2	2
CO4	3	2	3	1	-	-	-	-	-	-	-	-	2	2
CO5	3	2	3	-	-	2	-	-	-	-	-	-	2	2
Correlation levels:	1: Slight (Low)			2: Moderate(Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I CONSTITUENT MATERIALS 9

Cement: Chemical composition – Hydration of cement – Setting – Fineness – Structure of hydrated cement – Volume of products of hydration – Heat of hydration of cement – Cementitious materials of different types. Aggregates: Classification – Characteristics affecting Concrete Properties – BIS specifications. Water: General requirements – Tolerable concentrations of impurities – Quality of water for use in concrete

UNIT II ADMIXTURES 9

Benefits of admixtures – Types – Accelerating admixtures – Retarding admixtures – Water reducing Admixtures – Superplasticizers – Special admixtures – Waterproofing admixtures – Anti-bacterial and similar admixtures

UNIT III CONCRETE MIX PROPORTIONS 9

Cost considerations – Specifications – The process of mix selection – Mean strength and minimum

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strength – Quality control – Factors governing the selection of mix proportions – BIS method of mix design – Mix selection of high performance and light weight aggregate concrete – Mix design by ACI Methods

UNIT IV PROPERTIES OF FRESH AND HARDENED CONCRETE 9

Workability – Tests for workability of concrete – Segregation and Bleeding – Determination of strength properties of hardened concrete – Compressive strength – Split tensile strength – Flexural strength – Modulus of elasticity – Accelerated curing test – Durability of concrete – Water absorption – Permeability – Corrosion test – Acid resistance

UNIT V SPECIAL CONCRETE 9

Concrete containing fly ash, GGBS, Silica fume – High performance Concrete – Lightweight Concrete – Cellular Concrete – No-fines Concrete – Self compacting concrete –Geopolymer Concrete

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: - Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Neville A M, "Properties of Concrete", 5th edition, Pearson India, New Delhi, 2016
2. Santhakumar A R, "Concrete Technology", 6th edition OXFORD University Press India, New Delhi, 2018

REFERENCES:

1. Gambhir M L, "Concrete Technology",2nd edition, Tata Mc. Graw Hill Publishers, New Delhi, 2017
2. Shetty M S, "Concrete Technology", 7th edition, S.Chand and Company Limited, New Delhi,2013
3. Bhavikatti S S, "Concrete Technology", 6th edition, I.K.International Publishing House Pvt. Ltd, New Delhi, 2015
4. IS10262-2019 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi
5. https://nptel.ac.in/courses/105102012

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**			
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	**Total Internal Assessments**	**End Semester Examinations**
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER III

		Category: PCC				
U21CE302	FLUID MECHANICS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic properties of the fluids
- To gain the knowledge about fluid statics, fluid kinematics and dynamics
- To analyze the complexities involved in solving the fluid flow problems

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Summarize the fluid properties and fluid in statics (Understand)

CO2: Apply Bernoulli's equation in fluid flow problems (Apply)

CO3: Identify types of flow and losses of flow in pipes (Apply)

CO4: Understand the concept of boundary layer theory (Understand)

CO5: Apply the Principles of dimensional and model analysis in fluids (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I PROPERTIES OF FLUIDS AND HYDROSTATICS 9

Basic concepts of fluid mechanics – Fluid properties – 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, Venturimeter and Orifice meter

UNIT III FLOW THROUGH PIPES 9

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

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UNIT IV BOUNDARY LAYERS 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

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Bansal R.K., "Fluid Mechanics and Hydraulics Machines", 5th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2019
2. Modi P.N and Seth " Hydraulics and Fluid Mechanics including Hydraulic Machines",3rd edition, Standard Book House New Delhi. 2018

REFERENCES:

1. Ramamrutham, S., "Hydraulics, Fluid Mechanics and Fluid Machines", 1st edition, DhanpatRai and Sons, Delhi, 2011
2. Jain A. K. "Fluid Mechanics including Hydraulic Machines", 4th edition, Khanna Publishers, 2019
3. Rajput, R. K., "A Text Book of Fluid Mechanics and hydraulic Machines", 3rd edition, S. Chand & Co., New Delhi, 2015
4. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", 3rd edition, McGraw Hill, 2017

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER III

		Category: PCC				
U21CE303	STRENGTH OF MATERIALS I	L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- U21CE201: Engineering Mechanics

COURSE OBJECTIVES:

- To learn the fundamental concepts of stress, strain and deformation of solids
- To understand the mechanism of load transfer in beams, the induced stress resultants and deformations
- To apply the theory of torsion on shafts and springs and to analyze plane and space trusses

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the concepts of stress and strain in simple and compound beams (Understand)

CO2: Determine the shear force and bending moment in beams (Apply)

CO3: Identify the different methods for determining slope and deflection in beams (Analyze)

CO4: Analyze stresses and deformation in shafts and springs (Apply)

CO5: Analyze the pin jointed plane and space trusses (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	-	-	-	-	2	2	-	-	2	2
CO2	3	3	2	2	-	-	-	-	2	2	-	-	2	2
CO3	3	3	2	-	-	-	-	-	2	2	-	-	2	2
CO4	3	3	1	2	-	-	-	-	2	2	-	-	2	2
CO5	3	3	2	-	-	-	-	-	2	2	-	-	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid and deformable bodies – Stability, Strength and Stiffness – Axial and Shear stresses – Deformation of simple and compound bars – Thermal stresses – Biaxial state of stress – Elastic constants – Volumetric strain – Stresses at a point – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress – Maxwell's reciprocal theorem

UNIT II BENDING OF BEAMS 9

Beams – Types and transverse loading on beams – Shear force and bending moment in beams – Cantilever beams – Simply supported beams and over hanging beams – Theory of simple bending– Bending stress distribution – Shear stress distributions – Load carrying capacity – Proportioning of sections – Flitched beams

UNIT III DEFLECTION OF BEAMS 9

Slope and deflection of beams – Double Integration method – Macaulay's method – Moment area method – Conjugate Beam method

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UNIT IV TORSION AND SPRINGS 9

Theory of simple torsion – Stresses and deformation in circular (solid and hollow shafts) – Stepped shafts – Shafts fixed at both ends – Leaf springs – Stresses in helical springs – Deflection of springs

UNIT V ANALYSIS OF PLANE TRUSSES 9

Stability and equilibrium of plane frames – Perfect frames – Types of trusses – Analysis of forces in truss members – Method of joints – Method of sections – Tension coefficient Method

LIST OF EXPERIMENTS

1. Tension test on metal specimen
2. Compression test on wooden specimen
3. Double Shear test on metal specimen
4. Impact tests on metal specimen (Izod and Charpy)
5. Hardness tests on metal specimen (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Bending test – Verification of Maxwell's reciprocal theorem
8. Torsion test on metal specimen
9. Test on closed coil helical springs
10. Test on open coil helical springs

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 30 Periods Project – Periods

Total 75 Periods

TEXT BOOKS:

1. Rajput R.K. "Strength of Materials", 12th edition, S.Chand and Co, New Delhi, 2015.
2. Rattan. S. S, "Strength of Materials", 4th edition, Tata McGraw Hill Education Private Limited, New Delhi, 2012.
3. Bansal. R.K. "Strength of Materials", 18th edition, Laxmi Publications Pvt. Ltd., New Delhi, 2010.

REFERENCES:

1. Timoshenko.S.B. and Gere.J.M, "Mechanics of Materials", 2nd edition, Van Nos Reinbhold, New Delhi 1999.
2. Vazirani.V.N and Ratwani.M.M, "Analysis of Structures", 1st edition, Vol I Khanna Publishers, New Delhi,1995.
3. Singh. D.K., "Strength of Materials", 3rd edition, Ane Books Pvt. Ltd., New Delhi, 2016.

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		35	15
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER III

U21CE304	ENGINEERING SURVEY	Category: PCC				
		L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To study the various methods of surveying
- To understand the concept of control, astronomical and modern survey
- To use various survey instruments

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Impart knowledge on the usage of basic surveying instrument (Understand)

CO2: Make use of leveling instrument for surveying operation (Apply)

CO3: Determine the distances and relative positions of points (Apply)

CO4: Understand the concept of hydrographic and astronomical survey (Understand)

CO5: Demonstrate the modern surveying techniques (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	-	1	-	-	3	3	-	3	3	2
CO2	3	3	2	3	-	1	-	-	3	3	-	3	3	2
CO3	3	3	2	3	-	1	-	-	3	3	-	3	3	2
CO4	3	3	2	3	-	1	-	-	3	3	-	3	3	2
CO5	3	3	2	3	3	1	-	-	3	3	-	3	3	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

SYLLABUS

UNIT I FUNDAMENTALS OF SURVEYING 9

Definition – Classification - Principles – Equipment and accessories used for ranging and chaining – Methods of ranging – Compass Surveying – Types - Bearing – System and conversions - Plane table and its accessories – Merits and demerits – Radiation – Intersection – Resection – Plane table traversing.

UNIT II LEVELLING 9

Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly levelling – Check levelling – Booking – Reduction – Contouring - Characteristics of contours – Methods of contouring.

UNIT III THEODOLITE SURVEYING 9

Theodolite survey – Horizontal and Vertical angle Measurements and Distance – Temporary and permanent adjustments - Tangential and Stadia tachometric – Analytical lens

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UNIT IV HYDROGRAPHIC AND ASTRONOMICAL SURVEYING 9

Hydrographic survey - Tides – MSL – Sounding methods – Horizontal and Vertical control – methods – Satellite station – reduction to centre – Astronomical Surveying –determinations of Azimuth by altitude and hour angle methods

UNIT V MODERN SURVEYING 9

Total Station – EDM – Working principles - GPS - Accessories – Advantages, disadvantages and Applications, Procedure, Errors – Drone Survey – concept.

LIST OF EXPERIMENTS

1. Aligning, Ranging, Chaining and marking by perpendicular offsets.
2. Study of Bearings and Determination of Included angle by Prismatic Compass.
3. Plane table surveying : Traversing
4. Determination of Reduced Level by Check and Fly leveling.
5. Measurement of Horizontal angle by Repetition and Reiteration Method.
6. Determination of RL of object – Base of the object is accessible and inaccessible.
7. Determination of tacheometric constant.
8. Determination of Distance and Elevation by Stadia Method.
9. Determination of Distance and Elevation by tangential tacheometry Method.
10. Determination of Area by Total Station.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 30 Periods Project – Periods

Total 75 Periods

TEXT BOOKS:

1. Dr. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain, "Surveying (Volume –I and II)", 17th Edition, Lakshmi Publications, 2016.
2. Duggal S K., "Surveying", Vol-I and II, 4th Edition, MC Graw Hill Education (India) Private Limited, 2013

REFERENCES:

1. Basak N N, "Surveying & Levelling", 2nd Edition,Tata McGraw-Hill Education, 2014.
2. Venkatramaiah, "Text book of Surveying", 1st edition, University press, New Delhi, 2014.
3. Bhavikatti, S.S., "Surveying and Levelling, Vol. I and II", 2nd Edition, I.K. International, 2016.
4. Madhu, N, Sathiskumar, R and Satheesh Gobi, "Advanced Surveying: Total Station, GIS and Remote Sensing", 2nd Edition, Pearson India, 2017.

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		35	15
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER III

U21CE305	CONCRETE LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	4	2	3

PRE–REQUISITES:

- U21CE202: Building materials

COURSE OBJECTIVES:

- To understand the behavior of construction materials
- To perform tests on concrete making materials such as cement, fine and coarse aggregates
- To prepare concrete mix design based on standard procedures and to know the properties of fresh and hardened concrete

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Perform tests on cement as per IS codes of practice (Apply)

CO2: Categorize and conduct tests on fine and coarse aggregates according to IS codes (Apply)

CO3: Design the concrete mix as per codal provisions (Apply)

CO4: Experiment with various workability tests on fresh concrete as per IS codes (Apply)

CO5: Examine the properties of hardened concrete as per IS codes (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	2	-	2	3	3	-	2	3	3
CO2	3	3	3	2	-	2	-	2	3	3	-	2	3	3
CO3	3	3	3	2	-	2	-	2	3	3	-	2	3	3
CO4	3	3	3	2	-	2	-	2	3	3	-	2	3	3
CO5	3	3	3	2	-	2	-	2	3	3	-	2	3	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

LIST OF EXPERIMENTS

TESTS ON CEMENT

1. Specific gravity of cement
2. Normal consistency,
3. Initial and final setting time of cement
4. Compressive strength of cement

TESTS ON AGGREGATE

5. Sieve analysis of fine and coarse aggregate
6. Specific gravity of fine and coarse aggregate
7. Water absorption test on fine and coarse aggregate

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CONCRETE MIX PROPORTIONING APPROACHES

8. Concrete mix design by IS method
9. Concrete mix design by ACI method

TEST ON FRESH CONCRETE

10. Workability of concrete by slump test
11. Workability of concrete by flow table test
12. Workability concrete by compaction factor test
13. Workability of concrete by vee-bee test

TESTS ON HARDENED CONCRETE

14. Compressive strength of concrete
15. Split tensile strength of concrete
16. Flexural strength of concrete
17. Modulus of elasticity of concrete

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 45 Periods Project 30 Periods

Total 75 Periods

REFERENCES:

1. IS: 4031 (Part-4, 5, 7 and 11)-1988 (reaffirmed 2005), Method of physical tests for hydraulic cement.
2. IS: 2386 (Part-1 and 3) –1963 (reaffirmed 2002), Methods of Test for Aggregates for Concrete.
3. IS: 10262 – 2019, Concrete Mix Proportioning – Guidelines, ACI 211.1-91.
4. IS: 1199-1959 (reaffirmed 2004), Methods of Sampling and analysis of concrete.
5. IS 516-1959 (reaffirmed 2004), Method of test for Strength of Concrete, IS: 5816-1970 (reaffirmed 2004), Splitting Tensile Strength of Concrete Method of Test.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (Practical) (100 Marks)		Assessment II (Project) (100 Marks)			
Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test	Review I	Review II	Review III	Practical Examinations (Examinations will be conducted for 100 Marks)
75	25	15	25	60	
25		25			50
50					50
Total: 100					

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SEMESTER III

		Category: ESC				
		L	T	P	J	C
U21CE307	COMPUTER AIDED DRAFTING LABORATORY	0	0	2	2	2

PRE–REQUISITES:

- U21MEG01: Engineering Graphics

COURSE OBJECTIVES:

- To apply the AUTO CAD commands in layout and plans
- To prepare drawings with proper drafting standards
- To draw the plan, elevation and section of the different types of the building

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Draw plan, section and elevation of residential building with joinery details (Apply)

CO2: Prepare approval drawing for local body with rules and regulations (Apply)

CO3: Draw detailed working drawing for the residential building along with interior details (Apply)

CO4: Prepare plan, section and elevation of Industrial and Institutional buildings (Apply)

CO5: Plot the residential building for the given area (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	3	1	-	-	3	2	1	3	3	2
CO2	3	3	-	3	3	1	-	-	3	2	1	3	3	2
CO3	3	3	-	3	3	-	-	-	3	2	1	3	3	2
CO4	3	3	3	3	3	3	1	2	3	2	1	3	3	2
CO5	3	3	3	3	-	3	1	2	3	2	1	3	3	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

LIST OF EXPERIMENTS

1. Site plan, Floor plan ,Centre line marking, elevation and section of small residential buildings with functional requirements
2. Joinery details (Panelled and Glazed Doors and Windows)
3. Preparation of approval drawing for local body with rules and regulations. (Residential building - flat and pitched roof)
4. Detailed working drawing for single storey and double storey Residential buildings - site plan, foundation plan, floor plans, Cross section, elevation, staircase plan, Plumbing Layout - (Load bearing and framed structures)

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5. Residential Building: Interior plan for Hall, dining, Kitchen, Bed room, Bath room W/C and Toilet (2D only)
6. Preparation of plan, elevation and section of industrial buildings-workshop (steel structure)
7. Preparation of plan, elevation and section of institutional buildings (school, college-framed structure)

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: 30 Periods

Total 60 Periods

REFERENCES:

1. Geogre Omura and Brain C. Benton, "Mastering AutoCAD and AutoCAD LT ", 1st edition, J. Wiley & Sons, 2018
2. Randy Shih, "Autocad 2016 Tutorial First Level - 2D Fundamentals", 2nd edition, Schroff Development Corp, 2015
3. V.B. Sikka, "A Course in Civil Engineering Drawing", 4th edition, S.K. Kataria & Sons, New Delhi, 2017
4. https://www.mycadsite.com/tutorials.html

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (Practical) (100 Marks)		Assessment II (Project) (100 Marks)			
Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test	Review I	Review II	Review III	Practical Examinations (Examinations will be conducted for 100 Marks)
75	25	15	25	60	
25		25			50
50					50
Total: 100					

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SEMESTER III

		Category: EEC				
U21CE308	DESIGN STUDIO I	L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITES:

- U21ECG03: Engineering Studio

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product.
- To enable hands-on experience for active learning.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand Design thinking, system thinking, mapping the problem statements to UNSDG.

CO2: Apply the design thinking steps "Empathize, Define, ideate and prototype".

CO3: Create Experimental proof of concept (TRL 3)

CO4: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	3	3	3	3	3	3	3	-	-	-	-	-
CO2	3	3	3	3	3	3	3	3	3	-	2	1	-	-
CO3	3	3	3	3	3	3	3	3	3	-	3	2	-	-
CO4	-	-	-	-	2	-	-	2	3	3	3	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

Course conduction:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor.
- With the guidance of assigned mentor, the students will find & validate a problem statement, map to UNSDG, identify the skills required for the project and self-learn.
- Applying the design thinking concept, the students will provide a solution and produce the version 1 of prototype.
- The student will learn teamwork, project management, technical report writing and presentation skills through this course.

Contact Periods

Lecture: – Periods Tutorial: – Periods Practical: - Periods Project 30 Periods

Total 30 Periods

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EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER IV

U21MA401	NUMERICAL TECHNIQUES (for CE)	Category: BSC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of direct and iterative method for solving algebraic and transcendental equations using numerical methods of interpolation
- To obtain the solution of differentiation and integration using standard numerical techniques in solving kinematics simulation and composite materials
- To understand the concepts of ordinary and partial differential equations in elastic beams and elastic bars using numerical techniques

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the concepts of algebraic and transcendental equations to solve core engineering problems (Understand)

CO2: Use the concepts of interpolation for mathematical problems arising in various field (Understand)

CO3: Utilize differentiation and integration methods for finite difference and finite element method (Understand)

CO4: Solve initial value problems of ordinary differential equations using numerical techniques (Understand)

CO5: Use finite difference techniques, implicit and explicit methods for solving boundary value problem of partial differential equations (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I SYSTEM OF EQUATIONS 9

Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Gauss Seidel method

UNIT II INTERPOLATION 9

Interpolation with equal intervals – Newton's forward and backward difference formulae – Interpolation with unequal intervals – Lagrange interpolation

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UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal rule – Simpson's 1/3 rule – Evaluation of double integrals by Trapezoidal rule

UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations

UNIT V NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference method – Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total: 45 Periods

TEXT BOOKS:

1. Burden R L and Faires J D, "Numerical Analysis", 9th edition, Cengage Learning, 2016
2. Grewal B S and Grewal J S, "Numerical Methods in Engineering and Science", 10th edition, Khanna Publishers, New Delhi, 2015

REFERENCES:

1. Jain M K, Iyengar S R K. and Jain R K, "Numerical Methods for Scientific and Engineering computation", 6th edition, New Age international publishers, 2019
2. Sastry S S, "Introductory Methods of Numerical Analysis", 5th edition, PHI Learning Pvt. Ltd, 2012
3. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", 7th edition Tata McGraw-Hill, New Delhi, 2016

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER IV

		Category: PCC				
U21CE401	STRENGTH OF MATERIALS II	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE303: Strength of Materials I

COURSE OBJECTIVES:

- To understand different methods for determination of slope and deflection of beams and trusses using energy theorems
- To understand the concept of analyzing indeterminate beams
- To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the concept of strain energy and compute the deflection of determinate beams using energy principles (Apply)

CO2: Analyze propped cantilever, fixed beams and continuous beams for external loadings and support settlements (Analyze)

CO3: Evaluate the load carrying capacity of columns and stresses induced in columns (Apply)

CO4: Determine the stresses induced in cylinders, shells and various theories of failures (Apply)

CO5: Compute the stresses due to know symmetrical and unsymmetrical bending of beams (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	-	-	-	-	-	-	2	1
CO2	3	3	2	2	-	1	-	-	-	1	-	-	2	1
CO3	3	3	2	-	-	1	-	-	-	-	-	-	2	1
CO4	3	3	2	-	-	-	-	-	-	-	-	-	2	1
CO5	3	3	2	-	-	-	-	-	-	-	-	-	2	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I ENERGY PRINCIPLES 9

Strain energy and strain energy density – Strain energy in axial force, shear, flexure and torsion – Castigliano's theorems – Principle of virtual Work – Application of energy theorems for computing deflections in beams

UNIT II INDETERMINATE BEAMS 9

Concept of analysis – Propped cantilever and fixed beams – Fixed end moments and reactions due to lateral loads – Theorem of three moments – Analysis of continuous beams – Shear force and bending moment diagrams

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UNIT III COLUMNS 9

Eccentrically loaded short columns – Middle Third Rule – Core section – Columns of unsymmetrical Sections – Euler's theory of long columns – Critical loads for prismatic columns with different end conditions – Rankine Gordon formula for eccentrically loaded columns

UNIT IV THIN AND THICK CYLINDERS, THEORIES OF FAILURES 9

Thin cylinders and shells – Deformation of thin cylinders and shells –Thick cylinders – Compound cylinders – Theories of failure – Principal stress – Principal strain – Shear stress – Strain energy and Distortion energy theories – Applications – Analysis of stress – Three dimensions

UNIT V SYMMETRICAL AND UNSYMMETRICAL BENDING OF BEAMS 9

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear centre – Curved beams – Winkler Bach formula – Stress concentration, Fatigue and Residual stress

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods
Total 45 Periods

TEXT BOOKS:

1. Rajput R.K., "Strength of Materials (Mechanics of Solids)", 2nd edition, S. Chand & Company Ltd., New Delhi, 2015
2. Rattan S.S., "Strength of Materials", 4th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

REFERENCES:

1. Kazimi S.M.A., "Solid Mechanics", 4th edition, Tata McGraw–Hill Publishing Co., New Delhi, 2003.
2. Bansal. R.K., "Strength of Materials", 5th edition, Laxmi Publications Pvt. Ltd., New Delhi, 2018.
3. Egor P Popov., "Engineering Mechanics of Solids", 2nd edition PHI Learning Pvt. Ltd., New Delhi, 2012.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER IV

		Category: PCC				
U21CE402	APPLIED HYDRAULICS AND HYDRAULIC MACHINERY	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE302: Fluid Mechanics

COURSE OBJECTIVES:

- To study various hydraulic engineering problems like open channel flows and hydraulic machineries
- To learn the fundamentals of uniform and non-uniform flow in open channel
- To impart the knowledge on various types of turbines and pumps

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Design a most economical section of various channels in uniform flow (Apply)

CO2: Summarize the concept of gradually varied flows in steady state conditions (Apply)

CO3: Solve non-uniform flow problems and hydraulic jump phenomenon in open channel flow (Apply)

CO4: Design and study the performance of various types of turbines (Apply)

CO5: Design and select pumps for different hydraulic applications (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	1	-	-	1	-	2	3	-
CO2	3	3	2	-	-	-	1	-	-	1	-	2	3	-
CO3	3	3	2	-	-	-	1	-	-	1	-	2	3	-
CO4	3	3	2	-	-	-	1	-	-	1	-	2	3	-
CO5	3	3	2	-	-	-	1	-	-	1	-	2	3	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I OPEN CHANNEL 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 – Specific energy and specific force

UNIT II GRADUALLY VARIED FLOW 9

Nonuniform flow – Dynamic equation for gradually varied flow – Flow profiles in prismatic channels – Direct and standard step method – Computation of the length of the backwater curve and afflux

UNIT III RAPIDLY VARIED FLOW 9

Rapidly Varied Flow – Applications of momentum equation for RVF – Hydraulic Jump – Types – Rapidly varied unsteady flows (positive and negative surges)

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UNIT IV TURBINES 9

Impact of Jet on flat and curved plates – Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine – Specific Turbines – Characteristic Curves of turbine

UNIT V PUMPS 9

Classification of Pumps – Centrifugal pump – Work done – Minimum speed to start the pump - NPSH Multistage pump – Characteristic Curves – Reciprocating pump – Negative slip

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Chandramouli P.N., "Applied Hydraulic Engineering", 2nd edition Yes Dee Publishing Pvt. Ltd., 2017
2. Modi P.N and Seth., "Hydraulics and Fluid Mechanics including Hydraulic Machines", 7th edition Standard Book House New Delhi, 2018
3. Subramanya K., "Flow in open channels", 2nd edition Tata McGraw Hill, New Delhi, 2019

REFERENCES:

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2019
2. Ven Te Chow., "Open Channel Hydraulics", 2nd edition, McGraw Hill, New York, 2009
3. Ramamrutham, S., "Hydraulics, Fluid Mechanics and Fluid Machines", 4th edition, Dhanpat Rai and Sons, Delhi, 2011
4. Rajput, R. K., "A Text Book of Fluid Mechanics and hydraulic Machines", 5th edition, S. Chand & Co., New Delhi, 2015

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER IV

		Category: PCC				
U21CE403	SOIL MECHANICS	L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To identify the properties and classifications of soil
- To understand the consolidation and compaction effects of the soil
- To analyze the effective stress and shear strength in the soil

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the basic soil structure and its classification (Understand)

CO2: Determine the permeability and seepage flow in the soil (Apply)

CO3: Demonstrate the compaction and consolidation process in the soil (Apply)

CO4: Compute the stresses in the soil (Apply)

CO5: Analyze the slope stability of the soil (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	-	-	1	-	2	2	-	-	1	1
CO2	2	3	1	2	-	-	1	-	2	2	-	-	1	-
CO3	2	3	1	2	1	-	1	-	2	2	-	-	1	2
CO4	2	3	1	-	1	-	1	-	2	2	-	-	1	2
CO5	2	3	1	-	-	-	1	-	-	-	-	-	1	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I SOIL AND ITS PROPERTIES 9

Origin and Historical development of soil engineering – Soil structure – Phase relationship in soil – Index properties of soil – Classifications of soil

UNIT II PERMEABILITY AND SEEPAGE 9

One dimensional flow through soil – Permeability – Darcy's Law – Field and laboratory permeability tests – Factors affecting permeability – Flow through stratified soils – Uplift pressure and piping – Seepage – Seepage flow – Introduction to flow nets – Quick sand phenomenon

UNIT III COMPACTION AND CONSOLIDATION 9

Compaction – Proctor's test – Moisture – Density relations – Field compaction methods – Factors affecting compaction – California Bearing Ratio (CBR) test – Consolidation – Terzaghi's theory of one dimensional consolidation – Laboratory test – Determination of co-efficient of consolidation

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UNIT IV STRESS DISTRIBUTION AND SHEAR STRENGTH 9

Stresses in soils – Concept of effective and neutral stresses – Stress distribution in soil media – Boussinesq and Westergaard equation – Pressure bulb – Shear strength – Tests on shear strength of cohesive and cohesion less soil – Mohr coulomb's theory and its failure – Newmark's influence chart

UNIT V SOLPE STABILITY 9

Stability of slopes – Factor of safety – Bishop method – Use of stability number – Friction circle method – Infinite slopes and finite slopes – Slope protection measures

LIST OF EXPERIMENTS

1. Specific gravity of soil solids
2. Grain size distribution – Sieve analysis and hydrometer analysis
3. Atterberg limits of soil
4. Field density Test (Sand replacement method and core cutter method)
5. Permeability determination (constant head and falling head methods)
6. Determination of moisture – density relationship using standard Proctor compaction test
7. California Bearing Ratio Test
8. Direct shear test in cohesionless soil
9. Unconfined compression test in cohesive soil

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods. Practical: 30 Periods Project – Periods

Total 75 Periods

TEXT BOOKS:

1. Punmia B.C, "Soil Mechanics and Foundations", 10th edition, Laxmi Publications Pvt. Ltd., 2017
2. Murthy V.N.S, "Soil Mechanics and Foundation engineering", 5th edition, CBS publishers & Distributors, 2009

REFERENCES:

1. Arora K R, "Soil Mechanics and Foundation Engineering", 7th edition, Standard Publishers, New Delhi, 2019
2. Modi P N, "Soil Mechanics and Foundation Engineering", 7th edition, Standard Book house, New Delhi, 2019
3. Charles K. Alexander, Matthew N. O. Sadiku, "Electric Circuits", 6th edition, McGraw Hill Education, New Delhi, 2019

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		35	15
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER IV

		Category: PCC				
U21CE404	HIGHWAY ENGINEERING	L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concept of Highway planning and alignment
- To evaluate about pavement design, construction and maintenance (as per IRC codes)
- To select the pavement evaluation and strengthening methods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Determine highway planning and alignment (Understand)

CO2: Analyze geometric design of roads (Analyze)

CO3: Design various types of pavements (Analyze)

CO4: Identify various materials used (Apply)

CO5: Discuss the methods of pavement maintenance, evaluation and strengthening (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	-	1	1	-	-	-	1	1
CO2	3	1	2	-	-	3	-	3	3	-	-	-	3	-
CO3	3	3	2	-	-	3	-	3	3	-	-	-	3	2
CO4	3	1	1	-	-	3	-	2	2	1	-	-	2	-
CO5	3	3	2	-	-	3	-	2	2	-	-	-	2	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

Scope of Highway Engineering – Highway Development and planning in India – Highway Hierarchy Highway Alignment – Factors controlling alignment – Engineering surveys for Highway alignment – Classification of Urban and Rural Roads – Cross sections of different Roads

UNIT II GEOMETRIC DESIGN OF HIGHWAY 9

Geometric design elements – Highway cross sectional elements – Sight Distance – Design of Horizontal Alignment – Super elevation – PIEV Theory – Extra Widening on Curves – Horizontal transition curves – Design of Vertical Alignments – Gradients & Curves - Geometric design of hill roads (IRC Standards only)

UNIT III STRUCTURAL DESIGN OF HIGHWAY PAVEMENTS 9

Flexible pavements – Components and functions – Factors affecting design and performance of flexible pavements – Stresses in flexible pavements – Flexible pavement design methods as per

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IRC standards – Rigid pavements – Components and functions – Factors affecting design and performance of CC Pavements – Stresses in Rigid pavements

UNIT IV HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE 9

Materials used in Highway construction – Desirable properties and testing of Highway materials – Portland cement and Cement concrete – Features of Highway construction – Highway embankment and sub grade – Construction of Flexible pavements – CC pavements

UNIT V PAVEMENT MAINTENANCE EVALUATION AND STRENGTHENING 9

Objectives of Highway maintenance – Types of maintenance – Defects in Flexible and Rigid pavements – Types of failures, Causes and Treatment – Maintenance Management System – Maintenance techniques – Evaluation of highway pavements – Pavement evaluation techniques – Strengthening of pavements (Overlays)

LIST OF EXPERIMENTS

1. Determination of penetration value of Bitumen
2. Determination of specific Gravity of Bitumen
3. Determination of viscosity test on Bitumen
4. Determination of ductility value of Bitumen
5. Determination of softening point of bituminous material
6. Bitumen content by Centrifuge extractor
7. Marshall stability test and design of bituminous mix
8. Benkelman Beam deflection method (Demonstration only)

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 30 Periods Project – Periods

Total 75 Periods

TEXT BOOKS:

1. Khanna K., Justo C E G, "Highway Engineering", 5th edition, Khanna Publishers, Roorkee, 2021.
2. Kadiyali L.R., "Principles and Practice of Highway Engineering", 6th edition, Khanna Technical Publications, New Delhi, 2019.
3. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", 4th edition, SciTech Publications (India), Chennai, 2018.

REFERENCES:

1. Yang H. Huang., "Pavement Analysis and Design", 9th edition, Pearson Education Inc, South Asia, 2012.
2. Ian D. Walsh., "ICE manual of highway design and management", ICE Publishers, 1st Edition, USA, 2011.
3. Indian Road Congress (IRC), "Guidelines for the Design of Flexible Pavements", 3rd edition, IRC: 37-2012.

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test I	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		35	25
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER IV

		Category: PCC				
U21CE405	HYDRAULIC ENGINEERING LABORATORY	L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21CE302: Fluid Mechanics
- U21CE402: Applied Hydraulics and Hydraulic Machinery

COURSE OBJECTIVES:

- To measure flow in pipes and determine frictional losses
- To develop characteristic curves of pumps and turbines

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Estimate the discharge in Bernoulli's experiment and Rotameter (Apply)

CO2: Measure the theoretical and actual discharge in Venturimeter and Orificemeter (Apply)

CO3: Predict the Major and Minor losses in pipes (Apply)

CO4: Examine the characteristic curves for various turbines (Apply)

CO5: Identify the characteristic curves of various pumps (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	3	-	1	1	-	3	1	-	3	3	-
CO2	3	-	3	3	-	1	1	-	3	1	-	3	3	-
CO3	3	-	3	3	-	1	1	-	3	1	-	3	3	-
CO4	3	-	3	3	-	1	1	-	3	1	-	3	3	-
CO5	3	-	3	3	-	1	1	-	3	1	-	3	3	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

LIST OF EXPERIMENTS

FLOW MEASUREMENT

1. Calibration of Rotameter
2. Calibration of Venturi meter
3. Calibration of Orifice meter
4. Bernoulli's Experiment

LOSSES IN PIPES

5. Determination of friction factor in pipes
6. Determination of minor losses

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PUMPS

7. Characteristics of Centrifugal pumps
8. Characteristics of Gear pump
9. Characteristics of Submersible pump
10. Characteristics of Reciprocating pump

TURBINES

11. Characteristics of Pelton wheel turbine
12. Characteristics of Francis turbine/Kaplan turbine

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total 60 Periods

REFERENCES:

1. Sarbjit Singh "Experiments in Fluid mechanics", 1st edition, Prentice hall of India Pvt Ltd, Delhi, 2009.
2. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
3. Modi P.N and Seth " Hydraulics and Fluid Mechanics including Hydraulic Machines",22nd edition, Standard Book House New Delhi. 2018

EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

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SEMESTER IV

		Category: PCC				
U21CE406	SURVEY CAMP (Two Weeks during Semester Vacation)	L	T	P	J	C
		2 Weeks				1

PRE–REQUISITES:

- U21CE304: Engineering Survey

COURSE OBJECTIVES:

- To get practical training in survey field works, traverse and contour the given area

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the knowledge in contouring the area (Apply)

CO2: Develop the Longitudinal Sectioning and Cross Sectioning of the given area (Apply)

CO3: Perform survey using total station and GPS (Apply)

CO4: Demonstrate the field work using drone survey instruments (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	1	-	-	3	3	2	3	3	3
CO2	3	3	2	3	3	1	-	-	3	3	2	3	3	3
CO3	3	3	2	3	3	1	-	-	3	3	2	3	3	3
CO4	3	3	2	3	3	1	-	-	3	3	2	3	3	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

LIST OF EXPERIMENTS

1. Triangulation and Trilateration
2. Radial Contouring
3. Square Contouring
4. Longitudinal sectioning
5. Cross sectioning
6. Traversing and elevation between area calculation using – Total station
7. Traversing – GPS
8. Sun and star observation using azimuth
9. Drone survey

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 2 weeks Project – Periods

Total : 2 weeks

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EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

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SEMESTER IV

		Category: HSMC				
U21SSG01	SOFT SKILLS – I	L	T	P	J	C
		0	0	2	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To inculcate potential skills and to work as a team effectively.
- To develop confidence and enhance interpersonal skills.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Enhance decision making and negotiation skills (Analyze)

CO2: Maintain open, effective, and Professional Communication (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I VERBAL COMPETENCE 10

Verbal Analogy – Spotting Errors – Ordering of Sentences – Cloze Test – Effective Listening – Reading Comprehension

UNIT II EFFECTIVE COMMUNICATION 10

Overcoming Communication Barriers – Body Language and its Etiquettes – Contextual Communication – 7C's of Communication – Listening to Documentaries

UNIT III INTERPERSONAL SKILLS 10

Group Decision Making – Paralanguage – Negotiation Skills – Preparation & Planning, Bargaining & Problem Solving –Self Grooming – SWOT Analysis

Contact Periods:

Lecture: - Periods Tutorial: - Periods Practical 30 Periods Project – Periods

Total 30 Periods

TEXT BOOKS:

1. Prashant Sharma,"Soft Skills: Personality Development for Life Success",1st edition, BPB Publications,2022.
2. Suresh Kumar E, Sreehari P and Savithri J, "Communication Skills and Soft Skills: An Integrated Approach", 1st edition, Dorling Kindersley, 2011.

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REFERENCES:

1. Jeff Butterfield, "Problem Solving and Decision Making", 2nd edition, Course Technology, 2010.
2. Wushow Bill Chou, "Fast-Tracking your Career: Soft Skills for Engineering and IT Professionals", 1st edition, IEEE Press, 2013.

EVALUATION PATTERN:

Continuous Internal Assessments	Marks
Test - I	50
Test - II	50
Total	100

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SEMESTER IV

		Category: EEC				
U21CE407	DESIGN STUDIO II	L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITES:

- U21CE307: Design Clinic I

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product.
- To enable hands-on experience for active learning.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the problem-solving techniques (Design thinking & system thinking)

CO2: Create and validate low fidelity prototype / Experimental proof of concept. (TRL 4)

CO3: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	-	2	1	-	-
CO2	3	3	3	3	3	3	3	3	3	-	3	2	-	-
CO3	-	-	-	-	2	-	-	2	3	3	3	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course conduction:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor for this design clinic 2 course.
- With the guidance of assigned mentor, the students will find & validate a problem statement, map to UNSGD, identify the skills required for the project and self-learn.
- Applying design thinking & system thinking concept the students will solve the problem and produce the version 1 of prototype. (TRL 4)
- The student will learn teamwork, project management, technical report writing and presentation skills through this course.

Contact Periods

Lecture: – Tutorial: – Practical: - Project 30 Periods

Total 30 Periods

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EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER V

		Category: PCC				
U21CE501	DESIGN OF REINFORCED CONCRETE STRUCTURES	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic concepts of Limit state design using Indian standard codes and special publication
- To know the design concepts of all the structural members and learn economical design for materials saving
- To identify the design methodologies by limit state design for the beams, slabs, column and footings

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the usage of IS codes in design of reinforced concrete structures (Apply)

CO2: Identify the types and design of beams and slabs (Apply)

CO3: Design the uniaxial and biaxial bending of column (Apply)

CO4: Design the simple footings, combined footing and Mat foundation (Apply)

CO5: Develop skills in design of staircase, water tank, Septic tank and Lift (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	2	-	2	-	1	-	1	3	3
CO2	3	3	2	-	-	2	-	2	-	1	-	1	3	3
CO3	3	3	2	-	-	2	-	2	-	1	-	1	3	3
CO4	3	3	2	-	-	2	-	2	-	1	-	1	3	3
CO5	3	3	2	-	-	2	-	2	-	1	-	1	3	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO LIMIT STATE METHOD 9+3

Introduction - Concept of limit state method - Analysis and design of singly and doubly reinforced rectangular and flanged beams.

UNIT II DESIGN OF BEAMS AND RC SLABS 9+3

Design of RC Beams for combined bending shear and torsion - Design of different types of slabs - One way slab – Two-way slab – One way continuous slab.

UNIT III DESIGN OF RC COMPRESSION MEMBERS 9+3

Design of column for axial load – Uniaxial – Biaxial bending.

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UNIT IV DESIGN OF RC FOUNDATION 9+3

Design of wall footing- Design of isolated and combined footing – Raft foundation.

UNIT V DESIGN OF MISCELLANEOUS STRUCTURES 9+3

Types of staircases – Design of doglegged staircase - Design criteria for septic tanks, water tanks, Lift pit, Stair head room and Lift machine room as per codal provisions.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. Subramanian, N. "Design of Reinforced Concrete Structures", 3rd edition, Oxford University Press, New Delhi, 2013.
2. Raju N. Krishna, "Reinforced Concrete Design: Principles and Practice", 2nd edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2012.

REFERENCES:

1. B.C. Punmia. Ashok K. Jain and Arun K. Jain, Limit State design of Reinforced Concrete, 3rd edition, Laxmi Publications (P) Ltd., New Delhi, 2016.
2. Devadoss Menon and Pillai S., "Reinforced Concrete Design", McGraw Hill Education India Private Limited; 3rd edition 2009.
3. P.C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd.,New Delhi, 2nd edition, 2008.
4. IS 456: 2000 Plain and Reinforced Concrete - Code of Practice.
5. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), 3rd edition, Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2017.
6. https://archive.nptel.ac.in/courses/105/105/105105105/

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="2">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment II (100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER V

		Category: PCC				
U21CE502	STRUCTURAL ANALYSIS I	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- U21CE201: Engineering Mechanics
- U21CE303: Strength of Materials I
- U21CE401: Strength of Materials II

COURSE OBJECTIVES:

- To understand the basic theory and concepts of structural analysis
- To calculate energy and classical methods for the analysis of buildings
- To identify and analyse arches, cables and suspension bridges

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Analyze the continuous beams and plane frames by strain energy method (Analyze)

CO2: Examine the continuous beams and rigid frames analysis by slope defection method (Analyze)

CO3: Analyze the continuous beams and rigid frames by moment distribution method (Analyze)

CO4: Identify and analyze different types of arches (Apply)

CO5: Compute forces on cables and suspension bridges with stiffening girders (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	2	-	-	1	-	1	2	2
CO2	3	3	3	-	-	-	2	-	-	1	-	1	2	2
CO3	3	3	3	-	-	-	2	-	-	1	-	1	2	2
CO4	3	3	3	-	-	-	2	-	-	-	-	1	2	2
CO5	3	3	3	-	-	-	2	-	-	-	-	1	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I FUNDAMENTAL CONCEPTS AND STRAIN ENERGY METHOD **9+3**

Definition and Determination of Static and Kinematic Indeterminacy – 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+3**

Displacement method concept – Slope deflection equations – Fixed end moments – Analysis of continuous beams – Sinking of Supports – Analysis of single storey and single bay rectangular vertical frames with and without sway

UNIT III MOMENT DISTRIBUTION METHOD **9+3**

Basic concepts – Stiffness factor, Distribution factor and Carry over factors – Fixed end moments –

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Analysis of continuous beams – Sinking of Supports – Analysis of single storey and single bay rectangular vertical frames with and without sway

UNIT IV ARCHES **9+3**

Three hinged arch – Two hinged arch – Parabolic and semicircular arches – Concentrated loads – Uniform loads – Temperature effects – Determination of Reaction, Normal Thrust, Radial shear and Bending Moment

UNIT V CABLES AND SUSPENSION BRIDGES **9+3**

Components and their Functions – Analysis of cable under concentrated loads and UDL – Shape of cable under self-weight – Anchorage of suspension cables – Bending Moment and Shear Force in three hinged stiffened girders – Max Bending Moment due to single concentrated load and UDL– Two hinged stiffened girders

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXT BOOKS:

1. Vaidyanathan R., PerumalP.,"Comprehensive Structural Analysis", 13th edition, Vol I and II, Laxmi Publications, 2019
2. Punmia B.C., "Theory of Structures", 28th edition, Laxmi Publications, 2017

REFERENCES:

1. Reddy C.S., "Basic Structural Analysis", 4th edition,Tata McGraw-Hill Publications, 2011
2. Bhavikatti S.S., "Structural Analysis",Vol.I and II, 8th edition Vikas Publishing House, 2013
3. Punmia B.C., "Strength of Materials and Mechanics of Structures" Vol.II, 6th edition, Standard Publishers,2007

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER V

		Category: PCC				
U21CE503	ENVIRONMENTAL ENGINEERING I	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the process of water supply and distribution
- To explore the various water treatment techniques
- To gain the knowledge on planning and implementation of water supply projects

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Calculate the water demand for a water supply project (Apply)

CO2: Perform the tests on water quality parameters (Apply)

CO3: Design the water treatment units (Apply)

CO4: Identify the various techniques in advanced water treatment methods (Understand)

CO5: Plan the water supply for a city (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	-	-	1	1	1	-	-	-	1	-	1
CO2	-	-	2	-	2	1	1	1	-	-	-	-	-	-
CO3	2	-	2	-	-	1	1	1	-	1	-	1	-	1
CO4	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO5	1	-	2	-	-	1	1	-	-	-	1	1	-	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I WATER DEMAND AND CONVEYANCE SYSTEM 9

Water demand – design period – population forecasting methods. sources of water – hydrological concepts – ground water and its development. Conveyance of water – intake structures. pipe materials – corrosion – laying of pipes – pipe appurtenances.

UNIT II CHARACTERISTICS OF WATER 9

Physical, Chemical and Microbiological quality parameters. Drinking water quality criteria and standards. conventional contaminants and emerging contaminants – Impact on human health and Environment

UNIT III CONVENTIONAL TREATMENT UNITS AND DESIGN 9

Process, Mechanism and Design of conventional treatment units: Aeration, Screening, Sedimentation, Coagulation and Flocculation, Filtration and Disinfection

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UNIT IV ADVANCED TREATMENT UNITS 9

Process and Mechanism of an advanced treatment units: Water softening, Adsorption and Ion exchange processes, Electro coagulation, Desalination, Membrane filtration, Reverse osmosis, Electrodialysis, Treatment of specific contaminants: Fluoride, Nitrate, Iron, Manganese and Arsenic etc.

UNIT V PLANNING AND MAINTENANCE OF WATER SUPPLY PROJECTS 9

Water distribution system – House service connection – storage reservoirs – plumbing system in a building. Planning: rural, urban and metropolitan water supply project and its implementation. Operation and maintenance: water supply to buildings, rural, urban and metropolitan

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: 0 Periods Project - Periods

Total 45 Periods

TEXT BOOKS:

1. Garg, S.K. "Water Supply Engineering", Vol. 24th edition, Khanna Publishers, New Delhi, 2021
2. Punmia, B. C., Ashok Jain and Arun Jain, "Water Supply Engineering", 18th edition, Laxmi Publications (P) Ltd., New Delhi, 2014

REFERENCES:

1. "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Total Internal Assessments	End Semester Examinations
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER V

		Category: HSMC				
		L	T	P	J	C
U21SSG02	SOFT SKILLS - II	0	0	2	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the importance of communication and enhance self confidence
- To acquire employability skills

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Actively participate in Group Discussion (Analyze)

CO2: Enhance interview skills and make effective Presentation (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	-	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I PRESENTATION SKILLS 10

Presentation Techniques – Time Management Techniques – Body language – Managerial Skills – Making Effective Presentation

UNIT II GROUP DISCUSSION AND PUBLIC SPEAKING 10

Introduction to Group Discussion – Understanding Group Dynamics – Group Discussion Strategies– Activities to Improve GD Skills – Public Speaking Techniques – Public Speaking Activity

UNIT III INTERVIEW SKILLS 10

Listening to Interviews – Preparation for the Interview – Interview Techniques and Etiquettes – Handling Stress Interview – Mock Interview – Online Interview Techniques

Contact Periods:

Lecture: -Periods Tutorial: -Periods Practical: 30 Periods Project – Periods

Total 30 Periods

TEXT BOOKS:

1. Prashant Sharma, "Soft Skills: Personality Development for Life Success", BPB Publications, 1st edition,2022.
2. Leader Interpersonal and Influence Skills: The Soft Skills of Leadership." Routledge Publications, 2014.

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REFERENCES:

1. Ghosh B N, "Managing Soft Skills for Personality Development", 1st edition, Tata McGraw-Hill, 2012.
2. Nitin Bhatnagar and Mamta Bhatnagar, "Effective Communication and Soft Skills Strategies for Success", 1st edition, Pearson Education, 2012.

EVALUATION PATTERN:

Continuous Internal Assessments	Marks
Test - I	50
Test - II	50
Total	100

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SEMESTER V

		Category: EEC				
U21CE505	PROTO STUDIO I	L	T	P	J	C
		0	0	0	2	1

PRE-REQUISITES:

- U21CE407: Design Clinic II

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product.
- To enable hands-on experience for active learning.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the problem-solving techniques (Design thinking & system thinking)

CO2: Create Minimum Viable Prototype. (TRL 5)

CO3: Analyze product to technology fit.

CO4: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	-	2	1	-	-
CO2	3	3	3	3	3	3	3	3	3	3	3	2	-	-
CO3	3	3	3	3	3	3	3	3	3	3	3	2	-	-
CO4	3	3	3	3	3	3	3	2	3	3	3	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

Course conduction:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor for this Proto clinic 1 course.
- With the guidance from assigned mentor, the students will find & validate a problem statement, map to UNSGD, identify the skills required for the project and self-learn.
- The students will learn and apply design thinking, system thinking concept to solve the problem and produce the version 1 of MVP. (TRL 5)
- The student will learn teamwork, project management, product development, technical report writing and pitching through this course.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: - Periods Project 30 Periods

Total 30 Periods

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EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER VI

		Category: PCC				
U21CE601	ENVIRONMENTAL ENGINEERING II	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE503: Environmental Engineering I

COURSE OBJECTIVES:

- To provide Knowledge of sources and flow rates of wastewater and characteristics of Municipal waste water
- To introduce new developments in the field of waste water treatment
- To prepare students for higher studies and research in the field of wastewater treatment technology

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Outline the quality and quantity of wastewater (Apply)

CO2: Design the primary wastewater treatment technologies (Apply)

CO3: Design the secondary wastewater treatment technologies (Apply)

CO4: Infer decentralized wastewater treatment approach for sustainability (Apply)

CO5: Perform the sludge treatment (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	1	2	-	-	2	2	1	-	-	-	-	-	-
CO2	1	2	2	-	-	2	2	1	-	1	-	2	-	1
CO3	1	2	2	-	1	2	2	1	-	1	-	-	-	1
CO4	1	2	2	-	1	2	2	1	-	1	-	2	-	1
CO5	-	1	1	-	-	2	2	1	-	-	-	-	-	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I INTRODUCTION OF WASTE WATER 9

Components of Wastewater Flows – Wastewater Sources & Flow rate – Variations in Flow rates & Strength – Characteristics of Wastewater – Quantity of Wastewater, review of sewer design considerations – Minimum Size of Sewer – Limiting Velocities – Peak Factor Sewage Pumping, Location, Capacity, Pumping Station Design.

UNIT II PRIMARY TREATMENT OF WASTEWATER 9

Physical Unit Operations – Functions and design – Screening, Grit Removal, Oil & Grease Removal, Primary Sedimentation tanks and its types – Construction, operation and maintenance of treatment units

UNIT III SECONDARY TREATMENT OF WASTEWATER 9

Microbial Growth Processes – Suspended & Attached processes – Activated Sludge Process –

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Trickling Filters, Secondary Clarification tank – Aerated Lagoons – Oxidation Ditch – Anaerobic Lagoons – UASB – Septic Tank – Anaerobic Baffled Reactor.

UNIT IV DISPOSAL OF WASTE WATER AND DECENTRALIZED WASTEWATER TREATMENT 9

Standards for Disposal – Methods – dilution – Self-purification of surface water bodies – Oxygen sag curve – Streeter Phelp's Model – Stream Classification – Effluent Standards for Discharge into Surface Water & on Land. Concept of decentralized wastewater treatment systems – Case studies with sustainability approaches.

UNIT V SLUDGE TREATMENT 9

Solid Sources – Characteristics & Quantities – Sludge Pumping – Introduction to mass balance approach – Treatment – Thickening – Stabilization – Design of Sludge Digester – Conditioning, Dewatering, Drying, Ultimate Disposal of Sludge Solids – Treatment of waste water using Nanotechnology.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: 0 Periods

Total: 45 Periods

TEXT BOOKS:

1. Modi, P. N., "Sewage Treatment and Disposal & Waste Water Engineering", Vol II., 23rd edition, Standard book house since 1960, Revised edition January 2020.
2. Santosh kumar Garg, "Sewage Waste Disposal and.Air Pollution Engineering - Environmental Engineering" (Volume – 2), 18th edition, Khanna Publishers, 2021 Edition.
3. Manual on sewerage and sewage Treatment (Second Edition) prepared by the expert committee, constituted by the Government of India, Central Public Health, and Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, New Delhi, December 1993.

REFERENCES:

1. Metcalf & Eddy, "Wastewater Engineering: Treatment and Reuse", 4th Edition, Tata McGraw Hill (2nd Edition), year 2012, (ISBN: 0070495394 / 9780070495395).
2. Peavey, H.S.Rowe, D.R., and Tchobanoglous, "Environmental Engineering", 2nd edition, McGraw-Hill 46 Book Company, Revised edition January 2020.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER VI

		Category: PCC				
U21CE602	STRUCTURAL ANALYSIS II	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE201: Engineering Mechanics
- U21CE303: Strength of Materials I
- U21CE401: Strength of Materials II
- U21CE502: Structural Analysis I
- U21MA101: Calculus and differential equations

COURSE OBJECTIVES:

- To understand the concept of influence lines
- To solve by using classical methods for analysis of buildings
- To compute plastic analysis of beams and rigid frames

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Analyze the determinate beams with moving loads by using influence lines (Analyze)
CO2: Examine the indeterminate structures by using influence lines (Analyze)
CO3: Analyze the continuous beams, indeterminate plane frames and trusses by matrix flexibility method (Analyze)
CO4: Analyze the continuous beams, indeterminate plane frames and trusses by matrix stiffness Method (Analyze)
CO5: Compute plastic analysis of beams and frames (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	1	-	-	-	1	-	1	2	2
CO2	3	3	3	-	-	1	-	-	-	1	-	1	2	2
CO3	3	3	3	-	-	1	-	-	-	1	-	1	2	2
CO4	3	3	3	-	-	1	-	-	-	1	-	1	2	2
CO5	3	3	3	-	-	1	-	-	-	1	-	1	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I ROLLING LOADS AND INFLUENCE LINES FOR DETERMINATE BEAMS 9

Single concentrated load moving on the span – UDL longer than the span – UDL shorter than the span– Two concentrated loads – Series of concentrated loads –Influence lines for reactions, shear force, bending moment and Load Position for Absolute maximum Bending Moment.

UNIT II INFLUENCE LINES FOR INDETERMINATE STRUCTURES 9

Muller Breslau's principle – Application of Muller Breslau's principle to indeterminate beams.

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UNIT III MATRIX FLEXIBILITY METHOD 9

Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of static indeterminacy.

UNIT IV MATRIX STIFFNESS METHOD 9

Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of kinematic indeterminacy

UNIT V PLASTIC ANALYSIS 9

Statically indeterminate structures – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Static and kinematic methods –Upper and lower bound theorems–Plastic analysis of indeterminate beams and frames

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Vaidayanathan R and Perumal P., "Comprehensive Structural Analysis", 6th edition, Vol.I and II, Laxmi publications, 2019.
2. Reddy C.S., "Basic Structural Analysis", 4th edition, Tata McGraw Hill Publishing Co, 2013

REFERENCES:

1. Ramamurtham S, "Theory of structures", 2nd edition, Dhanpat Rai& Sons, New Delhi, 2013
2. Punmia B.C, "Strength of Materials and Mechanics of Structures", Vol. II, 1st edition, Standard publishers, 2007

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER VI

		Category: PCC				
U21CE603	DESIGN OF STEEL STRUCTURES	L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- U21CE303 - Strength of Materials I
- U21CE401 - Strength of Materials II

COURSE OBJECTIVES:

- To know the connections in steel structures.
- To introduce the limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
- To design the structural system for roof trusses as per current codal provisions.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Design the bolted connections (Apply)

CO2: Design the welded connections (Apply)

CO3: Determine the design strength of tension and compression members (Apply)

CO4: Select the suitable size and shape of beams according to design criteria (Apply)

CO5: Compute design loads on steel trusses as per IS codal provisions (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	3	2	2	-	2	2	2
CO2	2	2	2	2	-	-	-	3	2	2	-	2	2	2
CO3	2	2	2	2	-	-	-	3	2	2	-	2	2	2
CO4	2	2	2	2	-	-	-	3	2	2	-	2	2	2
CO5	2	2	2	2	-	-	-	3	2	2	-	2	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I INTRODUCTION AND BOLTED CONNECTION 9

Fundamental Concepts of limit state design of structures – Different types of rolled steel sections available to be used in steel structures – Stress-Strain relationship for mild steel. Connections: Behavior of bolted joints – Design strength of ordinary black bolts – high strength friction grip bolts – Pin connections – Simple connections – Eccentric bolted connections, Rivet connection.

UNIT II WELDED CONNECTION 9

Advantages of welding – Types and properties of welds –Types of joints – welded specifications – Design of welded joints subjected to axial load – Eccentric welded connections.

UNIT III TENSION AND COMPRESSION MEMBERS 9

Types of tension members – slenderness ratio – displacement of tension members – behaviour of

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tension members – modes of failure – factors affecting strength of tension members – angles under tension – design of tension members – Lug angles – splices. Possible failure modes – classification of cross-section – behavior of compression members – Effective length – radius of gyration and slenderness of compression members – Allowable stresses in compression – Design of axially loaded compression members – Built up compression members – Laced and Battened columns – eccentrically loaded columns.

UNIT IV DESIGN OF FLEXURAL MEMBERS 9

Beam types – section classifications – lateral stability of beams – Allowable stress in bending – Shear and Bearing stresses – Effective length of compression flange – Laterally supported and unsupported beams – Design of built up beams.

UNIT V FOUNDATION AND TRUSSES 9

Allowable stress in bearing – Slab base – Gusset base – Types of trusses – Economical spacing of roof trusses – loads on roof trusses – Estimation of wind load on roof trusses as per IS : 875. Design of members of roof truss and joints – Design of purlins.

LIST OF EXPERIMENTS

1. Detailing of bolted connections – Lap and Butt joint
2. Detailing of welded connections
3. Detailing of Tension members – Plate and angle
4. Detailing of Laced and Battened Columns
5. Bolted Connections – Beam to Beam, Beam to Column
6. Welded Connections – Beam to Beam, Beam to Column
7. Detailing of slab base and gusseted base
8. Detailing of Roof truss

Contact Periods:

Lecture:	45 Periods	Tutorial: – Periods	Practical: 30 Periods	Project	– Periods
				Total	75 Periods

TEXT BOOKS:

1. Subramanian.N, "Design of Steel Structures", 16th edition, Oxford University Press, New Delhi, 2018.
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", 3rd edition, McGraw Hill Education India Pvt.Ltd., 2013

REFERENCES:

1. Sai Ram. K.S. "Design of Steel Structures", 2nd Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2015.
2. Shiyekar. M.R., "Limit State Design in Structural Steel", 2nd Edition, Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2017.
3. Bhavikatti.S.S, "Design of Steel Structures by Limit State Method as per IS: 800 – 2007", 2nd Edition, IK International Publishing House Pvt. Ltd., 2012.
4. IS 800:2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007 & SP 6(1) Hand book on structural Steel Sections.

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EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations	
Assessment I (Theory) (100 Marks)			Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test I	Written Test II	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	60	75	25		
25			25		35	15
50					50	
Total: 100						

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER VI

		Category: PCC				
U21CE604	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	J	C
		0	0	2	2	2

PRE–REQUISITES:

- U21CE053: Environmental Engineering I
- U21CE601: Environmental Engineering II

COURSE OBJECTIVES:

- To learn the characteristics of water quality parameters
- To gain the knowledge on effluent standards
- To explore the various water treatment techniques

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the standard methods for the analysis of water and wastewater (Apply)

CO2: Analyze and quantify the physical and chemical quality parameters (Apply)

CO3: Calculate the coagulant dosage required for the treatment of water (Apply)

CO4: Demonstrate the microbiological analysis of water and wastewater (Apply)

CO5: Identify the advanced techniques in the water and wastewater quality analysis (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	3	-	1	1	1	2	1	-	1	-	1
CO2	-	-	2	3	-	1	1	1	2	1	-	-	-	-
CO3	2	-	2	3	-	1	1	1	2	1	-	1	-	1
CO4	-	-	-	3	-	1	1	1	2	1	-	-	-	-
CO5	1	-	2	3	2	1	1	1	2	1	-	1	-	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

LIST OF EXPERIMENTS

The following tests can be performed for water or wastewater samples

1. Determination of pH, EC and Turbidity
2. Determination of Acidity and Alkalinity
3. Determination of Chlorides and Hardness
4. Determination of optimum coagulant dosage
5. Determination of Solids
6. Estimation of Residual Chlorine
7. Determination of B.O.D

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8. Determination of C.O.D
9. Determination of Nitrates and Sulphates
10. Determination of Calcium, Potassium and Sodium
11. Microbiological study on MPN (Demonstration only)
12. Heavy metals determination - Chromium, Lead and Zinc (Demonstration only)

Contact Periods:

Lecture: 0 Periods Tutorial: 0 Periods Practical: 30 Periods Project: 30 Periods

Total: 60 Periods

TEXT BOOKS:

1. Garg, S.K. "Water Supply Engineering", Vol. I, 3rd edition, Khanna Publishers, New Delhi, 2016
2. Punmia, B. C., Ashok Jain and Arun Jain, "Water Supply Engineering", 2nd edition, Laxmi Publications (P) Ltd., New Delhi, 2014
3. Santosh kumar Garg, "Sewage Waste Disposal and Air Pollution Engineering - Environmental Engineering" (Volume – 2), Khanna Publishers, 2021 Edition, (ISBN: 978-81-7409-230-4).
4. Standard methods for the examination of water and wastewater, American Public Health Association, 2017.

REFERENCES:

1. "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (Practical) (100 Marks)		Assessment II (Project) (100 Marks)			
Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test	Review I	Review II	Review III	Practical Examinations (Examinations will be conducted for 100 Marks)
75	25	15	25	60	
25		25			50
50					50
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER VI

U21CE605	COMPUTER AIDED ANALYSIS AND DESIGN LABORATORY	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21CE501: Design of RC Elements
- U21CE502: Structural Analysis I

COURSE OBJECTIVES:

- To analyze and design of various RCC structural elements using Manual and ETABS software
- To Compare the results of manual design and software

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Analyze and design the various RCC structural elements manually (Analyze)

CO2: Analyze and design the beams and frames for different load cases (Analyze)

CO3: Analyze and design the multi-storey building (Analyze)

CO4: Analyze and design the RCC building for wind loads and seismic loads (Analyze)

CO5: Compare the manual design and software (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	3	3	1	-	-	2	2	-	2	2	2
CO2	1	3	3	3	3	1	-	-	2	2	-	2	2	2
CO3	1	3	3	3	3	1	-	-	2	2	-	2	2	2
CO4	1	3	3	3	3	1	-	-	2	2	-	2	2	2
CO5	1	3	3	3	3	1	-	-	2	2	-	2	2	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

LIST OF EXPERIMENTS

1. Manual calculation of Beams, Slabs, Column & Footing
2. Analysis of continuous beam
3. Analysis of single storey frame
4. Analysis of multi-storey frame
5. Design of multi-storey frame
6. Analysis of multi-storeyed building
7. Design of multi-storeyed building
8. Wind load and Seismic analysis on RCC building
9. Analysis and design of steel truss
10. Comparative study of Manual Design and Software

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Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total 60 Periods

REFERENCES:

1. T.S.Sarma, —STAAD Pro V8ifor Beginners ll, 1st Edition, Notion Press, 2014.
2. Sagale, Akshay, and Sandip Dongre. "Analysis and Design of Cable Stayed Bridge using STAAD-PRO, 1st Edition, Notion Press, 2014.

EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

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SEMESTER VI

		Category: HSMC				
U21SSG03	SOFT SKILLS – III	L	T	P	J	C
		0	0	2	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To improve language adeptness and to enhance fluency in language.
- To Gain emotional intelligence and to manage stress.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Write reports and make reasoning and assertions (Apply)

CO2: Overcome stress and attain work-life balance (Analyze)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	3	-	-	1	-
CO2	-	-	-	-	-	-	-	1	-	3	-	2	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I LANGUAGE ADEPTNESS 10

Sentence Completion – Report Writing – Logical Reasoning – Cause and Effect – Assertion and Reasoning – Digital Profiling – Creative Resume

UNIT II STRESS MANAGEMENT 10

Factors Causing Stress – Positive and Negative Stress – Effects of Stress – Stress Overcoming Techniques – Context Based Tasks

UNIT III EMOTIONAL INTELLIGENCE 10

Leadership effectiveness – Self-awareness – Self-management – Self-motivation – Empathy and Social Skills

Contact Periods:

Lecture: - Periods Tutorial: -Periods Practical: 30 Periods Project – Periods

Total 30 Periods

TEXT BOOKS:

1. Daniel Goleman, "Emotional Intelligence: Why it Can Matter More Than IQ", 1st edition, Bloomsbury, 2009.
2. Alan Barker, "Improve Your Communication Skills : Present with Confidence; Write with Style; Learn Skills of Persuasion",1st edition, Kogan Page, 2010.

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REFERENCES:

1. Jeremy Stranks, "Stress at Work: Management and Prevention", 1st edition, Butterworth-Heinemann, 2005.
2. Edward J Watson, "Emotional Intelligence: A Practical Guide on How to Control Your Emotions and Achieve Lifelong Social Success", 1st edition, Amazon Digital Services LLC, 2016.

EVALUATION PATTERN:

Continuous Internal Assessments	Marks
Test - I	50
Test - II	50
Total	100

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SEMESTER VI

U21CE606	PROTO STUDIO II	Category: EEC				
		L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITES:

- U21CE505: Proto Studio I

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product.
- To enable hands-on experience for active learning.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Apply the problem-solving techniques (Design thinking & system thinking)

CO2: Create Minimum Viable Prototype. (TRL 6)

CO3: Analyze product to market fit.

CO4: Develop a business model

CO5: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

Pos / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	-	2	1	-	-
CO2	3	3	3	3	3	3	3	3	3	-	3	2	-	-
CO3	3	3	3	3	3	3	3	3	3	-	3	2	-	-
CO4	3	3	3	3	3	3	3	3	3	-	3	2	-	-
CO5	-	-	-	-	3	-	-	3	3	3	3	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

COURSE CONDUCTION:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor for this Proto clinic 2 course.
- With the guidance from assigned mentor, the students will find & validate a problem statement, map to UNSGD, identify the skills required for the project and self-learn.
- The students will apply design thinking, system thinking concepts to solve the problem and produce the version 2 of MVP. (TRL 6)
- The student will learn teamwork, project management, product development, technical report writing and pitching through this course.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: - Periods Project 30 Periods

Total 30 Periods

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EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER VII

		Category: PCC				
U21CE701	CONSTRUCTION PROJECT MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To study the project life cycle in construction
- To understand the project network analysis
- To explain the concept of quality, material and safety management

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the project life cycle and role of project manager (Understand)

CO2: Outline the project formulation, preliminary analysis and feasibility report (Understand)

CO3: Apply the network analysis in construction project (Apply)

CO4: Explain the material, labour and safety management in construction (Understand)

CO5: Summarize the cost and quality control management in construction (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	-	1	2	2	1	2	-	1
CO2	3	-	-	-	-	3	-	1	2	2	1	2	-	1
CO3	3	3	-	-	2	3	-	1	2	2	1	2	-	1
CO4	3	-	-	-	-	3	-	1	2	2	1	2	-	1
CO5	3	-	-	-	-	3	-	1	2	2	1	2	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION 9

Introduction – Project Life Cycle – Types of Construction – Selection of Professional Services – Construction Project Characteristics – Role of Project Managers – Leadership and Motivation for the Project Team – Contract Management

UNIT II PROJECT FORMULATION 9

Project – Concept – Capital investments – Generation and Screening of Project ideas – Project identification – Preliminary analysis, Market, Technical, Financial, Economical and Ecology – Pre-Feasibility Report and its Clearance.

UNIT III PROJECT NETWORK ANALYSIS 9

Project Plan – Types – Defining Project activities – Work breakdown structure – Resources leveling – CPM – PERT – Precedence networks for construction

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UNIT IV MATERIAL, LABOUR AND SAFETY MANAGEMENT 9

Labour Productivity – Factors Affecting Job-Site Productivity – Labour Relations in Construction – Materials Management – Material Procurement and Delivery – Inventory Management – Safety Management – Importance –Safety measures.

UNIT V COST AND QUALITY CONTROL MANAGEMENT 9

Factors influencing construction quality – Responsibility and authority – Quality plan – Quality management Guidelines – Cost control – Cost control methods and techniques – Control of project cash flow.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Chitkara, K.K. "Construction Project Management", 1st Edition, Mc Graw Hill, 2019.
2. Srinath,L.S., "PERT and CPM Principles and Applications", 2nd Edition, Affiliated East West Press, 2001
3. Piyush Bhandari, "Construction Project Management", 4th Edition, Notion Press Media Pvt Ltd,2021.

REFERENCES:

1. Frederick E. Gould and Nancy Eleanor Joyce, "Construction Project Management", Pearson Education, London, 5th Edition, 2011.
2. George J.Ritz, "Total Construction Project Management", McGraw–Hill Inc,New York, 6th Edition, 2013.
3. Keoki Sears, S. Glenn Sears, S. and Richard Clough, H., "Construction Project Management - A Practical Guide to Field Construction Management", 1st Edition, Wiley Publication, New Jersey, 2010.

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="2">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment Ii (100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td>200</td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER VII

		Category: PCC				
U21CE702	ESTIMATION AND QUANTITY SURVEYING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To identify the methods used for different structural components
- To understand rate analysis and the process of preparation of bills
- To acquire knowledge on different methods of valuation of land and building

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Estimate the quantities for residential and industrial building (Apply)

CO2: Prepare detailed estimate for different types of structures (Apply)

CO3: Calculate the rate analysis for various types of works (Analyze)

CO4: Understand the different types of contracts, tender document for building (Understand)

CO5: Identify the different methods of valuation (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	2	-	-	2	3	-
CO2	3	1	3	-	-	-	-	-	2	-	-	2	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO5	2	-	-	-	-	-	-	-	-	2	-	2	-	3

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I ESTIMATE OF BUILDING 9

Introduction - General items of work in building – Standard units – Principles of working out quantities for detailed and abstract estimates – Methods of estimates of buildings – Long wall and Short wall method – Centre line method – Preparation of detailed estimate of R.C.C framed and load bearing structures.

UNIT II ESTIMATE OF INFRASTRUCTURES 9

Estimation of septic tank, soak pit – Sanitary and water supply installations – Plumbing and water supply pipe line – Estimate of Road materials for flexible and rigid pavements – Estimate of retaining walls – Culverts

UNIT III RATE ANALYSIS AND SPECIFICATIONS 9

Analysis of Rates: Purpose – Schedule of rates – Factors affecting rates – Importance –Materials for different items of work – Rate of materials and labours – Analysis of rates for cement concrete,

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R.C.C. , brick masonry, stone masonry, hollow block masonry, plastering, painting, flooring, road works, sanitary works, water supply works and electrical work. Specifications: Specifications – Purpose and basic principles – General and detailed specifications – Detailed specifications for various items of work.

UNIT IV TENDER AND CONTRACTS 9

Tender: Tender notices – Types – Prequalification of contractors – Pre-bid meeting – Drafting – Model tenders – Procedure for submission and opening of tender – Acceptance and rejection of tender – Tender validity period – E-tendering. Contracts: Contract – Type of contract – Contract laws – FIDIC – Contract conditions – Drafting of contract documents – Arbitration and legal requirements.

UNIT V VALUATION AND REPORT 9

Valuation: Necessity – Purpose of valuation – Types – Valuation methods – Market value – Scrap value – Salvage value – Annuity – Capitalized value – Sinking fund – Depreciation – Value of building – Rent fixation – Mortgage – Lease. Report: Principles for report preparation – Report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project - Periods

Total 45 Periods

TEXT BOOKS:

1. Dutta B N, "Estimating and Costing in Civil Engineering", 27th edition, UBS Publishers & Distributors Pvt. Ltd, Noida, 2016
2. Rangwala C, "Estimating, Costing and Valuation", 17th edition, Charotar Publishing House Pvt. Ltd, Gujarat, 2017

REFERENCES:

1. Vazirani V N, Chandola S P, "Estimating and Costing", 6th edition, Khanna Publishers, Delhi, 2015
2. Chakraborti M, "Estimating Costing Specification and Valuation in Civil Engineering", 24th edition, Jai Book, India, 2012
3. Standard schedule of rates and standard data book by public works department

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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SEMESTER VII

		Category: EEC				
U21CE703	PROJECT WORK PHASE - I	L	T	P	J	C
		0	0	0	4	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop the ability to identify and solve a specific problem in the field of Civil Engineering
- To train the students in preparing project reports and to face reviews and viva voce examination

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Identify the leading problems related to Civil Engineering (Apply)

CO2: Identify, discuss and justify the technical aspects of the chosen project with comprehensive and systematic approach (Apply)

CO3: Work as an individual or in a team in development of technical projects (Apply)

CO4: Gain practical professional experience in Civil Engineering (Apply)

CO5: Develop the solution for the problem identified in Civil Engineering (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO2	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO3	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO4	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO5	3	2	2	3	2	2	2	2	3	3	2	3	3	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)				

STRATEGY

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs

Contact Periods:

Lecture: - Periods Tutorial: – Periods Practical: – Periods Project: 60 Periods

Total: 60 Periods

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EVALUATION PATTERN:

Internal Assessments (60 Marks)			End Semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report		Viva-Voce	
			Supervisor	External	Internal	External
10	20	30	10	10	10	10
Total: 100 Marks						

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SEMESTER VIII

U21CE802	PROJECT WORK PHASE - II	Category: PCC				
		L	T	P	J	C
		0	0	0	16	8

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop the ability to identify and solve a specific problem in the field of Civil Engineering
- To train the students in preparing project reports and to face reviews and viva voce examination

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Practice acquired knowledge within the chosen area of technology for project development (Apply)

CO2: Identify, discuss and justify the technical aspects of the chosen project with comprehensive and systematic approach (Apply)

CO3: Reproduce, improve and refine technical aspects for engineering projects (Apply)

CO4: Work as an individual or in a team in development of technical projects (Apply)

CO5: Communicate and report effectively project related activities and findings (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO2	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO3	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO4	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO5	3	2	2	3	2	2	2	2	3	3	2	3	3	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)				

STRATEGY

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs

Contact Periods:

Lecture: - Periods Tutorial: – Periods Practical: – Periods Project: 280 Periods

Total: 280 Periods

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EVALUATION PATTERN:

Internal Assessments (60 Marks)			End Semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report		Viva-Voce	
			Supervisor	External	Internal	External
10	20	30	10	10	10	10
Total: 100 Marks						

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP01	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE501 Design of RC elements
- U21CE502 Structural Analysis I
- U21CE602 Structural Analysis II

COURSE OBJECTIVES:

- To understand the behaviour and response of structures under dynamic loading
- To introduce the basics of Earthquake Engineering and ground motions
- To discuss codal provisions and design concepts on different types of structures

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the concepts of single degree of freedom with free and forced vibration (Understand)

CO2: analyze the multi degree of freedom with free and forced vibration (Analyze)

CO3: summarize the basics of Earthquake Engineering (Understand)

CO4: determine the earthquake response in elastic and inelastic building (Apply)

CO5: interpret the suitable application of codal provisions in seismic design of buildings (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	–	–	–	–	–	–	–	–	1	2	2
CO2	3	3	2	–	–	–	–	–	–	–	–	1	2	2
CO3	3	–	–	–	–	1	–	–	–	–	–	1	2	2
CO4	3	3	2	–	–	2	–	–	–	–	–	1	2	2
CO5	3	3	3	–	–	2	–	2	–	–	–	1	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I INTRODUCTION AND SINGLE DEGREE OF FREEDOM SYSTEM 9

Introduction to structural dynamics – Importance of structural dynamics – Types of dynamic loads – Methodology of dynamic analysis – Single Degree of Freedom, Idealisation of structure as Single degree of freedom – Natural frequency – Viscous damping – Free and Forced vibration of damped and undamped structures – Response to harmonic and periodic forces

UNIT II MULTIPLE DEGREE OF FREEDOM SYSTEM 9

Equation of motion for multiple degree of freedom – Eigen values and Eigen Vectors – Response to

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free and forced vibration of undamped and damped MDOF systems

UNIT III INTRODUCTION ABOUT EARTHQUAKE ENGINEERING 9

Basic Seismology – General features of Tectonics of Seismic Regions – Basic Terminology – Earthquake intensity and magnitude – Earthquake ground motion – Past Earthquakes – Seismographs

UNIT IV EARTHQUAKE RESPONSE 9

Earthquake Response to Elastic and Inelastic Buildings – Application to Response Spectrum Theory – Base excitation motion – Ground motion parameters – Modal response contribution – Modal participation factor – Response history – Spectral analysis – IS codal provisions for the determination of lateral loads

UNIT V DESIGN CONCEPTS 9

Seismic design concepts – Design spectrum – Earthquake resistant design for simple framed structures as per IS: 1893 codal provisions – Ductile detailing of reinforced concrete frames as per IS: 13920

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Anil K. Chopra., "Dynamics of Structures - Theory and applications to Earthquake Engineering", Prentice - Hall of India Pvt. Ltd. New Delhi, 2005.
2. Pankaj Agarwal., "Earthquake Resistant Design of Structures", Prentice - Hall of India Pvt. Ltd. New Delhi, 2012.

REFERENCES:

1. Mukhopadhyay, M., "Structural Dynamics", Ane Books, India, 2006.
2. Craig, R.R., and Andrew J.K. "Structural Dynamics - An Introduction to Computer Methods", John Wiley & Sons, 2006.
3. Duggal, S.K., "Earthquake Resistant Design of Structures", Oxford university press, 2007.
4. Jaykrishna., "Elements of earthquake engineering", Saritha Prakasan, Naunchandi, Meerut.
5. IS 1893 (Part 1):2002, Criteria for Earthquake Resistant Design of Structures.
6. IS:13920:1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP02	PRESTRESSED CONCRETE STRUCTURES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce the basic principle and types of prestressing in structural elements
- To design the prestressed concrete structural elements
- To understand the various time dependent factors

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the general mechanical behaviour of prestressed concrete and analysis of various sections (Apply)

CO2: design the prestressed concrete member subjected to flexure and shear (Analyze)

CO3: explain about anchorage zone stresses and design the anchorage reinforcement (Apply)

CO4: analyze and design of the composite member for stresses and deflection (Analyze)

CO5: design the tension and compression member (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	1	-	-	-	-	-	-	1	2
CO2	3	2	2	-	-	1	-	1	-	-	-	1	1	2
CO3	3	2	2	-	-	1	-	1	-	-	-	1	1	2
CO4	3	2	2	-	-	1	-	1	-	-	-	1	1	2
CO5	3	2	2	-	-	1	-	-	-	-	-	-	1	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

SYLLABUS:

UNIT I INTRODUCTION 9

Principles – Pretensioning – Post tensioning – Advantages and Types of prestressing – Systems of prestressing – Comparison of prestressed concrete with reinforced concrete – Materials – Characteristics of concrete and high tensile steel – Theory and behaviour of prestressed concrete beams in bending – Calculating fibre stresses for various section (Rectangle, I, T) of simply supported beam due to prestressing force, dead load and external live load – Stress method – Moment of resistance method – Load balancing method. Losses of prestress – Estimation of crack width

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per IS1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned

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beams – Check for strength limit based on IS 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on IS 1343 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 state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343 code – 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 – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design

UNIT V MISCELLANOUS STRUCTURES 9

Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing – Merits and demerits of partial prestressing

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Krishna Raju N, "Prestressed concrete", 6th Edition, Tata McGraw Hill Company, 2018.
2. Pandit G S and Gupta S P, "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012

REFERENCES:

1. Dayaratnam P, "Prestressed Concrete Structures", Oxford and IBH, 2013
2. Lin T Y and Ned H Burns, "Design of Prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., 2013
3. IS1343:1980, "Code of Practice for Prestressed Concrete, Bureau of Indian Standards", New Delhi, 2012

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP03	PREFABRICATED STRUCTURES	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE501 Design of RC Elements

COURSE OBJECTIVES:

- To understand the principles and behavior of prefabrication
- To identify the economical sections and different type of joints
- To design prefabricated component and structural connections

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the production, transportation and erection of prefabrication systems (Understand)

CO2: outline the behaviour and construction sequence of prefabricated slabs, walls and columns (Understand)

CO3: design the economical cross section of prefabricated structures (Apply)

CO4: interpret the different types of connections between structural members (Understand)

CO5: design the structure for abnormal loads (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	1	-	-	-	-	-	2	2	2
CO2	3	3	2	-	-	1	-	-	-	-	-	2	2	2
CO3	3	3	3	-	-	-	-	1	-	-	-	-	2	2
CO4	3	3	2	-	-	1	-	1	-	-	-	2	2	2
CO5	3	2	2	-	-	1	-	1	-	-	-	1	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I INTRODUCTION 9

Need for prefabrication – Principles – Comparison of precast construction method and in-situ method – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection – Elimination of erection stresses

UNIT II PREFABRICATED COMPONENTS 9

Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

UNIT III DESIGN PRINCIPLES 9

Design of Structural components – Disuniting of structures – Design of cross section based on

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efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation

UNIT IV JOINT IN STRUCTURAL MEMBERS 9

Joints for different structural connections – Dimensions and detailing – Design of expansion joints - Jointing Materials

UNIT V DESIGN FOR ABNORMAL LOADS 9

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones – Importance of avoidance of progressive collapse

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers,USA,1991.
2. Mokk, "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian, Academy of Sciences, Budapest, 2007.
3. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011.

REFERENCES:

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP04	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE301 - Concrete Technology

COURSE OBJECTIVES:

- To study the available techniques adapted for evaluating and repairing the existing structure
- To understand the damage assessment, repair and rehabilitation of structures
- To obtain knowledge on quality of concrete, durability aspects, corrosion and causes of deterioration in structures

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: perform physical investigation and suggest approaches to repair the damaged structure (Understand)

CO2: identify the cracks and deterioration of concrete in structures (Apply)

CO3: apply suitable materials for repair and rehabilitation of structures (Apply)

CO4: understand the corrosion mechanism and its protection from concrete structures (Understand)

CO5: choose the techniques for retrofitting and strengthening of structural elements (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	2	-	-	-	-	-	-	2	1
CO2	3	2	2	-	-	2	-	-	-	-	-	-	2	1
CO3	3	2	2	-	-	2	-	-	-	-	-	2	-	2
CO4	3	2	-	-	-	2	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	2	-	-	-	-	-	2	2	2
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)						3: Substantial (High)					

SYLLABUS:

UNIT I MAINTENANCE AND EVALUATION 9

Facets and categories of maintenance – Procedure for evaluating damaged structure – Condition assessment of concrete structures under exposure conditions – Visual survey, on-site and laboratory testing – Non-destructive tests (NDT) – Inspection and monitoring – Quality assurance of concrete – Case studies

UNIT II CRACKS AND DETERIORATION OF STRUCTURES 9

Cracks: Types and causes of cracks – Characteristics of cracks – Measurement and interpretation of cracks – Crack repair and ceiling

Deterioration: Types of deterioration – Physical deterioration – Chemical deterioration –

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Deterioration due to water leakage, fire and ageing – Visual deterioration of structures

UNIT III SPECIAL CONCRETES AND REPAIR MATERIALS 9

Special concretes:Fiber reinforced concrete – Bendable concrete – Lightweight concrete – Self compacting Concrete – Concrete made with industrial wastes

Repair Materials: Criteria for durable concrete repair – Selection of repair materials – Different types of repair materials and their application – Repair techniques – Case studies

UNIT IV CORROSION 9

Introduction – Various forms of Corrosion – Corrosion of steel in concrete – Corrosion Inhibitors - Corrosion Resistant Steels – Coatings to Reinforcement – Cathodic Protection – Corrosion control and protection of concrete structures

UNIT V RETROFITTING OF STRUCTURES 9

Design philosophy of strengthening structures – Conventional and advanced techniques – Repair of structures distressed due to corrosion, fire, leakage, earthquake – SHM (Structural Health monitoring) – Advanced techniques to enhance the seismic resistance of structures – Demolition – Case Studies

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Shetty. M. S, "Concrete Technology-Theory and Practice", Chand and Company Publishers, 2018
2. Varghese. P.C, "Maintenance Repair and Rehabilitation & Minor works of building", Prentice Hall India Private Ltd, 2014
3. Dodge Woodson. R, "Concrete Structures - Protection, Repair and Rehabilitation", Butterworth-Heinemann, Elsevier, New Delhi 2012

REFERENCES:

1. Vidivelli .B, "Rehabilitation of Concrete Structures", Standard Publishers Distribution, 2009
2. Handbook on "Seismic Retrofit of Buildings", CPWD and Indian Buildings Congress, Narosa Publishers, 2008
3. Handbook on "Repair and Rehabilitation of RCC Buildings", Director General works CPWD, Govt of India, New Delhi, 2002

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
		L	T	P	J	C
U21CEP05	STRUCTURAL DESIGN AND DRAWING	3	0	0	0	3

PRE–REQUISITES:

- U21CE501 Design of RC Elements
- U21CE603 Design of Steel Structures

COURSE OBJECTIVES:

- To design and detail components of retaining wall
- To design flat slabs and liquid storage structures
- To acquire knowledge on designing and detailing of bridge components and industrial structures

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: design different types of reinforced concrete retaining walls (Analyze)

CO2: design flat slab and reinforced concrete solid slab bridge as per codal provisions (Analyze)

CO3: design reinforced concrete water tanks at different support levels (Analyze)

CO4: analyze and design various steel roof trusses (Analyze)

CO5: analyze and design plate girders and industrial gantry girders (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	-	2	-	-	-	2	-	2
CO2	3	3	2	-	-	1	-	2	-	-	-	-	-	2
CO3	3	3	2	-	-	1	-	2	-	-	-	2	1	2
CO4	3	3	2	-	-	1	-	2	-	-	-	2	1	2
CO5	3	3	2	-	-	1	-	2	-	-	-	1	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I RETAINING WALLS 9

Design of Reinforced concrete Cantilever and Counter fort retaining walls – Backfill with surcharge – Design of shear key

UNIT II FLAT SLAB 9

Design of Flat slabs with and without drops by direct design method of IS Code

UNIT III LIQUID STORAGE STRUCTURES 9

Design of RCC water tanks – Elevated Circular, On ground, Underground Rectangular and circular Tanks

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KPRIET
Learn Beyond

UNIT IV INDUSTRIAL STRUCTURES 9

Structural steel framing – Steel roof trusses – Roofing elements – Beam columns – Codal provisions

UNIT V GIRDERS AND CONNECTIONS 9

Plate girders – Behaviour of components – Deign of welded Plate Girder – Design of Industrial Gantry Girders – Design of Eccentric Shear and Moment Resisting Connections

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Krishnaraju N., "Structural Design and Drawing", Universities Press, 2009
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications Pvt. Ltd., 2003

REFERENCES:

1. Krishnamurthy D., "Structural Design and Drawing", Vol. I, II and III, CBS Publishers, 2010
2. Duggal S.K., "Limit State Design of Steel Structures", McGrew Hill Education, 2017

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP06	STEEL CONCRETE COMPOSITE STRUCTURES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE501 Design of RC Elements
- U21CE603 Design of Steel Structures

COURSE OBJECTIVES:

- To understand the behaviour and concepts of concrete composite elements and structures.
- To design the various steel concrete composite structures in construction.
- To gain knowledge about behavior of composite structures under seismic condition

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the design philosophy of composite action has on structural component (Understand)

CO2: design the connections for composite members (Apply)

CO3: apply the design concepts for simply supported composite slabs and beams (Apply)

CO4: understand the concepts for continuous beams and slabs, beams in frames (Analyze)

CO5: design composite columns and frames (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	1	-	2	-	-	-	-	1	-
CO3	3	3	3	-	-	1	-	2	-	-	-	-	-	-
CO4	3	3	2	-	-	1	-	2	-	-	-	1	1	-
CO5	3	3	3	-	-	1	-	2	-	-	-	1	-	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I INTRODUCTION 9

Introduction – composite beams and slab – Composite columns and frames – Limit state design philosophy – Properties of materials – Direct actions – Methods of analysis and design

UNIT II SHEAR CONNECTION 9

Introduction – Simply supported beam of rectangular cross-section – Uplift – Methods of shear connection – Properties of shear connections – partial interaction – Degree of shear connection on stresses and deflections – Longitudinal shear in composite slabs

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UNIT III SIMPLY SUPPORTED COMPOSITE SLABS AND BEAMS 9

Introduction – Layout, materials and loadings – Composite floor slabs – Composite beams – Sagging bending and vertical shear – Longitudinal shear stresses, deflections and cracking in service

UNIT IV CONTINUOUS BEAMS AND SLABS 9

Types of global analysis – Beam to column joint – Hogging moment regions of continuous composite beams – Global analysis of continuous beams – Stresses and deflections in continuous beams – Design strategies for continuous beams – Continuous composite slabs

UNIT V COMPOSITE COLUMNS AND FRAMES 9

Introduction – Composite columns – Beam to column joints – Design of non-sway composite frames – Simplified design method – Internal and external column – Concrete filled steel tube with high strength materials – Composite trusses

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Roger P.Johnson and Yong C.Wang, "Composite Structures of Steel and Concrete: Beams, Slabs, Columns and Frames for Buildings", 4th edition,Wiley-Blackwell, US,2018
2. Johnson R.P., 'Composite Structures of steel and concrete', Blackwell Scientific Publications, UK, 2004.

REFERENCES:

1. Proceedings of "Workshop on Steel Concrete Composite Structures", conducted at Anna University, 2000.
2. Owens, G.W. and Knowels. P. Steel Designers manual, 5th edition, Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.
3. IS 11384 - 1985, Code of Practice for Steel concrete Composite structures.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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KPRIET
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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP07	AIR POLLUTION AND MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the various air pollutant sources
- To explore the different air pollution control measures
- To gain the knowledge on air pollution management

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: examine the various type of air Pollutants coming out from different sources (Understand)

CO2: demonstrate the dispersion of pollutants, meteorological factors and dispersion models (Apply)

CO3: identify appropriate control equipment to minimize the air pollution problems in industries (Apply)

CO4: determine the major air pollutants as per the standards (Understand)

CO5: interpret the air pollution monitoring and its prevention (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	1	1	-	-	-	-	1	-	-
CO2	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO3	2	-	-	-	-	1	1	-	-	-	-	1	-	-
CO4	-	2	-	-	-	1	1	1	-	-	-	-	-	-
CO5	1	-	-	-	-	1	1	-	-	-	1	1	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)					3: Substantial (High)			

SYLLABUS:

UNIT I SOURCE AND EFFECTS OF AIR POLLUTANTS 9

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Effects of air pollution on human beings, materials, vegetation, animals – Global warming – Ozone layer depletion, Sampling and analysis of pollutants

UNIT II DISPERSION OF POLLUTANTS 9

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications – Emission Standards: Types, Variant Forms of emission standards, means for implementing emission Standards

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UNIT III AIR POLLUTION CONTROL 9

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – Gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries

UNIT IV AIR QUALITY STANDARDS 9

Air Quality Criteria and Standards: Air Quality Criteria, Conversion of effects data, Conversion of Physical data, Conversion of biological data and criteria to standards –Town planning regulation of new industries – Legislation and enforcement – National and International standards

UNIT V AIR QUALITY MANAGEMENT 9

Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Ambient Air Pollutants: Analysis and measurement of particulates and gaseous pollutants – Indoor air pollutants

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Project 0 Periods

Total 45 Periods

TEXT BOOKS:

1. Yerramilli, Anjaneyulu, "Air Pollution: Prevention and Control Technologies". India, BS Publications, 2019
2. Rao C.S., "Environmental Pollution Control Engineering". India, New Age International (P) Limited, 2020
3. "Air Pollution: Sources, Impacts and Controls". United Kingdom, CAB International, 2019

REFERENCES:

1. Cheremisinoff, Paul N, "Air Pollution Control and Design for Industry". United States, CRC Press, 2018
2. Bhatia S. C., "Industrial Pollution and Its Control" (2 Vol). India, Woodhead Publishing India Pvt Limited, 2017
3. Vallero, Daniel A., "Fundamentals of Air Pollution". Netherlands, Elsevier Science, 2014
4. De Visscher, Alex, "Air Dispersion Modeling: Foundations and Applications". Germany, Wiley, 2013

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP08	INDUSTRIAL WASTE WATER ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES

- Nil

COURSE OBJECTIVES

- To discuss the source and characteristics of Industrial wastewater
- To deliberate the Preliminary treatment of industrial wastewater from different industries
- To provide knowledge on disposal options for specific pollutants arising out of industrial processes

COURSE OUTCOMES

Upon completion of the course, the student will be able to

CO1: identify the properties of industrial wastewater (Understand)

CO2: interpret the industrial process, water utilization and waste reduction (Understand)

CO3: examine the characteristics and composition of industrial wastewater (Understand)

CO4: choose appropriate treatment method for industrial wastewater (Understand)

CO5: design the effluent treatment plant for any industry (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	1	1	-	-	-	-	-	-	-
CO2	1	1	-	-	-	1	1	-	-	-	-	-	-	-
CO3	1	1	-	-	-	1	1	-	-	1	-	-	-	2
CO4	1	1	-	-	-	1	1	-	-	1	-	-	-	2
CO5	1	1	2	-	-	1	1	1	-	1	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION 9

Basic theories of industrial wastewater management – Sources of pollution – Physical, Chemical, Organic & Biological properties of industrial Wastes – Difference between industrial & municipal wastewater – Effects of industrial effluents on sewers and Natural water Bodies.

UNIT II VOLUME AND STRENGTH REDUCTION 9

Pre & Primary Treatment – Equalization, Proportioning, Neutralization, recovery and recycling of waste products and by products, Oil separation by Floating – Waste reduction – Volume reduction– Strength reduction – Joint treatment of industrial wastes and domestic sewage

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UNIT III CHARACTERISTICS AND COMPOSITION 9

Characteristics and Composition of wastewater -- Manufacturing Processes of Industries like Sugar, Distilleries, Dairy, Textiles, Tanneries, fertilizer, Food processing Industries, Steel, and Petroleum refineries – Case studies

UNIT IV TREATMENT OF INDUSTRIAL WASTE 9

Waste Treatment Methods – Nitrification and De-nitrification – Phosphorous removal – Heavy metal removal – Membrane Separation Process – Special Treatment Methods – Disposal of treated wastewater

UNIT V COMBINED TREATMENT 9

Common Effluent Treatment Plants (CETP) – Site selection, Design, Operation and Maintenance Problems – Economical aspects

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Project 0 Periods

Total 45 Periods

TEXTBOOKS:

1. Metcalf & Eddy, "Wastewater engineering Treatment disposal reuse", Tata McGraw Hill.2009.
2. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill.2001

REFERENCE BOOKS:

1. M.N. Rao and Dutta "Industrial Waste". Oxford & IBH Publishing Co Pvt.Ltd.2005.
2. Mark J. Hammer, Mark J. Hammer, Jr., "Water & Wastewater Technology", Prentice Hall of India.2009
3. N.L.Nemerrow "Theories and practices of Industrial Waste Engineering". Addison-Wesley.2009.
4. C.G.Gurnham "Principles of Industrial Waste Engineering" Wiley.2005

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP09	MUNICIPAL SOLID WASTE MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on the reduction, segregation, and storage of wastes at sources
- To study the importance of transfer stations and processing technologies for resource recovery
- To enumerate and describe different disposal and treatment methods for municipal solid waste

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: classify the sources, types and effects of municipal solid wastes (Understand)

CO2: identify the methods of on-site storage and its process in solid waste management (Understand)

CO3: select the methods of collection involved in solid waste management (Apply)

CO4: demonstrate the off-site processing techniques in solid waste management (Understand)

CO5: summarize the various disposal methods of solid wastes (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	2	2	1	-	-	-	-	-	-
CO2	1	-	-	-	-	2	2	-	-	-	-	1	2	-
CO3	1	-	-	-	1	2	2	-	-	-	-	1	2	-
CO4	1	-	-	-	1	2	2	1	-	-	-	-	-	-
CO5	1	-	-	-	-	2	2	1	-	-	1	1	2	1

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I SOURCES AND EFFECTS OF SOLID WASTE 9

Sources and types of municipal solid waste – Waste generation rates – Factors affecting waste generation, composition, characteristics – Methods of sampling – Effects of improper disposal of solid wastes – Public health and environmental effects – Elements of solid waste management – Municipal solid waste rules – Role of NGO's, EPA.

UNIT II SOURCE REDUCTION, WASTE STORAGE AND RECYCLING 9

Source reduction of waste – Reduction, Reuse, Recycling and Recover – Segregation of wastes at source – Onsite storage methods – Materials used for containers – Public health & economic aspects of storage – Case studies under Indian conditions; Recent advances – Smart bins

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UNIT III COLLECTION AND TRANSFER 9

Methods of Collection – Types of vehicles – Vehicle time management – Manpower requirement – Collection routes; transfer stations – Selection of location, operation & maintenance; options under Indian conditions; Recent advances – Fleet collection system

UNIT IV PROCESSING AND DISPOSAL OF WASTES 9

Objectives of waste processing – Physical Processing techniques and Equipment – Composting – Bio methanation – Incineration, Disposal of solid wastes: Sanitary landfills – Design and operation of sanitary landfills – Leachate collection and treatment; Recent advances – Biomining

UNIT V INTEGRATED SOLID WASTE MANAGEMENT 9

ISWM: Definition – Challenges and opportunities – Life cycle, Generation source and Stakeholders perspective – Benefits, Plan, Activities and Strategy of ISWM

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. William, A. Worrell., P. Aarne Vesilind., "Solid Waste Engineering", Cengage Learning, 2012.
2. John Pitchel., "Waste Management Practices-Municipal, Hazardous and industrial", CRC Press, Taylor and Francis, New York, 2014.
3. Ramachandra, T. V., "Management of Municipal Solid Waste", TERI Press, New Delhi, 2009.

REFERENCES:

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation," Government of India, New Delhi, 2014.
2. George Tchobanoglous and Frank Kreith., "Handbook of Solid waste management," McGraw Hill, New York, 2002.
3. Marc J. Rogoff and Francois Screve., "Waste to Energy Technologies and Project Implementation," Second Edition, Noyes Publication, USA, 2011.
4. Mushtaq Ahemd MEMON, "Integrated solid waste management," International environmental technology centre (IETC), OSAKA - Japan.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP10	ENVIRONMENTAL IMPACT ANALYSIS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES

- Nil

COURSE OBJECTIVES

- To highlight the evolution of Environmental impact assessment methods
- To introduce the Impact assessment methods for various projects
- To explain the various components for preparing the EIA document

COURSE OUTCOME

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

CO1: understand the background of Environmental impact assessment (Understand)

CO2: perform impact assessment methods for various projects (Understand)

CO3: formulate the EIA report (Understand)

CO4: prepare an environmental management plan (Understand)

CO5: summarize the various EIA studies (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	1	1	1	-	-	-	-	1	-
CO2	1	-	-	-	-	1	1	1	-	-	-	-	1	-
CO3	1	3	1	-	-	1	1	1	-	2	-	-	1	-
CO4	1	3	1	-	-	1	1	1	-	2	-	-	1	-
CO5	1	3	1	-	-	1	1	1	-	2	-	-	1	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION 9

Concept of environment – Environmental impact, Environmental impact assessment (EIA) – Definitions, terminology and overview – Evolution of EIA in the USA, Key features of the National Environmental Policy Act and its implementation and the Council on Environmental Quality (CEQ) guidelines.

UNIT II METHODOLOGIES 9

Methods of EIA – Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives

UNIT III PREDICTION AND ASSESSMENT 9

Assessment of Impact on land, surface water, groundwater, air, social & cultural activities – Flora &

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fauna-Mathematical models – Evaluation of alternatives, Preparing the EIA document – Environmental impact statement (EIS), Environmental monitoring, Environmental audit (EA)

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 9

EMP preparation – Monitoring Environmental Management Plan – Identification of Significant or Unacceptable Impacts – Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation – Stipulating the Conditions, Monitoring Methods – Pre- Appraisal and Appraisal.

UNIT V CASE STUDIES 9

Preparation of EIA for developmental projects – Factors to be considered in making assessment decisions – Water Resources Project – Pharmaceutical industry, thermal plant – Nuclear fuel complex. Highway project – Sewage treatment plant, Municipal Solid waste processing plant.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Project 0 Periods

Total 45 Periods

TEXT BOOK:

1. Larry W Canter, "Environmental Impact Assessment" McGraw Hill, Inc, 2005.
2. Betty Bowers Marriot, "Environmental Impact Assessment" McGraw Hill, Inc, 2010.
3. Barrow, C. J., "Environmental and Social Impact Assessment" Edward Arnold, 2007.

REFERENCE BOOK:

1. Jain, R.K., Urban, L.V., Stracy, G.S., "Environmental Impact Analysis" Van Nostrand Reinhold Co., New York, 1991.
2. Rau, J.G. and Wooten, D.C., "Environmental Impact Assessment" McGraw Hill Pub. Co., 1996.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP11	HYDROLOGY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES

- Nil

COURSE OBJECTIVES

- To provide knowledge to students regarding occurrence of rainfall, storage of water, estimation of flood
- To learn about ground water permeability and transmissibility and yield of water from well
- To acquire study of surface and sub-surface flow & study of under-ground water

COURSE OUTCOMES

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

CO1: outline the scope of hydrology (Understand)

CO2: interpret the runoff data (Apply)

CO3: demonstrate the hydrological process (Apply)

CO4: examine the steady flow towards a well in confined & water table aquifer (Analyze)

CO5: estimate the flood routing (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	2	2	-	-	-	-	-	1	-
CO2	1	2	1	-	-	2	2	1	-	-	-	-	1	-
CO3	1	-	-	-	-	2	2	-	-	-	-	-	1	-
CO4	1	2	1	-	-	2	2	1	-	-	-	-	1	-
CO5	1	2	1	-	-	2	2	1	-	-	-	-	1	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION 9

Hydrologic cycle – Scope and application of hydrology to engineering problems – Drainage basins and its characteristics, stream geometry hypsometric curves.

UNIT II RUNOFF 9

Types & forms of precipitation, rainfall measurements – Interpretation of rainfall data – Missing rain fall data – Runoff, runoff cycle, infiltration indices – Hydrograph analysis-- Module hydrograph – Applications –Time Series Analysis.

UNIT III HYDROLOGICAL PROCESS 9

Evaporation Process – Process, reservoir evaporation and methods of its control – Transpiration Process – Evapo-transpiration and its measurement – Infiltration – Infiltration process, initial loss,

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infiltration capacity and measurement of infiltration, infiltration indices.

UNIT IV GROUNDWATER HYDROLOGY 9

Ground water – Aquifers, Permeability & transmissibility – Steady flow towards a well in confined & water table aquifer – Dupits & Theims equation – Measurement of yield of an open well – Tube well & infiltration gallaries. Interference among wells – well losses, comparison of well and flow irrigation.

UNIT V FLOOD ROUTING 9

Introduction to flood routing and its importance for the construction of hydraulic reservoirs – Hydrologic routing and hydraulic routing – Methods of flood routing – Step by step method, trial and error method

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Project 0 Periods

Total 45 Periods

TEXT BOOKS:

1. S.K. Garg "Irrigation Engineering and hydraulic Structure" Khanna Publication 2010.
2. B.C. Punmia "Irrigation Engineering and Hydraulic structure" Laxmi Publications. 2005.

REFERENCES:

1. Linsely, Kohler, Paulhus "Hydrology for Engineers" Tata McGraw-Hill Education.2009.
2. V.P.Singh "Elementary Hydrology". Prentice-Hall.2008.

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="2">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment II (100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
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*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

U21CEP12	IRRIGATION ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To apply the concepts of types and methods of irrigation, irrigation standards and crop water requirement
- To analyze the types of dams, spillways with their protection measures
- To design the components of irrigation canal

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: find the quality of irrigation water and frequency of irrigation for various crops (Understand)

CO2: identify and apply the appropriate irrigation methods (Understand)

CO3: design the principles of gravity and earth dams and their component parts (Apply)

CO4: classify the canals and design the impounding structures for irrigation purpose (Apply)

CO5: analyze the functions of regulating and cross drainage works (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	2	-	-	-	-	-	-	-
CO2	3	3	2	-	-	2	2	-	-	-	-	2	-	-
CO3	-	3	2	-	-	2	2	1	-	-	-	-	-	-
CO4	-	3	-	-	-	2	2	1	-	-	-	-	-	-
CO5	2	3	2	-	-	2	2	1	-	-	-	2	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I IRRIGATION PRACTICES 9

Need for Irrigation in India – Scope, National Water Policy – Crop water requirements – Irrigation Scheduling – Irrigation efficiencies – Duty – Delta – Base Period – Surface and Subsurface irrigation methods – Standards for irrigation water

UNIT II IRRIGATION METHODS 9

Irrigation and its types: Gravity irrigation – Lift irrigation – Well irrigation – Tube well irrigation – Infiltration galleries – Sewage irrigation – Advantages and Disadvantages – Environmental impacts of irrigation

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UNIT III DAMS 9

Dams: Types of dams – Earthen dam: types – Description – Causes of failure and protection measures – Gravity dam: types – Description – Causes of failure and protection measures – Spillways: types – Description – Causes of failure and protection measures.

UNIT IV DIVERSION AND IMPOUNDING STRUCTURE 9

Introduction – Types of diversion headwork – Causes of failure – Bligh's and Lane's theories – Design of vertical weir – Silt control devices – Appurtenances – Fish ladder, divide wall, under & scouring sluices, canal head regulator

UNIT V CANAL AND ITS ALIGNMENT 9

Classification of canals – Alignment, lining and maintenance of canals – Design of rigid boundary canals Lacey's and Tractive force concepts in canal design – River Training works – Canal drops – Cross drainage works – Canal Outlet and Escapes

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: –Periods Project: – Periods

Total 45 Periods

TEXT BOOKS:

1. Punmia B.C and Pande B.B Lal, "Irrigation and Water Power Engineering", 16th edition, Laxmi Publications (P) Ltd, New Delhi, 2016
2. Santhosh Kumar Garg, "Irrigation Engineering and Hydraulic Structures", 19th edition, Khanna Publishers Pvt. Ltd, New Delhi, 2013

REFERENCES:

1. Punmia B. C., Ashok Kumar Jain., Arun Kumar Jain and Pande Brij Basi Lal, "Irrigation and Water Power Engineering", 16th edition, Laxmi Publications (P) Ltd, New Delhi, 2012
2. Sharma R K and Sharma T K, "Irrigation Engineering", S. Chand and company, New Delhi, 2007
3. Asawa G L, "Irrigation and Water Resources Engineering", New Age International Publishers, New Delhi, 2005

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="2">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment II (100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP13	GROUND WATER ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES

- Nil

OBJECTIVES

- To introduce the student to the principles of Groundwater governing Equations
- To acquire knowledge of Characteristics of different aquifers
- To understand the techniques of development and management of groundwater

COURSE OUTCOMES

Upon completion of the course, the student will be able to

CO1: identify aquifer properties and its dynamics (Understand)

CO2: model the well design and its practical problems (Apply)

CO3: plan the groundwater management (Apply)

CO4: examine the quality of groundwater (Apply)

CO5: summarize the groundwater conservation techniques (Understand)

CO-PO MAPPING

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	-	2	2	-	-	-	-	-	-	-
CO2	1	2	-	-	-	2	2	1	-	-	-	-	-	-
CO3	1	2	-	-	-	2	2	1	-	-	1	-	-	-
CO4	1	2	-	-	-	2	2	1	-	-	-	-	-	-
CO5	1	2	-	-	-	2	2	-	-	-	-	-	-	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I HYDRO GEOLOGICAL PARAMETERS 9

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – Permeability, specific yield – Methods of Estimation – GEC norms - Steady state flow – Darcy's Law – Groundwater Velocity

UNIT II WELL HYDRAULICS 9

Unsteady state flow – Theis method – Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method – tests – Image well theory – Partial penetrations of wells – Well losses

UNIT III GROUNDWATER MANAGEMENT 9

Need for Management Model – Database for Groundwater Management – Groundwater balance

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study – Introduction to Mathematical model – Model Conceptualization – Sensitivity Analysis – Uncertainty – Development of a model

UNIT IV GROUNDWATER QUALITY 9

Ground water chemistry – Origin, movement and quality – Water quality standards – Drinking water – Industrial water – Irrigation water – Ground water Pollution and legislation – Environmental Regulatory requirements

UNIT V GROUNDWATER CONSERVATION 9

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Protection zone delineation – Contamination source inventory and remediation schemes – Rain water harvesting

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Project 0 Periods

Total 45 Periods

TEXT BOOKS:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2010.

REFERENCES

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishna, S, "Ground Water" K.J. Graph arts, Chennai, 2005

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP14	CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICES	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To create awareness of the various construction techniques and practices
- To identify the equipment needed for different types of construction activities
- To understand the methods and techniques involved in demolition of structures

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: outline the construction practices involved in site (Understand)

CO2: explain the techniques involved in substructure construction (Understand)

CO3: summarize the super superstructure construction techniques (Understand)

CO4: compare the different equipment used in various construction works (Understand)

CO5: identify the demolition methods, sequence and safety precaution involved in demolishing the building (Understand)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	–	–	–	3	–	–	2	–	–	2	2	1	2
CO2	2	–	–	–	3	–	–	2	–	–	2	2	1	2
CO3	2	–	–	–	3	–	–	2	–	–	2	2	1	2
CO4	2	–	–	–	3	–	–	2	–	–	2	2	1	2
CO5	2	–	–	–	3	2	–	2	–	–	2	2	1	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

SYLLABUS:

UNIT I CONSTRUCTION PRACTICES 9

Specifications, details and sequence of activities – Site Clearance – Marking – Earthwork – Masonry and types – Flooring – Damp proof courses – Construction joints and types – Pre cast pavements – Building foundations – Basements – Temporary shed – Centering and Shuttering – Slip forms – Scaffoldings – De-shuttering forms – Fabrication and erection of steel trusses – Frames – Braced domes – Laying brick – Weather and water proof – Roof finishes – Acoustic and fire protection.

UNIT II SUB STRUCTURE CONSTRUCTION 9

Techniques of Box jacking – Pipe Jacking – Under water construction of diaphragm wall – Tunneling techniques – Piling techniques – Well and caisson – Sinking cofferdam – Cable anchoring and grouting – Well points – Dewatering and stand by Plant equipment for underground open excavation.

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UNIT III SUPER STRUCTURE CONSTRUCTION 9

Launching girders, bridge decks, off shore platforms – Special forms for shells – Techniques for heavy decks – In-situ pre-stressing in high rise structures, Material handling – Erecting light weight components on tall structures – Support structure for heavy Equipment and conveyors – Erection of articulated structures, braced domes and space decks.

UNIT IV EQUIPMENT IN CONSTRUCTION 9

Earthwork moving operations – Selection of Equipment's for earthwork, Foundation work and piling – Material handling – Hoisting and lifting equipment's (Derricks, cranes, gantry and cable ways) – Equipment's for Concreting (Mixing, batching and compaction) – Equipment's for dredging, trenching and tunneling

UNIT V DEMOLITION OF STRUCTURES 9

Definition – Demolition methods for buildings and other structures – Common types – Demolition Sequence – Safety precautions – Machines – Explosives – Robotic Machines – Dismantling Techniques

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Sarkar, S.K., and Saraawati, S., "Construction Technology", Oxford University press, New Delhi, 2008.
2. Peurifoy, R.L., Clifford J. Schexnayder, Aviad Shapira., "Construction Planning, Equipment and Methods", McGraw Hill Education, 2018.
3. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 2010.

REFERENCES:

1. Deodhar, S.V., "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.
2. Velumani, P., "Construction Techniques and Practices", SIA Publishers & Distributers Pvt Ltd, 2020.
3. Sharma S.C., "Construction Equipment and Management", Khanna Publishers New Delhi, 2019.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
		L	T	P	J	C
U21CEP15	CONSTRUCTION PLANNING AND SCHEDULING	3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To have learnt about planning of construction projects
- To make the students to schedule the network diagrams by scheduling procedures and techniques, cost and quality control projects
- Use of Project information as a decision tool

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: develop construction plans and estimate the resource requirements (Understand)

CO2: prepare bar charts for work schedule (Understand)

CO3: outline the cost control monitoring and accounting (Understand)

CO4: understand the quality control and safety during construction (Understand)

CO5: learn Project information and databases in an organization (Understand)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	–	1	–	–	–	2	–	–	3	2	2	–	–	2
CO2	–	1	–	–	–	2	–	–	3	2	2	1	3	2
CO3	–	1	–	–	–	2	–	–	3	2	2	3	–	2
CO4	–	1	–	–	–	2	2	–	3	2	2	2	–	2
CO5	–	1	–	–	–	2	–	–	3	2	2	2	–	2
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)					3: Substantial (High)			

SYLLABUS:

UNIT I CONSTRUCTION PLANNING 9

Basic concepts in the development of construction plans – Choice of Technology and Construction method – Defining Work Tasks – Definition – Precedence relationships among activities – Estimating Activity Durations – Estimating Resource Requirements for work activities – Coding systems.

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 9

Relevance of construction schedules – Bar charts – The critical path method – Calculations for critical path scheduling – Activity float and schedules – Presenting project schedules – Critical path scheduling for Activity-on-node and with leads, Lags and Windows – Resource oriented scheduling – Scheduling with resource constraints and precedence's – Use of Advanced Scheduling Techniques – Scheduling with uncertain durations – Crashing and time/cost trade–offs – Improving the Scheduling process – Introduction to application software

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UNIT III COST CONTROL MONITORING AND ACCOUNTING 9

The cost control problem – The project Budget – Forecasting for Activity cost control – Financial accounting systems and cost accounts – Control of project cash flows – Schedule control – Schedule and Budget updates – Relating cost and schedule

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9

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

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 9

Types of project information – Accuracy and Use of Information – Computerized organization and use of Information – Organizing information in databases – Relational model of Data bases – Other conceptual Models of Databases – Centralized database Management systems – Databases and application programs – Information transfer and Flow.

Contact Periods:

Lecture: 45 Periods Tutorial: Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Srinath, L.S, "Pert and CPM Principles and Applications", Affiliated East West Press, 2001.
2. Hinze, "Construction Planning and Scheduling", Pearson Education India, 2013.
3. Abdrew Baldwin., "Handbook of Construction Planning and Scheduling", Wiley, 2014.

REFERENCES:

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall,Pitsburgh,2000.
2. David R.Pierce Jr. "Project Schedule and Management for Construction", Wiley 2013.
3. Moder.J.,C.Phillips and Davis, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983
4. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons 1986..

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
		L	T	P	J	C
U21CEP16	SAFETY ENGINEERING	3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To give an overview about the safety considerations
- To study safety aspects in various construction areas and protective measures
- To gain knowledge in equipment safety and fire safety

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: explain the concepts of preconstruction considerations (Understand)

CO2: understand the basic safety measures in construction (Understand)

CO3: identify the safety aspects in height works (Understand)

CO4: study the safety aspects in truss and roof area (Understand)

CO5: discover the equipment safety procedures (Understand)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	–	2	2	–	2	2	3	2	–	2	1	–	1
CO2	1	–	2	2	–	2	2	3	2	–	2	1	3	1
CO3	1	–	2	2	–	2	2	3	2	–	2	1	3	1
CO4	1	–	2	2	–	2	2	3	2	–	2	1	3	1
CO5	1	–	2	2	–	2	2	3	2	–	2	1	3	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I PRE–CONSTRUCTION CONSIDERATIONS 9

Planning and scheduling – On-site safety – Basic checklist – Pre contract activities – Pre construction meeting – Underground electrical hazards – Risk assessment for construction – Risk and hazard management in all activities.

UNIT II CONSTRUCTION PROTECTIVE MEASURES & CONTROL MEASURES 9

Basic personal protective equipment and clothing – Foot protection, Head protection, Hearing protection – Trenches and excavations – General requirements, Sloping and Shoring requirements – Additional excavation requirements – Working with heights – Material safety and its usage.

UNIT III HEIGHT WORKS 9

Safe access and egress – Safe use of ladders – Scaffoldings, requirement for safe work platforms, stairways, gangways and ramps – Fall prevention and fall protection, safety belts, safety nets, fall

arrestors, controlled access zones, working on fragile roofs, work permit systems – Erection of structural frame work, road works, safety in high rise construction.

UNIT IV TRUSSES AND ROOF WORK 9

Trusses – Instruction for truss installers, Truss erection Roof Work – Roof Jacks and toe – Holds (Slide guards) Scaffolds – Guardrails for scaffolds Toe boards for scaffolds – Wood scaffold erection guidelines – Design and erection requirements for job – Constructed wood scaffolds Scaffold planks – Other types of scaffolds, Ladder – Jack scaffolds Trestle scaffolds, Shore and lean – to scaffolds – Rolling scaffolds.

UNIT V EQUIPMENT SAFETY AND DEMOLITION 9

Electrical power tools and records, Safe work procedures – Safe assembly point – Hand tool ergonomics – Factors affecting tool use – Crane safety – Safe work procedures – Demolition – demolition techniques – Fire hazards and preventing methods, implosion.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Patrick X.V. Zou., "Strategic Safety Management in Construction and Engineering" John Wiley &Sons Publications, 2015
2. Allen St John Hot., "Construction Safety" John Wiley &Sons Publications, 2005.

REFERENCES:

1. J Grimaldi Simonds., "Safety Management" AITBS Publishers, New Delhi 2001
2. Louis J. Di Berardinis., Handbook of occupational safety and health, Wiley Publications, 1999
3. V.J. Davies. K. Tomasin., "Construction Safety Handbook" 1996

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided

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PROFESSIONAL ELECTIVES

		Category: PEC				
		L	T	P	J	C
U21CEP17	QUALITY CONTROL AND ASSURANCE	3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the concept of quality management systems
- To make the students to study the quality control systems
- To gain knowledge in quality improving techniques

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: describe the principles of Quality management (Understand)

CO2: implement the basic in quality management system (Understand)

CO3: suggest the feasibility in planning in quality procedures (Understand)

CO4: recognize the quality assuring and control systems (Understand)

CO5: examine the quality techniques to be followed in improving the construction field (Understand)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	–	1	2	–	–	–	2	–	–	2	2	–	–	2
CO2	–	1	2	–	–	–	–	–	–	2	2	–	–	2
CO3	–	1	2	–	–	–	2	–	–	2	2	–	–	2
CO4	–	1	2	2	–	–	2	–	–	2	2	–	–	2
CO5	–	1	2	2	–	–	2	–	–	2	2	–	–	2
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I QUALITY MANAGEMENT 9

Introduction – Definitions and objectives – Factor influencing construction quality – Responsibilities and authority – Quality plan – Quality management guidelines – Quality circles – Project management

UNIT II QUALITY SYSTEMS 9

Introduction – Quality system standard – ISO 9000 family of standards – Requirements – Preparing quality system documents – Quality related training – Implementing a quality system – Third party certification

UNIT III QUALITY PLANNING 9

Quality policy – Objectives and methods in construction industry – Consumers satisfaction –

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Ergonomics – Time of completion statistical tolerance – Taguchi"s concept of quality – Codes and standard documents – Contract and construction programming – Inspection procedures – Processes and products – Total QA/QC – Programme cost implication

UNIT IV QUALITY ASSURANCE AND CONTROL 9

Objectives – Regularity agent, owner, design, contract and construction oriented objectives – QA/QC – Methods and techniques for QA/QC – Different aspects of quality – Appraisals, factors influencing construction quality – Critical, major failure aspects and failure mode analysis, – Stability methods and tools, optimum design – Reliability testing, Reliability coefficient and reliability prediction

UNIT V QUALITY IMPROVEMENT TECHNIQUES 9

Selection of new materials – Influence of drawings, detailing, specification, standardization – Bid preparation activity, Environmental safety, social and environmental factors – Natural causes and speed of construction – Life cycle costing – Value engineering and value analysis

Contact Periods:

Lecture: 45 Periods Tutorial: Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. James Brien, J.o., Construction Inspection Handbook – Quality Assurance and Quality Control, VanNostrand, NewYork, Third Edition, 2013.
2. Ashford, J.L., The Management of Quality in Construction, CRC Press, Taylor & Francis Group, Oxfordshire,FourthEdition, 2020.

REFERENCES:

1. Clarkson H. Oglesby, "Productivity Improvement in Construction", McGraw–Hill, (1989).
2. John L. Ashford," The Management of Quality in Construction", Taylor & Francis , (1989).
3. Steven McCabe, "Quality Improvement Techniques in Construction", Addison Wesley Longman Ltd, England. (1998).

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided

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PROFESSIONAL ELECTIVES

U21CEP18	BUILDING SERVICES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the knowledge on building services
- To know the various types of mechanical and electrical services
- To understand the importance of fire protection and green buildings

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the various types of building services (Understand)

CO2: outline the electrical service requirements for a given building (Understand)

CO3: plan various types of mechanical services as per requirements of building (Understand)

CO4: summarize the fire protection and acoustics services of a building (Understand)

CO5: apply green building technology aspects (Understand)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	–	–	–	–	2	–	–	–	–	2	–	–	–
CO2	2	–	–	–	3	2	–	2	–	–	2	2	–	2
CO3	2	–	–	–	–	2	–	2	–	–	2	2	–	2
CO4	2	–	3	–	–	2	–	2	–	–	2	2	–	2
CO5	2	–	–	–	–	2	3	2	–	–	2	2	–	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION TO BUILDING SERVICES 9

Definitions – Objective and uses of services – Applications of services for different types building – Classification of building services – Types of services and selection of services – Natural and artificial lighting – Principles and factors – Arrangement of luminaries, Distribution of illumination factors – Necessity of Ventilation – Types – Natural and Mechanical – Factors to be considered in the design of Ventilation

UNIT II ELECTRICAL SERVICES AND LAYOUT 9

Electrical services in the building – Technical terms and symbols for electrical installations and accessories of wiring – Systems of wiring like wooden casing, cleat wiring, CTS wiring conduit wiring – Types of insulation – Electrical layout for residence, small work shop, show room, school building etc.,

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UNIT III MECHANICAL AND PLUMBING SERVICES IN BUILDINGS 9

Introduction of mechanical services – Lift – Definition, Types of Lifts, Design Considerations – Air Conditioning – Definition, Different controllers, Air Distribution system – Types of Air Conditioners – Piping Materials and Fittings – Plumbing fixture – Water Supply Systems – Designing Plumbing Systems – Installation

UNIT IV FIRE PROTECTION, ACOUSTICS AND SOUND INSULATIONS 9

Introduction – Causes of fire and Effects of fire – General Requirements of Fire Resisting building as per IS and NBC 2016 – Characteristics of Fire resisting materials – Maximum Travel Distance – Fire Fighting Installations for Horizontal Exit, Roof Exit / Fire Lifts, External Stairs – Requirement of good Acoustic – various sound absolvent – Factors to be followed for noise control in residential building

UNIT V GREEN BUILDING 9

Concept of green buildings – Components of green building – Advantages and applications – Utility of solar energy in buildings – Day lighting – Building energy analysis – Lighting economics and aesthetics – Low energy and passive cooling – Green composites for buildings – Low energy approaches – Water utilization in building – Technological options for energy management

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Punmia B.C, "Building Construction", Laxmi Publications (P) Ltd., New Delhi, 2016
2. Varghese P.C, "Building Construction", PHI Learning, New Delhi, 2011
3. Stephen Emmit, "Advanced Construction of Buildings", Blackwell Publishing (P) Ltd., 2019

REFERENCES:

1. Udhayakumar R, "A Text book of building services", Eswar press, India, 2007
2. Rangwala, "Building Construction", Charotar publishing (P) Ltd., India, 2019
3. Varghese P.C, "Building Materials", PHI Learning, New Delhi, 2015
4. David V.Chadderton. "Building Services Engineering", Taylor and Francis, Canada, 2013

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided

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PROFESSIONAL ELECTIVES

		Category: PEC				
		L	T	P	J	C
U21CEP19	SUSTAINABLE AND LEAN CONSTRUCTION	3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To gain knowledge about the basics of lean construction.
- To analyze about the concepts lean principles and study their core concepts in construction.
- To explore the lean tools and techniques, implementation in the construction industry.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: explain the management techniques and the advancements in the recent development (Understand)

CO2: implement the lean management principles from the manufacturing industry to the construction industry to observe the evolution (Apply)

CO3: understand the core concepts of lean construction tools and techniques and their importance in achieving productivity with quality and safety (Apply)

CO4: investigate lean techniques to achieve sustainability in construction projects (Apply)

CO5: apply lean construction techniques in design and modelling (Apply)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	–	–	2	–	1	–	–	2	1	3	1
CO2	2	1	1	–	–	2	–	1	–	–	2	1	3	1
CO3	2	1	1	–	–	2	–	1	–	–	2	1	3	1
CO4	2	1	1	–	–	2	–	1	–	–	2	1	3	1
CO5	2	1	1	–	–	2	–	1	–	–	2	1	3	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION 9

Introduction and overview of the construction project management – Review of Project management & Productivity measurement systems – Productivity in construction – construction project phases – Essential features of contemporary construction management techniques – The problems with current construction management techniques – Current production planning – Sustainable engineering concepts and life cycle analysis.

UNIT II LEAN MANAGEMENT& SUSTAINABLE CONCEPTS 9

Introduction to lean management – Toyota's management principle – Evolution of lean in the construction industry – Production theories in construction – Lean construction value – Value in construction – Target value design – Lean project delivery system – Forms of waste in the

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construction industry – Waste elimination and sustainability planning.

UNIT III CORE CONCEPTS 9

Concepts in lean thinking – Principles of lean construction – Variability and its impact – Traditional construction and lean construction – Traditional project delivery – Lean construction and workflow reliability – Work structuring – Production control.

UNIT IV TOOLS AND TECHNIQUES FOR LEAN CONSTRUCTION 9

Value Stream mapping – Work sampling – Last planner system – Flow and pull – based production – Last Planner System – Look ahead schedule – constraint analysis – weekly planning meeting– Daily Huddles – Root cause analysis – Continuous improvement – Just in time.

UNIT V TECHNIQUES IN LEAN CONSTRUCTION 9

Lean construction implementation – Enabling lean through information technology – Lean in design – Design Structure Matrix Location Based Management System – BIM (Building Information Modeling) – IPD (Integrated Project Delivery) – Sustainability through lean construction approach

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Corfe, C. and Clip, B., Implementing lean in construction: Lean and the sustainability agenda, CIRIA, 2013.
2. Shang Gao and Sui Pheng Low, Lean Construction Management: The Toyota Way, Springer, 2014.
3. Dave, B., Koskela, L., Kiviniemi, A., Owen, R., and Tzortzopoulos, P., Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.

REFERENCES:

1. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
2. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site Implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.
3. Lincoln H. Forbes , Syed M. Ahmed, Lean Project Delivery and Integrated Practices in Modern Construction, Routledge Publishers, 2nd edition, 2020.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided

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PROFESSIONAL ELECTIVES

U21CEP20	FORMWORK ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the basic concepts and types of formwork, parameters to be considered for the selection of right formwork, design principles deployed, different systems and materials adopted in construction.
- To identify the formwork selection criteria, applications across structures and scaffolding systems.
- To understand the special formwork for tunneling, high rise constructions and bridges.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: explain the Role of Engineer in formwork and objectives of formwork (Understand)

CO2: design of formwork systems based on Industry requirements (Understand)

CO3: analyse the formwork erection and quantity takeoff (Understand)

CO4: identify the formwork material selection (Understand)

CO5: examine the application of formwork for RCC structures (Understand)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	–	–	–	–	–	2	–	–	1	–	–	–	–
CO2	2	3	3	–	–	–	2	–	–	1	–	–	–	–
CO3	2	3	–	–	–	–	2	–	–	1	–	–	–	–
CO4	2	3	–	–	3	–	2	–	–	1	–	–	–	–
CO5	2	–	–	–	–	–	2	–	–	1	–	–	–	–
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)							

SYLLABUS:

UNIT I INTRODUCTION 9

General objectives – Classification – Benefits – Areas of competitiveness – Selection of formwork, Selection of materials – Accessories and consumables – Application of tools – Formwork for foundation – Wall, Columns, Slab and Beam – Conventional drawings – Vertical application of conventional foundation formwork – Formwork system – Components, assembly, De–shuttering, Flex system, Heavy duty Tower system – Safety of work – Formwork for stairs – Load bearing tower.

UNIT II FORMWORK DESIGN 9

Formwork planning and monitoring – Configuration, Scope, Strategy & costing of formwork –

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Productivity – Design loads, Pressures on concrete – Design methods & assumptions – Vertical & horizontal applications – Concepts, Slab design, Wall formwork, Checks – Formwork drawing concept and preparation guidelines – General layout and detailed drawings – BOQ calculation and checklist.

UNIT III FORMWORK ERECTION AND QUANTITY 9

Formwork assembly for wall & column panels, Stop end & box outs – Equipment and layout – Formwork erection and safety – Inspection and corrections – Plant and machinery – Codal and contractual requirements – Schedule of formwork – Mobilization distribution – BOQ – Quantity calculation – Cost optimization – BIM for planning operations.

UNIT IV SCAFFOLDING AND MODULAR FORMWORK 9

Modular scaffold Installation sequence – Tie and material specification – Ladder safety, Loading classification, application – Components of LTMS – Access scaffold Do's and Don'ts – Innovation and global practices – Modular formwork – Advantages and limitations – Vertical and horizontal application – Shuttering & De–shuttering – Application – Aluminum formwork – Drawings & components – Activities.

UNIT V SPECIAL FORMWORK AND APPLICATION 9

Tunnel formwork – 3D design details – High rise construction – Various climbing system – Table lifting system – Bridge construction systems – Project application.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Janardan Jha.,and Sinha S.K., "Modern Practices in Formwork for Civil Engineering Construction Works", Laxmi Publications, 2017.
2. Kumar. Neeraj Jha , "Formwork for Concrete Structures", McGraw Hill Education, 2017.
3. Arora S.P. and Bindra S.P., "Formwork and False work for heavy Construction", fib Federation international du béton, 2009.

REFERENCES:

1. Awad S.Hanna, "Concrete Formwoork Systems", CRC Press, 2019.
2. Geoffrey Lee, Peter McAdam, "Formwork, A Practical" CRC Press, 1997.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP21	URBAN PLANNING AND MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide basic understanding about the concepts of urban planning
- To develop the students to find the solution for problems in planning of urban areas
- To enable the students to apply the knowledge of implementation of urban concepts in city area

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: identify the issues involved in urban areas (Understand)

CO2: outline the principles, types and stages of urban planning (Understand)

CO3: summarize the development plans, formulation and evaluation techniques (Understand)

CO4: evaluate the planning and development methods of urban projects (Apply)

CO5: understand the development of management of urban system (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	-	-	-	-	-	-	-	-
CO2	3	1	2	-	1	1	-	-	-	-	-	-	3	-
CO3	3	1	2	-	1	1	-	-	-	-	-	-	2	-
CO4	3	1	2	-	1	1	-	-	-	-		-	1	-
CO5	3	1	2	-	1	1	-	-	-	-	-	-	1	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

SYLLABUS:

UNIT I BASIC ISSUES IN URBAN AREAS 9

Definition of Human settlement – Urban area – Town, City – Urbanisation – Sub-urbanisation – Urban sprawl – Peri-urban areas – Central Business District (CBD) – Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II PLANNING PROCESS 9

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas – Surveys and Questionnaire Design.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 9

Scope and Content of Regional Plan, Master Plan – Detailed Development Plan – Development Control Rules – Transfer of Development Rights – Special Economic Zones – Development of small

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town and smart cities – case studies

UNIT IV PLANNING AND DESIGN OF URBAN DEVELOPEMENT PROJECTS 9

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM 9

Town and Country Planning Act – Land Acquisition and Resettlement Act – Urban Planning Standards and Regulations – Involvement of Public, Private, NGO, CBO and Beneficiaries.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. P.P.Anil kumar, "Introduction to smart cities", Pearson India, 2019.
2. Mike Barlow, Cornelia Levy-Bencheton, "Smart Cities, Smart Future: Showcasing Tomorrow", Wiley and SAS Business series, 2018.
3. Ananya Ray and Aitiwa Ong Eds, 'World of Cities: Asian Experiments and the Art of Being Global, Wiely Blackwell, US 2011.
4. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002.

REFERENCES:

1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai.
2. CMDA, Second Master Plan for Chennai, Chennai 2008.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP22	RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE404 Highway Engineering

COURSE OBJECTIVES:

- To enable the students to apply the concept and the applications of Railway planning, design, construction and maintenance works
- To develop the students to apply the concept and the applications of Airports planning design, construction and maintenance works
- To create the students to apply the concept and the applications of Harbor Planning, design, construction and maintenance works

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the concept of Railway planning and its management (Understand)

CO2: identify the methods of Railway construction and maintenance (Apply)

CO3: summarize Air transportation infrastructure planning and its operations (Understand)

CO4: interpret the requirements of air transport management (Understand)

CO5: plan the conceptual design of Harbour layout and Inland water transportation (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	1	1	-	-	-	-	-	2	-
CO2	3	2	-	-	-	1	1	-	-	-	-	-	-	-
CO3	3	3	2	-	-	1	1	-	-	-	-	-	2	-
CO4	3	-	-	-	-	1	1	-	-	-		-	-	-
CO5	3	3	1	-	-	1	1	-	-	-	-	-	2	-
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)			3: Substantial (High)								

SYLLABUS:

UNIT I RAILWAYS PLANNING AND MANAGEMENT 9

Railway Industry – Privatization – Financing – Competition with Road Transport – Railway Track – Permanent way and its components – Route alignment surveys – Geometric design of railways, Gradient, Super elevation, Widening of gauge on curves – Points and Crossings.

UNIT II RAILWAY INFRASTRUCTURES 9

Earthwork – Stabilization of track on poor soil – Calculation of Materials required for Track laying – Construction and maintenance of tracks – Modern methods of construction & maintenance – Railway station, Station and yards – Case studies of railway stations in India.

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UNIT III AIRPORT PLANNING AND DESIGN 9

Air transport characteristics – Airport classification – Criteria for airport site selection – Typical airport layouts – Runway Design – Wind Rose Diagram – Runway length – Problems on basic and Actual Length – Geometric design of runways – Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Runway and Taxiway Markings and Lighting.

UNIT IV AIR TRANSPORT MANAGEMENT 9

Airport – Passenger Facilities and Services – Accessibility – Transport Connections - Feasibility Studies – Environmental and Social Issues – Forecasting Future Traffic – Airfield Capacity and Delay – Airport Performance, Demand Management, Multi-airport Systems.

UNIT V HARBOUR PLANNING, DESIGN AND MANAGEMENT 9

Definition of Harbor, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbor – Harbour Layout and Terminal Facilities – Coastal Structures – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Harbour field visit.

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: - Periods Project - Periods

Total 45 Periods

TEXT BOOKS:

1. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", V Scitech Publications (India), Chennai, 2018.
2. Satish Chandra and Agarwal M.M, "Railway Engineering", Oxford University Press, New Delhi, 2013.
3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.

REFERENCES:

1. Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill, New York, 1996.
2. Richard De Neufille and Amedeo Odoni, Airport Systems Planning and Design, McGraw Hill, New York, 2003.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP23	TRAFFIC ENGINEERING AND MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE404 Highway Engineering

COURSE OBJECTIVES:

- To provide an insight on traffic and its components, factors affecting road traffic and the design of intersection.
- To develop a strong knowledge base of traffic planning and its management in any transportation area.
- To provide knowledge of traffic control devices and its techniques in transportation interaction

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the traffic characteristics and fundamental traffic flow theories (Understand)

CO2: conduct traffic studies and analyse traffic data (Understand)

CO3: analyze various traffic control measures and design traffic engineering facilities (Apply)

CO4: summarize the impact of traffic on the environment (Understand)

CO5: develop the various Traffic Management Measures to reduce the congestion (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	-	1	-	-	-	-	-	1	1	-
CO2	3	3	1	2	2	1	-	-	-	-	-	1	1	-
CO3	3	3	1	2	-	1	-	-	-	-	-	1	1	-
CO4	3	1	1	2	-	1	-	-	-	-	-	1	1	-
CO5	3	1	3	2	2	1	-	-	-	-	-	1	1	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I TRAFFIC CHARACTERISTICS 9

Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town ,country ,regional and all urban infrastructure – Towards Sustainable approach. – land use & transport and modal integration.

UNIT II TRAFFIC SURVEYS 9

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Level of service – Concept, applications and significance.

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UNIT III TRAFFIC DESIGN AND VISUAL AIDS 9

Intersection Design – Channelization – Rotary intersection design – Signal design – Coordination of signals – Grade separation – Traffic signs including VMS and road markings

UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 9

Road accidents – Causes, effect, prevention, and cost – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

UNIT V TRAFFIC MANAGEMENT 9

Area Traffic Management System – Traffic System Management (TSM) with IRC standards — Traffic Regulatory Measures – Travel Demand Management (TDM) – Intelligent Transport System for traffic management.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2019
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.

REFERENCES:

1. Wolfgang S.Homburger et.al., "Fundamentals of Traffic Engineering" 15th Edition, Institute of Transportation Studies, University of California, 2012.
2. James L.Pline (Edr) "Traffic Engineering Hand Book", Institute of Transportation Engineers, Washington DC, USA, 1999.
3. Nicholas T.Garber, Lester A Hoel, "Traffic and Highway Engineering", Revised Second Edition, ITP, California, USA, 1999.

EVALUATION PATTERN:

<table>
<tr><td colspan="4">Continuous Internal Assessments</td><td rowspan="2">Total Internal Assessments</td><td rowspan="3">End Semester Examinations</td></tr>
<tr><td colspan="2">Assessment I
(100 Marks)</td><td colspan="2">Assessment II
(100 Marks)</td></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP24	SMART CITIES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide basic understanding about the infrastructure development and smart city
- To develop the students to find the solution for problems in smart city planning
- To enable the students to apply the knowledge about smart cities in complex infrastructures

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: identify the necessity of infrastructural development in smart cities (Understand)

CO2: outline the components of smart city and preparation of infrastructure plan (Understand)

CO3: apply the concept of smart transport system for smart cities (Apply)

CO4: evaluate the requirements of water resource system for smart city (Understand)

CO5: predict National and Global policies to implement for smart city development in India (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	1	-	-	-	-	-	-	3	-
CO2	3	3	3	3	1	1	-	-	-	-	-	-	3	-
CO3	3	3	2	3	1	1	-	-	-	-	-	-	2	-
CO4	3	3	2	1	1	1	2	-	-	-	-	-	1	-
CO5	3	3	-	-	-	1	-	-	-	-	-	-	1	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I FUNDAMENTALS OF SMART CITY AND INFRASTRUCTURE 9

Introduction of Smart City – Concept of smart city – Objective for smart cities – History of Smart city – Need to develop smart city – Challenges of managing infrastructure in India and world – Various types of Infrastructure systems – Financing for smart cities - India "100 smart cities" mission.

UNIT II PLANNING AND DEVELOPMENT OF SMART CITY INFRASTRUCTURE 9

Energy and Ecology – Solar energy for smart city – Housing – Sustainable green building – Safety, security – Disaster management – Economy – Cyber security – Project management.

UNIT III INTELLIGENT TRANSPORT SYSTEMS 9

Intelligent Transportation system for smart cities – Smart vehicles and fuels – Geographical Information System – Global Positioning System – Navigation system – Traffic safety management

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– Mobility services – E-ticketing – Smart parking system

UNIT IV GREEN BUILDINGS AND WATER RESOURCE MANAGEMENT 9

Sustainability – Rating system of green buildings – Energy Efficient Building I&II – Energy saving system in Buildings I&II – Storage and conveyance system of water – Sustainable water and sanitation – Sewerage system – Flood management – Conservation system

UNIT V INFRASTRUCTURE MANAGEMENT SYSTEMS & POLICY FOR SMART CITY 9

Integrated infrastructure management systems for smart city – Infrastructure management system applications for existing smart city – Worldwide policies for smart city Government of India – policy for smart city – Mission statement & guidelines – Smart cities in India, Case studies of smart city.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. P.P.Anil kumar, "Introduction to smart cities", Pearson India, 2019
2. Mike Barlow, Cornelia Levy-Bencheton, "Smart Cities, Smart Future: Showcasing Tomorrow", Wiley and SAS Business series, 2018.
3. Houbing Song, Ravi Srinivasan, Tamim Sookoor, Sabina Jeschke, "Smart cities: Foundations, Principles and Applications", Wiley, 2017.

REFERENCES:

1. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf
2. Smart city government of India. http://smartcities.gov.in

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP25	METRO ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the various components of metro rail technology
- To discuss about the various environmental like ventilation, fire, drainage for metros
- To provide adequate knowledge about Analysis and Design of components in Elevated and UG Metro

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: identify the various components of Metro & its Planning for various disciplines (Understand)

CO2: develop a Conceptual layout of elevated and underground metro station (Apply)

CO3: design Diaphragm wall for the construction of Underground Metro station (Apply)

CO4: understand contracts systems and quality systems in Metro Engineering (Understand)

CO5: apply different load combinations model generation using software (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO2	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	1	1	1	-
CO4	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO5	3	2	1	-	2	-	-	-	-	-	1	1	1	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO MASS RAPID TRANSIT SYSTEM 9

Overview of Metro – Transit Oriented Development – Feasibility Study for MRTS Project – Sustainable and Smart Technologies – Recent Advancements & Future Technologies (High Speed Rail Technology, 'Maglev &Ground Effect Trains etc.)

UNIT II PLANNING AND MANAGEMENT SYSTEM OF METRO 9

Basic Interfacing Principles – Alignment, Urban level planning, constraints and restrictions – Building Information Modelling in Metros – HVAC Systems – Tunnel Ventilation System – Public Health Engineering – Fire Alarm System – Introduction to Contracts – Overview of FIDIC standards – Introduction to Quality Systems – Knowledge check.

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UNIT III CONSTRUCTION TECHNOLOGY 9

Precasting Yard Development – Types of Precast Super Structure – Precast Mould development – Formwork System Overview – introduction to Precast Erection – Superstructure launching Methods – Obligatory Spans – substructure and foundation Construction Methodology – Challenges in Foundation Construction – Substructure system – Choosing type of Pier based on alignment profile, Rail / Over Head Equipment mast – Station overall layout – Pier arm - spine wing / cantilever and Platform- precast/cast-in-situ system.

UNIT IV ELEVATED DESIGN OF STATION AND VIADUCT 9

Overview of Elevated station – Analysis and Design – Spine beam method – Design of station components, Loads – Introduction to IRC/IRS Codes – Analysis and Design of superstructure – Substructure and foundation – Introduction to Modelling Software - STAAD Pro and Midas Civil – Ductile detailing of structures .

UNIT V MISCELLANEOUS TOPICS 9

Underground Stations and its configurations – Shoring Systems – supporting systems – Construction Methodology (Bottom-Up method/ Top Down method) – Earth retaining structures – Secant pile wall design – Guide walls – Introduction to Loads – Load combinations – Fire resistant criteria and Floatation check – 2D & 3D model generation – SOD restrictions & Element sizing for UG Stations – Design of all the components of UG station.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Agarwal M M, Sudhir Chandra, K. K. Miglani "Metro Rail in India for Urban Mobility", Kindle Edition, 2021
2. M. Ramachandran, E. Sreedharan "Metro Rail Projects in India – A study in Project planning", Kindle Edition, 2011

REFERENCES:

1. https://hmrl.co.in/PDF/executive-summary.pdf

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP26	PAVEMENT ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE404 Highway Engineering

COURSE OBJECTIVES:

- To understand the various types of pavement
- To develop the students for designing the pavements as per IRC standards
- To enable the students to select pavement materials, construction, evaluation and maintenance

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: summarize concepts and standards in Planning, Design and construction of Pavements (Understand)

CO2: apply IRC standards to design the flexible pavement (Apply)

CO3: apply IRC standards to design the rigid pavement (Apply)

CO4: identify the materials used for pavement construction (Understand)

CO5: select appropriate methods for construction and evaluation of Pavements (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	1
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	1
CO4	3	-	-	-	-	-	-	-	-	-	-	-	1	1
CO5	3	3	3	-	-	-	-	-	-	-	-	-	1	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I PAVEMENT TYPES AND STRESS DISTRIBUTION 9

Introduction – Pavement as layered structure – Pavement types rigid and flexible – Resilient modulus – Stress and deflections in pavements under repeated loading

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 9

Flexible pavement – Components and functions – Factors influencing design of flexible pavement – Design procedure as per IRC guidelines – Design and specification of rural roads – Stresses in flexible pavements

UNIT III DESIGN OF RIGID PAVEMENTS 9

Cement concrete pavements – Components and functions – Factors influencing design of CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines –

Concrete roads and their scope in India.

UNIT IV PAVEMENT MATERIALS 9

Aggregates – Requirements, properties and testing – Cement grades, chemical composition, testing, admixtures, fibers, properties and testing of pavement quality concrete, – Bitumen and Tar – origin, preparation, properties and chemical constitution of bituminous road binders – Bituminous emulsions and cutback – preparation, characteristics uses and tests, mechanism of stripping, adhesion failure. Bituminous mixes: preparation, design and testing.

UNIT V PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE 9

Construction of pavements – Construction Equipments – Methods of construction. 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).

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

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, 2005.
3. Kerbs and Walkes, "Highway Materials", McGraw Hill Book Co.2007.

REFERENCES:

1. Yoder, R.J. and Witchak M.W. Principles of Pavement Design, John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements,IRC-37-2001,The Indian roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

U21CEP27	FOUNDATION ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE403 Soil Mechanics

COURSE OBJECTIVES:

- To impart knowledge on site investigation
- To understand the type and behaviour of soil
- To learn the different types of foundations

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the concept of site investigation, methods and soil sampling (Understand)

CO2: apply the knowledge to compute bearing capacity and settlement for shallow foundations (Apply)

CO3: examine the load carrying capacity of pile and design of pile as per coding provision (Apply)

CO4: inspect field problems and implement solutions on expansive soils (Apply)

CO5: calculate the earth pressure of retaining wall (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	-	-	2	2	2
CO2	3	3	2	1	-	-	-	-	2	-	-	2	2	3
CO3	3	3	3	1	-	-	-	-	1	-	-	2	2	2
CO4	3	2	2	1	-	-	-	-	1	-	-	3	2	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION **9**

Introduction – Methods of exploration – Depth and spacing of boreholes – Soil sampling – Samplers (split spoon, thin-wall, Stationary piston) – Penetration tests (SPT, SCPT) – Data interpretation - Strength parameters – Bore log report. Choice of foundation – Basic definitions – Requirements of foundation – Plate load test – Types of foundations

UNIT II SHALLOW FOUNDATIONS **9**

Introduction – Depth of foundation – Codal recommendations – Bearing Capacity of shallow foundation – Types of failure – Terzaghi's theory, BIS formula Bearing Capacity from SPT, SCPT, and plate load test. Determination of Settlement of foundations on cohesive and cohesionless deposits – Total and differential settlements – Allowable settlement – Codal provision – Remedies to minimize total and differential settlements – Modulus of sub-grade reaction

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UNIT III PILE FOUNDATIONS 9

Introduction – Types – Factors influencing the selection of pile – Static formulae, dynamic formulae (ENS & Hiley's), Correlations with SPT data – Negative skin friction – Pile load test - Uplift capacity - Group action of piles – Settlement of pile groups in sand and clays – Piled-raft concept

UNIT IV SPECIAL FOUNDATIONS 9

Introduction – Clay minerals – Identification of expansive soils – Swell pressure tests – Field conditions favor swelling – Causes & consequences of swelling & shrinkage – Design of foundation on expansive soils – Under-reamed piles – Concept of CNS layer – Problematic soils in India - Foundations for bridge piers, transmission towers, chimneys (theory only)

UNIT V EARTH PRESSURE 9

Introduction – Earth pressure – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Critical failure plane – Earth pressure on retaining walls of simple configurations – Stability analysis of retaining walls – Codal provisions – Effect of excavation – Effect of lateral spreading and tunneling on adjacent foundations.

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Ranjan, G., Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International P. Ltd., Publishers, New Delhi, 3rd Edition, 2016
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017

REFERENCES:

1. Swamy Saran, "Analysis and Design of Substructures", Oxford and IBH Publishing Co. P. Ltd., 2006
2. Bowles, J.E., "Foundation Analysis and Design", McGraw Hill Education, 5th Edition, 2015
3. Das, B.M., "Principles of Foundation Engineering", Cengage Learning, 8th Edition, 2014

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

U21CEP28	GROUND IMPROVEMENT TECHNIQUES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE403 Soil Mechanics

COURSE OBJECTIVES:

- To understand the various principles of ground treatment techniques
- To apply construction procedures for the construction sites
- To apply various chemical and thermal modification process

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand various ground improvement treatment techniques (Understand)

CO2: analyze different stabilization techniques to improve ground water (Analyze)

CO3: apply various concepts along with case studies where ground failures are resolved using ground improvement techniques (Apply)

CO4: analyze the conditions using various chemical and thermal modification process (Analyze)

CO5: apply various materials for ground improvement and containment purposes (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	1	-	-	-	-	-	2	-
CO3	3	2	2	2	-	-	2	-	-	-	-	-	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	1	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I INTRODUCTION TO GROUND IMPROVEMENT TECHNIQUES 9

Need for ground improvement – Different types of problematic soils – Classification of ground improvement techniques – Emerging trends in ground improvement.

UNIT II MECHANICAL STABILIZATION 9

Shallow and Deep Compaction – Conventional and Intelligent compaction – Deep dynamic and Rapid impact compaction – Vibro compaction – Blasting densification – Deep Replacement – Stone Columns – Vibro concrete columns – Design and Construction Methods.

UNIT III HYDRAULIC MODIFICATION 9

Drainage and Dewatering System – Dewatering methods – Prefabricated vertical drains – Vacuum consolidation – Electro-kinetic dewatering – Design and construction methods.

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UNIT IV CHEMICAL AND THERMAL MODIFICATION 9

Modification by Admixtures – Lime and Cement columns – Admixtures in Pavement design – Stabilization of Industrial Waste – Modification by Grouting – Different Types – Grouting techniques and control – Thermal Modification – Heat Treatment of Soils – Ground Freezing.

UNIT V MODIFICATION BY INCLUSIONS AND CONFINEMENT 9

Soil nailing – Stabilization using soil nailing – Types – Construction methods – Anchors – Construction methods on soft ground tunnels.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Hausmann, M.R, "Engineering principles of ground modification", McGraw Hill. New Delhi, 2019
2. Koerner, R.M, "Designing with geosynthetics", 6th edition, Xlibris. India, 2018
3. Babu, G.L.S,"An introduction to soil reinforcement and geosynthetics", 1st Edition, Universities Press, India, 2020.

REFERENCES:

1. Han, J."Principles and practice of ground improvement", 1st Edition, Wiley, 2017
2. Van Impe W.F, "Soil improvement techniques and their evolution", Balkema, 2000.
3. Moseley, M.P,"Ground improvement", Taylor and Francis, 2017.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP29	GEO ENVIRONMENTAL ENGINEERING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE403 Soil Mechanics

COURSE OBJECTIVES:

- To understand the behaviour of soils, rocks under the groundwater
- To provide adequate knowledge about site remediation techniques
- To discuss about the various environmental methods in ground water improvement towards sustainable development.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand various geo environmental problems and fundamental background (Understand)

CO2: discuss the risk assessment techniques for contaminated site and its remediation (Apply)

CO3: discuss the types of surface impoundments, analysis and design of different components (Apply)

CO4: identify the characterization of different waste for its reuse (Apply)

CO5: apply the case studies on reuse of mining and industrial waste monitoring (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)						3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION TO GEO ENVIRONMENTAL ENGINEERING 9

Geo environmental Problems – Geo environmental Engineering – Fundamental Background Needed for Geo environmental Engineering – Relevant Environmental Laws – Soil Composition and properties – Geochemistry – Contaminant Transport and Fate

UNIT II SITE REMEDIATION 9

Contaminated Site Characterization – Risk Assessment and Remedial Strategy – In-Situ Containment Technologies – Soil Remediation Technologies.

UNIT III LANDFILLS AND IMPOUNDMENTS 9

Waste Characterization and Properties – Landfill impoundments and theirstability analysis – Liner

Systems – Leachate Collection and Removal Systems – Final Cover Systems.

UNIT IV SUSTAINABLE DEVELOPMENT 9

Beneficial Use of Waste and Recycled Materials – End Use of Closed Landfill Sites – Green and Sustainable Remediation.

UNIT V MISCELLANEOUS TOPICS 9

Advance instrumentations – Sustainable used of Mining and Industrial wastes – Rehabilitation of contaminated sites.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Sharma, H.D, "Geo environmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies", John Wiley & Sons, Inc. New Jersey, 2015.
2. J. K. Mitchell, "Fundamentals of Soil Behavior", John Wiley and Sons, New Jersey, 2016.
3. Kerry Rowee, "Geotechnical and Geo environmental Engineering Handbook" 1st Edition, Kindle Edition, Springer Science, 2002.

REFERENCES:

1. Mohamed, A.M.O, "Fundamentals of Geo environmental Engineering: Understanding Soil, Water, and Pollutant Interaction and Transport", Butterworth – Heinemann, 2017.
2. David Frost, "Failures in Civil Engineering: Structural, Foundation, and Geo environmental Case Studies", American Society of Civil Engineers, 2003.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP30	TUNNELLING ENGINEERING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE403 -Soil Mechanics

COURSE OBJECTIVES:

- To understand the design aspects in the field on geotechnical/rock engineering and tunnelling
- To learn instrumentation and monitoring of underground structures such as tunnels, caverns, shafts and stations
- To explain the construction methodology, support systems and challenges in the constructions of Tunnels, caverns, shafts and stations

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: outline the different types of underground structures, components associated with it and its support system (Understand)

CO2: illustrate the challenges for construction of tunnels, caverns, shafts and stations and suggest the solutions (Apply)

CO3: make use of the design methodologies to be used for instrumentation and monitoring of v tunnels (Understand)

CO4: understand the basics of support systems and design software's used in the industry for design of underground structures (Understand)

CO5: interpret the results obtained through software analysis with practical application and case studies (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	2	-	2
CO4	3	2	2	2	-	-	-	-	-	-	-	2	-	2
CO5	3	2	-	2	-	-	-	-	-	-	-	2	-	1
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)							3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO UNDERGROUND CONSTRUCTIONS AND TUNNELLING 9

General Description of Various Tunnels and other underground structures – Components of a tunnel Stress around an underground opening – Methods of excavations – Subsurface investigation – Surface investigation – Sampling Techniques – Laboratory and in-situ testing of soil and rock – IS codes

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UNIT II CONSTRUCTION, CHALLENGES AND SOLUTIONS FOR CAVERNS, SHAFT AND UNDERGROUND STATIONS 9

Factors affecting the choice of method of tunnel construction – Cut and cover method, Bored method, Drill and blast method, Sequential excavation method and shaft method – Norwegian tunnel boring method (NTM), New Austrian tunnel boring method (NATM) – Methods of construction of caverns and shafts and underground stations – Challenges and solutions for execution of these methods – Different types of Tunnel boring machines

UNIT III DESIGN METHODOLOGY, INSTRUMENTATION AND MONITORING FOR TUNNELS 9

Rock mass classification – Geotechnical and geological inputs for design – Empirical, semi empirical and joint set analysis – Numerical 2D modelling and final support recommendations – Need for Instrumentation and monitoring in tunnels – Types of Instruments – Planning and execution.

UNIT IV SUPPORT SYSTEMS AND DESIGN SOFTWARE FOR TUNNELS 9

Need for pre-excavation support system – Fore piling, Bolts and Anchors, Shotcrete, wire meshes, lattice girders and integrated support systems – Different types of retaining structures and their applicability – Secant piles, Sheet piles, contiguous piles and soldier piles and D wall – Requirement of investigation to be carried out for underground structure – Preparation geotechnical interpretation report for design of retaining structure – Numerical analysis to be performed for temporary / permanent retaining system – Introduction to software to be used in embedded retaining system –Case studies.

UNIT V INDIAN AND INTERNATIONAL CODAL PROVISIONS WITH CASE STUDIES 9

Introduction to interpretation using Rock data – Introduction to Wallap – Introduction to Plaxis – Introduction to RS-2 – Introduction to CIRIA 143 – Wallap and their application – Practical application & case studies

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Pokorovski, "Driving Horizontal Workings and Tunnel", Mir Publishers, 1980.
2. Nick Barton, "Tunnel Boring Machines", 2000.

REFERENCES:

1. Carlos L Jimeno, A.A. Balkema., "Drilling and Blasting of Rocks", Rotterdam/Brookfield 1995
2. Hoek, E., Brown, E., "Underground excavations in Rock", CRC Press, 1980.
3. Hoek, E. and Brady, J. D Rock Slope Engineering", Taylor and Francis, 1981.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided

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Learn Beyond

PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP31	SOIL DYNAMICS AND MACHINE FOUNDATION	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE403 - Soil Mechanics
- U21CEP26 - Foundation Engineering

COURSE OBJECTIVES:

- To understand the fundamentals of vibration
- Understand the wave propagation and dynamic properties of soil
- To analyze and design machine foundation

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: distinguish different types of vibrations and its response (Understand)

CO2: examine the wave propagation and dynamic properties of soil (Apply)

CO3: evaluate the soil modeling for cyclic loading (Analyze)

CO4: analyze and design machine foundation (Analyze)

CO5: apply the principles of vibration isolation (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1	1	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	1	1
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	1
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I FUNDAMENTALS OF VIBRATION 9

Introduction – Sources of vibrations – Basics concepts of vibration – classification of vibrations – Vibration analysis procedure – Simple harmonic motion – Undamped free vibration of SDOF systems – Damping: Linear, Non-linear damping, Equivalent viscous damping – Damped free vibration of SDOF systems – Response of damped SDOF system under harmonic force and rotating unbalanced force.

UNIT II WAVE PROPAGATION AND DYNAMIC SOIL PROPERTIES 9

Shear and Dilational waves, Rod waves – Natural frequencies and mode shapes, Rayleigh waves and their significance in soil dynamics, attenuation of shear waves. Dynamic soil properties – Gmax, Gsec, Gtan, G/Gmax and damping – Factors affecting dynamic soil properties. Field and Laboratory methods of determination – Uphole, Down hole and Cross hole methods – Cyclic plate load test – Block vibration test.

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UNIT III SOIL MODELING FOR CYCLIC LOADING 9

Linear visco elastic model – stress-strain relationship – Kelvin model – Maxwell model. Nonlinear stress-strain model – Hyperbolic model, Masing model, Ramberg-Osgood model.

UNIT IV ANALYSIS AND DESIGN OF MACHINE FOUNDATIONS 9

Block foundations for reciprocating engines and low speed rotary machines – Block foundations for forge hammers and other impact machines – Frame foundations for high speed rotary machineries – Spring mounted foundations.

UNIT V VIBRATION ISOLATION 9

Principles of vibration isolation – Active and Passive Isolation – Methods of isolation – Design of wave barriers.

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Das B.M and Ramanna G.V., Principles of soil dynamics 2nd Edition, Cengage learning, Stanford, USA, (2011).
2. K.G. Bhatia, Foundations for Industrial Machines, D-CAD Publishers, (2008).

REFERENCES:

1. Kramer, S. L., Geotechnical Earthquake Engineering, Pearson Education Inc., New Delhi, (2010).
2. Bowles, J.E., "Foundation Analysis and Design", McGraw Hill Education, 5th Edition, 2015
3. Das, B.M., "Principles of Foundation Engineering", Cengage Learning, 8th Edition, 2014

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

U21CEP32	ENGINEERING GEOLOGY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the importance of geological knowledge such as earth, earthquake, volcanism.
- To apply geological knowledge in projects such as dams, tunnels, bridges, roads, airport and harbour.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: outline the interior and exterior surface of the earth (Understand)

CO2: discuss the crystal structure, mineral types and its properties (Understand)

CO3: understand the formation of rocks and its properties (Understand)

CO4: identify subsurface information and groundwater potential sites through geophysical investigations (Understand)

CO5: apply geological principles for mitigation of natural hazards and select sites for dams and tunnels (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	2	3	-	-	-	-	-	-	-	-	-	2
CO4	1	-	-	2	3	-	-	-	-	-	-	-	-	2
CO5	1	1	1	-	-	-	-	-	-	-	-	-	-	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I PHYSICAL GEOLOGY 9

Geology in civil engineering – branches of geology – structure of earth and its composition – weathering of rocks – scale of weathering – soils – landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering – Plate tectonics – Earth quakes – Seismic zones in India.

UNIT II MINERALOGY 9

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene – hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

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UNIT III PETROLOGY 9

Classification of rocks – Distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks – Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V APPLICATION OF GEOLOGICAL INVESTIGATIONS 9

Remote sensing for civil engineering applications – Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining – Coastal protection structures – Investigation of Landslides – causes and mitigation.

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Parbin Singh, "Engineering and General Geology", Katson Publication House, 2016.
2. A.Parthasarathy, V.Panchapakesan and R. Nagarajan, "Engineering Geology", Willey India Pvt. Ltd, 2015.

REFERENCES:

1. Prakash Jadhav and Raviraj Sorate, "Engineering Geology", Nirali Prakahan,2015
2. Haakon Fasson, "Structural Geology", Cambridge University Press, 2016.
3. K.V.G.K. Gokhale, "Principles of Engineering Geology", B.S publications, 2018.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP33	AI IN CIVIL ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of Artificial Intelligent models and algorithms
- To gain the knowledge about learning methods, model analysis and Fuzzy concepts
- To know the applications of AI in Geotechnical Engineering, Structural Engineering, Construction management and Transportation Engineering

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the concepts of AIN network and general algorithm (Understand)

CO2: identify the geotechnical characteristics (Apply)

CO3: examine the structural elements by using AI (Apply)

CO4: analyze the AI based construction activities and scheduling (Analyze)

CO5: apply the AI in traffic management system (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	1	-	-	1	-	-	1	-	-
CO2	3	2	1	-	1	1	-	-	1	-	-	1	-	-
CO3	3	2	1	-	1	1	-	-	1	-	-	1	-	-
CO4	3	2	1	1	1	2	-	1	1	1	-	1	-	-
CO5	3	3	2	1	1	2	-	1	1	-	-	1	1	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO ARITIFICIAL INTELLIGENCE 9

Introduction to AI – Applications of AI in Engineering – Implementation of AI in Civil Engineering – Fundamentals of AIN Networks in AI – Genetic algorithm – Machine Learning – Regression model – Dimension Analysis – Simulation Theory – Game theory and its applications.

UNIT II APPLICATION OF AI IN GEOTECHNICAL ENGINEERING 9

Expert system for Landslide hazard and risk management – Advisor on the selection of Earth retaining structures – Development of a prolonged based expert system for ground water control – Real time expert system for excavation – Knowledge based assistant for earthquake resistant design in AI – Case studies.

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UNIT III APPLICATION OF AI IN STRUCTURAL ENGINEERING 9

Prolog standards for structural design – Expert system for conceptual design of bridges – Structural design using Intelligent objects – Expert system for design of offshore structures – Knowledge based system for design of Reinforced concrete walls – Damage assessment based on Fuzzy reasoning using AI – ANN - Expert system for base plates – Expert system for structural inspection and maintenance – Case studies

UNIT IV APPLICATION OF AI IN CONSTRUCTION MANAGEMENT 9

Knowledge based regulation processing for Site Development – Key approach to site layout problems – Duration of each activity forecasting techniques – Expert system for construction industry – A Fuzzy expert system for priority ranking in Network Resource Allocation – Expert system in Network resource allocation – Generation and scheduling of construction activities – Case studies

UNIT V APPLICATION OF AI IN TRANSPORTATION ENGINEERING 9

Traffic Control System of Non-autonomous Vehicles at Signalized Road Intersection – Traffic Lights – Traffic Patterns – Improved Safety services – Application in traffic management system – Application in health monitoring – Case studies.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Daugherty, Paul R., and H. James Wilson. "Human+ machine: reimagining working the age of AI" Harvard Business Press, 2nd edition, 2018.
2. Prateek, J. "Artificial Intelligence with Python", Packt Publishing, Birmingham, 1st edition, 2017.

REFERENCES:

1. Husain, Amir "The sentient machine: The coming age of artificial intelligence", Scribner Publishing, 1st edition, 2017.
2. Kaplan, Jerry "Artificial intelligence: What everyone needs to know" Oxford University Press, 1st edition, 2016.
3. B.H.V Topping, "Artificial Intelligence Techniques and Applications for Civil and Structural Engineers", Civil Compress press, 10 Saxe-Coburg places, Edinburgh, 1st edition, 1989.
4. https://nptel.ac.in/courses/106102220

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**			
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	**Total Internal Assessments**	**End Semester Examinations**
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP34	ENERGY EFFICIENT BUILDING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To introduce the green composite techniques for buildings
- To explain the importance of recycling materials and techniques involved in green buildings
- To emphasis the significance of sustainable development and construction through solar energy

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: analyze the energy required and energy balance of buildings (Apply)

CO2: classify the recycling materials (Understand)

CO3: outline the behavior of thermal comfort in green buildings (Understand)

CO4: calculate the utility of solar energy in green buildings (Apply)

CO5: summarize the concepts of green composites (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	1	1	3	3
CO2	3	-	-	-	-	1	2	1	-	-	1	1	3	3
CO3	3	-	-	2	-	-	2	1	-	-	1	1	3	3
CO4	3	3	-	-	-	1	2	1	-	-	1	1	3	3
CO5	3	-	-	-	-	1	2	1	-	-	1	1	3	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

SYLLABUS:

UNIT I SOURCES OF WATER AND ITS CONVEYANCE 9

Energy use, carbon emissions, water use, waste disposal – Green building materials: sources, methods of production and environmental Implications – Maintenance Energy for Buildings – Indian Green building Council

UNIT II IMPLICATIONS OF BUILDING TECHNOLOGIES 9

Resources for Building Materials in construction – Alternative concepts – Recycling of Industrial and Buildings Wastes – Biomass Resources for buildings

UNIT III COMFORTS IN BUILDING 9

Thermal Comfort in Buildings – Issues – Heat Transfer Characteristic of Building Materials and Building Techniques – Incidence of Solar Heat on Buildings – Hybrid methods – Energy conservation measures, thermal storage integration in buildings

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UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS 9

Utility of Solar energy in buildings – concepts of Solar Passive Cooling and Heating of Buildings – Low Energy Cooling – Case studies of Solar Passive Cooled and Heated Buildings

UNIT V GREEN COMPOSITES AND RENEWABLE ENERGY IN BUILDINGS 9

Concepts of Green Composites – Water Utilization in Buildings – Low Energy Approaches to Water Management – Management of Solid Wastes – Management of Sullage Water and Sewage – Biogas generation – Small wind turbines, standalone PV, Hybrid systems for residential buildings with economics.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total 45 Periods

TEXT BOOKS:

1. Jagadish, K. S., Venkataramareddy, B. U. and Nanjundarao, K. S. "Alternative Building Materials and Technologies' New Age International, 2007.
2. Ursula Eicker, "Low Energy Gooling For Sustainable Buildings", John Wiley and Sons Ltd, 2009
3. Charles. J. Kibert, Sustainable Construction: Green Building Design and Deliver, John Wiley and Sons, 2016.

REFERENCES:

1. Duffie, A and Beckmann, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.
2. R. Velraj, "Sensible heat Storage for solar heating and cooling systems" in the book titled "Advances in Solar Heating and Cooling" – Pages 399 – 428 Elsevier Publication, 2016.
3. Sukhatme, S.P., Solar Energy, Tata McGraw Hill, 1984.
4. UrsalaEicker, "Solar Technologies for buildings", Wiley Publications, 2003.3 Guide book for national certification examination for energy managers and energy auditors. (downloaded from www.energymanagertraining.com).
5. Michael Bauer, Peter Mosle and Michael Schwarz, Green Building – Guidebook for Sustainable Architecture, 2009.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

U21CEP35	BUILDING INFORMATION MODELLING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CE306 – Computer Aided Drafting Laboratory

COURSE OBJECTIVES:

- To design the virtual building model with intelligent building elements
- To work with building components
- To design the architectural, structural and MEP components

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: create a workflow for a building with all required deliverables to be covered in the project output (Apply)

CO2: design a 3D building model to explain how information is inter-related with structural elements (Apply)

CO3: create the clash detection matrix for the federated structural, architectural and specialist designer project model (Analyze)

CO4: coordinate different discipline models with clash checking to arrive at the final design solution, inclusive of the deliverable from the model at each stage (Analyze)

CO5: apply the concept of 4D, 5D and how BIM works in coordination with other disciplines (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	1	2	2	-	1	-
CO2	-	-	-	-	3	-	-	-	1	2	2	-	1	-
CO3	-	-	-	-	3	-	-	-	1	2	2	-	1	-
CO4	-	-	-	-	3	-	-	-	1	2	2	-	1	-
CO5	-	-	-	-	3	-	-	-	1	2	2	-	1	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO BIM 9

Building Information Modelling – Introduction & Process – Evolution of BIM – BIM Model of various buildings like Commercial & Residential, WTP, Transportation, Airports – Isometric View – Introduction – Examples and Problems – 3D Modelling

UNIT II DESIGN AUTHORING AND VISUALIZATION 9

Design Authoring – Workflow, Discipline Based Modeling, Architectural, Engineering Analysis, Structural Analysis, HVAC, Electrical, Plumbing, Energy Analysis, Lighting Analysis, Design Review – Views in Model, Visualization Modes, Walkthrough & Fly through the Model, Layers & Properties, AR, VR & MR.

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UNIT III INTERFERENCE / CLASH CHECK 9

Clash Check – Types of Clashes – Federated Model – Clash avoidance process – Clash Detection Process – Introduction, Clash Detection – Priority Matrix, Clash Detection – Rules, Clash Detection – Report, Clash Detection – Grouping, Clash Detection – Roles & Responsibilities, Clash Detection Process – Demo.

UNIT IV DOCUMENTATION, CDE & LOE 9

2D drawings generation, Cloud Computing, CDE – Level of Detail & Level of Information, LOD – Structural elements – Chart & Matrix.

UNIT V 4D AND 5D IN BUIDING INFORMATION MODELLING 9

Project Schedule – 4D BIM Modelling – Construction Analysis – 3D Control & Planning – BIM for Safety – Disaster & Risk Analysis – Digital Fabrication – Phase Planning – As-built / Record Models – 5D in BIM – 5D BIM and Quantity Take off with UOM, Exercise & Demo, Quantity Take Off, 5D – Estimation and Analysis – Cost Control – Asset Information Model – COBie and Deliverables – Space Attributes – Asset Attributes and Asset requirement – Infrastructure System – Information Exchange with Facility Management.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total 45 Periods

TEXT BOOKS:

1. Karen Kensek , Douglas Noble, "Building Information Modeling: BIM in Current and Future Practice", 2014.
2. Autodesk Revit 2023 - BIM Management Template and Family Creation by ASCENT, ISBN: 978-1-63057-528-1, 2023

REFERENCES:

1. Eastman, C., Teicholz, P., Sacks, R., & Liston, C. BIM handbook: "A guide to building information modeling for owners, managers, designers, engineers and contractors", John Wiley & Sons, 2011.
2. Hardin, B., & McCool, D., "BIM and construction management: proven tools, methods, and workflows", John Wiley & Sons, 2015.
3. Issa, R. R., & Olbina, S., "Building Information Modeling Applications and Practices", American Society of Civil Engineers, 2015.
4. Pittard, S., & Sell, P. "BIM and Quantity Surveying" Routledge, 2016

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**			
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	**Total Internal Assessments**	**End Semester Examinations**
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
		L	T	P	J	C
U21CEP36	PRINCIPLES OF ARCHITECTURE	3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental concepts and theories of architecture drafting principles.
- To analysis different geometric shapes, their projections and functional design of buildings relating to the load, environment and climate

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the knowledge of architectural design principles to critically evaluate building (Understand)
CO2: design the site layout and site analysis (Apply)
CO3: implement the building rules and regulations, safety standards in integration of building services (Apply)
CO4: analyze the characteristics of climate types and environment response in the building (Apply)
CO5: evaluate the various rules and regulation of town planning and development authorities to develop landscape design (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	-	-	-	-	-	2	-
CO2	-	2	2	-	-	-	-	2	-	-	-	-	2	-
CO3	-	2	2	-	-	-	2	2	-	-	-	-	-	-
CO4	-	-	2	-	-	-	2	-	-	-	-	-	-	-
CO5	-	2	2	-	-	-	2	2	-	-	-	-	2	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

SYLLABUS:

UNIT I ARCHITECTURAL DESIGN 9

Definition of Architecture – Elements of Architecture – need and fulfillment – Architecture design – Analysis – Integration of aesthetic and function – Mass and space, visual and emotional effects of geometric forms and their derivatives.

UNIT II SITE PLANNING 9

Surveys – Site analysis – Development Control – Layout regulations – Layout design concepts – Zoning regulations – sub division regulations – building regulations – Floor Space Index – minimum plot sizes and building frontage – open spaces – minimum standard dimensions of building elements.

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UNIT III BUILDING TYPES 9

Residential, institutional, commercial and Industrial – Application of anthropometry and space standards – Inter relationships of functions – Safety standards – Building rules and regulations – Integration of building services – Interior design.

UNIT IV CLIMATE AND ENVIRONMENTAL RESPONSIVE DESIGN 9

Man and environment interaction – Factors that determine climate – Characteristics of climate types Design for various climate types – Passive and active energy controls – Green building concept – Effect of landscape elements on Climate and Architecture – Impact of climate and building on Ecological balance – Brief introduction of rating systems for climate responsive buildings such as LEED, GRIHA and others.

UNIT V TOWN PLANNING 9

Evaluation of planning – Objects of town planning – principles of town planning – origin of towns – growth of towns – origin – direction – various forms of planning . Principles of city planning - levels of planning – scope and contents of regional plan, master plan, detailed development plan and structure plan – preparation and implementation – planning of new towns – slum clearance and urban renewal.

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Muthu Shoba Mohan.G, "Principles of Architecture". Oxford University Press, New Delhi, 2018.
2. Arvind Krishnan, Nick Baker, Simos Yannas, Szokolay.S.V, "Climate Responsive Architecture", A Design Hand Book for Energy Efficient Building, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
3. Steven V. Szokolay, "Introduction to Architectural Science - The Basis of Sustainable Design", Elsevier, 2008.

REFERENCES:

1. Pramar. V.S. "Design fundamental in Architecture", Somaiya Publications Pvt. Ltd., New Delhi, 1997.
2. Rangwala. S.C. "Town Planning" Charotar Publishing House, Anand, 2005.
3. National Building Code of India. SP7 (Group 1) Bureau of Indian Standards, New Delhi, 2005.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP37	DISASTER MITIGATION AND MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide knowledge among students to take actions to reduce the vulnerability of disaster
- To understand the factors like hazard and vulnerability analysis, preparedness, and mitigation and prevention measures
- To make the students to learn about the disaster management schemes of the Government and Private organisation

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the different types of disasters (Understand)

CO2: discuss the risk assessment and its vulnerability (Understand)

CO3: explain the various disaster management techniques (Understand)

CO4: illustrate the rehabilitation and precaution in disaster management (Apply)

CO5: apply the risk assessment and preparedness techniques from case studies (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	2	-	-	-	-	-	2	-
CO2	2	-	2	-	-	1	-	-	-	-	-	-	2	-
CO3	2	-	2	-	-	1	2	-	-	-	-	-	-	-
CO4	2	-	2	-	-	1	2	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	2	-	2	2	-	-	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I INTRODUCTION TO DISASTERS 9

Disasters: Definition of disaster – Natural and Manmade Types of disasters – Natural Disaster such as Earthquake, Landslide, Flood, Drought, Fire, Land subsidence, severe heat aves, Cyclone, volcanoes, tsunami, avalanches, global climate extremes etc – Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism, forest fire etc. Causes, effects and practical examples for all disasters.

UNIT II VULNERABILITY AND DISASTER RISK REDUCTION 9

Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community

based DRR, Structural – nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders – Institutional Processes and Framework at State and Central Level – State Disaster Management Authority(SDMA).

UNIT III MITIGATION AND DISASTER MANAGEMENT 9

Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems - Preparedness through (IEC) Information, education & communication – Pre-disaster stage (mitigation), Effect to mitigate natural disaster at national and global levels – International strategy for disaster reduction, Emerging approaches in Disaster Management – Concept of disaster management .

UNIT IV REHABILITATION, RECONSTRUCTION AND RECOVERY 9

Reconstruction and Rehabilitation as a Means of Development – Damage Assessment – Post Disaster effects and Remedial Measures – Creation of Long-term Job Opportunities and Livelihood Options – Disaster Resistant House Construction – Sanitation and Hygiene – Education and Awareness – Dealing with Victims' Psychology – Long-term Counter Disaster Planning.

UNIT V TRAINING, AWARENESS PROGRAM AND PROJECT ON DISASTER MANAGEMENT 9

Training and drills for disaster preparedness – Awareness generation program – Mini project on disaster risk assessment and preparedness for disasters with reference to disasters in India.

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Dave R K, "Disasters: Management in India – Challenges and Strategies", Prowess Publishing, Chennai, 2018.
2. Sulthey M M, "Disaster Management", PHI Learning PVT Ltd, New Delhi, 2016.
3. Chakraborty, S C, "Natural Hazards and Disaster Management" Pargatishil Prokashak, Kolkata, 2007.

REFERENCES:

1. Singhal J.P, "Disaster Management", Laxmi Publications, 2010.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
3. Gupta Anil K, Sreeja S. Nair. "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP38	GIS AND REMOTE SENSING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To give an overview about the basic concepts and principles of various components of remote sensing and satellite image processing
- To learn the different components of GIS and map projection & coordinate system
- To provide an exposure to spatial data structures, input, output processes and its practical applications in Civil Engineering

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: select the type of remote sensing technique / data for required purpose (Understand)

CO2: identify the earth surface features from satellite images (Understand)

CO3: classify the maps, coordinate systems and explain GIS data models (Understand)

CO4: interpret spatial and attribute data and study the errors in maps (Understand)

CO5: apply GIS models for solving geospatial problems (Apply)

CO-PO MAPPING:

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	-	2
CO2	3	2	-	-	1	-	-	-	-	2	-	2	2	2
CO3	3	-	-	-	1	-	-	-	-	-	-	2	-	2
CO4	3	2	-	-	1	-	-	-	-	2	-	2	2	2
CO5	3	2	-	-	1	-	-	-	-	2	-	2	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I REMOTE SENSING SYSTEM **9**

Elements of EMR – wavelength regions – energy interaction in atmosphere – Absorption – scattering- atmospheric windows – terrestrial interaction – spectral reflectance curves – active and passive remote sensing – platforms and sensors – types of resolutions, Plank's blackbody law – displacement law and emissivity effects

UNIT II SATELLITE DATA PRODUCT AND INTERPRETATION OF SATELLITE IMAGERIES **9**

Types of data product – software and hardware requirement for data processing – Elements of visual image interpretation – Digital Image processing techniques, Landuse / landcover classification

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UNIT III GEOGRAPHIC INFORMATION SYSTEMS AND DATABASE 9

Map and map scale – Types of map, Digital Cartography and Evolution of GIS, Components of GIS – Software, Hardware and organization- Coordinate system – Map projection - Datums, ellipsoids, geoids, Type of data – spatial and non-spatial data, various sources of data – Coordinate Transformation, georeferencing – Database Structures – data models – spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures – Raster vs Vector Models – TIN and GRID data models.

UNIT IV DATA INPUT AND OUTPUT 9

Scanner – Raster Data Input – Raster Data File Formats – Vector Data Input – Digitiser – Raster and Vector overlay method – Reclass, Recode, Types of output data, Map Design, source of errors, types of errors, elimination, accuracies.

Data quality – Basic aspects – completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata

UNIT V GIS APPLICATIONS 9

GIS for water distribution network, sewer network, transportation network, telecom network, power network and other utilities – Site selection for larger projects based on GIS analysis – Remote Sensing data integration – Navigation and tracking using GPS and GIS – GIS database for buildings, Emergency planning, Internet GIS, AHP and weighted overlay method – Application of ArcGIS.

Contact Periods:

Lecture:	45 Periods	Tutorial:	- Periods	Practical:	– Periods	Project	- Periods
						Total	45 Periods

TEXT BOOKS:

1. Chang K. T., "Introduction to Geographical Information Systems", Tata McGraw Hill, 2015
2. Jensen, John R., "Remote Sensing of the Environment", An Earth Resource Perspective, 2nd Ed., Prentice Hall, New Jersey, 2013

REFERENCES:

1. Chandra M. and Ghosh S. K., "Remote Sensing and Geographic Information System", Narosa Publishing House, 2017
2. Anji Reddy, "Remote Sensing and Geographical Information Systems", BS Publications, Hyderabad, 2012
3. Elangovan K., "GIS: Fundamentals, Applications and Implementation", New India Publishing Agency, New Delhi, 2006

28/5/23

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVE

		Category: PEC				
U21CEP39	FINANCE FOR ENGINEERS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To discuss basic financial elements, financial statement analysis
- To evaluate the cost and working capital management, risk analysis, basics of personal finance
- To know the decision making in finance, different strategies, and Taxation

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: understand the work and efforts contribute to organizational financial performance (Understand)

CO2: equips them with financial acumen and tools so as to optimize outcomes (Apply)

CO3: understand the risk analysis and personal finance (Understand)

CO4: analyze the strategy and finance with EVA measures (Analyze)

CO5: apply the financial decision making and taxation (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	2	-	-	-	-	-	3	-	-	-
CO2	1	1	-	-	2	-	-	-	-	-	3	-	-	-
CO3	-	2	1	-	1	-	-	-	-	-	3	-	-	-
CO4	-	2	2	2	1	-	-	-	-	-	3	-	-	-
CO5	-	2	2	-	2	-	-	2	-	-	3	1	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I BASICS OF ECONOMICS AND FINANCIAL STATEMENTS WITH ANALYSIS 9

Introduction to economics and policies – Unique role of finance with example – Introduction to accounting – Finance & auditing – Capital Vs. revenue with example – Sources & uses of funds – Revenue recognition principles – Double entry bookkeeping – P&L with examples – Finance metrics & financial statement analysis – Understanding liquidity – Funds flow and cash flow analysis

UNIT II WORKING CAPITAL AND COST MANAGEMENT 9

Understanding working capital management – Estimation of working capital, understanding operating cycle with examples – Modern practices in Inventory Management – Understanding receivable management – Understanding cash management, cost accounting, cost & volume, cost, volume and profit relationship – Activity based approach in cost management – Introduction to

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budgeting – Principle in budgeting and budgetary control

UNIT III RISK ANALYSIS AND PERSONAL FINANCE 9

Target costing – Life cycle costing and quality costing – Value spiral management – Value engineering – Understanding financial functions – Applications of time value of money – Management of risk – Understanding risk management measurement & products example – Holistic look at risk management – Portfolio management principles – Example of portfolio – Forming a portfolio

UNIT IV STRATEGY, FINANCE & FINANCIAL ANALYTICS 9

Introduction to strategy – Firm Value – Valuation of strategy – Economic value add measure (EVA), Financial analytics – Descriptive financial analytics – Predictive financial analytics

UNIT V FINANCIAL DECISION MAKING AND TAXATION 9

Optimization as a tool for financial decision making – Planning the product mix – Logistics cost optimization – Overview of taxation – Personal taxes and investment planning – Indirect taxes – GST

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Frank Crundwell, "Finance for engineers: evaluation and funding of Capital Projects", Springer, 2nd edition, 2008.
2. Rupak Chatterjee, "Practical methods of financial engineering and risk management: Tools for modern financial", third edition, Springer, 2014.

REFERENCES:

1. John Hull's "Options, Futures, and Other Derivatives", 8th edition, Goodwill of Silicon Valley, 2013.
2. Anya Beder, Cara M. Marshall, "Financial engineering: The evolution of a profession", 6th edition, Wiley Online Library, 2011.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP42	INFRASTRUCTURE PLANNING AND ENGINEERING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

The objectives encompass defining the significance of infrastructure and private sector involvement, identifying planning challenges, and proposing effective strategies for project implementation to ensure sustainable development.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand and elucidate the concepts of infrastructure planning (Understand)

CO2: Outline private sector participation in infrastructure (Apply)

CO3: Identify challenges in successful infrastructure planning and implementation (Apply)

CO4: Describe the strategies for the successful execution of infrastructure projects (Apply)

CO5: Discuss sustainable development principles in infrastructure (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	1	1	3	-	1	-	2	2	3	1
CO2	3	3	3	-	1	1	3	-	1	-	2	2	3	1
CO3	3	3	3	-	1	1	3	-	1	-	2	2	3	1
CO4	3	3	3	-	1	1	3	-	1	-	2	2	3	1
CO5	2	3	3	-	1	1	3	-	1	-	2	2	3	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INFRASTRUCTURE PLANNING **9**

Organizations and layers in the field of Infrastructure development – Typical infrastructure planning steps– Planning and appraisal of major infrastructure projects– Screening of project ideas – Infrastructure Project Lifecycle Analysis – Multi-criteria analysis for comparison of infrastructure alternatives

UNIT II PRIVATE INVOLVEMENT IN INFRASTRUCTURE **9**

Infrastructure Privatization –Benefits of Infrastructure Privatization–Problems with Infrastructure Privatization – Case Studies

UNIT III RISKS AND CHALLENGES IN SUCCESSFUL INFRASTRUCTURE PROJECTS **9**

Classification of challenges based on different stages of the project lifecycle –Mapping and Facing

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the Landscape of Risks– Economic and Demand Risks, Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects– Legal and Contractual Issues – Challenges in Construction and Maintenance of Infrastructure – Risk Management Framework for Infrastructure Projects

UNIT IV STRATEGIES FOR IMPLEMENTATION OF INFRASTRUCTURE PROJECT 9

Planning Phases of Infrastructure Projects to mitigate risks– Designing Sustainable Contracts– Introduction to Fair Process and Negotiation–Negotiating with multiple Stakeholders on Infrastructure Projects

UNIT V SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE 9

Innovative Design and Maintenance of Infrastructure Facilities–Infrastructure Modeling and Life Cycle Analysis –Capacity Building and Improving the Governments Role in Infrastructure Implementation–An Integrated Framework for Successful Infrastructure Planning and Management – Infrastructure Management Systems and Future Directions.

PROJECTS / CASE STUDUES

1. Privatization of Road Infrastructure in TN/ India- Case Study
2. Privatization of Airports Infrastructure in TN/ India- Case Study
3. Privatization of Seaports Infrastructure in TN/ India- Case Study
4. Privatization of Railways Infrastructure in TN/ India- Case Study
5. Privatization of Water supply Infrastructure in TN/ India- Case Study
6. Profile Analysis of Private Agencies involved in India's Infrastructure Development – Detailed Analysis
7. Risks and Mitigation measures in India's Infrastructure Privatization Projects- Road/ Air/ Sea

Course Delivery:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project : - Periods

Total 45 Periods

REFERENCES:

1. A. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
2. J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
3. David I. Cleland and Roland Gareis, "Global Project Management Handbook: Planning,Organization and Controlling International Projects", 2nd edition, McGraw Hill Series,2006
4. Jeffrey L. Beard, Edward C. Wundran, Michael C. Loulakis, "Design, Build: Planningthrough development", McGraw Hill Series, 2001
5. Richard Lambeck, John Eschemuller, "Urban Construction Project Management",McGraw Hill Series, 2009
6. Sidney Levy, "Project Management in Construction", McGraw Hill Series, 5th edition,2006,
7. VISION –TAMILNADU 2023-Strategic plan for Infrastructure Development inTamilnadu

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EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP43	REMOTE SENSING AND GIS FOR INFRASTRUCTURE PLANNING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

To use Remote Sensing and GIS for infrastructure planning and management of natural resources

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand concepts of Remote Sensing (Understand)

CO2: Describe GIS data input and output (Apply)

CO3: Assess water resources in the study area using remote sensing (Apply)

CO4: Apply GIS and Remote Sensing techniques for natural resources management (Apply)

CO5: Examine the land use characteristics for infrastructure projects (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	2	-	-	2	-	-	-	2	1	-	-
CO2	2	-	-	-	3	-	2	-	1	1	2	1	-	-
CO3	2	1	2	2	3	-	2	1	1	1	2	1	3	3
CO4	2	1	2	2	3	-	2	1	1	1	2	1	3	3
CO5	2	1	2	2	3	-	2	1	1	1	2	1	3	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I REMOTE SENSING 9

Components of Remote Sensing- electromagnetic spectrum, active and passive remote sensing, Significance of Remote Sensing – limitation, energy interaction with atmosphere and earth surface materials - atmospheric characteristics, atmospheric interference - scattering of EMR - Atmospheric Windows, Remote Sensing satellites and data interpretation

UNIT II GEOGRAPHIC INFORMATION SYSTEMS 9

Map – types of maps – map projections – components of GIS – types of data - point, line and polygon – vector and raster data – database structures – vector and raster data structures-important GIS software. data retrieval – query – simple analysis – spatial analysis – overlay – vector data analysis – raster data analysis – digital elevation model – cost and path analysis –expert

systems, data output, sources of errors –types of errors–elimination–accuracies, GIS standards

UNIT III WATER RESOURCES MANAGEMENT 9

Aerial assessment of surface water bodies - capacity survey of water bodies - mapping of snow - covered areas - flood risk zone mapping - identification of groundwater potential zones - recharge areas - droughts - definition - drought assessment and management.

UNIT IV GIS AND RS IN RESOURCE MANAGEMENT 9

Fields of applications – natural resources – agriculture – soil - water resources – site selection for infrastructure projects, wasteland management - social resources - cadastral records – LIS, soil mapping - crop stress detection - estimation of soil erosion - forest types and density mapping - forest fire risk zone mapping, land slide zones mapping

UNIT V LAND USE APPLICATIONS 9

Definition of landuse - landuse / landcover classification - schemes and levels of classification systems with RS data - landuse mapping - change detection - urban landuse planning - site suitability analysis - transportation planning. Urban Sprawl analysis, quality of life analysis, AM/FM – utility network management – integration with Remote Sensing – knowledge based techniques – multicriteria techniques

PROJECTS / CASE STUDIES:

1. Prepare a map based on landuse / landcover classification
2. Perform site suitability analysis for various infrastructure projects
3. Interpret the object on the earth from satellite images
4. Compare different commercial systems/software/instruments available in e GIS domain

Course Delivery:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

REFERENCES:

1. Chen C H , "Image Processing for Remote Sensing", CRC Press, 2008.
2. George Joseph , "Fundamentals of Remote Sensing", University Press, 2004.
3. Kang-TsungChang , "Introduction to Geographic Information Systems", TMH, 2002.
4. Michael N Demers , "Fundamentals of Geographical Information Systems", Second, John Wiley Publications, 2002.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP44	PROJECT MANAGEMENT FOR INFRASTRUCTURE DEVELOPMENT	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop proficiency in project management techniques, time management using CPM and PERT, analysis of contemporary trends, strategic planning evaluation, resource balancing to prevent resource idling.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Explain project management techniques, life cycle and project formulation(Understand)

CO2: Analyse and manage time in projects through CPM and PERT(Apply)

CO3: Analyse contemporary project management trends and evaluate strategic planning methods(Apply)

CO4: Balance resource requirements of projects so as to avoid idling of resources(Apply)

CO5: Crash projects to determine its optimum time- minimum cost relationships(Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	1	1	1	2	1	3	2	3	1
CO2	3	3	3	-	2	1	1	1	2	1	3	2	3	1
CO3	3	3	3	-	2	1	1	1	2	1	3	2	3	1
CO4	3	3	3	-	2	1	1	1	2	1	3	2	3	1
CO5	2	3	3	-	2	1	1	1	2	1	3	2	3	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I PROJECT MANAGEMENT 6

Project Management processes– Project Management techniques–Relationship with other management disciplines, Related endeavors–Concentric project management–Project formulation and development

UNIT II PROJECT SCOPE AND TIME MANAGEMENT 12

Project Scopes in Management –Scope definition, Scope planning, Scope verification, and Scope change control, Initiation

Project Time Management – Activity definition – Work breakdown structure, Activity sequencing – scheduling logic, precedence diagramming methods, arrow diagramming method, Time estimation,

Schedule development and analysis – Critical Path Method (CPM)– Program Evaluation and Review Technique (PERT).

UNIT III ORGANIZING FOR PROJECT MANAGEMENT 9

Project Management – Modern trends – Strategic Planning – Effects of Project Risks on Organization and structure – Organization of Project Participants –Traditional Designer–Constructor Sequence – Professional Construction Management – Owner-Builder Operation – Turnkey Operation – Leadership and Motivation for the Project Team – Hidden workforce – Gig Force

UNIT IV RESOURCE MANAGEMENT 9

Types of resources – Time, Manpower, Material, Machinery, Money, Space – Balancing of resources– Resource Smoothing techniques – Time constraints – Resource leveling techniques – Resource constraints – Case study

UNIT V PROJECT COST ANALYSIS 9

Types of cost – Direct, Indirect and Total Cost – Variation of Cost with time – Schedule Compression Techniques – Crashing, Fast Tracking & Re-estimation – Crash timeand crash cost– Optimize project cost for time and resource.

PROJECTS

Use an open source or commercial software and create an infrastructure project to develop your hometown infrastructure of,

i. Roadways
ii. Water and Power supply

Course Delivery:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

REFERENCES:

5. Harold Kerzner – Project Management – systems approach to planning, scheduling & controlling – 7 th edition, John wiley& sons, Canada.
6. A Guide to the Project Management Body of Knowledge (PMBOK Guide) – FourthEdition, An American National Standard, ANSI/PMI 990001-2008
7. Microsoft Project for Windows 2000 –Microsoft Press, USA 2000.
8. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.
9. Choudhury S , "Project Management", McGraw-Hill Publishing Company, New Delhi, 1988.
10. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000.
11. Frederick E. Gould, "Construction Project Management", Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
12. George J.Ritz , "Total Construction Project Management" - McGraw-Hill Inc, 1994.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

U21CEP45	EIA FOR INFRASTRUCTURE PROJECTS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- **NIL**

COURSE OBJECTIVES:

- To assess the impact of the infrastructure projects on the environment
- To study the legislation for Environmental Impact Assessment

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand and elucidate the elements of EIA (Understand)

CO2: Explain the methodologies and prediction of EIA (Understand)

CO3: Identifymitigation plan and implementation (Apply)

CO4: Discuss theprocedure for licensing and environmental clearance (Apply)

CO5: Apply the EIA for various infrastructure projects (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	3	3	2	1	1	-	2	3	1
CO2	3	3	3	-	-	3	3	2	1	1	-	2	3	1
CO3	3	3	3	-	-	3	3	2	1	1	-	2	3	1
CO4	3	3	3	-	-	3	3	2	1	1	-	2	3	1
CO5	2	3	3	-	-	3	3	2	1	1	-	2	3	1
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I ELEMENTS OF ENVIRONMENT IMPACT ASSESSMENT 9

Impact of development projects underCivil Engineering on environment – international scenario of environmental protection – Environmental protectionmethods;Environmental Impact Assessment (EIA)- Elements of EIA Objectives - Environmental Impact Statement (EIS) - EIA capability and limitations - Legal provisions on EIA - Impact of development projects under Civil Engineering on environment

UNIT II METHODOLOGIES AND PREDICTION 9

Methods of EIA - Checklists - Matrices - Networks - Cost-benefit analysis - Analysis of alternatives - case studies - Impact prediction, assessment and monitoring on Socio-economic, - Soil, Water and Air quality, Noise, Transport, Ecology - Mathematical models - public participation - Rapid EIA

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UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on environment - options for mitigation of impact on water - air and land - flora and fauna; addressing the issues related to the project affected people- Remote sensing and GIS in EIA - ISO 14000.

UNIT IV EIA IN INDIA 9

Procedure for environmental clearance - Flow chart - Environmental guidance for Thermal power plants - Mining projects - River valley development projects - Legislation and Institutional support - International co-operation - Guidance for industrial licensing – CRZ, NGT

UNIT V CASE STUDIES 9

EIA for infrastructure projects –Industries, Mines, Bridges, Stadium, Highways, Airports, Dams, Multi-storey Buildings, water supply and drainage projects and abandoned Projects due to high impacts

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

REFERENCES:

13. Anji Reddy M, "Environmental Impact Assessment: Theory and Practices", BS Publications, Hydrabad, 2017.
14. Barthwal RR, "Environmental Impact Assessment", New Age International P Ltd, New Delhi, 2014.
15. Charles H Eccleston, "Environmental Impact Assessment: A Guide to Best Professional Practices", CRC Press,2011.
16. Rau Whooten,"Environmental Impact Analysis Handbook", McGraw Hill publications, 2007.
17. Glasson J., TherivelRiki, Chadwick Andrew, "Introduction to Environmental Impact Assessment", Oxford Brookes University, 2012.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

		Category: PEC				
U21CEP46	INFRASTRUCTURE FINANCING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To introduce the unique characteristics of financing infrastructure projects to students of civil engineering who are going to play a major role in development and management of infrastructure projects.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the fundamental concepts of infrastructure financing(Understand)

CO2: Evaluate the benefits of Public-Private Partnership (PPP) in infrastructure development (Apply)

CO3: Identify and assess various risks associated with infrastructure projects(Apply)

CO4: Develop project financing plans using financial analysis techniques(Apply)

CO5: Evaluate different forms of financial support available for infrastructure projects in India (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	1	1	1	1	2	1	3	2	2	1
CO2	3	3	3	-	1	1	1	1	2	1	3	2	2	1
CO3	3	3	3	-	1	1	1	1	2	1	3	2	2	1
CO4	3	3	3	-	1	1	1	1	2	1	3	2	2	1
CO5	2	3	3	-	1	1	1	1	2	1	3	2	2	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I ELEMENTS AND MEANS OF INFRASTRUCTURE FINANCING 9

Infrastructure financing– Elements of a project finance structure–Benefits of Project finance– Sources of financing infrastructure projects: Traditional and privateInvestments – Financial instruments – Procurement of infrastructure projects–Commercial banks, Different Infrastructure Bonds and Mutual funds

UNIT II PUBLIC PRIVATE PARTNERSHIP IN INFRASTRUCTURE PROJECTS 9

PPP route in Infrastructure Projects–Benefits of PPP mode of procurement –Types of PPP Models and their contractual structure –Government's role in PPP projects – PPP procurement process –

Lifecycle of PPP projects

UNIT III RISKS IN INFRASTRUCTURE PROJECTS 9

Risks associated with various infrastructure projects –Risk analysis techniques– Risk mitigation strategies – Risk allocation frameworks of major infrastructure projects procured through PPP modes – Design approach to risk management in infrastructure finance – Case study

UNIT IV FINANCIAL STRUCTURING AND SUPPORT 9

Introduction to project financing concept– Analysis of project viability –Designing security arrangements – Project financing plan –Case study– Indirect and direct Public-sector financial support – Gap Financing – Credit Guarantee Finance – Capital Grant Viability – Gap Funding – Minimum Revenue Guarantee –Tariff

UNIT V CASE STUDIES / PROJECTS 9

Financial structure and Financing of Roadways in India–Seaports in India–Airports in India–Power Supply in India–Water Supply projects in India

Course Delivery:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project - Periods

Total 45 Periods

REFERENCES:

1. Akintoye,A.,Beck, M.,&Hardcastle, C.(Eds.).(2003).Public-Private Partnerships - Managing risks and opportunities. Oxford:Blackwell Science Limited.
2. Finnerty, J. D.(1996).Project financing - Asset-based financial engineering. New York: John Wiley & Sons, Inc.
3. Merna, T, &Njiru, C.(2002). Financing infrastructure projects, London: Thomas Telford.
4. Nevitt,P.K.,&Fabozzi, F. J.(2000).Project financing, London, UK:Euromoney Books.
5. Raghuram, G., Jain, R.,Sinha,S.,Pangotra,P.,&Morris,S. (2000), "Infrastructure Development and Financing: Towards a Public-Private Partnership", MacMillan.
6. Tinsley, R.(2002).Project Finance in Asia Pacific:Practical Case Studies. London, UK: Euromoney Books.
7. UNIDO.(1996). Guidelines for infrastructure development through Build-Operate-Transfer (BOT) projects.Vienna: UNIDO.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

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PROFESSIONAL ELECTIVES

U21CEP47	EXPERIENTIAL PROJECT	Category: PEC				
		L	T	P	J	C
		0	0	0	6	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To help students gain practical experience in designing, constructing, and managing infrastructure projects.
- To develop students' ability to manage time, resources, and teamwork in real-world infrastructure projects.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Identify and address key challenges related to Infrastructure Engineering(Apply)

CO2: Identify potential risks in infrastructure projects and implement strategies for risk mitigation and management(Apply)

CO3: Comply with the legal, ethical, and regulatory standards related to infrastructure projects (Apply)

CO4: Analyze the importance of sustainable practices and environmental considerations in infrastructure projects.(Apply)

CO5: Develop their teamwork and communication skills to work effectively on projects. (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO2	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO3	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO4	3	2	2	3	2	2	2	2	3	3	2	3	3	3
CO5	3	2	2	3	2	2	2	2	3	3	2	3	3	3
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

STRATEGY

Identify a relevant topic in consultation with the faculty or supervisor, and conduct a thorough literature review to gather pertinent information on the selected topic. Define clear objectives and develop a methodology to achieve these goals. Execute the design, fabrication, or develop the necessary computer models and simulations. Demonstrate the uniqueness and innovation of the project through the results and outcomes, showcasing its practical application in Infrastructure Engineering.

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Contact Periods:

Lecture: - Periods Tutorial: – Periods Practical: – Periods Project: 60 Periods

Total: 60 Periods

EVALUATION PATTERN:

Continuous Internal Assessments (40 Marks)			End Semester Examinations (60 Marks)	
Review I	Review II	Review III	Project Report	Viva-Voice
10	15	15	10	50
Total: 100 Marks				

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MICRO – SPECIAL ELECTIVES

		Category: MSC				
U21MCG01	SUSTAINABLE WATER MANAGEMENT: PRINCIPLES AND PRACTICES	L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the principles of sustainable water management and their relevance to global development goals
- To demonstrate the water demand and conservation techniques across various sectors
- To explain the laboratory techniques for assessing water quality and informing management decisions

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the key principles and challenges of sustainable water management (Understand)
CO2: Analyse case studies of water demand management to identify best practices (Analyze)
CO3: Examine watershed management approaches and their impact on water sustainability (Analyze)
CO4: Explore the role of governance in sustainable water management (Apply)
CO5: Interpret laboratory data to evaluate water quality and inform management actions (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	3	3	2	-	-	1	-		
CO2	2	1	-	-	-	3	3	2	-	-	1	-		
CO3	2	1	-	-	-	3	3	2	-	-	1	-		
CO4	-	-	-	-	-	3	3	3	-	-	-	-		
CO5	2	1	-	3	2	3	3	3	-	1	-	-		

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I INTRODUCTION TO SUSTAINABLE WATER MANAGEMENT 6

Overview of sustainable development goals related to water (SDG 6) - Principles of sustainability and their application to water management - Key challenges and drivers of unsustainable water use - Introduction to integrated water resources management (IWRM) approach

UNIT II WATER DEMAND MANAGEMENT AND CONSERVATION 6

Understanding water demand dynamics and drivers - Strategies for reducing water demand in domestic, industrial, and agricultural sectors - Water conservation practices and technologies - Case studies of successful water demand management initiatives

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UNIT III WATERSHED MANAGEMENT AND PROTECTION 6

Concept of watershed management and its importance for water sustainability - Land use planning and best management practices for watershed protection - Ecosystem-based approaches to watershed management - Integrated approaches for addressing water quality and quantity issues in watersheds

UNIT IV WATER GOVERNANCE AND POLICY 6

Role of governance in promoting sustainable water management - Analysis of water policies and regulations at local, national, and international levels - Stakeholder engagement and participatory decision-making processes - Case studies of effective water governance models and policy implementation.

UNIT V LABORATORY PRACTICES IN SUSTAINABLE WATER MANAGEMENT 6

Introduction to laboratory techniques for water quality analysis - Hands-on experience with water sampling, testing, and analysis methods - Interpretation of water quality data and assessment of treatment effectiveness - Application of laboratory results to inform sustainable water management decisions

LABORATORYPRACTICES 30

1. Water Sampling Techniques and Quality Control
2. Physical Parameters Analysis: Turbidity, Temperature, TDS and Conductivity
3. Chemical Analysis of Water: pH, Alkalinity, Chlorides and Hardness
4. Determination of Nutrients: Nitrates, Phosphates, and Ammonia
5. Microbial Analysis of Water: Total Coliform and E. coli Detection
6. Heavy Metals Detection: Lead, Copper, and Zinc Analysis
7. Interpretation of Water Quality Data and Compliance with Standards
8. Sustainable Water Management Case Study: Data-Driven Decision Making

Contact Periods:

Lecture: 30 Periods	Tutorial: – Periods	Practical: 30 Periods	Project: – Periods
			Total: 45 Periods

TEXT BOOKS:

1. Neil S. Grigg, Sustainable Water Management: A Comprehensive Approach, Wiley-Blackwell publications, ISBN: 978-1119821002, 2002.
2. David Butler, Sarah Ward, and Michael Cook, Water Demand Management: The Next Generation of Urban Water Management, IWA Publishing, ISBN: 978-1789060577, 2021.
3. Michael E. Campana, Thomas E. Williard, Watershed Management and Governance: Advanced Approaches and Practices, Elsevier publications, ISBN: 978-0323997258, 2023.
4. Richard Connor, Cecilia Tortajada, Water Governance in a Changing Climate: Insights and Lessons from Recent Experiences, Routledge publications, ISBN: 978-0367766659, 2023
5. Asit K. Biswas, Cecilia Tortajada, Handbook of Water Quality Analysis and Monitoring: Techniques and Applications, CRC Press, ISBN: 978-0367690312, 2022.

REFERENCE BOOKS:

1. Claudia Pahl-Wostl, Anik Bhaduri, Joyeeta Gupta, Water Resources: Sustainable Livelihoods, Development, and Governance, ISBN: 978-3030246429, 2020.
2. IS 10500: Drinking Water - Specification" by Bureau of Indian Standards (BIS).

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (100 Marks)**	**Practical Examinations (100 Marks)**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics based Assessments)	Test		
40	60	75	25	25	25
25		25		25	25
50				50	
Total: 100					

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MICRO – SPECIAL ELECTIVES

		Category: MSC				
U21MCG02	WATER TREATMENT ESSENTIALS: PRINCIPLES AND PRACTICES	L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental principles and challenges in water treatment, including basic water chemistry and regulatory standards
- To understand and explain the mechanisms of physical, chemical and biological water treatment techniques in practical laboratory settings
- To apply laboratory skills to water quality analysis and treatment optimization

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Describe the key objectives of water treatment and list the major water quality parameters (Understand)
CO2: Demonstrate the operation of filtration systems and explain the principles of sedimentation and clarification (Apply)
CO3: Demonstratethe chemical treatment processes(Apply)
CO4: Analyze the principles and applications of biological treatment processes and their role in water quality management (Analyze)
CO5: Perform water sampling and analysis, interpret the results, and recommend treatment improvements (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	3	3	2	-	-	-	-		
CO2	2	1	-	2	-	3	3	2	-	-	-	-		
CO3	2	1	-	2	-	3	3	2	-	-	-	-		
CO4	-	-	-	2	-	3	3	3	-	-	-	-		
CO5	2	1	-	3	2	3	3	2	-	1	-	-		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO WATER TREATMENT 6

Overview of water treatment objectives and challenges - Basic principles of water chemistry relevant to treatment processes - Introduction to key concepts such as coagulation, flocculation, sedimentation, and filtration - Regulatory frameworks and standards for water quality.

UNIT II PHYSICAL TREATMENT PROCESSES 6

Sedimentation and clarification processes for particle removal - Filtration techniques including rapid sand filtration and multimedia filtration - Overview of granular media and membrane filtration

technologies - Laboratory session: Demonstration and hands-on practice of basic physical treatment processes.

UNIT III CHEMICAL TREATMENT PROCESSES 6

Coagulation and flocculation mechanisms for suspended solids removal - Chemical disinfection methods such as chlorination and ozonation - pH adjustment and chemical precipitation for metal and nutrient removal - Laboratory session: Chemical dosing experiments and jar testing.

UNIT IV BIOLOGICAL TREATMENT PROCESSES 6

Overview of aerobic and anaerobic biological treatment processes – Introduction to biofilm reactors and biological filtration - Laboratory session: Microbial analysis and biological treatment simulation.

UNIT V LABORATORY PRACTICES IN WATER TREATMENT 6

Introduction to laboratory safety procedures and equipment for water treatment- Hands-on experience with water treatment setup and its quality testing methods - Water sampling, analysis, and interpretation of results - Application of laboratory findings to optimize treatment processes.

LABORATORY PRACTICES 30

1. Laboratory Safety and Proper Handling of Equipment in Water Treatment
2. Water Sampling Techniques and Preservation for Treatment Analysis
3. pH Adjustment and Alkalinity Control in Water Treatment Systems
4. Coagulation and Flocculation: Jar Test for Optimal Coagulant Dosage
5. Filtration Efficiency: Analysis of Filter Media and Backwashing
6. Disinfection Process: Chlorine Demand and Residual Chlorine Testing
7. Biological Testing: Detection of Microbial Contamination Post-Treatment

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Mark J. Hammer and Mark J. Hammer Jr., Water and Wastewater Technology, Prentice Hall, 7th Edition, ISBN-13: 978-0135114049, 2011.
2. S.K. Garg, Environmental Engineering I, Khanna Publishers, 2021.

REFERENCES:

1. APHA, American Water Works Association (AWWA), Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater" by American Public Health Association (APHA), 23rd Edition, 2017.
2. IS 10500: Drinking Water - Specification" by Bureau of Indian Standards (BIS).

EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (100 Marks)	Practical Examinations (100 Marks)
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics based Assessments)	Test		
40	60	75	25	25	25
25		25		25	25
50				50	
Total: 100					

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MICRO – SPECIAL ELECTIVES

		Category: MSC				
		L	T	P	J	C
U21MCG03	PLUMBING – THEORY AND PRACTICE	2	0	2	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the Fundamentals of Plumbing Systems and their Historical Development
- To demonstrate the Plumbing Materials, Fixtures, and Installation Techniques
- To expertise the skill in Plumbing Codes, Regulations, and Practical Laboratory works

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Outline the historical development of plumbing and importance of plumbing in modern practice (Understand)
CO2: Identify the appropriate plumbing materials and fixtures (Apply)
CO3: Demonstrate competence in plumbing installation and maintenance (Apply)
CO4: Apply Knowledge of Plumbing Codes and Regulations to Ensure Compliance (Apply)
CO5: Perform Hands-On Plumbing Laboratory Practices (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	3	3	1	-	-	-	-		
CO2	2	1	-	-	-	3	3	-	-	-	-	-		
CO3	2	1	-	-	-	3	3	2	-	-	-	-		
CO4	2	1	-	-	-	3	3	2	-	-	-	-		
CO5	2	1	-	3	2	3	3	2	-	-	-	-		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO PLUMBING SYSTEMS 6

Overview of plumbing as a trade and profession - Historical development of plumbing systems - Role of plumbing codes and regulations - Basic principles of fluid mechanics and hydraulics.

UNIT II PLUMBING MATERIALS AND FIXTURES 6

Common plumbing materials (pipes, fittings, valves) - Types of plumbing fixtures (sinks, toilets, faucets) - Selection criteria for plumbing materials and fixtures - Introduction to plumbing system layout and design principles.

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UNIT III PLUMBING INSTALLATION AND MAINTENANCE 6

Installation procedures for plumbing systems and fixtures - Pipe sizing and layout considerations - Maintenance practices for plumbing systems - Troubleshooting common plumbing problems.

UNIT IV PLUMBING CODES AND REGULATIONS 6

Overview of plumbing codes and standards (IPC and BIS) - Compliance requirements for plumbing installations - Role of inspections and permits in ensuring code compliance - Case studies of plumbing code violations and their consequences.

UNIT V LABORATORY PRACTICES IN PLUMBING 6

Introduction to plumbing tools and equipment - Hands-on experience with pipe cutting, threading, and soldering techniques - Assembly and installation of plumbing fixtures - Leak detection and repair exercises.

LABORATORY PRACTICES 30

1. Pipe Cutting Techniques for Different Materials (PVC, Copper, Steel)
2. Threading and Joining of Pipes
3. Assembly and Installation of Plumbing Fixtures
4. Leak Detection in Plumbing Systems
5. Installation and Testing of Valves and Faucets
6. Installation of Drainage Systems and Traps
7. Troubleshooting and Repair of Common Plumbing Issues

Contact Periods:

Lecture: 30 Periods	Tutorial: – Periods	Practical: 30 Periods	Project: – Periods
			Total: 45 Periods

TEXT BOOKS:

1. S. K. Garg, Rajesh Garg, Plumbing: Basics, Installation, Maintenance; Khanna Publishers, 2019
2. M. K. Gupta, Plumbing: Theory and Practice, Standard Publishers Distributors, ISBN: 978-8180140560

REFERENCES:

1. National Building Code of India 2016" by Bureau of Indian Standards (BIS), 2016.
2. IS 1239: Water Supply and Sanitation for Buildings" by Bureau of Indian Standards (BIS).
3. IS 2064: Code of Practice for Selection, Installation and Maintenance of Sanitary Appliances, 2009.

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (100 Marks)**	**Practical Examinations (100 Marks)**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics based Assessments)	Test		
40	60	75	25	25	25
25		25		25	25
50				50	
Total: 100					

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MICRO – SPECIAL ELECTIVES

		Category: MSC				
U21MCG04	EXPERIENTIAL PROJECT	L	T	P	J	C
		0	0	0	6	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the principles and technologies used in water treatment
- To apply water treatment techniques in real-world scenarios and evaluate their effectiveness
- To foster a multidisciplinary approach to solving water management and treatment challenges.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Conduct Comprehensive Water Quality Assessments (Analyze)
CO2: Design and Implement effective Water Treatment systems using appropriate technologies(Apply)
CO3: Evaluate the Effectiveness of Water Treatment Solutions through practical studies(Evaluate)
CO4: Manage and Operate Water Treatment Systemsincluding troubleshooting and maintenance(Analyze)
CO5: Communicate Water Treatment Solutions Effectively (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	2	3	1	1	2	1	2	2	2
CO2	3	3	3	2	3	3	3	1	2	2	3	2	2	2
CO3	3	3	2	3	2	3	3	1	2	2	2	3	2	2
CO4	2	2	3	2	3	3	2	2	3	2	3	2	2	2
CO5	1	1	1	1	1	1	1	1	3	3	2	2	2	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

STRATEGY

Designing a course content for an experiential project on water and water treatment involves a practical, project-based learning experience where students engage directly with real-world water quality and treatment challenges. The course begins with foundational knowledge in water quality parameters and assessment techniques, followed by hands-on projects involving comprehensive water quality testing and analysis. Students then design and implement water treatment systems, applying various technologies and methods to address specific water treatment problems. The course emphasizes the integration of modern tools and sustainable practices while fostering

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teamwork and problem-solving skills. Students will also manage and operate water treatment systems, gaining practical experience in troubleshooting and maintenance. Finally, the course culminates in a project presentation, where students effectively communicate their findings and solutions, demonstrating a deep understanding of the impacts and complexities of water treatment processes. Throughout the course, students will engage in continuous learning, reflecting on the societal and environmental implications of their work, and honing their abilities to apply engineering knowledge to complex, real-world issues.

Contact Periods:

Lecture: - Periods Tutorial: – Periods Practical: - Periods Project: 90 Periods

Total: 90 Periods

REFERENCES:

1. Manual on Water Supply and Treatment" by Central Public Health and Environmental Engineering Organization (CPHEEO), Government of India.
2. IS 10500: Drinking Water - Specification" by Bureau of Indian Standards (BIS).

EVALUATION PATTERN:

Internal Assessments (60 Marks)			End Semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report		Viva-voce	
10	20	30	Supervisor	External	Internal	External
			10	10	10	10
Total: 100 Marks						

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