BASAVESHWAR ENGINEERING COLLEGE,BAGALKOTE

B.E. in Civil Engineering

Scheme of Teaching and Examinations 2022 (2023-24 Admitted Year) (2025-26 Academic Year)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22UCV511C	Irrigation Engg and Hydraulic Structures	TD: CV PSB: CV	3	0	0	0	03	50	50	100	**3**
2	PCC	22UCV512C	Geotechnical Engineering	TD: CV PSB: CV	3	0	0	0	03	50	50	100	**3**
3	PCC	22UCV513C	Concrete Technology	TD: CV PSB: CV	2	0	0	0	03	50	50	100	**2**
4	PCCL	22UCV514L	Environmental Engineering Lab	TD: CV PSB: CV	0	0	2	0	03	50	50	100	**1**
5	PEC	22UCV52XE	Professional Elective Course - 1	TD: CV PSB: CV	3	0	0	0	03	50	50	100	**3**
6	OEC	22UCV53XN	Open Elective -1	TD: CV PSB: CV	3	0	0	0	03	50	50	100	**3**
7	PROJ	22UCV515P	Mini Project	TD: CV PSB: CV	0	0	4	0	03	50	50	100	**2**
8	HSSM	22UCV523C	Environmental Studies	TD: CV PSB: CV	1	0	0	0	02	50	50	100	**1**
9	HSMC	22UHS522C	Quantitative Aptitude and Professional Skills	TD: CV PSB: CV	2	0	0	0	02	50	50	100	**2**
10	MC	22UHS002M	National Service Scheme (NSS)	NSS coordinator	-	-	-	-	-	-	-	-	**-**
		22UHS003M	Physical Education (PE)	Physical Director									
		22UHS001M	Yoga	Yoga Teacher									
		22UHS004M	Music	Music Teacher									
									Total	450	450	900	**20**

Professional Elective Course -1

22UCV 521E	Water Resource Engineering	22UCV 524E	Solid Waste Management
22UCV 522E	Occupational Health and Safety	22UCV 525E	Remote Sensing and GIS
22UCV 523E	Air Pollution and Control	22UCV 526E	Process Economics and Plant Design
22UCV 527E	Highway Geometric Design	22UCV 528E	Masonry structures

Open Elective Course -1

22UCV531N	Air Pollution and Control	22UCV534N	Integrated Waste Management for a Smart City
22UCV532N	Geographic Information Systems	22UCV535N	Green Building Technology
22UCV533N	Occupational Health and Safety	22UCV536N	Water conservation and Rainwater Harvesting

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VI SEMESTER

Sl.No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22UCV611C	Design of RCC Structures	TD: CV PSB: CV	3	0	2		03	50	50	100	**3**
2	PCC	22UCV612C	Construction Management	TD: CV PSB: CV	3	0	0		03	50	50	100	**3**
3	PCC	22UCV613C	Applied Geotechnical Engineering	TD: CV PSB: CV	3	0	0		03	50	50	100	**3**
4	PCC	22UCV614C	Advanced wastewater Treatment	TD: CV PSB: CV	3	0	0		03	50	50	100	**2**
5	PEC	22UCV62XE	Professional Elective Course-2	TD: CV PSB: CV	3	0	0		03	50	50	100	**3**
6	OEC	22UCV63XN	Open Elective Course -2	TD: CV PSB: CV	3	0	0		03	50	50	100	**3**
7	PCCL	22UCV615L	Geotechnical Engineering Lab	TD: CV PSB: CV	0	0	2		03	50	50	100	**1**
8	PCCL	22UCV616L	Software Application Lab	TD: CV PSB: CV	0	0	2		03	50	50	100	**1**
9	AEC	22UHS600C	Indian Knowledge System	TD: CV PSB: CV	1	0	0		03	50	50	100	**1**
10	MC	22UHS002M	National Service Scheme (NSS)	TD: CV PSB: CV	-	-	-	-	-	-	-	-	**-**
		22UHS003M	Physical Education (PE)	TD: CV PSB: CV									
		22UHS001M	Yoga	Yoga Teacher									
		22UHS004M	Music	Music Teacher									
Total										400	400	800	**20**

Professional Elective Course – 2

22UCV 621E	Design of Bridges	22UCV 625E	Design and Construction of Highway Pavements
22UCV 622E	Geomorphology	22UCV 626E	Industrial Wastewater Treatment
22UCV 623E	Open Channel Flow	22UCV 627E	Traffic Engineering
22UCV 624E	Matric Methods of structural Analysis	22UCV 628E	Ground Improvement Techniques

Open Elective Course -2

22UCV 631N	Occupational Health and Safety	22UCV 634N	Disaster Management and Mitigation
22UCV 632N	Geographic Information Systems	22UCV 635N	Sustainable Development Goals
22UCV 633N	Public Health Engineering	22UCV 636N	Water conservation and Rainwater Harvesting

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VII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical /	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22UCV711C	Design of Steel Structures	TD: CV PSB: CV	3	0	0		03	50	50	100	3
2	HSSM	22UCV712C	Estimation and Contract Management	TD: CV PSB: CV	3	0	0		03	50	50	100	3
3	PEC	22UCV72XE	Professional Elective Course-3	TD: CV PSB: CV	3	0	0		03	50	50	100	3
4	PEC	22UCV73XE	Professional Elective Course-4	TD: CV PSB: CV	3	0	0		03	50	50	100	3
6	PROJ	22UCV714P	Major Project Phase-II	TD: CV PSB: CV	0	0	12		03	50	50	100	12
					12		12			250	250	500	24

Professional Elective Course -3

22UCV721E	Intelligent Transportation Systems	22UCV724E	Design and Execution of Pile Foundations
22UCV722E	Earthquake Resistant Structures	22UCV725E	Building services-hvac, acoustics and fire safety
22UCV723E	Design of Prestressed Concrete Structures	22UCV726E	Advanced Design of RC Structures

Professional Elective Course -4

22UCV731E	Road Safety Engineering	22UCV734E	Numerical Techniques in Civil Engineering
22UCV732E	Conservation Of Natural Resources	22UCV735E	Precast Members – Systems & Construction
22UCV733E	Energy and Environment	22UCV736E	Industrial Pollution and Control

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VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	AEC	22UCV81XE	Professional Elective (Online Courses)	TD: CV PSB: CV	3	0	0		03	50	50	100	**3**
2	OEC	22UCV8XXN	Open Elective (Online Courses)	TD: CV PSB: CV	3	0	0		03	50	50	100	**3**
3	INT	22UCV802I	Internship (Industry/Research) (14 - 15 Weeks)	TD: CV PSB: CV	0	0	10		03	50	50	100	**10**
					06	00	10			150	150	300	**16**

Professional Elective Course (Online courses)

22UCV811E	Deep Excavation and Tunnels	22UCV813E	Project management and finance
22UCV812E	Advanced Design of RCC Structures	22UCV814E	Metro and Seaports Engineering

Open Elective Courses (Online Courses)

22UCV8XXN	Energy Conservation in Buildings	22UCV8XXN	Green Buildings
22UCV8XXN	Occupational Health and Safety	22UCV8XXN	Integrated Building Services

22UCV511C	Irrigation and Hydraulic Structures	Credits:3
L:T:P-3: 0: 0		CIEMarks:50
Total Hours/Week:3		SEEMarks:50

UNIT-I	10Hrs.

Introduction: Practical application of hydrology, Horton Hydrological cycle,
Precipitation: Definition and forms and types of precipitation. Weather seasons in India. Measurement of precipitation by Tipping Bucket Rain gauge. Computation of average depth of Precipitation by Isohytal method , Estimation of missing precipitation record. Numerical
WATER LOSSES: Infiltration: Factors affecting infiltration. Double Ring Infiltrometers, infiltration capacity curve, Infiltration indices. Numericals
Evaporation: Factors affecting evaporation. Evaporation pans, ISI standard pan, Numericals Evapotranspiration, PET and AET definitions.

UNIT-II	10Hrs.

Run-off:, factors affecting run off, methods to measure runoff, time of concentration by Kirpitch formula , problems
Hydrograph theory: Components of hydrograph. Separation of base flow, Unit hydrograph theory. Derivation of unit hydrograph and derivation of UH of different durations, Numericals. S-curve and its use (Theory only).
Ground water hydrology: Occurrence, aquifers, aquitard, aquifuge, aquiclude, perched aquifer. Aquifer parameters and Darcy's law for 1-Dimensional flow only

UNIT–III	10Hrs.

Irrigation engineering: Necessity, benefits and ill effects of irrigation, Types of Irrigation, Techniques of water distribution in the farm, quality of irrigation water, Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor.
Canals: Classifications, Regime theory, Design of canals cross sections by Lacey's method.
Water requirement of crops: consumptive use, duty, delta and base period, and problems, factors affecting and methods to improve duty.

UNIT-IV	10Hrs.

Reservoirs: Investigation for reservoir site, storage zones, determination of storage capacity using mass curve, Economical height of dam.
Gravity dams: Forces acting on gravity dam, Profile of gravity dam, Analytical method of Stability analysis and problems, Drainage gallery.
Earthen dams: Types, Construction, Causes of failure of earthen dams, Seepage control measures, Spillways: Different types of spill ways (theory and equations only), Energy dissipaters.

After completion of the course student will be able to

1. After completion of this course students will be able to:
2. Understand components of hydrological cycle, measure and quantify precipitation, Evaporation and infiltration.
3. Estimate runoff and generate hydrographs.
4. To be able to compute duty, delta and frequency of irrigation, and design canal cross sections.
5. Determine storage capacity of reservoirs & understand basics of gravity and earthen dams & spillways.

Reference Books *

1.S.K..Garg , " Irrigation Engineering and Hydraulic Structures", , Laxmi Publications, New Delhi, 2005.
2. H. M. Raghunath, Hydrology, New age international publishers, 2006.
3. G. L. Asawa, Irrigation Engineering, New Age international publications, 2005.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	2	2	1	-	-	-	-	-	-	2	2	2
CO 2	3	3	2	2	2	2	-	-	-	-	-	-	2	2	2
CO 3	3	3	2	2	2	3	-	-	-	-	-	-	2	2	2
CO 4	3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
Average	**3**	**2.5**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

22UCV512C	**Geotechnical Engineering**	**Credits: 03**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**

Introduction: Formation of soil, phase diagram, basic definitions and their interrelationships.

Index Properties-Definitions and their determination, particle size analysis (sieve and Hydrometer analysis) consistency limits and indices, plasticity chart, activity of clay, field identification tests, BIS soil classification (IS: 1498-1970).

Clay Mineralogy: Soil structure- single grained, honeycombed, flocculent and dispersed structures, soil-water system, electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures-Kaolinite, Illite and Montmorillonite and their application in engineering.

UNIT-II	**10 Hrs.**

Flow Through Soils: Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, seepage velocity, superficial velocity and coefficient of percolation, capillary phenomena.

Seepage Analysis: Laplace equation, assumptions, limitations and its derivation. flow nets-characteristicsandapplications.Flownetsforsheetpilesandbelowthedamsection.Unconfined flow, phreaticline (Casagrande's method–with and without toefilter), flow through dams, design of dam filters.

UNIT–III	**10 Hrs.**

Compaction of Soil: Definition, principle of compaction, standard and modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, field compaction control- compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, compacting equipments and their suitability.

Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (C_C, a_V, $m_V$and C_V), Time rate of consolidation.

UNIT–IV	**10 Hrs.**

Shear Strength of Soils: Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelops, total and effective shear strength parameters, concept of pore pressure, factors affecting shear strength of soils, sensitivity and thixotropy of clay.

Measurement of shear parameters- direct shear test, unconfined compression test, triaxial compression test and vane shear test, Test under different drainage conditions.

Reference Books *

1. G. Ranjan and A.S.R Rao (2022), Basic and Applied Soil Mechanics (4th Edition), New Age International (P) Ltd., New Delhi.
2. B. M. Das (2021), Principles of Geotechnical Engineering (10th Edition), Cengage India Pvt. Ltd.
3. J. Knappett and R. F. Craig (2019), Craig's Soil Mechanics (9th Edition), CRC Press.
4. B. C. Punmia, A. K. Jain and A. K. Jain (2017), Soil Mechanics and Foundation Engineering (17th Edition), Laxmi Publications Co, New Delhi.

Course Outcomes**
After completion of the course student will be able to 1. Analyse and interpret soil properties and clay mineralogy to effectively apply engineering principles in practical scenarios. 2. Apply Darcy's law, seepage phenomena, and utilize flow nets to solve practical engineering problems related to flow through soils and seepage analysis. 3. Apply the principles of compaction and consolidation to effectively control soil behaviour in engineering projects. 4. Determine settlement of soils and utilize testing methods to find shear strength parameters.

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	1						1					3	
CO2	2	1											3	**2**
CO3	3	2		1				1					3	
CO4	2	2		1				1					3	
	2.5	1.5		1.0				1.0					3	**2**

22UCV513C	CONCRETE TECHNOLOGY	Credits: 02
L:T:P-2: 0:0		CIE Marks:50
Total Hours/Week:2		SEE Marks:50

UNIT-I	6 Hrs.

Cement - Chemical Composition, Hydration of Cement. Types of cement, Manufacture of cement, Testing of cement - Field testing. Fineness by Sieve test and Blaine's air permeability test, Normal consistency test, Setting time test and Soundness test.

UNIT–II	7 Hrs.

Fresh Concrete Properties - Workability - Factors affecting workability, Measurement of workability.

Hardened Concrete Properties - Testing of hardened concrete – Compressive strength, Split tensile strength and Flexural Strength test. Factors affecting strength. w/c ratio, aggregate properties. Relation between Compressive strength and Tensile strength, Bond strength.

UNIT–III	6 Hrs.

Elasticity, Creep & Shrinkage – Modulus of elasticity, Poisson's ratio, Creep of concrete, Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage –types of shrinkage, environmental exposure conditions.

UNIT–IV	7 Hrs.

Concrete Mix Design - Concept of mix design, variables in proportioning, exposure conditions. Procedure of mix design as per IS 10262:2019. Numerical examples of mix design on mix design for OPC concrete mixes and Fly ash concrete mixes.

Reference Books *

1. M. S. Shetty Concrete Technology Theory and Practice, S. Chand and Co, New Delhi, 2002.
2. Neivelle A. M and Brooks, Concrete Technology, J.JELBS Edition, London Delhi, 4th Edition, 2004.
3. P. Kumar Mehta & Paul J.M, Concrete Technology, Monterio Indian Concrete Institute USA- 1999
4. IS 10262:2019 for Concrete Mix Design.
5. A. R. SanthaKumar, "Concrete Technology", Oxford University Press, New Delhi(New Edition).
6. M. L. Gambhir, "Concrete Technology", Mc Graw Hill Education, 2014.
7. N. V. Nayak, A. K. Jain Hand book on advanced Concrete Technology, ISBN:978-818487-186-9
8. Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.

Course Outcomes**

After completion of the course student will be able to

CO1: **Explain** the manufacturing process, types, chemical composition, and hydration of cement, **perform** relevant standard tests on cement and aggregates.

CO2: **Evaluate** the properties of fresh and hardened concrete by analyzing factors affecting workability and strength, and conduct standard tests.

CO3: **Analyze** the fundamental concepts of elasticity, creep, and shrinkage in concrete, including their influencing factors and effects on structural performance under various environmental exposure conditions.

CO4: **Apply** the IS 10262:2019 guidelines to **design** concrete mixes and **solve** numerical problems related to mix design.

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	3	2		1					2	2	
CO2	2	2	2	2	3		1		1			2	2	
CO3	2	3	2	3	2	1	2		1	1	1	2	2	
CO4	3	3	3	3	2	1	2		1	1	2	2	2	

22UCV514L	Environmental Engineering Lab	Credits: 01
L:T:P - 0: 0: 2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

I. Tests on Water Quality

i. Physical Parameters

1) To find the colour of a given sample of water.
2) To find the turbidity of a given sample of water.
3) To determine the conductivity of a given sample of water.
4) To determine the temperature of a given sample of ater.

ii. Chemical Parameters

1) To find out total dissolved solid, settle able solids, suspended solids and volatile solids of the given sample.
2) To determine the pH value of a given sample of water.
3) To determine the acidity of a given sample of water.
4) To determine the carbonate, bicarbonate, and hydroxide alkalinity of a sample.
5) To find out the concentration of chlorides in the given sample of water.
6) To estimate the hardness of the given sample of water by standard EDTA method.
7) To determine the sulphate of a given sample of water.
8) To determine the fluoride of a given sample of water.
9) To determine the Iron of a given sample of water.
10) To determine residual chlorine in a given sample of water.
11) To determine chlorine demand for the given sample of water.
12) To determine nitrate in a given sample of water.
13) To determine dissolved oxygen in a given sample of water.

iii. Bacteriological Parameters

1) To determine MPN of coliforms of the given sample.
2) Microbial Examination of Water Samples Using the Membrane Filtration Technique.

II. Tests on Sewage

1) To determine biochemical oxygen demand (BOD) exerted by the given wastewater sample.
2) To determine Chemical oxygen demand (COD) exerted by the given wastewater sample.

III. Other Tests

1) To determine the optimum dose of alum required to treat the given water.
2) To determine the percentage of chlorine present in the given bleaching powder.

References

1. Manual of Water and Wastewater Analysis- NEERI Publication 1988.
2. Standard methods for Examination of Water and Wastewater Analysis APHA, AWWA. 2011.
3.Manual for Sewer and Sewerage, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India.
4. Manual for water supply and treatment, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India.

Course Outcomes**
After completion of the course student will be able to 1. Able to determine the physical, chemical and biological parameters for drinking purpose as per BIS standards. 2. Analyze the test results and recommend the water for its potability. 3. Identify and characterize wastewater using standard methods. 4. Analyze the test results and recommend wastewater for its disposal.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
CO1	3	3	2	2	2	2	2	-	2	1	-	2	3	2	
CO2	3	3	2	2	1	1	2	-	1	1	-	2	3	2	
CO3	3	3	2	2	2	1	2	-	2	1	-	2	3	2	
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	2	

22UCV515P	EXTENSIVE SURVEY PROJECT	Credits:2
L:T:P-0:2:2		CIE Marks: 50
Total Hours/Week:4		SEEMarks:50

1. NEW TANK PROJECTS: The work shall consist of**;**

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Alignment of Centre line of the proposed bund, Longitudinal and cross sections of the centre line.

c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement

d. Design and preparation of drawing with report.

2. WATER SUPPLY AND SANITARY PROJECT: The work shall consist of**;**

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.

c. Preparation of village map by using total station.

d. Survey work required for laying of water supply and UGD pipelines

e. Location of sites for water tank. Selection of type of water tank to be provided (ground level, overhead and underground)

f. Design of all elements and preparation of drawing with report.

3. HIGHWAY PROJECT: The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Preliminary and detailed investigations to align a new road (min. 1.5 to 2 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using conventional instruments and total station.

c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.

d. Drawing shall include key plan, alignment, and longitudinal section along alignment, typical cross sections of road.

EXAMINATION

1. The student shall submit a project report consisting of designs and drawings.

2. Drawings should be done using CAD and survey work using total station.

3. Students should learn data download from total station, generation of contours, block levelling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant software.

EVALUATION FOR CIE (FOR 50 MARKS)

1. Field work : 12.5Marks
2. Office work (Design and drawing): 12.5Marks
3. Presentation of the prepared report: 12.5Marks
4. Final report submission: 12.5Marks

EVALUATION FOR SEE (FOR 50 MARKS)

1. Presentation of the prepared report: 37.5Marks
2. Viva: 12.5Marks

Course Outcomes

1. Apply Surveying knowledge and tools effectively for the projects.
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioural competencies in designing New tank project, water supply & sanitary project and Highway projects.
3. Application of individual effectiveness skills in team and at organizational level.

COURSE ARTICULATION MATRIX

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	1	2	-	3	1	1	-	3	2	2	2	3	2	2
CO 2	3	3	3	2	3	3	3	2	3	3	3	2	3	3	3
CO 3	3	2	-	-	-	1	-	2	3	3	2	3	3	1	3
CO 4	3	3	3	2	3	3	3	2	3	3	3	2	3	3	3
Average	**3**	**2.25**	**2**	**1**	**2.25**	**2**	**1.75**	**1.5**	**3**	**2.75**	**2.5**	**2.25**	**3**	**2.25**	**2.75**

22UCV522E	Occupational Safety and Health	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week: 03		SEE Marks:50

UNIT-I	10 Hrs.

Introduction - History and Development, Occupational Safety and Health Act. Occupational Safety and Health Administration, Right to know Laws.

Accident Causation-Need for Accident Investigation, Accident investigation plan, Methods of acquiring Accident Facts, Correcting Missing Skills, Investigator Tendencies and Characteristics, Supervisory Rolein Accident investigation. Human Error Model, Petersew's Model, Epidemiological Models.

Ergonomics- Ergonomics at workplace, Ergonomic Task Analysis, Preventing Ergonomic Hazards, Setting up of Ergonomics Programme.

UNIT–II	10 Hrs.

Occupational Hazard and Control- Hazard Analysis, Human Error Analysis in Causation with Hazard Analysis, Fault Tree Analysis, Emergency Response. Decision for Action, Purpose and Considerations, Right Decision, Wrong Remedy, Hazard Control Measures, Hazards and their Control in Pharmaceutical, Construction, Textiles, Petroleum Refineries and LPG Bottling, Iron and Steel industries

UNIT–III	10 Hrs.

Fire prevention and Protection- Fire Development and its Severity effects. Enclosure, need for early Detection of Fire, Extinguishing Fire Electrical Safety Product Safety, Technical Requirements of Product Safety Programme. Environmental Safety and ISO 14000 ISO series of standards, ISO14001Standards, Environmental Management systems. (EMS) Total quality Management (TQM) and Total safety Management (TSM).

UNIT–IV	10 Hrs.

Occupational Health-Health and Safety Considerations, Personal Protective Equipment's, Effects of Exposure and Treatment for Metal Working Trades, Municipal Solid Waste, Epoxy Resins, Foundries. Occupational Health and Safety Considerations in Wastewater Treatment Plants.

Reference Books *

1. Nemerow N. N., Liquid waste of industry theories, practices and treatment, Addison Willey, New York, 1971.
2. Azad N. S., Industrial waste water management handbook, Mc Graw Hill book, co. New York.
3. Ross R. D., Industrial waste disposal, Reinhold environmental series, New York, 1968
4. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 1999.

Course Outcomes**

1. Design policies and regulations for the development and maintenance of a healthy and safe work environment.
2. Interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces and apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.
3. Analyse the change by advancing OH&S principles within management systems, cultures, practices, and priorities.
4. Construct the Occupational Health and Safety Considerations in Wastewater Treatment Plants.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	**1**	**2**	**2**	
CO2	3	2	3	-	2	1	-	-	-	-	-	**1**	**2**	**2**	
CO3	3	2	3	-	3	-	-	-	1	-	-	**1**	**2**	**2**	
CO4	2	1	1	-	2	1	-	-	1	-	-	1	**2**	**2**	

22UCV523E	Air Pollution and Control	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction:

Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Atmosphere and water bodies, Photo-chemical Smog, .

UNIT–II	10 Hrs.

Meteorology:

Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model and Numerical problems.

UNIT–III	10Hrs.

Sampling:

Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants ($PM_{2.5,}$ PM_{10}, SO_X, NO_X, CO, NH_3) and Air pollution emission standards and Numerical problems

UNIT–IV	10 Hrs.

Control Techniques:

Air pollution control devices, equipment and their design. Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP. Including Numerical problems. Indoor air quality-sources, types and control of air pollutants

Reference Books *

1. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell,“ Introduction to Environmental Engineering” McGraw-Hill Co. Noel De Nevers, “Air Pollution Control Engineering” , Waveland Pr Inc.

Anjaneyulu Y, “Text book of Air Pollution and Control Technologies”, Allied Publishers

Course Outcomes

After studying this course, students will be able to:

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	1	2	1								1	1	2	1	
CO 2	1	1	2								2	1	2	1	
CO 3	1	2	1								1	1	2	1	
CO 4	1	1	1								2	1	2	1	

22UCV524E	Solid Waste Management	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week: 03		SEE Marks:50

UNIT-I	10 Hrs.

Solid Waste: Definition and scope, Necessity and importance, Sources, Classification, Integrated Solid Waste Management (ISWM), Hierarchy of waste management options, 4 R's - reduce, recover, recycle and reuse, Physical, Chemical and Biological characteristics of municipal solid waste (MSW), Generation rates and methods, Chemical composition, Numerical problems.

Functional elements: Flow chart, Waste generation, Storage, Collection, Transfer and transport, Processing and recovery, Disposal.

Collection, Transfer and Transport: Collection equipment, systems of collection - hauled container system, stationary container system, numerical problems; Transfer stations, Bailing and Compacting

UNIT–II	10 Hrs.

Separation and Processing Technologies: Size reduction, Size separation, Density separation, Magnetic & Electric Field separation, Densification (Compaction), Design of Material Recovery Facilities (MRFs), Numerical problems.

Thermal Treatment Processes: Combustion Systems (Mass-Fired Combustion Systems, RDF-Fired Combustion Systems, Fluidized Combustion Systems, Hear recovery sytems, Water wall Combustion Systems, Waste heat boiler) Pyrolysis Systems, Gasification Systems, Environmental Control Systems, Energy Recovery Systems

UNIT–III	10 Hrs.

Disposal methods: Types, Selection of suitable site, Ocean disposal, Feeding to hogs, Merits and demerits of various disposal methods.

Open dumping: Environmental implications of open dumping, Construction debris - management & handling, Rag pickers and their role

Sanitary land filling: Definition, methodology, Types - trench, area, ramp, pit methods, Basic steps involved, Site selection, Prevention of site pollution, Landfill remediation, Geo-technical considerations, Densification - earthen, Geo-membrane, Geo-synthetics and Geo-textiles

UNIT–IV	10 Hrs.

Operational aspects of Landfills: Daily cover, Final cover, Leachate disposal, Ground water monitoring, Leachate and its treatment, Gas collection and re-circulation systems,Post-closure environmental monitoring.

Treatment of other wastes: E-Waste Management, Hazardous waste management and Bio-medical waste.

Reference Books *

1. George Tchobanoglous, Hilary Theisen, Samuel A. Vigil, Integrated Solid Waste Management-Engineering Principles and Management Issues, McGraw-Hill, International Editions, 1993.
2. Ramachandra T.V., Management of Municipal Solid Waste, The Energy and Resources Institute, TERI, ISBN: 9788179931875, 9788179931875, 2006
3. Peavy and Tchobanoglous, Environmental Engineering, McGraw-Hill International Editions, 1985.

Course Outcomes**

After completion of the course student will be able to

1. Design Appropriate treatment component for municipal and certain industrial effluents

2. Evaluate the operational problems of treatment units and apply the solutions in water and wastewater treatment plant.

3. Construct appropriate treatment schemes to remove certain pollutants present in water or wastewater

4. Construct the alternative sludge processing techniques apply the knowledge in nutrient removal from the wastewater

Course out come	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	3		2						2	2	2	
2	1	2	2	2		2						2	2	2	
3	2	2	1	2		1						2	2	2	
4	3	2	2	1		2						2	2	2	

22UCV525E	REMOTE SENSING AND GEOGRPHIC INFORMATION SYSTEMS	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week: 03		SEE Marks:50

UNIT-I	10 Hrs.

Basics: Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, Types of reflections, Energy Interactions with earth atmosphere and surface features, spectral reflectance curves- For Vegetation, soil & water, Idealised Remote Sensing System

Sensors: Definition, Sensor Parameters, Types, Choice of sensor, Optical Remote Sensing, Across and Along track scanning systems.

Platforms: Definition, Space borne platform attitudes (only definitions, No Problems).

Indian Remote Sensing Programme: Definition and Objectives

Satellite Specifications for IRS-1C, 1D, CARTOSAT-1 & CARTOSAT-2 - Ikonos, Quick bird, Risat.

UNIT–II	10 Hrs.

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation.

Digital Image Processing (DIP):(No problems/programming on DIP) Definition, Image Rectification & Restoration, image enhancement (contrast manipulation-Grey Level Thresholding, Level Slicing only), Supervised Image Classification using minimum distance to means classifier algorithm- GIS integration – stages & procedure., Image Filtering (spatial filters) -Low Pass and High pass image filters.(Brief discussion only, no problems or programming)

Applications of REMOTE sensing in urban applications and water resource management

UNIT–III	10 Hrs.

Maps and Projections: Map Projections Plane and geodetic , latitude and longitude map projections, types of map projections Spheroid, Datum (WGS84 Datum) and UTM (No Problems)

GIS: History, Definition, Components, concept, Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing, Storage and Output.

GIS functions in vector and raster data- Input, Analysis and out put

GIS Analysis (**Vector Data-** Buffering & Overlay analysis using overlay operators)

GIS Analysis **(Raster Data**-Local Operations and neighbourhood using arithmetic, Logical and Overlay operators)

Cartography-Definition, basic map layout, significance of cartography

Data Standards in GIS errors, precision and accuracy-Definition and Types

UNIT–IV	10 Hrs.

Advanced Concepts:

GPS.- Definition, working principle, segments and uses (Brief Discussion only)

Drones- Classification of drones, Basics of drones part, basics of drone surveying, Property mapping using drones

Applications of GIS and Remote Sensing:

1**)** Identifying suitable site for urban development

2) Planning of network for sewage collection and transport (laying of sewer lines)

3) Land Use Land Cover mapping (LU/LC).

Drainage Patterns- Definition, Types, significance. .

Reference Books *

Text books:

1. Thomas.m.lillysand & ralph.w.keifer, "remote sensing & image interpretation" –-7th edition, weiley india publications, new delhi, august 8, 2015.
2. Basudeb.bhatta, "remote sensing and gis", -2nd edition", oxford press publications, 2011.
3. M. Angireddy , " textbook of remote sensing and geographical information systems", 3rd edition, b.s.publications, hyderabad, january 1 2005, telangana, india. Isbn:978-81-7800-135-7.
4.c.p.lo albert .k.w.yeung ,"concepts and techniques in geographic information systems", 2nd edition, preintice hall publications, august 10th 2006, ontorio usa. .

Course Outcomes**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	2	1	2	2	-	-	-	-	-	-	2	2	2
CO 2	3	3	2	1	2	2	-	-	-	-	-	-	2	2	2
CO 3	3	3	2	2	2	3	-	-	-	-	-	-	2	2	2
CO 4	3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
Average	**3**	**2.5**	**2**	**1.5**	**2**	**2.5**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

22UCV526E	Process Economics and Plant Design (Open Elective)	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.

PROCESS DESIGN DEVELOPMENT:

Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design and equipment design and specialization, safety factors specifications, and materials of construction.

GENERAL DESIGN CONSIDERATIONS:

Marketability of the product, availability of technology, raw materials, human resources, land and utilities, site characteristics, plant location, plant layout, plant operation and control, utilities, storage, materials handling, materials and fabrication selection.Waste disposal community factors. Safety and hazard control measures.

UNIT–II	10 Hrs.

CAPITAL INVESTMENTS:

Fixed capital investments including land, building, equipment and utilities, installation costs,(including equipment, instrumentation, piping, electrical installation and other utilities),working capital investments.

MANUFACTURING COSTS AND PLANT OVERHEADS:

Manufacturing Costs: Direct Production costs (including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties, etc.), fixed charges Plant Overheads: Administration, safety and other auxiliary services, Conceptual numerical

UNIT–III	10 Hrs.

COST ANALYSIS:

Cost Analysis: Factors involved in project cost estimation, methods employed for the estimation of the capital investment. Estimation of working capital and

DEPRECIATION: Different type of depreciation methods of and calculations, Conceptual numerical

UNIT–IV	10 Hrs.

PROFITABILITY ANALYSIS:

Methods for the evaluation of profitability. Return on original investment, interest rate of return, Cash flow diagrams. Break-even analysis. Conceptual numerical.

Reference Books *

Text Books:

1.Peters and Timmerhaus (1989) Plant Design and Economics for Chemical Engineers, 4th edn., McGraw Hill.

2.Rudd and Watson (1987) Strategy of Process Engineering, Wiley.

3.Poornima M C (2006) Entrepreneurship Development and Small Business Enterprises", Pearson education.

Reference Books:

1. Vasanth Desai (2007) Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House.

2. Khanka SS (2004) Entrepreneurship Development, S Chand & Co.

3. Thomas W. Zimmer, Norman M. Scarborough.(2007), Essentials of Entrepreneurship and small Business Management

Course Outcomes**

Course outcomes:

After studying this course, students will be able to:

1. To understand the process design of plant.
2. To study the feasibility survey for the plant design.
3. To Calculate the project profitability and alternative investment
4. To identify the cost analysis involved in the design of plant.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2	2	1	1			1	1	1		2		2	2	
CO 2	2	1	2	1			1	1	1		3		2	2	
CO 3	1	2	1	2			1	1	1		2		1	2	
CO 4	2	1	2	2			1	1	1		3		2	2	

22UCV527E	Highway Geometric Design	Credits: 3
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	10Hrs.

INTRODUCTION: Geometric control factors like Topography- design speed- design vehicle- Traffic- Capacity- volume- environmental & other factors as per IRC & AASHTO standards & specifications- PCU concepts- factors controlling PCU for different design purpose.

CROSS SECTIONAL ELEMENTS: Pavement surface characteristics- friction- skid resistance- pavement unevenness- light reflecting characteristics-camber-objectives-types of camber- method of providing cambers in the field- problems- carriage way- kerb- median- shoulder- foot path- parking lanes- service roads- cycle tracks- Driveways- Right of way- Factors influencing right of way- Design of Road humps as per latest IRC provision.

UNIT–II	10 Hrs.

SIGHT DISTANCE: Importants, types, SSD, OSD & Sight distances at uncontrolled intersections, derivations, factors affecting sight distance, IRC, AASHTO standards, problems on above.

HORIZONTAL ALIGNMENT: Definition, Checking the stability of vehicle, while moving on horizontal curve, Super elevation, Ruling minimum & maximim radius, Assumptions- problems- methods of providing super elevation for different curves- Extra widening of pavement on curves- Objectives- Mechanical widening- Psychological widening- Transition curve- Objectives- Ideal requirments- Types of transition curves- Method of evaluating length of transition curve- Setting the transition curve in the field, set back distance on horizontal curve & problems on above.

UNIT–III	10 Hrs.

VERTICAL ALIGNMENT: Gradient- Types of gradient- Design criteria of summit & valley curve- Design of vertical curves based on SSD-OSD-Night visibility considerations-Design standards for hilly roads- problems on the above.

INTERSECTION DESIGN: Principle- At grade & Grade separated junctions- Types- Channelization- Features of channelizing Island- Median opening- Gap in median at junction

UNIT–IV	10 Hrs.

ROTARY INTERSECTIONS: Elements- Advantages- Disadvantages- Design guide lines- problem on above- Grade seperated intersection- Three legged intersection- Diamond interchange- Half clover leaf- Clover leaf- Advantages- Disadvantages only

HIGHWAY DRINAGE: Importance – sub surface drinage- surface drinage- Design of road side drives- Hydrological- Hydraulic considerations and design of filter media, problems on above.

Reference Books *

1. Khanna, S.K. Justo, C.E.G. and Veeraghavan A “Highway Engineering”, Nem Chand & Bros. 2015
2. Papacostas, C.S. and Prevedouros, P.D., “Transportation Engineering and Planning”, Prentice Hall. 2002
3. JotinKhisty, C. and Kent Lall, B., “Transportation Engineering – An Introduction”, Third edition, Pearson India 2016
4. K. Subramaniam, “Transportation Engineering”, SciTech Publications, Chennai.
5. Relevant Indian Roads Congress Codes –
6. C. Jotin Khisty, B. Kentlal, “Transportation Engineering”, PHI Learning Pvt. Ltd. New Delhi.
7. Right, Paul H. and Dixon, Karen K., “Highway Engineering”, John Wiley and Sons Inc. 2004

Course Outcomes**

1. Describe various geometric elements like speed, topography, traffic volume, Design hourly, traffic volume etc.
2. Determine the various sight distances, evaluate extra widening required for horizontal curves
3. Design and setting out of Summit and Valley curves and describe different types of at-grade, grade separated intersection and channelization.
4. Design Rotary intersection, surface and subsurface drainage system.

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1		1		**1**							1	1		
CO2	1				1				1				1	
CO3			1			1	**1**				1			1
CO4	1			**1**						1			1	

22UCV528E	MASONRY STRUCTURES	Credits: 03
L-T-P : 3-0-0		CIE Marks:50
Total Hours/Week: 03		SEE Marks:50

UNIT-I	10 Hrs.

MASONRY UNITS, MORTARS, TYPES AND MASONRY CONSTRUCTION: Brick, stone, concrete block, stabilized mud block masonry units-strength, modulus of elasticity, and initial rate of absorption (IRA) of brick, classification and properties of mortar, workability of fresh mortar, water retentivity of mortar, stress-strain behavior of mortar, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking and remedial measures.(5 Hrs)

STRUCTURAL MASONARY: Introduction, stresses in masonry in compression, factors influence compressive strength of masonry; effect of unit strength, unit height, hollowness and moisture absorption, effect of mortar strength, plasticity, joint thickness, type of masonry loading, modular ratio of unit and mortar and direction of loading. Strength formulae and mechanism of failure for masonry prism subjected to direct compression. (5 Hrs)

UNIT–II	9 Hrs.

DESIGN CONSIDERATIONS: Boundary conditions and the effective height of wall in the design of masonry wall and column; effective length of wall based on conditions of support and, effective thickness for solid wall, cavity wall with and without stiffeners; slenderness ratio; assessment of eccentricity of loading on walls. (5 Hrs)

PERMISSIBLE STRESSES: Permissible compressive stress in masonry wall, stress reduction, area reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses in masonry wall. (4 Hrs)

UNIT–III	9 Hrs.

DESIGN OF MASONRY WALLS: Reduction of basic compressive strength to allow slenderness ratio and eccentricity; elastic buckling of brittle columns. Design of load bearing masonry for building up to three storeys using IS: 1905-1987. (5 Hrs)

DESIGN OF SOLID WALLS: Design of axially loaded unstiffened solid wall; determination of safe load carrying capacity of wall. Design of solid wall with piers. Solid wall supported at the ends by cross wall. (4 Hrs)

UNIT–IV	10 Hrs.

DESIGN OF CAVITY WALL: Design of cavity wall with and without piers. Design of cavity wall with cross wall. Determination of safe load carrying capacity of cavity wall. (5 Hrs)

DESIGN OF FREE-STANDING WALL: Transverse load acts perpendicular to plane of wall. Lateral load acts in the plane of wall. Design of free-standing walls with and without staggered, design of masonry tabular structure representing a chimney. (5 Hrs)

TextBooks

1. Brick and Reinforced Brick Structures Dayaratnam P.: Oxford & IBH, 1987
2. Alternative Building Materials and Technologies K S Jagadish, B V Venkatarama Reddy, K S Nanjunda Rao, 2008
3. Design of Masonry structures Sinha B.P Davies S.R: E & FN spon, 1997

REFERENCES BOOKS

1. Structural Masonry Henry, A.W.: Macmillan Education Ltd, 1990
2. IS 1905-1987 Code of practice for structural use of un-reinforced masonry (3rd revision) BIS, New Delhi.
3. SP 20 (S&T)-1991, Hand book on Masonry design and construction (1st revision) BIS, New Delhi.

Course Outcomes

After completion of the course student will be able to

CO1: Identify various materials used in masonry, their characteristics and the influence of various parameters on the stability of concentrically loaded masonry walls. Factors influence the compressive strength of masonry.

CO2: Apply boundary conditions to evaluate the effective height, length and thickness of wall in the design of masonry wall and column; Slenderness ratio: Determine the slenderness ratio of walls and reduction factors, to evaluate the permissible stresses.

CO3: Analyse the reduction of basic compressive strength due to slenderness ratio and eccentricity, elastic buckling of brittle columns. Design of masonry up to three storeys.

CO4: Design the cavity wall. Design the free-standing walls subjected to wind load perpendicular to plane of wall, and wind load acts in the plane of wall.

COURSE ARTICULATION MATRIX

Course Outcomes	Programme Outcomes (POs)												Programme Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	1	1	1	1	1				1	2	1	1
CO2	3	2	2	3	2	2	1					1	1	2	1
CO3	3	3	3	2	1	3	1	1				2	3	3	2
CO4	3	3	3	2		2	1	1				2	3	3	2
Average	2.75	2.25	2.25	2.00	1.33	2.00	1.00	1.00	0	0	0	1.50	2.25	2.25	1.50

22UCV531N	Air Pollution and Control	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction:

Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Atmosphere and water bodies, Photo-chemical Smog, .

UNIT–II	10 Hrs.

Meteorology:

Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model and Numerical problems.

UNIT–III	10Hrs.

Sampling:

Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants ($PM_{2.5,}$ PM_{10}, SO_X, NO_X, CO, NH_3) and Air pollution emission standards and Numerical problems

UNIT–IV	10 Hrs.

Control Techniques:

Air pollution control devices, equipment and their design. Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP. Including Numerical problems. Indoor air quality-sources, types and control of air pollutants

Reference Books *

1. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell,“ Introduction to Environmental Engineering” McGraw-Hill Co. Noel De Nevers, “Air Pollution Control Engineering” , Waveland Pr Inc.

Anjaneyulu Y, “Text book of Air Pollution and Control Technologies”, Allied Publishers

Course Outcomes

After studying this course, students will be able to:

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	1	2	1								1	1	2	1	
CO 2	1	1	2								2	1	2	1	
CO 3	1	2	1								1	1	2	1	
CO 4	1	1	1								2	1	2	1	

22UCV532N	Geographic Information Systems	Credits:3
L:T:P-3: 0: 0		CIEMarks:50
Total Hours/Week:4		SEEMarks:50

UNIT-I	10Hrs.

Basics: Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, Types of reflections, Energy Interactions with earth atmosphere and surface features, spectral reflectance curves-For Vegetation, soil & water, Idealized Remote Sensing System

Sensors: Definition, Sensor Parameters, Types, Choice of sensor, Optical Remote Sensing, Across and Along track scanning systems.

Platforms: Definition, Space borne platform attitudes (only definitions, No Problems).

Indian Remote Sensing Programme: Definition and Objectives

Satellite Specifications for IRS-1C, 1D, CARTOSAT-1 & CARTOSAT-2 - Ikonos, Quick bird, RISAT

UNIT–II	10Hrs.

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation.

Digital Image Processing (DIP):(No problems/programming on DIP) Definition, Image Rectification & Restoration, image enhancement (contrast manipulation-Grey Level Thresholding, Level Slicing only), Supervised Image Classification using minimum distance to means classifier algorithm- GIS integration –stages & procedure., Image Filtering (spatial filters) -Low Pass and High pass image filters.(Brief discussion only, no problems or programming)

Applications of REMOTE sensing in urban applications and water resource management

UNIT–III	10Hrs.

Maps and Projections : Map Projections Plane and geodetic , latitude and longitude map projections, types of map projections Spheroid, Datum (WGS84 Datum) and UTM (No Problems)

GIS: History, Definition, Components, concept, Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing, Storage and Output.

GIS functions in vector and raster data- Input, Analysis and out put

GIS Analysis **(Vector Data-** Buffering & Overlay analysis using overlay operators)

GIS Analysis **(Raster Data**-Local Operations and neighborhood using arithmetic, Logical and Overlay operators)

Cartography-Definition, basic map layout, significance of cartography

Data Standards in GIS errors, precision and accuracy-Definition and Types

UNIT–IV	10Hrs.

Advanced Concepts: GPS.- Definition, working principle, segments and uses (Brief Discussion only)

Drones- Classification of drones, Basics of drones part, basics of drone surveying, Property mapping using drones

Applications of GIS and Remote Sensing:

1**)** Identifying suitable site for urban development

2) Ground water Vulnerability assessment.

Reference Books *

TEXT BOOKS:

1.Thomas.M.LILLYSAND & RALPH.W.KEIFER, "REMOTE SENSING & IMAGE INTERPRETATION" –-7TH EDITION, Weiley INDIA Publications, New Delhi, August 8, 2015

2.Basudeb.BHATTA, "REMOTE SENSING AND GIS", -2nd edition", Oxford press publications, 2011.

3.M. ANGIREDDY , " TEXTBOOK OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS", 3rd EDITION, B.S.Publications, Hyderabad, January 1 2005, Telangana, India. ISBN:978-81-7800-135-7.

4.C.P.LO ALBERT .K.W.YEUNG ,"Concepts and Techniques in GEOGRAPHIC INFORMATION SYSTEMS", 2nd

REFERENCE BOOKS

1.George Joseph, "Fundamentals of Remote Sensing", 2nd edition, University press, Hyderabad, 2005.

2.Micheal.F.Goodchild, Paul.A.Longely, "Geographic Information Science and Systems", 4th edition, Wieley publications, April 24/2015.

3. S.Kumar, "Basics of Remote Sensing and GIS", 2nd Edition, Laxmi Publications, New Delhi, January 1/2016.

WEB SITES

1. WWW.GISDEVELOPMENT.NET
2. WWW.JSYS.ORG
3. WWW.NRSC.GOV.IN

NPTEL NOTES, IIRS NOTES

Learning Objectives*

1. Acquire knowledge of Basics of remote sensing, its need and advantages in civil engineering , method of acquiring satellite images, ISRO satellite launch programs (This will be useful in choicing the type of satellite image for a particular application in civil engineering works)
2. To apply the concept of Remote Sensing for engineering planning purposes
3. Analyse the application of GIS and modern tools like GPS for quantification of parameters needed for Infrastructure planning purposes.
4. Assess the utility of GIS and RS for real time engineering application with case studies.

After Learning the Course, the student will be able to

1.Differenciate the procedure of data acquisition between remote sensing and conventional methods

2.Apply the concept of remote sensing to asses the ground properties of a region and quantify the ground properties.

3. Choice the tools and techniques needed for generation of quantified data required for engineering and infrastructure planning purposes.

4. Assess, the application RS and GIS techniques for real time engineering applications**.**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	1	1	-	-	-	-	-	-	2	2	2
CO 2	3	3	2	1	2	2	-	-	-	-	-	-	2	2	2
CO 3	3	3	2	2	2	3	-	-	-	-	-	-	2	2	2
CO 4	3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
Average	**3**	**2.5**	**2**	**1.5**	**1.75**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

22UCV533N	Occupational Safety and Health	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week: 03		SEE Marks:50

UNIT-I	10 Hrs.

Introduction - History and Development, Occupational Safety and Health Act. Occupational Safety and Health Administration, Right to know Laws.

Accident Causation-Need for Accident Investigation, Accident investigation plan, Methods of acquiring Accident Facts, Correcting Missing Skills, Investigator Tendencies and Characteristics, Supervisory Role in Accident investigation. Human Error Model, Petersew's Model, Epidemiological Models.

Ergonomics- Ergonomics at workplace, Ergonomic Task Analysis, Preventing Ergonomic Hazards, Setting up of Ergonomics Programme.

UNIT–II	10 Hrs.

Occupational Hazard and Control- Hazard Analysis, Human Error Analysis in Causation with Hazard Analysis, Fault Tree Analysis, Emergency Response. Decision for Action, Purpose and Considerations, Right Decision, Wrong Remedy, Hazard Control Measures, Hazards and their Control in Pharmaceutical, Construction, Textiles, Petroleum Refineries and LPG Bottling, Iron and Steel industries

UNIT–III	10 Hrs.

Fire prevention and Protection- Fire Development and its Severity effects. Enclosure, need for early Detection of Fire, Extinguishing Fire Electrical Safety Product Safety, Technical Requirements of Product Safety Programme. Environmental Safety and ISO 14000 ISO series of standards, ISO14001Standards, Environmental Management systems. (EMS) Total quality Management (TQM) and Total safety Management (TSM).

UNIT–IV	10 Hrs.

Occupational Health-Health and Safety Considerations, Personal Protective Equipment's, Effects of Exposure and Treatment for Metal Working Trades, Municipal Solid Waste, Epoxy Resins, Foundries. Occupational Health and Safety Considerations in Wastewater Treatment Plants.

Reference Books *

1. Nemerow N. N., Liquid waste of industry theories, practices and treatment, Addison Willey, New York, 1971.
2. Azad N. S., Industrial waste water management handbook, Mc Graw Hill book, co. New York.
3. Ross R. D., Industrial waste disposal, Reinhold environmental series, New York, 1968
4. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 1999.

Course Outcomes**

1. Design policies and regulations for the development and maintenance of a healthy and safe work environment.
2. Interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces and apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.
3. Analyse the change by advancing OH&S principles within management systems, cultures, practices, and priorities.
4. Construct the Occupational Health and Safety Considerations in Wastewater Treatment Plants.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	**1**	**2**	**2**	
CO2	3	2	3	-	2	1	-	-	-	-	-	**1**	**2**	**2**	
CO3	3	2	3	-	3	-	-	-	1	-	-	**1**	**2**	**2**	
CO4	2	1	1	-	2	1	-	-	1	-	-	1	**2**	**2**	

22UCV535N	GREEN BUILDING TECHNOLOGY	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction, Concept of green building, History of green building, Need of green building in present scenario, Importance of green building Merits and demerits, Classification of green building, Assessment methods Global assessment and certification, Local assessment, LEED (Leadership in energy and environmental design) GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council) and Green star rating systems.	
UNIT–II	**10 Hrs.**
Principles and elements of design of green building; Sustainability: concept and reality Climate responsive process of design: Climatic zones, design sequence, shelter or form, land form, vegetation, water bodies, street widths, open spaces, ground character, plan form, orientation, roof form Shading devices and their effect.	
UNIT–III	**10 Hrs.**
Thermal comfort inside the building: Factors affecting, indices, cooling and heating requirement, Heat transmission through building sections, thermal performance of building sections, simple calculation for U value and insulation thickness Day lighting Ventilation.	
UNIT–IV	**10 Hrs.**
Water conservation: 3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling Material conservation: concept of embodied energy, low energy materials, sustainable materials, alternative materials Concept of carbon emission and its reduction Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings.	

REFERENCE BOOKS**

1. Climate responsive architecture (A design hand book for energy efficient buildings), Arvind Krishnana, Simos Yannas, Nick Baker, S V Szokolay, McGraw hill Education, Seventh reprint, 2013.
2. Renewable Energy and Environment -A Policy Analysis for India, H, Ravindranath, K Usha Rao, B Natarajan, P Monga, Tata McGraw Hill, 2000.Energy and the Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984.IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.

Course Outcomes**

After completion of the course student will be able to

1. Understand, recognize, and evaluate green building's significance, principles, and advantages and disadvantages in sustainable construction.
2. Gain a comprehensive understanding of green building design principles and sustainability concepts, with a focus on climate-responsive design processes, shading devices, and their

effects on building performance.

3. Proficiently optimize thermal comfort, daylighting, and ventilation in buildings, creating sustainable and comfortable indoor environments.
4. Understand and apply water and material conservation techniques, grasp the concept of embodied energy and carbon emissions reduction, and analyze existing green buildings and the role of the Bureau of Energy Efficiency.

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	-	**-**	-	2	**3**	**2**	**-**	**-**	**2**	**2**		
CO2	3	2	-	**-**	-	1	**3**	**2**	**-**	**-**	**2**	**2**		
CO3	3	2	-	**-**	-	-	**3**	**2**	1	**-**	**2**	**2**		
CO4	2	2	-	**-**	-	1	**3**	**2**	1	**-**	**2**	**2**		

22UCV611C	DESIGN OF RC STRUCTURES	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs

General features reinforced concrete: Introduction, Design loads, Materials for reinforced concrete, Code requirements of reinforcements, Elastic theory of RC sections, Moment of resistance of section, Balanced, under reinforced and over reinforced section.

Principles of limit state design and ultimate strength of RC section: Philosophy of Limit state design, Principles of limit states, Factor of safety, Characteristic and design loads, Characteristic anddesign strength, General aspects of ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of rectangular sections, Ultimate flexural strength of flanged sections, Ultimate flexural strength of doubly reinforced sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage, Analysis examples for rectangular sections, flanged sections, doubly reinforced, sections, shear strength and development length.

UNIT–II	11 Hrs.

Limit state: General aspects, Deflection limits in IS: 456-2000, Calculation of deflection (Theoretical method), Cracking Serviceability in structural concrete members. Design of beams: Practical requirements of an RCC beam, Size of the beam, Cover to the Reinforcement, Spacing of bars, Design procedure, Critical sections for moments and

Shear, Anchorage of bars: check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, Design examples for simply supported and cantilever beams (rectangular).

UNIT–III	09 Hrs.

Design of slabs: Introduction, General consideration of design of slabs, Rectangular slabs spanning in one direction, Rectangular slabs spanning in two directions for various boundary conditions, Design of simply supported slabs, cantilever slabs.

Design of stair case: General features, types of stair case, Loads on stair cases, effective span as perIS codal provisions, distribution of loading on stairs, design of stair cases.

UNIT–IV	09 Hrs.

Design of columns: General aspects, Effective length, Loads on columns, Slenderness limits for columns, Minimum eccentricity, Design of short axially loaded columns, Design of column subject to combined axial load and uniaxial moment using SP 16.

Design of footings: Introduction, Load for foundation, Design basis (limit state method), Design ofisolated square or rectangular footing for axial load.

Reference Books *

1.Unnikrishnan and Devadas Menon, Design of reinforced concrete structures, PHI, New Delhi.2013.

2.Karve S.R. and Shah V.L, Limit state theory and design of reinforced concrete, Vidyarthi Prakashan, Pune. 2017.

3.A.K. Jain, Limit state method of design, Nemchand and Bros, Roorikee, Jan 2012.

4.Park and Paulay, Reinforced concrete, John Wiley & Sons. 1975.

5.Kong and Evans, Reinforced and prestressed concrete, ELBS, London

6.H.J. Shah, Reinforced concrete Vol. I, Charotor Publishing House, Anand. Jan 2016.7. IS: 456-2000, SP-24, SP-16.

(Note: Use of IS: 456-2000 is permitted and SP-16 to be used in design of columns only).

Course Outcomes**
After completion of the course student will be able to 1. Students will have the knowledge of methods of design of RC sections & will analyse the different RC sections. 2. Students will be able to solve the problems related to serviceability conditions and design different beamsections. 3. Students will be able to design different slab and staircase. 4. Students will be able to design columns and isolated footings.

Course Outcomes	**Programme Outcomes**											**Programme Specific Outcomes**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO 1	3	3										2	1	
CO 2	3	3										2	2	
CO 3	3	3	3	3								2	2	
CO 4	3			2								2	1	
Average	3	3	3	2.5								2	1.5	

22UCV612C	CONSTRUCTION MANAGEMENT	Credits 3:0:0
Hrs/Week : 03		CIE Marks:50
Total Hours: 40		SEE Marks:50

UNIT – I	10 Hrs

Construction industry and Management: Introduction to construction industry, value engineering, labour, time, financial and material management, organization and administration.

Construction safety: Introduction, causes of accidents, general safety precautions during excavation, demolition of buildings, erection of steel structures, storing and blasting of explosives, general concreting works, pile operations.

UNIT – II	10 Hrs

Engineering Economics: Introduction, project feasibility report, basic concepts of economic analysis, Interest and time value of money: concept of simple and compound interest, interest formula or single payment, equal payment and uniform gradient series.

Comparison of alternatives: Present worth, future worth, annual equivalent, capitalized and rate of return methods, break even analysis, Problems.

UNIT – III	10 Hrs

Construction planning: Introduction, planning methods of projects, Bar and Mile stone charts, Critical Path Method, Earliest and latest event times, Activity time, slack, Critical path, Float, A-O-A and A-O-N networks.

Program Evaluation and Review Technique, time estimates, Earliest expected time, Latest allowable occurrence time, Probability of completion time for a project.

UNIT - IV	10 Hrs

Project Cost: Cost model, direct, indirect and optimum costs, optimum duration and numerical problems.

Resource Management: Introduction, types of resources, resource allocation, updating and line of balance technique.

Transportation Problems: Introduction, balanced and unbalanced types of transportation problems, methods for initial basic feasible solution, North west corner method, Lowest cost entry method, Vogel's approximation methods.

TEXT BOOKS

1. R. Panneerselvam, Engineering economics, PH1 Publications, 2010, New Delhi
2. S.C. Sharma, Construction equipment and its management, Khanna Publishers, 5th Ed, Delhi, 2016.
3. S. Seetharaman, Construction engineering and management by, Umesh Publishers, 4th Ed, Delhi, 2008.
4. L.S. Srinath, EWP PERT and CPM principles and applications, Affiliated east west press Pvt. Ltd, 3 rd Ed, 2001.
5. SP 7:2005, "National Building Code of India", Bureau of Indian Standards, New Delhi.
6. SP 70:2001, "Handbook on Construction safety Practices", Bureau of Indian Standards, New Delhi.
7. S.S. Chitkara, "Construction project management: Planning, scheduling and controlling", McGraw Higher Ed., New Delhi.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any FOUR Full questions are to be answered choosing at least one from each unit.

Course Outcomes: After completion of the course students will be able to

1. Demonstrate the concept of management, value engineering, organization and safety measures in construction industry.
2. Apply fundamental principles of engineering economics to evaluate project feasibility through economic analysis.
3. Develop and analyze project schedules using planning tools such as Bar charts, Milestone charts, Critical Path Method (CPM), and Program Evaluation and Review Technique (PERT)
4. Apply cost modeling techniques and resource management strategies to optimize project duration and cost, and solve transportation problems using standard methods

CO-PO Matrix															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	2	2	1	1	2	2	2	2	1	3	2	2	2	1
2	3	2	3	2	2	2	2	2	2	2	3	2	2	2	2
3	2	3	3	2	2	2	2	2	2	2	3	2	2	2	2
4	2	3	3	2	2	2	2	2	2	2	3	2	2	2	2
Avg	**2.5**	**2.5**	**2.75**	**1.75**	**1.75**	**2**	**2**	**2**	**2**	**1.75**	**3**	**2**	**2**	**2**	**1.75**

22UCV613C	Applied Geotechnical Engineering	Credits: 3
L:T:P - 3:0:0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10Hrs.

Subsurface exploration- Importance of exploration program, methods of exploration: boring, sounding tests, geophysical methods-electrical resistivity and seismic refraction methods. Types of samples-undisturbed, disturbed and representative samples samplers, sample disturbance, area ratio, recovery ratio, clearance stabilisation of boreholes - typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report.

UNIT–II	10 Hrs.

Stress in Soils- Introduction, Boussinesq's and Westergaard's theory of concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart.

Effective Stress Analysis- Geostatic stresses, effective stress concept-total stress, effective stress and neutral stress and impact of the effective stress in construction of structures, quick sand phenomena

UNIT–III	11 Hrs.

Lateral earth pressure- Active and passive earth pressures, earth pressure at rest, earth pressure coefficient. Earth pressure theories - Rankine's and Coulomb's – assumptions and limitations, graphical solutions for active earth pressure (cohesionless soil only) – Culmann's and Rebhann's methods lateral earth pressure in cohesive and cohesionless soils, earth pressure distribution.

Stability of earth slopes - Types of slopes, causes and type of failure of slopes. Definition of factor of safety, stability of finite and infinite slopes - method of slices, friction circle method, Fellineous method, Taylor's stability number

UNIT–IV	9 Hrs.

Bearing Capacity of Shallow Foundation- Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil - SPT and plate load test.

Foundation settlement-Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

Reference Books *

1. G. Ranjan and A.S.R Rao. (2022), "Basic and Applied Soil Mechanics". New Age International (P) Ltd., New Delhi.
2. B.C. Punmia (2021), 17th Edition "Soil Mechanics and Foundation Engg". Laxmi Publications Co. , New Delhi
3. B. M. Das and N. Sivakugan, Principles of Foundation Engineering with MindTap, Cengage Learning, 9th Edition, 2019.
4. V.N.S. Murthy (2018), 4th Edition, "Soil Mechanics and Foundation Engineering".UBS Publishers and Distributors, New Delhi.
5. C.Venkatrahmaiah (2018), 6th Edition "Geotechnical Engineering". New Age International (P) Ltd., Newe Delhi.
6. A. Singh and Chowdhary G.R. (2017), "Soil Engineering in Theory and Practice". CBS Publishers and Distributors Ltd., NewDelhi.
7. J.E. Bowles (2017), 5th Edition, "Foundation Analysis and Design". McGraw Hill Pub. Co. New York.
8. I. H. Khan (2005), 2nd Edition, Text Book of Geotechnical Engineering- PHI, India.
9. B. M. Das (2002), 5th Edition, Principles of Geotechnical Engineering- Thomson Business Information

Course Outcomes**
After completion of the course student will be able to: 1) Evaluate and interpret various soil test results to determine soil properties and geotechnical parameters for engineering design. 2) Demonstrate proficiency in determining vertical stress in the soil, effective stresses by considering pore water pressure and their role in soil behavior and stability analysis. 3) Apply knowledge of lateral earth pressure and slope stability to real-world engineering projects, considering slope geometry and soil types. 4) Calculate and interpret ultimate and allowable bearing capacities and settlement of soil using different methods

COURSE ARTICULATION MATRIX:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO 1	3	-	-	-	-	-	-	-		-	-	2	1	-
CO 2	3	1	-	-	-	-	-	-	-	-	-	2	1	1
CO 3	3	2	2	2	-	-	-	-	-	-	-	2	1	1
CO 4	3	2	2	2	-	-	-	-	-	-	-	2	1	1

22UCV614C	ADVNCED WASTEWATER TREATMENT	Credits: 02
L:T:P - 2 : 0: 0		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

UNIT-I	07 Hrs.

Introduction: Necessity for sanitation, Sewerage systems and their suitability.

Estimation of Wastewater Flows: Dry weather flow, factors affecting, Flow variations and their effects on design of sewerage system, Numerical problems. Computation of sewage and storm water discharge, Numerical problems.

Design of Sewers: Self cleansing and non-scouring velocities, Numerical problems.

Self Study: Laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.

UNIT–II	07 Hrs.

Sewer Appurtenances: Catch basin, manholes, flushing tanks, oil and grease traps

Sewage Characteristics: Sewage Sampling. Physical, Chemical and Biological characteristics, with emphasis on BOD & COD, BIS and CPCB standards, Numerical problems.

Self Study: Drainage traps, Basic principles of house drainage, Typical layout plan showing house drainage connections, maintenance of house drainage.

UNIT–III	07Hrs.

Sewage Treatment - Primary Treatments: Flow diagram of municipal wastewater treatment plant. Primary treatment Screening, grit chambers, skimming tanks, primary sedimentation tanks- Theory and Design.

Secondary Treatments: Fixed film bioprocess-Trickling filter theory and design.

Self study: Suspended growth system-Activated sludge process-Theory and design**.**

UNIT–IV	07 Hrs.

Sludge Treatment Methods: Sludge digestion tanks, Sludge drying beds. Low cost wastewater treatment -Septic tanks**.**

Sewage Disposal: Dilution method - self-purification phenomenon. Streeter-Phelps equation, Oxygen sag curve, Zones of purification and numerical.

Self study: Oxidation Pond and Oxidation ditches, Land disposal: Sewage farming, sewage sickness.

Reference Books *

1. Environmental Engineering, Peavy H. S., Rowe D. R. and George Tchobanoglous, McGraw-Hill International.
2. Garg, S.K., "Environmental Engineering", Vol. 1 & II Khanna Publishers, New Delhi, 2005.
3. Water Supply and Sewerage, McGhee T. J., McGraw-Hill Inc.,
4. Wastewater Engineering Treatment and Reuse, Metcalf & Eddy, McGraw Hill Education, 2017, 4th Edition.
5. APHA, Standard Methods Examination of Water and Wastewater, American Public Health Association, Washington DC, 1995.
6. CPCB, Guide Manual: Water and Wastewater Analysis.

Course Outcomes**
After completion of the course student will be able to 1. To estimate sewage and drainage quantity, for the design of sewers and drainage sections. 2. To demonstrate the characterization of sewage and sewer appurtenances. 3. To identify the impact of sewage disposal on water and land and minimum treatment necessary for sewage. 4. To design biological treatment units for sewage and knowledge of sludge disposal.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	1	1	3	3	-	-	-	-	2	2	3	3
CO2	3	-	-	3	2	3	3	-	-	-	-	1	3	2	3
CO3	2	2	1	2	2	3	3	-	-	-	-	2	2	2	2
CO4	3	3	3	2	2	2	3	-	-	-	-	1	3	3	3

22UCV615L	Geotechnical Engineering Lab	Credits: 01
L:T:P - 0: 0: 2		CIEMarks:50
Total Hours/Week: 2		SEEMarks:50

Sl. No	Experiments
1.	Water content determination by oven drying and Rapid moisture meter method
2.	Determination of specific Gravity of fine grained and course grained soil
3.	Grain size analysis (Sieve analysis of soil)
4.	In-situ density tests i) Core-cutter method ii) Sand replacement method
5.	Consistency limits i) Liquid limit test (by Casagrande's and cone penetration method) ii) Plastic limit test iii)Shrinkage Limit
6.	Co-efficient of permeability test i) Constant head test ii). Variable head test
7.	Standard compaction test (light compaction only)
8.	Direct shear test
9.	Unconfined compression test
10.	Laboratory vane shear test
11.	Triaxial test (unconsolidated undrained test only)
12.	Field Identification of soil
13.	Demonstration of Standard penetration test & Boring equipment
14.	Demonstration of Proctors Needle

Reference Books *

1. Soil Testing for Engineers by S. Mittal and J.P. Shukla 2020
2. Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol. I, II, III, Princeton Press, London 2006
3. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi. 2017

Course Outcomes**

After completion of the course student will be able to

1. Carry out experiments to assess the index properties of soil
2. Evaluate consistency and plasticity characteristics of soils through Atterberg limit tests and assess their significance in soil classification
3. Conduct in-situ density measurements and assess compaction characteristics of soils through laboratory compaction tests.
4. Assess permeability and strength parameters of soils using laboratory methods

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	-	-	-	-	2	-	-	3	-	3	-
CO2	3	3	3	2	-	-	-	2	-	-	2	-	3	-
CO3	3	3	3	2	-	-	-	2	-	-	2	-	3	-
CO4	3	1	3	2	-	-	-	2	-	-	2	-	3	-

22UCV616L	SOFTWARE APPLICATION LAB	Credits: 1
L:T:P - 0 : 0: 2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

MICROSOFT EXCEL: Analysis and design of singly beam, doubly beam, one way slab and two way slabs.

ANALYSIS AND DESIGN SOFTWARES: Analysis and Design of structural Engineering components using commercially available Software's: Cantilevers, Simply supported beams, Propped Cantilevers, Fixed and Continuous Beams. 2D Portal frames - Single and two storied.

AUTOCAD: Drawing and detailing of: singly Beam, doubly beam, one way slab, two way slab doglegged stair case and isolated footing with column.

Reference Books *

1. Unnikrishnan and Devadas Menon, Design of reinforced concrete structures, PHI, New Delhi.2013.
2. Karve S.R. and Shah V.L, Limit state theory and design of reinforced concrete, VidyarthiPrakashan, Pune. 2017.
3. A.K. Jain, Limit state method of design, Nemchand and Bros, Roorikee, Jan 2012.
4. H.J. Shah, Reinforced concrete Vol. I, Charotor Publishing House, Anand. Jan 2016.7. IS: 456-2000, SP-24, SP-16.
5. MS Excel Manuals and Tutorials for engineering applications.
6. AUTOCAD User guide.
7. STAAD Pro manual.

(Note: Use of IS: 456-2000 is permitted and SP-16 to be used in design of columns only).

Course Outcomes**

After completion of the course student will be able to

1. Analyse and design simply supported doubly reinforced beams and slabs using MS Excel.
2. Apply commercial structural software to design cantilevers, fixed beams, portal frames.
3. Draft and details beams of beams, slabs, staircase and footing using AutoCAD

Course Articulation Matrix:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO 1	3	3									3	2	1	
CO 2	3	3										2	2	
CO 3	3	3	3	3								2	2	
Average	3	3	3	2.5								2	1.5	

22UCV621E	DESIGN OF BRIDGES	Credits: 03
L:T:P-3: 0:0		CIE Marks:50
Total Hours/Week:3		SEE Marks:50

UNIT-I	10 Hrs.

Introduction & Design of Slab Culvert: Overview of bridge engineering and its development in the past. Ideal site selection for bridges and bridge classifications. Discussion of forces acting on bridges and analysis for maximum bending moment (BM) and shear force (SF) at critical sections for dead and live loads, as per IRC Class A, B, and AA tracked and wheeled vehicles. Structural design of slab culverts using the limit state method including reinforcement details.

UNIT–II	10 Hrs.

Box Culvert: Introduction to box culverts and advantages of structural continuity. Analysis involves determining maximum bending moment (BM) and shear force (SF) at critical sections using the moment distribution method for various load combinations, including dead, surcharge, soil, water, and live loads (as per IRC Class A, B, and AA for tracked and wheeled vehicles). The structural design will utilize the Limit State Method with detailed reinforcement specifications.

UNIT–III	10 Hrs.

T-Beam Bridge: Components of T-Beam Bridge, Load transfer mechanism, Proportioning the Components, Analysis of Slab using Pigeauds Method for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of Slab using limit state method with reinforcement details. Analysis of Cross Girder for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of slab using limit state method with reinforcement details. Analysis of Main Girder using Courbon's Method for maximum BM and SF at critical sections for Dead and Live load as per IRC class A, B, AA tracked and wheeled vehicles and design of Main Girder using limit state method with reinforcement details

UNIT–IV	10 Hrs.

PSC-Bridge: Introduction to Pre & Post Tensioning, Proportioning of Components, 28032025 Analysis & Structural Design of Slab, Analysis of Main Girder Using Courbon’s Method for IRC Class AA, Tracked vehicle, Calculations of Pre-stressing Force, Calculations of Stresses, Cable profile, Design of End Block, Detailing of Main Girder.

Reference Books *

1. Essentials of Bridge Engineering by Dr. D Johnson Victor , Oxford & IBH Publishing Co New Delhi
2. Design of Bridges by Dr N Krishna Raju, Oxford & IBH Publishing Co New Delhi
3. References:
4. Principles and Practice of Bridge Engineering by S P Bindra, Dhanpat Rai & Sons New Delhi
5. IRC 6 -1966 Standard Specifications And Course Code Of Practice For Road Bridges Section II Loads and Stresses, The Indian Road Congress New Delhi
6. IRC 21 - 1966 Standard Specifications And Course Code Of Practice For Road Bridges Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
7. IS 456 -2000 Indian Standard Plain and Reinforced Concrete Course Code of Practice (Fourth Revision) BIS New Delhi
8. IS 1343-Indian Standard Pre-stressed Concrete Course Code of Practice BIS New Delhi

Course Outcomes**

After completion of the course student will be able to

CO1: Select a suitable site and bridge type. **Calculate** design parameters for a slab culvert at critical sections as per IRC guidelines, and **outline** the design and detailing procedures required for project implementation.

CO2: Analyze the structural behavior of a box culvert as per IRC provisions to **determine** design parameters. **Design** and **detail** the structural components using standard IS code procedures.

CO3: Apply Pigeaud's and Courbon's Methods to **analyze** T-beam bridges as per IRC standards. **Design** key components to obtain safe dimensions and **evaluate** reinforcement requirements in accordance with IS code guidelines.

CO4: Utilize Courbon's Method to **analyze** prestressed concrete (PSC) bridges as per IRC standards. **Design** structural elements by determining suitable prestressing force values and **ensure** that stress levels comply with codal provisions using IS code procedures.

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	1	2	1					1	3	2	
CO2	3	3	3	2	2	1					1	3	2	
CO3	3	3	3	2	2	1					1	3	2	
CO4	3	3	3	2	2	1					1	3	2	

22UCV622E	GEOMORPHOLOGY	Credits: 03
L:T:P - 0:0:3		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

INTRODUCTION: Introduction to Geomorphology- Definition meaning, nature, development and scope; Basic concepts; Geological Time Scale; Distribution of continents and oceans; Internal structure of the earth.

UNIT–II	10 Hrs.

EARTH MOVEMENTS:

Epierogenic and Orogenic earth movements; Theories of continental drift , plate tectonics, sea floor spreading, Isostasy ,Earthquakes, volcanoes and their distribution.

UNIT–III	10 Hrs.

GEOMORPHIC PROCESSES AND AGENTS:

Constructive and destructive processes: exogenetic and endogenetic processes and agents. Agents of Denudation: River; Drainage patterns, Groundwater, Sea Waves, Wind and Glaciers. Weathering, erosion and mass wasting.

UNIT–IV	10 Hrs.

EVOLUTION OF LANDFORMS:

Meaning, types and factors controlling landforms development. Slope development; concept and types, Concept of Cycle of Erosion–W.M. Davis and W. Penck. Erosional and depositional landforms made by wind, rivers, glaciers and underground water. Application of geomorphology.

Reference Books *

1. Ahmed E. (1985) Geomorphology, Kalyani Publishers, New Delhi.
2. Strahler A.N. (1968) The Earth Sciences, Harper & Row Intl. Edn, New York
3. Thornberry W.D. (1969) Principles of Geomorphology 2nd Edition, Wiley International Edn. & Wiley Eastern Reprints 1984.
4. Verstappen H. (1983) Applied Geomorphology, Geomorphological Surveys for Environmental Development, Elsevier, Amsterdam
5. Woodridge S.W and R.S. Morgan (1991) An Outline of Geomorphology, The Physical Basis of Geography, Orient Longman, Kolkata.
6. Dayal P. (1995) A Text Book of Geomorphology 2nd Edition. Sukla Book/Dept. Patna.
7. Homes A. (1965) Principles of Physical Geology, 3rd Edition, ELBSS Edn.
8. Goudie Anrew et.al. (1981) Geomorphological Techniques, George Allen & Unwin,London.
9. Bloom A.L. (1978) Geomorphology: A Systematic Analysis of Late Cenozoic Landforms Prentice Hall of India, New Delhi.
10. Brunsden D. (1985) Geomorphology in the Service of Man: The Future of Geography, Methnen, U.K.
11. Worcester P.G. (1965), A Text Book of Geomorphology, Can North and 2nd Edition, East West Edn. New Delhi.
12. William D. Thornbury(2004). Principles of Gomorphology, 2nd Edition, CBS Publisher and Distributor Pvt. Ltd, New Delhi
13. Vishwas S. Kale, Avijit Gupta (2018), Introduction to Geomorphology, Universities Press.

Course Outcomes**
After completion of the course student will be able to 1. Define the field of Geomorphology, its basic principles and interior of earth. 2. To outline the mechanism and theories of dynamic nature of the Earth. 3. To illustrate the geomorphic processes, agents and their effects on the earth. 4. To explain the conceptual and dynamic aspects of landform development

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1							2				1		1	
CO2							2				1		2	
CO3							1				1		1	
CO4							1				1		2	

22UCV 623E	Open Channel Flow	Credits: 3
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.

Definition and classification: open vs closed conduit flow, types of open channels: natural and artificial, Types of flow: steady/unsteady, uniform/non-uniform, subcritical/supercritical, Velocity distribution in open channels, Energy and momentum principles, Pressure distribution in open channel flow, Hydraulic radius, hydraulic depth. Numerical Examples

UNIT–II	10 Hrs.

Chezy's equation and Manning's formula Most efficient channel sections (rectangular, trapezoidal, circular) Computation of uniform flow and normal depth Flow resistance and estimation of roughness coefficients Velocity measurement in open channels.

UNIT–III	10 Hrs.

Dynamic equation of gradually varied flow Classification of channel slopes and flow profiles Characteristics of water surface profiles Methods of computation of GVF (direct step, standard step, graphical integration) Practical applications of GVF analysis (e.g., backwater curves)

UNIT–IV	10 Hrs.

Hydraulic jump: types, characteristics, energy dissipation Flow over spillways, sluice gates, and weirs Critical flow concepts: critical depth and critical velocity Specific energy and specific force concepts Surges and moving hydraulic jumps Introduction to flow transitions and control structures

Text Books *

1. Open Channel Flow" by F.M. Henderson- Macmillan
2. Open Channel Hydraulics" by Terry W. Sturm -McGraw-Hill
3. Flow in Open Channels" by K. Subramanya- McGraw-Hill Education (India)
4. Open-Channel Hydraulics" by Ven Te Chow -McGraw-Hill Education

REFERENCE BOOKS**

1. "Hydraulics of Open Channel Flow" by Hubert Chanson.
2. "Fluid Mechanics with Engineering Applications" by Finnemore & Franzini

Course Outcomes**

After completion of the course student will be able to

1. Explain the characteristics and classifications of open channel flows.

2. Apply hydraulic principles to compute uniform flow and design efficient channel sections.

3. Analyze gradually varied flows using differential equations and numerical methods.

4. Evaluate rapidly varied flow phenomena and design hydraulic structures like weirs and spillways.

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2			2	1					1		2	
CO2	3	2	3		3	2							2	
CO3	3	3	2	2	3						1		2	
CO4	3	3	3	2	3	2				1	1		2	

22UCV624E	MATRIX METHODS OF STRUCTURAL ANALYSIS	Credits: 03
L:T:P-3: 0:0		CIE Marks:50
Total Hours/Week:3		SEE Marks:50

UNIT-I	10 Hrs.
Definitions and Concepts: Comparison of classical, matrix and approximate methods of structural analysis, System approach versus Element approach, degrees of freedom, coordinate systems, stiffness and flexibility coefficients, Flexibility and stiffness methods. Flexibility Method: Introduction, element flexibility matrix, Principle of contragradience, construction of member and structure flexibility matrix, determination of member forces. Procedure for analysis of indeterminate structures: analysis of continuous beams and plane frames.	
UNIT–II	10 Hrs.
Flexibility Method Continued: Analysis of indeterminate structures: analysis of plane trusses.Stiffness Method: Introduction, element stiffness matrix, Principle of contragradience, construction of member and structure stiffness matrix, determination of member displacements. Procedure for analysis of indeterminate structures: continuous beams.	
UNIT–III	10 Hrs.
Stiffness Method continued: Analysis of indeterminate structures: plane frames and Plane trusses.	
UNIT–IV	10 Hrs.
Direct Stiffness Method: Introduction, transformation of variables, transformation of stiffness matrix for member of truss and continuous beams. Global stiffness matrix, Boundary conditions, computation of internal forces, analysis of plane trusses and continuous beams.	

Reference Books *

1. S. Rajasekaran and G. Sankarasubramanian - Computational Structural Mechanics, PHI Learning, 2023.
2. Kassimali Aslam – Matrix Analysis of Structures, Cengage Learning Custom Publishing, Boston USA, 2011.
3. William Weaver Jr. and James M. Gere– Matrix Analysis of Framed Structures, CBS Publishers and distributors, New Delhi, 2018.
4. Neville A M and Ghali A- Structural Analysis: A Unified Classical and Matrix Approach, CRC Press, 2009.

Course Outcomes**

CO1: *Explain* the definitions, basic concepts, and differences between classical and matrix methods, including force and displacement methods, as well as system and element approaches. *Analyze* and *evaluate* member forces for continuous beams and plane frames using the force transformation method.
CO2: *Apply* the flexibility matrix method to determine member forces in trusses. *Explain* the fundamental concepts related to the stiffness matrix method. *Evaluate* member forces for continuous beams using the displacement transformation method.
CO3: *Apply* the displacement transformation method to *analyze* and *evaluate* member forces in plane frames and trusses.
CO4: *Illustrate* the core concepts of the direct stiffness method. *Apply* the method to *evaluate* member forces in plane trusses and continuous beams.

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2								2	2	3
CO2	3	3	2	2								2	2	3
CO3	3	3	2	2								2	2	3
CO4	3	3	2	2								2	2	3

22CV613E	DESIGN AND CONSTRUCTION OF HIGHWAY PAVEMENTS	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	10Hrs.

Introduction and Subgrade Materials: Overview of highway - Classification of roads, Pavement Layers – Components and Functions, Highway alignment and Survey, road development in India, Components and Geometric Standards of Highway Design

Pavement subgrade material: Soils, Soil Characteristic Evaluation, desirable properties, tests (Virtual) - Liquid Limit, Plastic limit, Shrinkage Limit, Grain size analysis - Wet sieve and Hydrometer analysis, Water Content, Specific gravity, Free swell index, Relative density, Heavy compaction, California Bearing Ratio

UNIT–II	10 Hrs.

Pavement Materials Stone aggregates: Desirable properties, tests (Virtual) - Sieve analysis, Specific gravity, Water absorption, Bulk density, Wet Sieve analysis, Aggregate crushing value, Aggregate impact value, Combined Flakiness and Elongation index, Aggregate abrasion value, Soundness of aggregate, Characteristic evaluation

Bituminous binders: Desirable properties, tests (Virtual) - Specific gravity, Penetration, Softening Point, Ductility, Elastic recovery, Flash point, Separation, Loss on heating, Matter soluble in trichloro ethylene, Absolute, Kinematic and Rotational Viscosity, Aging of Bitumen, Characteristic evaluation. Bituminous paving mix: Desirable properties, tests (Virtual) - Stripping value of coarse aggregate, Stone polishing value of coarse aggregate, Maximum specific gravity of bituminous mix, Marshall stability & flow, Binder content, Bulk specific gravity and density, Indirect tensile strength, Resilient Modulus (indirect tension test), Resistance of compacted asphalt mixtures to moisture-induced damage, Characteristic evaluation

Cement: Desirable properties, tests (Virtual) - Consistency, Initial Setting Time, Final Setting Time, Mortar Cube compressive strength, Fineness of cement, Specific gravity of cement, Soundness of cement, Characteristic evaluation

Concrete: Desirable properties, requirements, tests (Virtual) - Workability, Compressive Strength, Flexural strength, Characteristic evaluation

UNIT–III	10 Hrs.

Principles and Design of Pavements

Flexible Pavement: Introduction, composition, factors governing design, design of flexible pavements as per IRC; Bituminous mix design (Marshall method), IIT Pave Software; Case study - Design Problem

Rigid pavement: Introduction, composition, factors governing design, DLC and PQC mix design;
design of concrete pavements as per IRC; Joints; Case study-Design problem

Plants and Machinery: Introduction; Asphalt Hot Mix Plant, Concrete Batching Plant, Wet Mix Macadam Plant, Earthmoving and Excavation Equipment, Paving Equipment, Slipform Paver, Paver Milling and Road Marking Equipment; Factors affecting output of Plant & Equipment; Initiatives to improve quality

Construction Planning: Concept of Highways, Planning; Schedules in Planning; Monitoring; Software in Planning

UNIT–IV	10 Hrs.

Subgrade and Base Layer: Construction Practices and Quality Control; Granular Sub-base Construction Activities; Cement Treated Sub-base Construction Activities

Flexible Layers: Wet Mix Macadam; Construction Practices of Wet Mix Macadam; Hot Mix Asphalt; Construction Practices of Hot Mix Asphalt Layer, Quality Control of Flexible Layers

Rigid Layers: Dry Lean Concrete; Construction Practices of Dry Lean Concrete; Pavement Quality Concrete; Construction Practices of Pavement Quality Concrete, Quality Control of Rigid Layers

Pavement Evaluation: Introduction, Pavement Condition Survey, Pavement Evaluation Functional and Structural, Distresses - Flexible and Rigid Pavement, Overlay Design of Flexible Pavement.

Reference Books *

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2. Partha Chakraborty, “Principles of Transportation Engineering”, PHI Learning,
3. Principles and Practices of Highway Engineering by Kadiyali L.R and Dr.Lal N.B., Khanna Publishers, New Delhi, 2003
4. Relevant IRC and IS Codes of Practices, MoRTH Specification

Course Outcomes**

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

1. Develop an understanding of the fundamentals of pavement layer behaviour.
2. Comprehend the material specifications by interpreting the relationship between material properties and pavement behaviour.
3. Conduct different tests on road construction materials to evaluate their characteristics
4. Carry out the design of flexible and rigid pavements Acquire skilful knowledge of pavement construction practices, plant and machinery selection and quality control

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1			1	**1**				1			1	1	1		
CO2	1				1				1			1		1	
CO3			1			1	**1**	1			1	1	1		1
CO4	1		1	**1**				1		1		1		1	

22UCV626E	Industrial Wastewater Treatment	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week:03		SEE Marks:50

UNIT-I	10 Hrs.
Effects of industrial waste water on receiving water bodies, Effect of organic wastes on the DO profile of the stream, Streeter Phelps model, oxygen sag curve and numerical there upon. Receiving water quality protection measures – receiving water quality standards and stream quality control, Sample-Grab, composite and integrated samples, stream sampling. Economics of industrial waste water treatment systems primary/secondary benefits, intangible benefits, Quantification of benefits, Relationship of treatment cost to benefits.	
UNIT–II	**10 Hrs.**
Waste minimizing techniques– Volume reduction, Strength reduction, Neutralization, Equalization and Proportioning, Removal of suspended, colloidal, inorganic and organic dissolved solids. Treatment and disposal of sludge solids, Sludge characteristics, Sludge volume and solids content relationship	
UNIT–III	**10 Hrs.**
Manufacturing process, waste water characteristics, treatment and disposal of waste water of following industries: Dairy, Distillery, Sugar, Textile, Paper and pulp, Pharmaceutical, Fertilizer.	
UNIT–IV	**10 Hrs.**
Effects of industrial waste water on sewage treatment plants, Limiting values for discharge into municipal sewer systems, Joint treatment of industrial and domestic waste water, Membrane filter, electro dialysis and bioremediation techniques of waste water treatment. Radioactive waste treatment, Environmental auditing, Regulatory norms for waste water treatment, present scenario of waste water treatment in India	

Reference Books *

1. Nemerow N. N., Liquid waste of industry theories, practices and treatment, Addison Willey, New York, 1971.
2. Azad N. S., Industrial waste water management handbook, Mc Graw Hill book, co. New York.
3. Ross R. D., Industrial waste disposal, Reinhold environmental series, New York, 1968
4. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill, 1999.

Course Outcomes**

Students will be able to

1. Assess the impact of industrial waste discharges on the water quality of stream and take the necessary measures to protect the water quality.
2. Analyze the economics of industrial wastewater treatment vis -a- vis water quality of the stream for its best designated uses.
3. Implement the modern technical tools like waste minimization, strength reduction etc, in efficient and cost-effective practice.
4. Demonstrate the understanding of green environment and practicing the environmentally friendly processes for the manufacture of various industrial products and also implementing the state-of-art technologies for wastewater treatment.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	1	2	2	
CO2	3	2	3	-	2	1	-	-	-	-	-	1	2	2	
CO3	3	2	3	-	3	-	-	-	1	-	-	1	2	2	
CO4	2	1	1	-	2	1	-	-	1	-	-	1	2	2	

22UCV627E	Traffic Engineering	Credits: 3
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	10 Hrs.
Introduction: Definition-Objective Scope of Traffic Engineering. Road User and Vehicle Characteristics Static and Dynamic characteristics- Power performance of vehicles- Resistances to the motion of vehicles- Reaction time of driver- Problems of above	
UNIT–II	**10 Hrs.**
Traffic Parameter Studies and Analysis: Various types of traffic engineering studies, data collection, Objectives and Method of study. Definition of study area- Sample size- Data Collection and Analysis- Interpretation of following Traffic Studies- Volume, Spot Speed study, presentation of spot speed data problems on spot speed, Speed and Delay study Origin and Destination. Parking-on Street and off Street Parking, Accidents-Causes, Analysis (collision with parked vehicle only) Measures to reduce Accident,	
UNIT–III	**10 Hrs.**
Traffic Flow Theories: Traffic flow theory Green shield theory Goodness of fit correlation and regression analysis (linear only)- Queuing theory Car following theory relevant Problems on above. Traffic Regulation- Driver, Vehicle and Road controls- Traffic Regulations- One Way- Traffic Signs- Traffic Markings-Canalization, Classified traffic volume at intersections, PCU, Traffic Rotary elements, analysis of capacity of rotary.	
UNIT–IV	**10 Hrs.**
Traffic Control: Traffic operation Traffic Signals-Vehicle actuated and synchronized signals Signal Coordination – Intelligent Transport system- Webster's method of signal Design, IRC Method, Street lighting Road Side Furniture.	

Reference Books *

1. Khanna and Justo., "Highway Engineering" Nemchand Bros
2. L.R. Kadiyali., " Traffic Engineering and Transport Plankling". Khann Publisher.
3. Matson, Smith and Hurd.," Traffic Engineering ", McGraw Hill and Co
4. Traffic flow theory Drew McGraw Hill Co.,

REFERENCE BOOKS:

1. Pignataro.," Traffic Engineering"., Prentice Hall
2. Highway capacity Manual-2000
3. An Introduction to Transportation Engineering, Jotin Khistey and Kent Lall, PHI.
4. Traffic Engineering-Mc Shane and Roess, PHI

Course Outcomes**

After completion of the course student will be able to

1. Able to analyze the vehicles behavior and reaction time of driver

2. Able to interpret the traffic data in analyzing different vehicular speeds.
Able to provide different parking facilities and analyze the accidents and give the remedial measures

3. Understand the traffic flow behavior able to design rotary and channelization

4. Design the signals by different methods and understands ITS

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	-	3		
CO2	3	2	3	-	2	1	-	-	-	-	-	-		2	
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	1			2

22UCV628E	Ground Improvement Techniques	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	10 Hrs.

Introduction: Principles and objectives of ground improvement and History of ground improvement developments. Classification of ground improvement techniques, Factors affecting ground improvement.
Mechanical modification: Mechanical modification method of ground improvement; Theory of compaction, moisture-density relationship, optimum moisture content and maximum dry density; Laboratory compaction test using Proctor's mould and modified Proctor Mould, Factors affecting compaction .

UNIT–II	10 Hrs.

Field compaction: Dead weight surcharge for compaction;; Equipment for field compaction: smooth wheel rollers, pneumatic rollers, sheep foot rollers, grid rollers, Power rammers. Role of vibrations in dynamic compaction; Dynamic Field Compaction Equipment: Impact type of compaction, Vibratory rollers, Vibratory pneumatic tyre, compaction piles, vibroflotation, vibratory probes, compaction sand columns and sand piles, underground blasts. Specifications for field compaction
Hyd. Modification: Preloading by lowering ground water table, Filters, Control of ground water seepage, Sand drains and wick drains, Well point system, Vertical drains, Electrosmosis and its application in ground improvement.

UNIT–III	10 Hrs.

Chemical modification: Factors affecting chemical modification, Lime stabilization, Cement stabilization, Bitumen stabilization, Chemical Stabilization, Methods of construction- mix in place method, traveling plant and stationary plant methods.
Grouting: Factors affecting grouting, Grout ability, Grouting materials and their properties, Pressure grouting, Compaction grouting, Grouting procedures, Applications of grouting

UNIT–IV	10 Hrs.

Applications of Geosynthetics for ground improvement Miscellaneous: Rock cutting, anchoring, heating, soil nailing.

Reference Books *

1. Purushothama Raj., Ground Improvement Techniques, Laxmi Publications Pvt Ltd, 2nd edition, 2016
2. Manfired R.H. (1990), Engineering Principles of Ground Modification, McGraw-Hill Pub.
3. Koerner R M., Construction and Geotechnical Methods in Foundation Engineering, McGraw-Hill Pub Co New York, 1985.
4. Hausmann, M R, Engineering Principles of Ground Modifications, McGraw Hill Pub NewYork, 1990.
5. Ingles O G and Metcalf J B., Soil Stabilisation: Principles and practice, Butterworths, London, 1972.
6. Nelson J D and Miller D J., Expansive soils, John Wiley and sons. Inc new, 1992.

Course Outcomes**

After completion of the course student will be able to

1. perform the laboratory tests to determine compaction properties and characterize problematic soils
2. improve the properties of soil in field by mechanical techniques like blasting, vibro compaction, dynamic tamping, compaction piles etc… and Describe various dewatering methods with various hydraulic ground modification techniques.
3. explore the concept of soil chemical modification techniques and method of grouting
4. recognize the need for Soil reinforcement technique like reinforcement with strip, in-situ ground reinforcement, ground anchors and soil nailing etc… and geosynthetics

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2		-	-	-	-	-	-	3	-	3	-
CO2	3	3	2		-	-	-	-	-	-	2	-	3	-
CO3	3	3	2		-	-	-	-	-	-	2	-	3	-
CO4	3	1	2		-	-	-	-	-	-	2	-	3	-

22UCV631N	Occupational Safety and Health	Credits: 03
L:T:P – 3:0:0		CIE Marks:50
Total Hours/Week: xx		SEE Marks:50

UNIT-I	10 Hrs.
Introduction - History and Development, Occupational Safety and Health Act. Occupational Safety and Health Administration, Right to know Laws. Accident Causation-Need for Accident Investigation, Accident investigation plan, Methods of acquiring Accident Facts, Correcting Missing Skills, Investigator Tendencies and Characteristics, Supervisory Rolein Accident investigation. Human Error Model, Petersew's Model, Epidemiological Models. Ergonomics- Ergonomics at workplace, Ergonomic Task Analysis, Preventing Ergonomic Hazards, Setting up of Ergonomics Programme.	
UNIT–II	**10 Hrs.**
Occupational Hazard and Control- Hazard Analysis, Human Error Analysis in Causation with Hazard Analysis, Fault Tree Analysis, Emergency Response. Decision for Action, Purpose and Considerations, Right Decision, Wrong Remedy, Hazard Control Measures, Hazards and their Control in Pharmaceutical, Construction, Textiles, Petroleum Refineries and LPG Bottling, Iron and Steel industries	
UNIT–III	**10 Hrs.**
Fire prevention and Protection- Fire Development and its Severity effects. Enclosure, need for early Detection of Fire, Extinguishing Fire Electrical Safety Product Safety, Technical Requirements of Product Safety Programme. Environmental Safety and ISO 14000 ISO series of standards, ISO14001Standards, Environmental Management systems. (EMS) Total quality Management (TQM) and Total safety Management (TSM).	
UNIT–IV	**10 Hrs.**
Occupational Health-Health and Safety Considerations, Personal Protective Equipment's, Effects of Exposure and Treatment for Metal Working Trades, Municipal Solid Waste, Epoxy Resins, Foundries. Occupational Health and Safety Considerations in Wastewater Treatment Plants.	

Reference Books *

1. Nemerow N. N., Liquid waste of industry theories, practices and treatment, Addison Willey, New York, 1971.
2. Azad N. S., Industrial waste water management handbook, Mc Graw Hill book, co. New York.
3. Ross R. D., Industrial waste disposal, Reinhold environmental series, New York, 1968
4. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 1999.

Course Outcomes**

1. Design policies and regulations for the development and maintenance of a healthy and safe work environment.
2. Interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces and apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.
3.Analyse the change by advancing OH&S principles within management systems, cultures, practices, and priorities.
4. Construct the Occupational Health and Safety Considerations in Wastewater Treatment Plants.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	1	2	2	
CO2	3	2	3	-	2	1	-	-	-	-	-	1	2	2	
CO3	3	2	3	-	3	-	-	-	1	-	-	1	2	2	
CO4	2	1	1	-	2	1	-	-	1	-	-	1	2	2	

22UCV532N	Geographic Information Systems	Credits:3
L:T:P-3: 0: 0		CIEMarks:50
Total Hours/Week:4		SEEMarks:50

UNIT-I	10Hrs.

Basics: Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, Types of reflections, Energy Interactions with earth atmosphere and surface features, spectral reflectance curves-For Vegetation, soil & water, Idealized Remote Sensing System

Sensors: Definition, Sensor Parameters, Types, Choice of sensor, Optical Remote Sensing, Across and Along track scanning systems.

Platforms: Definition, Space borne platform attitudes (only definitions, No Problems).

Indian Remote Sensing Programme: Definition and Objectives

Satellite Specifications for IRS-1C, 1D, CARTOSAT-1 & CARTOSAT-2 - Ikonos, Quick bird, RISAT

UNIT–II	10Hrs.

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation.

Digital Image Processing (DIP):(No problems/programming on DIP) Definition, Image Rectification & Restoration, image enhancement (contrast manipulation-Grey Level Thresholding, Level Slicing only), Supervised Image Classification using minimum distance to means classifier algorithm- GIS integration –stages & procedure., Image Filtering (spatial filters) -Low Pass and High pass image filters.(Brief discussion only, no problems or programming)

Applications of REMOTE sensing in urban applications and water resource management

UNIT–III	10Hrs.

Maps and Projections : Map Projections Plane and geodetic , latitude and longitude map projections, types of map projections Spheroid, Datum (WGS84 Datum) and UTM (No Problems)

GIS: History, Definition, Components, concept, Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing, Storage and Output.

GIS functions in vector and raster data- Input, Analysis and out put

GIS Analysis (**Vector Data-** Buffering & Overlay analysis using overlay operators)

GIS Analysis **(Raster Data**-Local Operations and neighborhood using arithmetic, Logical and Overlay operators)

Cartography-Definition, basic map layout, significance of cartography

Data Standards in GIS errors, precision and accuracy-Definition and Types

UNIT–IV	10Hrs.

Advanced Concepts: GPS.- Definition, working principle, segments and uses (Brief Discussion only)

Drones- Classification of drones, Basics of drones part, basics of drone surveying, Property mapping using drones

Applications of GIS and Remote Sensing:

1**)** Identifying suitable site for urban development

2) Ground water Vulnerability assessment.

Reference Books *

TEXT BOOKS:

1.Thomas.M.LILLYSAND & RALPH.W.KEIFER, "REMOTE SENSING & IMAGE INTERPRETATION" –-7TH EDITION, Weiley INDIA Publications, New Delhi, August 8, 2015

2.Basudeb.BHATTA, "REMOTE SENSING AND GIS", -2nd edition", Oxford press publications, 2011.

3.M. ANGIREDDY , " TEXTBOOK OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS", 3rd EDITION, B.S.Publications, Hyderabad, January 1 2005, Telangana, India. ISBN:978-81-7800-135-7.

4.C.P.LO ALBERT .K.W.YEUNG ,"Concepts and Techniques in GEOGRAPHIC INFORMATION SYSTEMS", 2nd

REFERENCE BOOKS

1.George Joseph, "Fundamentals of Remote Sensing", 2nd edition, University press, Hyderabad, 2005.

2.Micheal.F.Goodchild, Paul.A.Longely, "Geographic Information Science and Systems", 4th edition, Wieley publications, April 24/2015.

3. S.Kumar, "Basics of Remote Sensing and GIS", 2nd Edition, Laxmi Publications, New Delhi, January 1/2016.

WEB SITES

1. WWW.GISDEVELOPMENT.NET
2. WWW.JSYS.ORG
3. WWW.NRSC.GOV.IN

NPTEL NOTES, IIRS NOTES

Learning Objectives*

1. Acquire knowledge of Basics of remote sensing, its need and advantages in civil engineering , method of acquiring satellite images, ISRO satellite launch programs (This will be useful in choicing the type of satellite image for a particular application in civil engineering works)
2. To apply the concept of Remote Sensing for engineering planning purposes
3. Analyse the application of GIS and modern tools like GPS for quantification of parameters needed for Infrastructure planning purposes.
4. Assess the utility of GIS and RS for real time engineering application with case studies.

After Learning the Course, the student will be able to

1.Differenciate the procedure of data acquisition between remote sensing and conventional methods

2.Apply the concept of remote sensing to asses the ground properties of a region and quantify the ground properties.

3. Choice the tools and techniques needed for generation of quantified data required for engineering and infrastructure planning purposes.

4. Assess, the application RS and GIS techniques for real time engineering applications**.**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	1	1	-	-	-	-	-	-	2	2	2
CO 2	3	3	2	1	2	2	-	-	-	-	-	-	2	2	2
CO 3	3	3	2	2	2	3	-	-	-	-	-	-	2	2	2
CO 4	3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
Average	**3**	**2.5**	**2**	**1.5**	**1.75**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

22UCV633N	Public Health Engineering	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction: Water: Need for protected water supply, Demand of Water: Types of water demands – domestic demand, industrial, institutional and commercial demand, public use and fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor. Numericals

Design period and factors governing design period. Methods of population forecasting and numerical problems. Physico-chemical characteristics of water ,Numerical

UNIT–II	10 Hrs.

Water Treatment: Objectives, Unit flow diagrams – significance of each unit, Aeration process Limitations and types, Sedimentation – Theory, settling tanks, types and design with numericals, Coagulation and flocculation, types of coagulants, Filtration: mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation and cleaning. Design of slow and rapid sand filter without under drainage system Numericals

UNIT–III	10Hrs.

Disinfection: Methods of disinfection with merits and demerits. Breakpoint of chlorination Softening: Lime soda and Zeolite process. Wastewater: Introduction: Need for sanitation, methods of sewage disposal, types of sewerage systems, Treatment of municipal wastewater: Wastewater characteristics sampling, significance and techniques, physical, chemical and biological characteristics, Numericals on BOD

UNIT–IV	10 Hrs.

Treatment Process: flow diagram for municipal wastewater treatment unit operations and process Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks (no numerical), Suspended growth system – conventional activated sludge process and its modifications

Reference Books *

- Howard S. Peavy, Donald R. Rowe, George T, “Environmental Engineering” - Tata McGraw Hill, New York, Indian Edition, 2013
- S. K. Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010
- B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.
- B C Punmia, “Environmental Engineering vol-II”, Laxmi Publications 2nd, 2016
- Karia G.L., and Christian R.A, “Wastewater Treatment Concepts and Design Approach” , Prentice Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
- S.K.Garg, “Environmental Engineering vol-II, Water supply Engineering”, Khanna Publishers, – New Delhi, 28th edition and 2017

Course outcomes:

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

CO1 Estimate average and peak water demand for a community.

CO2 Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.

CO3 Design the different units of water treatment plant

CO4 Understand and design the various units of wastewater treatment plant

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	1	2	1								1	1	2		
CO 2	1	1	2								2	1	2		
CO 3	1	2	1								1	1	2		
CO 4	1	1	1								2	1	2		

22UCV634N	DISASTER MANAGEMENT AND MITIGATION	Credits: 3
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	08 Hrs.
Introduction: Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency, capacity, impact, prevention, mitigation. India's natural disaster proneness and disaster prone zones .	
UNIT–II	**10 Hrs.**
Disasters classification: Natural disasters (floods, draughts, cyclones, volcanoes, earthquakes, tsunamis. Landslides etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, transportation accidents, terrorist strikes, etc.)	
UNIT–III	**10 Hrs.**
Disaster Impacts and Mitigation measures: Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters; mitigation measures and case studies of common disasters .	
UNIT–IV	**12 Hrs.**
Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Importance of disaster education and community awareness and preparedness in disaster management. Roles and responsibilities of citizens, technology, media, community, government and non-government organizations in disaster management; Policies and legislation for disaster risk reduction; Disaster management system in India.	

Reference Books *

1. R. Subramanian, 2021, Disaster Management, Vikas publishing house Pvt. Ltd., Noida, India.
2. A.K. Srivastava, 2021, Text book of Disaster Management, Scientific publishers, India.
3. Tushar Bhattacharya, 2012,Disaster science and Management, Tata McGraw Hill publications, New Delhi, India.
4. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
5. Singh B.K., 2008, Handbook of Disaster Management: Techniques and Guidelines, RajatPublication.
6. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.
7. Jagbir Singh, 2007, Disaster Management, I.K International Publishing House, New Delhi.
8. Vinod.K.Sharma, 2013,Disaster Management, second Edn., Scientific International Pvt. Ltd., New Delhi,India.
9. Carter.W.Nick, 1991, Disaster Management: A Disaster Manager's Hand book, Asia Development Bank, Manila.
10. Government of India website on Disaster Management : www.ndmindia.nic.in

Course Outcomes**

After completion of the course student will be able to:

CO1: Explain the concepts of disaster management and disaster profile of India.

CO2: Categorize the disasters and their causes

CO3: Predict the various impacts of disasters and their mitigation measures.

CO4: Evaluate the significance of disaster management cycle along with role of various government and non-government organizations in disaster risk reduction.

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1						1	1				1		2	
CO2						1	1				1		2	
CO3						2	2						2	
CO4							1		1	1			2	

22UCV621E	Sustainable Development Goals	Credits: 3
L:T:P -3: 0: 0		CIE Marks: 50
Total Hours/Week:3		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction to Sustainable Development and SDGs: Concept and evolution of sustainable development, Need for sustainability in engineering and infrastructure, Overview of the United Nations Sustainable Development Goals (UN SDGs Relevance of SDGs in India and in the Civil Engineering domain, SDG integration in urban planning, transportation, water, and housing. Role of civil engineers in achieving sustainability

UNIT–II	10 Hrs.

SDGs and Infrastructure Development: Infrastructure and its impact on social, economic, and environmental aspects. Sustainable infrastructure principles and Green buildings, Sustainable transportation systems. Affordable and resilient housing (Pradhan Mantri Awas Yojana), smart cities and SDG implementation

UNIT–III	10Hrs.

Sustainable Development in Construction: Recycled and reused materials. Bio-based materials: bamboo, hempcrete, mycelium, etc. Low-carbon concrete and geopolymer cement. Energy-efficient insulation materials. Stages of Life Cycle Assessment (LCA): extraction, production, transportation, use, disposal. Affordable and resilient materials for sustainable housing.

UNIT–IV	10 Hrs.

Environmental Sustainability and Climate Action: SDG 13: Climate Action – Civil engineering role in mitigation and adaptation, Sustainable construction practices (low carbon footprint, waste reduction, recycling). Environmental Impact Assessment (EIA) and Life Cycle Assessment (LCA). Role of civil engineers in reducing urban heat islands, air and noise pollution. Disaster-resilient infrastructure (SDG 11 and SDG 13 linkage). Role of policy, public participation, and governance

Reference Books*

1. Civil and Environmental Engineering for the Sustainable Development Goals: Emerging Issues, Manuela Antonelli & Gabriele Della Vecchia (Springer, 2022)
2. Civil Engineering Innovations for Sustainable Communities with Net-Zero Targets, Sreevalsa Kolathayar et al. (Taylor & Francis, 2024)
3. Sustainable Civil Engineering: Principles and Applications, Varinder Kanwar, Sanjay K. Shukla & Siby John (Taylor & Francis, 2023)
4. An Introduction to Sustainable Development, Peter P. Rogers, Kazi F. Jalal & John A. Boyd (Earthscan, 2007)
5. The Role of Civil Engineering in Achieving UN SDGs, chapter in Advances in Sustainable Materials and Resilient Infrastructure (Springer, 2022)
6. Engineering for Sustainable Development: Delivering on the SDGs (UNESCO) – An interdisciplinary engineering-policy guide

Course Outcomes**(Students will be able to…)

CO1: Explain the concept of sustainable development and **illustrate** the relevance of the United Nations Sustainable Development Goals (SDGs) in civil engineering practices.

CO2: Analyze the sustainability aspects of civil infrastructure such as transportation, housing, and urban development in alignment with SDG targets.

CO3: Evaluate the sustainability potential of recycled, bio-based, and low-carbon construction materials by applying Life Cycle Assessment (LCA) principles to recommend affordable and resilient solutions for sustainable housing.

CO4: Apply environmental and climate-responsive strategies in civil engineering projects to promote sustainable construction, disaster resilience, and reduced ecological footprint.

COs	Programme Outcomes (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1				2	3					2			3
CO2	2	3	2	2	2	2	3					2			3
CO3	2	3	3	2	2	2	3					2			3
CO4	2	2	3	2	2	2	3					2			3
Average	**2**	**2.25**	**2**	**2**	**2**	**2**	**3**					**2**			**3**