B.Tech. III Year I Semester (DR24) - Civil Engineering

S.No.	Category	Title	Subject code	L	T	P	Credits
1	Professional Core	Design and Drawing of Reinforced Concrete Structures	BT24CE3101	3	0	0	3
2	Professional Core	Engineering Hydrology	BT24CE3102	3	0	0	3
3	Professional Core	Geotechnical Engineering -I	BT24CE3103	3	0	0	3
4	Professional Elective-I	1. Advanced structural analysis 2. Architecture and town planning 3. Construction Technology and Management	BT24CE31P1A BT24CE31P1B BT24CE31P1C	3	0	0	3
5	Open Elective-I	Entrepreneurship Development & Venture Creation OR 1.Green Buildings 2.Construction technology and management 3. Climate Change impact on Eco system	BT24HS3101 BT24CE31O1A BT24CE31O1B BT24CE31O1C	3	0	0	3
6	Professional Core	Geotechnical Engineering Lab	BT24CE3104	0	0	3	1.5
7	Professional Core	Fluid Mechanics & Hydraulic Machines Lab	BT24CE3105	0	0	3	1.5
8	Skill Enhancement course	Estimation, Specifications & Contracts	BT24CE3106	0	1	2	2
9	Engineering Science	Tinkering Lab	BT24CE3107	0	0	2	1
10	Evaluation of Community Service Internship	Community Service Internship	BT24BS3101	-	-	-	2
Total				**15**	**1**	**10**	**23**

B.Tech. III Year II Semester (DR24) - Civil Engineering

S.No	Category	Title	Subject code	L	T	P	Credits
1	Professional Core	Design and Drawing of Steel Structures	BT24CE3201	3	0	0	3
2	Professional Core	Highway Engineering	BT24CE3202	3	0	0	3
3	Professional Core	Environmental Engineering	BT24CE3203	3	0	0	3
4	Professional Elective-II	1. Ground Improvement Techniques 2. Repair and Rehabilitation of Structures 3 Valuation and Quantity Survey	BT24CE32P2A BT24CE32P2B BT24CE32P2C	3	0	0	3
5	Professional Elective-III	1. Finite element method 2. Bridge Engineering 3. Water Resource Engineering	BT24CE32P3A BT24CE32P3B BT24CE32P3C	3	0	0	3
6	Open Elective-II	1.Disaster management 2.Sustainability in Engineering practices 3.Water Supply Systems	BT24CE32O2A BT24CE32O2B BT24CE32O2C	3	0	0	3
7	Professional Core	Environmental Engineering lab	BT24CE3204	0	0	3	1.5
8	Professional Core	Highway Engineering lab	BT24CE3205	0	0	3	1.5
9	Skill Enhancement course	CAD Lab	BT24CE3206	0	1	2	2
10	Audit course	Technical paper writing & IPR	BT24HS3201	2	0	0	-
Total				**20**	**1**	**08**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation							

OPEN ELECTIVES

S.NO	Category	Titles
1	Open Elective -1	1.Green Buildings 2.Construction technology and anagement 3. Climate Change impact on Eco system
2	Open Elective-2	1.Disater management 2.Sustainability in Engineering practices 3.Water Supply Systems
3	Open Elective-3	1.Building technology for engineers 2.Environmental impact assessment
4	Open Elective-4	1.Geo-Spatial Technologies 2. Solid waste management

Honors Degree courses

1. Introduction to Earthquake Engineering
2. Structural dynamics
3. Traffic Engineering and Management
4. Advanced Hydrology
5. Geosynthetics Engineering: In theory and practice
6. Environmental Geotechnics
7. Seismic Analysis of Structures
8. Environmental Air Pollution
9. Soil Dynamics
10. Advanced Transportation Engineering

Minors Degree courses

1. Surveying
2. Mechanics of solids
3. Soil Mechanics
4. Fluid Mechanics
5. Civil Engineering- Building Materials and Construction
6. Building Planning and drawing
7. Estimation and Costing
8. Sustainable Materials and Green building
9. Safety in Construction
10. Construction planning and Management

Note: Students can opt any course in Honors and Minors through NPTEL/MOOCs/JNTUK, Kakinada University approved courses.

UG - Civil Engineering Programme
III Year I Semester
Detailed Syllabus

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3101		3	0	0	3
DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES							

Course Learning Objectives:

The objective of this course is:

1. Familiarize Students with different types of design philosophies.
2. Equip student with concepts of design of flexural members.
3. Understand Concepts of shear, bond and torsion.
4. Familiarize students with different types of compressions members and Design.
5. Understand different types of footings and their design.

Course Outcomes:

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

1. Work on different types of design philosophies
2. Carryout analysis and design of flexural members and detailing
3. Design structures subjected to shear, bond and torsion.
4. Design different type of compression members and footings
5. Design of slabs and stair case
6. Design of one way and two-way slabs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	1	–	1	–	–	2	2
CO2	3	3	3	2	1	–	1	–	–	2	2
CO3	3	3	3	2	1	–	1	–	–	3	3
CO4	3	3	3	2	1	–	1	–	–	2	3
CO5	3	3	3	1	2	–	1	–	–	1	3
CO6	3	2	3	1	2	–	1	–	–	2	2

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	2	3
CO4	2	2
CO5	3	2
CO6	3	3

UNIT –I

Introduction: Working stress method Design codes and handbooks, loading standards – Dead, live, wind and earthquake loads, elastic theory, design constants, modular ratio, neutral axis depth and moment of resistance, balanced, under-reinforced and over-reinforced sections, working stress method of design of singly and doubly reinforced beams.

Limit State Design: Concepts of limit state design – Basic statistical principles – Characteristic loads –Characteristic strength – Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

UNIT –II

Design for Flexure: Limit state analysis and design of singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel- Minimum Tension Reinforcement Maximum Flexural Steel- Design of Flanged Sections (T)- Effective width of flange – Behavior- Analysis and Design.

UNIT – III

Design for Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion for L Beam – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing. **Limit state design for serviceability:** Deflection, cracking and code provision.

UNIT – IV

Design of Compression members: Effective length of a column, Design of short and long columns – under axial loads, uniaxial bending and biaxial bending – Braced and un-braced columns – I S Code provisions.

Footings: Different types of footings – Design of isolated footings, Square footings – Rectangular footings – circular footing – spread & sloped footings - subjected to axial loads.

UNIT – V

Slabs: Classification of slabs, design of one - way slabs, two - way slabs, and continuous slabs using IS Coefficients (conventional), design of waist-slab staircase.

NOTE: All the designs to be taught in Limit State Method. Drawing classes must be conducted every week and the Following plates should be prepared by the students.

- Reinforcement detailing of T-beams, L-beams and continuous beams and cantilevers.
- Reinforcement detailing of columns and isolated footings.
- Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

Textbooks:

1. 'Limit State Design' by A. K. Jain
2. 'Reinforced Concrete Structures' by S. Unnikrishna Pillai &Devdas Menon, Tata Mc.Graw Hill, New Delhi.

Reference books:

1. 'Design of concrete structures' by N. Krishna Raju.
2. 'Reinforced Concrete Structures' by Park and Pauley, John Wiley and Sons.

IS Codes:

1. IS -456-2000 (Permitted to use in examination hall)
2. IS – 875, 3(SP-16)

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3102		3	0	0	3
ENGINEERING HYDROLOGY							

Course Learning Objectives:

The course is designed to make the students,

1. Understand hydrologic cycle and its relevance to Civil engineering.
2. Learn physical processes and their interactions in hydrology.
3. Learn measurement and estimation of the components of hydrologic cycle.
4. Have an overview and understanding of Hydrographs.
5. Learn flood frequency analysis, design flood and flood routing methods.
6. Study the concepts of groundwater movement and well hydraulics.

Course Outcomes:

At the end of the course the students are expected to

1. Have a thorough understanding of the theories and principles governing the hydrologic processes.
2. Be able to quantify hydrologic components and apply concepts in hydrologic design of water resources projects.
3. Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
4. Develop design storms and carry out frequency analysis.
5. Estimate flood magnitude and carry out flood routing.
6. Determine aquifer parameters and yield of wells.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	–	–	–	–	–	–	2
CO2	3	3	1	2	–	–	–	–	–	–	3
CO3	3	3	2	2	–	–	–	–	–	–	3
CO4	3	3	3	2	2	–	–	–	–	–	2
CO5	3	3	2	2	3	–	–	–	–	–	3
CO6	3	3	2	2	3	–	–	–	–	–	2

	PSO1	PSO2
CO1	–	–
CO2	2	–
CO3	2	–
CO4	3	2
CO5	3	3
CO6	3	2

UNIT - I

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, introduction to radar measurement of rain fall, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

UNIT-II

Abstractions: Initial abstractions, Evaporation: factors affecting, measurement, estimation, reduction, Evapotranspiration: factors affecting, measurement, estimation, control, Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

UNIT-III

Runoff: Factors affecting runoff, components, empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S hydrograph methods, limitations and applications of unit hydrograph, dimensionless unit hydrograph, synthetic unit hydrograph, introduction to IUH.

UNIT-IV

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management.

Flood Routing: Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

UNIT-V

Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation-steady radial flow to wells in confined and unconfined aquifers, yield of an open well-recuperation test.

Textbooks:

1. 'Engineering Hydrology' by Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013), New Delhi.
2. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
3. 'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt Ltd, (2011), New Delhi.

4. 'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press, (2010).

Reference books:

1. 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2. 'Hydrology' by Raghunath. H.M., New Age International Publishers, (2010)
3. 'Engineering Hydrology – Principles and Practice' by Ponce V.M., Prentice Hall International, (1994)
4. 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications, (2011).

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3103		3	0	0	3
GEOTECHNICAL ENGINEERING– I							

Course Learning Objectives:

The objective of this course is:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

Course Outcomes:

Upon successful completion of this course, student will be able to

1: Understand soil formation, its index properties and classification.

2: Understand soil moisture and flow of water through soils and its effects.

3: Understand stress distribution in soils.

4: Understand Compressibility characteristics under partially saturated and fully saturated conditions.

5: Understand shear strength of soil at different loading & drainage conditions for different oils.

6: Analyse the stress strain of soils with different mechanisms

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	2	–	–	1	–	–	–	3
CO2	3	2	–	2	–	2	2	–	–	–	2
CO3	3	3	–	2	2	2	–	–	–	–	2
CO4	3	3	–	2	2	–	–	–	–	2	3
CO5	3	3	–	2	–	–	–	–	–	2	1
CO6	3	2	-	2	–	–	–	–	–	–	2

	PSO1	PSO2
CO1	3	–
CO2	–	–
CO3	3	–
CO4	–	–
CO5	2	2
CO6	3	2

SYLLABUS:

UNIT – I

Introduction: Soil formation – Structure of Soils – Texture of Soils – Three phase system and phase relationships.

Index Properties and Classification Tests of Soils: Index properties – Density Index - Grain size analysis – Sieve and Hydrometer methods – Consistency of Clay Soils – Activity of Clays – Thixotropy of clays - soil Classification – Unified soil classification and I.S. Soil classification.

UNIT – II

Soil moisture and Capillarity: Soil moisture and modes of occurrence – Total, Neutral and Effective Pressures – Capillary Rise in soils.

Permeability: Flow of water through soils –- One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability –Permeability of layered systems.

UNIT –III

Seepage and Flow Nets: Flow net for one-dimensional flow – two-dimensional flow – Basic equation for Seepage – Flow nets & Characteristics and Uses – Quicksand condition – Seepage forces

Stress Distribution in Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method. - Pressure Blubs.

UNIT – IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

Consolidation: Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (c_v) - Over consolidated and normally consolidated clays.

UNIT - V

Shear Strength of Soils: Basic mechanism of shear strength - Mohr – Coulomb Failure theories – total and effective shear strength parameters – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions – stress paths.

Text books:

1. Soil Mechanics and Foundation Engineering by Dr. K.R. Arora, Standard Publishers and Distributors, New Delhi.
2. Basic and Applied Soil Mechanics' by Gopal Ranjan and A.S.R.Rao, New Age International Publishers.
3. Soil Mechanics and Foundation Engineering' by V.N.S.Murthy ,CBS publishers
4. Geotechnical Engineering' by C. Venkataramaiah, New Age International Publishers.

Reference books:

1. Fundamentals of Soil Mechanics' by D.W.Taylor., Wiley.
2. An introduction to Geotechnical Engineering' by Holtz and Kovacs; Prentice Hall
3. Principles of Geotechnical Engineering, BrajaM.Das, Cengage Learing.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31P1A		3	0	0	3
ADVANCED STRUCTURAL ANALYSIS							

Course Learning Objectives:

1. Understand the concepts of strain energy, energy theorems, and their application to determinate and indeterminate structures.
2. Analyze indeterminate trusses, arches, frames, cables, and suspension bridges using classical and approximate methods.
3. Apply displacement-based methods such as moment distribution, slope deflection, and Kani's method for structural analysis.
4. Interpret structural response through shear force and bending moment diagrams, elastic curves, and evaluate the effects of temperature and support conditions.

Course Outcomes:

At the end of this course; the student will be able to

1. Differentiate Determinate and Indeterminate Structures
2. Carry out lateral Load analysis of structures
3. Analyze Cable and Suspension Bridge structures
4. Analyze structures using Moment Distribution, Kani's Method
5. Analyze structures using Matrix method.
6. Analyze continuous beams using Kani's Method

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	-	-	-	-	-	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-
CO3	2	3	3	2	-	-	-	-	-	-	2
CO4	2	3	1	1	-	-	-	-	-	-	2
CO5	2	3	2	2	-	-	2	-	-	-	1
CO6	2	2	1	2	1	-	2	-	-	-	-

	PSO1	PSO2
CO1	-	-
CO2	3	2
CO3	2	3
CO4	3	2
CO5	2	-
CO6	2	-

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

Indeterminate Trusses: Determination of static and kinematic indeterminacies –
Analysis of trusses having single and two degrees of internal and external indeterminacies – Castigliano's second theorem.

UNIT-II Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels.

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches – (No analytical question)

UNIT-III Approximate Methods of Analyses: Application to building frames. (i) Portal Method (ii) Cantilever Method (iii) Substitute frame method for approximate analysis of multi-storey frames subjected to gravity loads and lateral loads. Shear force and bending moment diagrams - Elastic curve.

UNIT – IV Cable Structures and Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

UNIT – V Moment Distribution Method: Analysis of Portal frames – including Sway- Substitute frame analysis by two cycle. Slope deflection method: Analysis of Portal frames – including Sway. Analysis of inclined frames. Shear force and bending moment diagrams - Elastic curve.

Kani's Method: Analysis of continuous beams–including settlement of supports and single bay portal frames with and without side sway. Shear force and bending moment diagrams - Elastic curve.

Text Books:

1 Structural Analysis by R.C. Hibbeler, Pearson, New Delhi.

2 Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna Publishers, New Delhi.

Reference books:

1. Mechanics of Structures Vol – II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
2. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31P1B		3	0	0	3
ARCHITECTURE AND TOWN PLANNING							

Course Learning Objectives:

The objectives of this course are:

1. Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
2. The salient features of Egyptian, Greek, Roman, and Indian Vedic, Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
3. Architectural design concepts, principles of planning and composition are imparted.
4. Enabling the student to understand town planning from ancient times to modern times.
5. To impart the concepts of town planning standards, landscaping and expansion of towns.

Course Outcomes:

Upon the successful completion of this course, the student should be able to:

CO1 Explain the evolution of Western and Indian architecture.
CO2 Identify major religious architectural styles and monuments.
CO3 Apply basic principles of residential planning and design.
CO4 Describe the contribution of post-classic and modern architects.
CO5 Explain the historical development of town planning in India and abroad.
CO6 Apply modern town planning principles, standards, and town expansion concepts.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	2	–	1	2	–	–	2
CO2	3	2	1	1	3	–	2	3	–	–	3
CO3	3	3	1	2	2	1	2	–	–	–	1
CO4	3	3	1	2	–	–	2	–	–	–	3
CO5	2	3	1	2	–	–	2	–	–	–	1
CO6	2	2	1	–	1	–	2	–	–	–	2

	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	2	2
CO4	3	3
CO5	3	–
CO6	3	3

UNIT–I

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization.

Temples of Religions: Buddhist period: Stambas, Stupas, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhubaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

UNIT-II

Principles of designing and Planning: Principles of planning a residence-site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.

Post-classic Architecture: Introduction of post-classic architecture-contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping.

UNIT–III

Historical Back Ground of Town Planning: Town planning in India –Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjo- Daro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT–IV

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighborhood Planning.

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations.

UNIT–V

Land Scaping and Expansion of Towns: Land scaping for the towns, horizontal and vertical expansion of towns-garden cities, satellite towns-floating towns-skyscraperspyramidal cities.

Text books:

1. ‘The great ages of World Architecture ’by G.K.Hiraskar.
2. ‘Planning and Design of Buildings by Section of Architecture’ by Y.S.Sane.
3. ‘Professional Practice’by G.K. Krishnamurthy, S.V.Ravindra, PHI Learning,New Delhi.
4. ‘Indian Architecture–Vol.I&II’byPercy Brown, Taraporevala Publications, Bombay.
5. ‘Fundamentals of Town Planning’ by G.K.Haraskar.

Reference books:

1. ‘Drafting and Design for Architecture’by Hepler, Cengage Learning
2. ‘Architect’s Portable Hand book’ by John Patten Guthrie–McGraw Hill International Publications.
3. ‘Modern Ideal Homes for India’by R.S.Deshpande.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31P1C		3	0	0	3
CONSTRUCTION TECHNOLOGY & MANAGEMENT							

Course Learning Objectives: The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. To introduce the importance of safety in construction projects

Course Outcomes:

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

CO1 Appreciate the importance of construction planning and project management techniques.

CO2 Understand the functioning and selection of earth moving and construction equipment.

CO3 Know the methods of production of aggregates and concreting operations.

CO4 Apply construction management knowledge to project planning, scheduling, and execution.

CO5 Analyze construction methods, equipment productivity for efficient project delivery.

CO6 Apply principles of quality control, safety engineering, and BIM in construction projects.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	1	–	–	–	1
CO2	3	2	2	1	–	–	2	1	–	–	2
CO3	3	3	2	2	–	–	2	2	–	–	2
CO4	3	3	–	2	–	–	2	2	–	–	1
CO5	2	2	1	2	–	–	3	–	–	–	2
CO6	3	2	2	2	3	1	3	–	–	–	2

CO	PSO1	PSO2
CO1	3	–
CO2	2	–
CO3	3	–
CO4	2	3
CO5	2	3
CO6	2	3

UNIT-I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique–cost analysis updating crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

Hoisting and earth work equipment–hoists–cranes–tractors-bulldozers–graders–scrapers–draglines-clam shell buckets

UNIT-IV

Concreting equipment— concrete mixers– Batching plants, mobile using plants like "Ajax"etc. mixing and placing of concrete – consolidating and finishing.

UNIT-V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

Textbooks:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha(2011), Pearson.
3. 'Construction Technology' by Subir K.Sarkar and Subhajit Sarasvati, Oxford University press

Reference books:

1. 'Construction Project Management-An Integrated Approach'by Peter Fewings,Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by TreforWilliams , Cengage learning

III	Year	I	Semester	L	T	P	C
Course Code:		BT24HS3101		3	0	0	3
ENTRPRENEURSHIP DEVELOPMENT&VENTURE CREATION (Open Elective - 1)							

Course Objectives:

By the end of the program, students will be/able to:

1. Inspired; develop entrepreneurial mind-set and attributes; entrepreneurial skill sets for venture creation and entrepreneurial leadership
2. Apply process of problem-opportunity identification and feasibility assessment through developing a macro perspective of the real market, industries, domains and customers while using design thinking principles to refine and pivot their venture idea.
3. Analyze Customer and Market segmentation, estimate Market size, develop and validate Customer Persona.
4. Initiate Solution design, Prototype for Proof of Concept. Understand MVP development and validation techniques to determine Product-Market fit
5. Craft initial Business and Revenue models, financial planning and pricing strategy for profitability and financial feasibility of a venture. Understand relevance and viability of informal and formal funding with respect to different business models.
6. UnderstandanddevelopGo-to-Marketstrategieswithafocusondigitalmarketingchannels.

Course Outcomes

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

1. Develop an entrepreneurial mindset and appreciate the concepts of entrepreneurship, cultivate essential attributes to become an entrepreneur or Entrepreneur and demonstrate skills such as problem solving, team building, creativity and leadership
2. Comprehendtheprocessofproblem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution
3. Analyse and refine business models to ensure sustainability and profitability
4. Build Prototype for Proof of Concept and validate MVP of their practice venture idea
5. Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture
6. Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	1	–	–	–	1
CO2	3	2	2	1	–	–	2	1	–	–	2
CO3	3	3	2	2	–	–	–	2	–	–	2
CO4	3	3	–	2	–	–	–	2	–	–	1
CO5	2	2	1	2	–	–	–	–	–	–	2
CO6	3	2	2	2	3	–	–	–	–	–	–

CO	PSO1	PSO2
CO1	3	–
CO2	-	–
CO3	3	–
CO4	-	–
CO5	2	–
CO6	–	–

Unit I: Entrepreneurship Fundamentals & Context

Meaning and concept, attributes and mindset of entrepreneurial and entrepreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skillets, attributes and networks while on campus. Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

Unit II: Problem &Customer Identification

Understanding and analyzing the macro-Problem and Industry perspective, technological, socio economic and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problem using Design thinking principles. Analyzing problem and validating with the potential customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity. Core Teaching Tool: Several types of activities including Class, game, Gen AI, 'Get out of the Building'

And Venture Activity.

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition. Developing Problem-solution fit in an iterative manner. Understanding prototyping and MVP. Developing a feasibility prototype with differentiating value, features and benefits. Initial testing for proof-of-concept and iterate on the

prototype. Assess relative market position via competition analysis, sizing the market and assess scope and potential scale of the opportunity.Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity.

Unit IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach,9block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.

Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance.

Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options.

Core Teaching Tool: Founder Case Studies–Sama and Securely Share; Class activity and discussions; Venture Activities

Unit V: Scale Outlook and Venture Pitch readiness

Understand and identify potential and aspiration for scale visa is your venture idea. Persuasive Story telling and its key components. Build an Investor ready pitch deck. Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

Suggested Reading:

1. Hisrich, R. D., Peters, M. P., Shepherd, D. A., & Sinha, S. (2020). Entrepreneurship. McGraw Hill, 11th Edition.
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.
3. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.
4. Sinek, S. (2011). Start with Why. Penguin Books Limited.
5. Brown, T. (2019). Change by Design (Revised & Updated): How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business.
6. Thapar, N. (2022). The Dolphin and the Shark: Stories on Entrepreneurship. Penguin Books Limited.
7. Sarasvathy, S. D. (2008). Effectuation: Elements of Entrepreneurial Expertise. Edward Elgar Publishing Ltd.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31O1A		3	0	0	3
GREEN BUILDINGS							

Course Objectives

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

1. Understand the concepts, importance, benefits, and key requirements of green buildings in the Indian context.
2. Familiarize with green building rating systems, sustainable materials, energy efficiency, and water conservation practices.
3. Understand green building design strategies, renewable energy integration, and energy demand reduction techniques.
4. Gain knowledge of HVAC systems, energy modeling, and eco-friendly power generation for sustainable buildings.
5. Appreciate material conservation, indoor environmental quality, and occupational health aspects in green buildings.

Course Outcomes:

CO1: Explain the concept, need, benefits, and essential requirements of green buildings.

CO2: Describe green building concepts, practices, and rating systems with special reference to the Indian context.

CO3: Analyze green building design strategies for reducing energy demand and integrating renewable energy sources.

CO4: Explain HVAC system design, energy modeling, and energy-efficient building services used in green buildings.

CO5: Apply material conservation techniques and waste management strategies in sustainable construction.

CO6: Evaluate indoor environmental quality measures and their impact on occupant health and comfort in green buildings.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	–	–	–	–	–	–	–	1
CO2	2	3	1	2	–	2	–	–	–	–	1
CO3	2	3	–	2	–	2	3	–	–	–	2
CO4	2	3	1	2	–	3	2	–	–	–	2
CO5	2	3	–	2	–	–	–	–	–	–	2
CO6	2	2	2	–	–	–	–	–	–	–	2

CO	PSO1	PSO2
CO1	2	–
CO2	–	–
CO3	2	2
CO4	2	2
CO5	2	–
CO6	2	–

UNIT – 1:

Introduction

What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

UNIT – 2:

Green Building Concepts And Practices Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

UNIT-3:

Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Eco friendly captive power generation for factory, Building requirement,

UNIT- 4:

Air Conditioning Introduction, CII Godrej Green business centre, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller selection, pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco-friendly captive power generation for factory, Building requirement.

UNIT –5:

Material Conservation Handling of non process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels,

Text Books:

- Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
- Green Building Hand Book by Tom woolley and Samkimings, 2009. Recommended Reference bookss:
  Complete Guide to Green Buildings by Trish riley Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31O1B		3	0	0	3
CONSTRUCTION TECHNOLOGY & MANAGEMENT							

Course Learning Objectives:

The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. To introduce the importance of safety in construction projects

Course Outcomes:

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

1. Appreciate the importance of construction planning
2. Understand the functioning of various earth moving equipment
3. Know the methods of production of aggregate products and concreting
4. Apply the gained knowledge to project management and construction techniques
5. Explain the working mechanism of concrete batching plants
6. Discuss the importance of safety in different construction works

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	1	–	–	–	1
CO2	3	2	1	1	–	–	2	–	–	1	1
CO3	3	3	2	2	–	2	–	3	2	2	2
CO4	3	3	2	2	2	–	–	–	–	2	2
CO5	2	3	2	2	–	–	–	1	2	2	2
CO6	3	3	1	2	–	–	–	2	1	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	2	–
CO4	2	2
CO5	1	1
CO6	2	3

SYLLABUS:

UNIT-I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique–cost analysis-updating–crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers Hoisting and earth work equipment–hoists–cranes–tractors-bull dozers–graders–scrapers– draglines clam shell buck

UNIT-IV

Concreting equipment— concrete mixers–Batching plants, mobile using plants like "Ajax" etc. mixing and placing of concrete – consolidating and finishing.

UNIT-V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

Text books:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha (2011), Pearson.
3. 'Construction Technology' by Subir K.Sarkarand Subhajit Sarasvati, Oxford University press

Reference books:

1. 'Construction Project Management-An Integrated Approach 'by Peter Fewings, Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE31O1C		3	0	0	3
CLIMATE CHANGE IMPACT ON ECO-SYSTEM							

Course Objectives

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

1. Explain the fundamentals of the climate system, atmospheric processes, radiation balance, and temperature variations in the atmosphere and soil.
2. Analyze the hydrologic cycle and climate variables influencing precipitation, runoff, evapotranspiration, floods, droughts, and other climate extremes.
3. Describe and interpret climate change causes, climate variability, and climate modeling approaches including GCMs, downscaling techniques, and IPCC scenarios.

Course Outcomes

CO1 Explain the components of the climate system, atmosphere, and temperature processes.

CO2 Analyze the hydrologic cycle and global and land-based water balance models.

CO3 Interpret climate variables affecting precipitation, winds, evaporation, and runoff.

CO4 Assess climate variability and extremes such as floods, droughts, and heat waves.

CO5 Explain the causes and mechanisms of climate change using scientific principles.

CO6 Apply climate change models and IPCC scenarios for understanding future climate impacts.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	–	–	–	–	2	–	–	–	2
CO2	3	2	–	2	–	2	2	–	–	–	2
CO3	3	2	–	2	–	3	2	–	–	–	2
CO4	2	3	–	2	–	3	3	–	–	–	3
CO5	3	2	–	2	–	–	3	–	–	–	3
CO6	2	2	–	2	3	–	3	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	3	2
CO3	2	–
CO4	3	2
CO5	1	–
CO6	2	–

UNIT I:

Climate System; Climate, weather and Climate Change; Overview of Earth's Atmosphere; Vertical Structure of Atmosphere; Radiation and Temperature; Laws of Radiation; HeatBalance of Earth Atmosphere System; Random Temperature Variation; Modelling Vertical Variation in Air Temperature; Temporal Variation of Air temperature; Temperature Change in Soil; Thermal Time and Temperature Extremes.

UNIT II:

Hydrologic Cycle: Introduction; Global water balance; Cycling of water on land, a simple water balance model.

UNIT III:

Climate Variables affecting Precipitation: Precipitation and Weather, Humidity, Vapor Pressure, Forms of Precipitation, Types of Precipitation; Cloud; Atmospheric Stability; Monsoon; Wind Pattern in India; Global Wind Circulation; Evaporation and Transpiration, Processes of Vadose Zone, Surface Runoff, Stream flow

UNIT IV:

Climate Variability: Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

UNIT V:

Climate Change: Introduction; Causes of Climate Change; Modeling of Climate Change, Global Climate Models, General Circulation Models, Downscaling; IPCC Scenarios

Text books:

1. Barry, R. G., and Chorley, R. J. Atmosphere, Weather and Climate, 9th Edition, Routledge, Taylor & Francis Group, London, UK, 2010.
2. Wallace, J. M., and Hobbs, P. V. Atmospheric Science: An Introductory Survey, 2nd Edition, Academic Press (Elsevier), Amsterdam, Netherlands, 2006.
3. Ahrens, C. D., and Henson, R. Meteorology Today: An Introduction to Weather, Climate, and the Environment, 11th Edition, Cengage Learning, Boston, USA, 2016.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3104		0	0	3	1.5
GEOTECHNICAL ENGINEERING LAB							

Learning Objectives:

The objective of this course is

1. To determine the index properties for soil classification– Grain size distribution & Atterberg's limits.
2. To determine the engineering properties–Permeability, Compaction, consolidation, shear strength parameters & CBR value.
3. To find the degree of swelling by DFS test.
4. To impart knowledge of determination of index properties required for classification of soils.
5. To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
6. To teach how to determines shear parameters of soil through different laboratory tests.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Determine index properties of soil and classify them.
2. Determine permeability of soils.
3. Determine Compaction, Consolidation
4. Determine shear strength characteristics
5. Determine Unconfined Compression test
6. Determine Triaxial Compression test

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	2	2	–	–	–	2
CO2	3	2	1	–	2	–	2	–	–	–	2
CO3	3	3	2	2	–	–	2	–	–	–	3
CO4	2	3	2	–	2	3	3	–	–	–	2
CO5	3	3	2	–	–	3	3	–	–	–	3
CO6	3	3	2	–	–	3	2	–	–	–	2

CO	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	2	–
CO4	3	–
CO5	3	2
CO6	2	2

SYLLABUS:

LIST OF EXPERIMENTS

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Permeability of soil-Constant and Variable head tests
6. Compaction test
7. Consolidation test (to be demonstrated)
8. Direct Shear test
9. Triaxial Compression test
10. Unconfined Compression test
11. Vane Shear test
12. Differential free swell (DFS)
13. Field Plate Load Test demo
14. Field CBR demo

At least **Eight** experiments shall be conducted.

LIST OF EQUIPMENT:

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrink age limits 3. Field density apparatus for
   a) Core cutter method
   b) Sand replacement method
4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
5. Hydrometer
6. Permeability apparatus for
   a) Constant head test
   b) Variable head test
7. Universal auto compactor fo rI. Slight and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10tons loading frame with proving rings of 0.5 tons and 5tons capacity
11. One dimensional consolation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38mm dia specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (rangeoftemperature50-150 ^{0}C)
16. Field plate load Test equipment
17. Field CBR test equipment

Reference books:

1. 'Determination of Soil Properties'by J.E.Bowles.
2. IS Code2720 –relevant parts.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3105		0	0	3	1.5
FLUID MECHANICS AND HYDRAULIC MACHINES LAB							

Course Objectives

The objectives of this laboratory course are:

1. To verify fundamental principles of fluid mechanics through laboratory experiments.
2. To determine discharge coefficients, head losses, and friction characteristics in pipe flow.
3. To calibrate flow-measuring devices such as venturimeters, orificemeters, and notches.
4. To develop experimental skills in conducting, observing, and interpreting fluid flow experiments.

Course Outcomes

1. Verify Bernoulli's equation and explain the distribution of energy in fluid flow.
2. Determine the coefficient of discharge for orifices, mouthpieces, and notches using laboratory experiments.
3. Calibrate flow-measuring devices such as venturi meters, orifice meters, and notches.
4. Evaluate friction factor of pipes and head losses due to bends, sudden expansion, and contraction in pipelines.
5. Conduct fluid mechanics experiments systematically and interpret experimental observations and results.
6. Analyze experimental data and present results effectively through laboratory records and reports.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	–	–	2	–	–	–	2
CO2	3	3	2	2	–	–	2	–	–	–	2
CO3	3	3	2	2	–	–	2	–	–	1	2
CO4	3	3	2	2	–	–	1	–	–	1	1
CO5	3	3	–	2	–	–	2	–	–	1	1
CO6	3	2	2	2	–	1	–	–	–	1	1

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	3	–
CO4	2	–
CO5	1	–
CO6	3	–

List of Experiments:

1. Verification of Bernoullis' equation.
2. Calibration of Venturimeter.
3. Calibration of orificemeter.
4. Determination of coefficient of discharge of a small orifice by constant head method
5. Determination of coefficient of discharge of an external cylindrical mouth piece by variable head method.
6. Calibration of a contracted rectangular notch.
7. Calibration of a triangular notch.
8. Determination of friction factor of the pipe material.
9. Determination of coefficient of head loss due to friction a sudden expansion/ contraction in a pipeline.
10. Determination of head loss coefficient due to a bend in pipe line.

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3106		0	1	2	2
ESTIMATION, SPECIFICATION AND CONTRACTS							

Course Learning Objectives:

The objective of this course is to enable the students to:

1. Understand the quantity calculations of different components of the buildings.
2. Understand the rate analysis of different quantities of the buildings components.
3. Learn various specifications and components of the buildings.

Course Outcomes:

Upon the successful completion of this course:

1. Explain types of contracts, contract documents, conditions of contract, valuation of buildings, and modern procurement methods.
2. Apply principles of quantity take-off and prepare approximate estimates for building works.
3. Perform rate analysis for various items of work including earthwork, RCC, and reinforcement.
4. Prepare bar bending schedules and estimate material requirements for building and road works.
5. Prepare detailed estimates of buildings using the individual wall method.
6. Prepare detailed estimates of buildings using the centre line method and standard estimation software.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	1	2	–	–	2	2
CO2	3	3	2	2	1	1	3	–	–	2	2
CO3	3	2	2	2	2	1	2	–	–	2	2
CO4	3	3	2	2	2	2	3	–	–	2	2
CO5	3	3	3	2	1	1	3	–	–	3	2
CO6	3	2	2	–	–	1	2	–	–	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	2	–
CO4	2	3
CO5	3	2
CO6	3	3

UNIT–I

Contracts–Types of contracts–Contract Documents–Conditions of contract, Valuation of buildings-concepts of e-procurement and reverse auctions. Standard specifications for different items of building construction.

UNIT–II

General items of work in Building–Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT–III

Rate Analysis– Working out data for various items of work over head and contingent charges. Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

UNIT-IV

Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings.

UNIT-V

Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

Text books:

1. 'Estimating and Costing' by B.N.Dutta,UBS publishers, 2000.
2. 'Civil Engineering Contracts and Estimates' by B.S.Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.

Reference books:

1. 'Standard Schedule of rates and standard data book' by public works department.
2. IS1200 (PartsItoXXV-1974/ Method of Measurement of Building & Civil Engg Works
3. 'Estimation, Costing and Specifications' by M.Chakraborthi; Laxmi publications.
4. National Building Code

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE3107		0	0	2	1
TINKERING LAB							

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Objectives:

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

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

Course Outcome

CO1 Build and test basic electrical and electronic circuits using breadboards.

CO2 Design and demonstrate sensor-based systems using Arduino and ESP32.

CO3 Simulate and implement microcontroller programs using appropriate software tools.

CO4 Develop IoT-based applications for remote monitoring and control.

CO5 Design, model, and fabricate functional prototypes using 3D printing.

CO6 Apply design thinking principles to develop innovative engineering solutions.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	–	–	–	–	1
CO2	3	3	–	2	1	1	–	–	–	–	1
CO3	3	2	–	2	–	2	2	–	–	1	2
CO4	3	2	2	2	–	2	1	–	–	1	1
CO5	3	3	–	2	1	1	2	–	–	1	1
CO6	3	2	2	–	–	2	–	–	–	–	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	3	3
CO6	3	3

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinker CAD.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.
10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike. Students need to refer to the following links:

    1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
    2) https://atl.aim.gov.in/ATL-Equipment-Manual/
    3) https://aim.gov.in/pdf/Level-1.pdf

III	Year	I	Semester	L	T	P	C
Course Code:		BT24BS3101		0	0	0	2
EVALUATION OF COMMUNITY SERVICE INTERNSHIP							

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3201		3	0	0	3
DESIGN AND DRAWING OF STEEL STRUCTURES							

Course Learning Objectives:

The objective of this course is to:

1. Familiarize students with different types of connections and relevant IS codes
2. Equip student with the concepts of designing flexural members
3. Understand design concepts of tension and compression members in trusses
4. Familiarize students with different types of columns and column bases and their design
5. Familiarize students with Plate girder and Gantry Girder and their design

Course Outcomes:

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

1. Analyze and design steel structural members with relevant IS codes
2. Carryout analysis and design of flexural members and detailing
3. Design compression members of different types with connection detailing
4. Design of purlins, members and joints.
5. Design Plate Girder and Gantry Girder with connection detailing
6. Produce the drawings pertaining to different components of steel structures

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	1	–	1	–	–	2	2
CO2	3	3	3	2	1	–	1	–	–	2	2
CO3	3	3	3	2	1	–	1	–	–	3	3
CO4	3	3	3	2	1	–	1	–	–	2	3
CO5	3	3	3	1	2	–	1	–	–	1	3
CO6	3	2	3	1	2	–	1	–	–	2	2

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	2	3
CO4	2	2
CO5	3	2
CO6	3	3

SYLLABUS:

UNIT – I

Connections: Riveted connections – definition, rivet strength and capacity, Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT – II

Beams: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.

UNIT –III

Tension Members and compression members: Effective length of members, slenderness ratio-permissible stresses. Design compression members subjected to axial and eccentric loading. Design of members subjected to direct tension and bending. **Roof Trusses:** Different types of roof trusses – Design loads – Load combinations as per IS Code recommendations, structural details –Design of purlins, members and joints.

UNIT – IV

Design of Columns: Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns.

Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected to moment.

UNIT – V

Design of Plate Girder: Design consideration – IS Code Recommendations Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections.

Design of Gantry Girder: impact factors - longitudinal forces, Design of Gantry girders.

NOTE: Welding connections should be used in Units II – V. Drawing classes must be conducted every week and the students should prepare the following plates.

Plate 1 Detailing of simple beams

Plate 2 Detailing of Compound beams including curtailment of flange plates.

Plate 3 Detailing of Column including lacing and battens. Plate 4

Detailing of Column bases – slab base and gusseted base Plate 5

Detailing of steel roof trusses including joint details.

Plate 6 Detailing of Plate girder including curtailment, splicing and stiffeners. Plate 7

Detailing of gantry girder.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part-B is 60%.

Textbooks

1. 'Steel Structures Design and Practice' by N.Subramanian, Oxford University Press.
2. 'Design of Steel Structures' by Ramachandra, Vol – 1, Universities Press.
3. 'Design of steel structures' by S.K. Duggal, Tata Mcgraw Hill, and New Delhi

Reference books

1. 'Structural Design in Steel' by Sarwar Alam Raz, New Age International Publishers.
2. 'Design of Steel Structures' by P. Dayaratnam; S. Chand Publishers
3. 'Design of Steel Structures' by M. Raghupathi, Tata Mc. Graw-Hill
4. 'Structural Design and Drawing' by N. Krishna Raju; University Press,

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3202		3	0	0	3
HIGHWAY ENGINEERING							

Course Learning Objectives:

The objectives of this course are:

- To impart different concepts in the field of Highway Engineering.
- To acquire design principles of Highway Geometrics and Pavements
- To acquire design principles of Intersections

Course Outcomes:

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

1. Plan high way network for a given area.
2. Determine High way alignment and design high way geometrics.
3. Acquire design principles of Intersections
4. Design Intersections and prepare traffic management plans.
5. Judge suitability of pavement materials and design flexible and rigid pavements
6. Design of flexible and rigid pavements as per IRC codes.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	–	–	1	1	1	–	–	3
CO2	3	3	3	1	1	1	–	–	–	3	2
CO3	3	3	2	2	–	2	2	–	–	2	2
CO4	3	2	2	2	–	2	1	–	–	1	2
CO5	3	3	2	2	1	2	2	–	–	1	3
CO6	3	2	3	–	–	2	–	–	–	–	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	3	3
CO4	2	–
CO5	3	3
CO6	3	3

UNIT-I

Highway Planning and Alignment: Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans– First, second, third road development plans, road development vision 2021, Rural Road Development

Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT – II Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical Alignment- Gradients- Vertical curves.

UNIT – III Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method.

UNIT –IV

Highway Materials: Sub grade soil: classification –Group Index–Subgrade soil strength – California Bearing Ratio–Modulus of Subgrade Reaction. Stone aggregates: Desirable properties– Tests for Road Aggregates–Bituminous Materials: Types–Desirable properties— Testson Bitumen - Bituminous paving mixes: Requirements – Marshall Method of Mix Design

UNIT–V

Design of Pavements: Types of pavements; Functions and requirements of different components of pavements; Design Factors

Flexible Pavements*:* Design factors–Flexible Pavement Design Methods–CBR method–IRC method–Burmister method–Mechanistic method–IRC Method for Low volume Flexible pavements.

Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses–Combination of stresses–Design of slabs–Design of Joints–IRC method– Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

Textbooks:

1. Highway Engineering, Khanna S.K., Justo C.E.G and Veeraragavan A,Nem Chand Bros., Roorkee. Traffic Engineering and Transportation Planning, KadiyaliL. R,Khanna Publishers, New Delhi.

Reference books:

1. Principles of Highway Engineering, KadiyaliL .R,Khanna Publishers, NewDelhi
2. Principles of Transportation Engineering, Partha Chakraborty and Animesh Das,PHI Learning Private Limited, Delhi

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3203		3	0	0	3
ENVIRONMENTAL ENGINEERING							

Course Learning Objectives:

The course will address the following:

1. Outline planning and the design of water supply systems for a community/town/city
2. Provide knowledge of water quality requirement for domestic usage and knowledge on design of water distribution network
3. Selection of valves and fixture in water distribution systems
4. Outline the planning and design of Sewerage System for a community/town/city 5. To impart knowledge on waste water treatment and disposal

Course Outcomes:

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

1. Plan and design the water and distribution networks and sewerage systems
2. Able to identify the appropriate source of water based on quality and quality requirements
3. Select a suitable treatment for raw water treatment as well as sewage treatment
4. Decide the manner of disposal of wastewater
5. Analyze water demand, population forecasting, and hydraulic behavior of water and sewer networks.
6. Apply modern treatment technologies, sustainability concepts, and standards in water and wastewater engineering.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	2	–	2	–	–	–	2
CO2	3	2	–	1	1	3	3	–	–	–	1
CO3	3	3	2	2	2	2	3	–	–	–	2
CO4	2	3	2	2	1	3	3	–	–	2	2
CO5	3	3	2	2	2	2	2	–	–	2	2
CO6	2	2	2	2	3	–	3	–	–	2	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	1	1
CO4	2	2
CO5	–	–
CO6	3	3

SYLLABUS:

UNIT–I

Introduction: Importance and Necessity of Protected Water Supply systems. Water borne diseases. Planning of public water supply systems. Per capita demand and factors influencing it, types of water demands and its variations, factors affecting water demand, Design Period, Factors affecting the Design period, estimation of water demand for a town or city, Population Forecasting.

Sources of Water: Various surface and subsurface sources considered for water supply and their comparison- Capacity of storage reservoirs, Conveyance of Water from the source to the point of interest: Gravity and Pressure conduits, Types of Pipes and Pipe joints.

UNIT-II

Physical, Chemical and Biological characteristics of water. Water quality criteria for different uses- Rural, Municipal, Industrial and Agricultural uses. Drinking water quality standards: IS and WHO guidelines.

Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods – Appurtenances of water distribution system–Laying and testing of pipe lines.

UNIT-III

Typical treatment flow of a municipal water treatment plant, Unit operations of water treatment: Theory and Design of Sedimentation, Coagulation, flocculation, Filtration, Water conditioning and softening, Disinfection, Removal of color and odors – Removal of Iron and manganese – Fluoridation and De-fluoridation –Ion Exchange - Ultra filtration- Reverse Osmosis.

UNIT-IV

Characteristics and composition of sewage — population equivalent -Sanitary sewage flow estimation — Sewer materials — Hydraulics of flow in sanitary sewers — Sewer design — Storm drainage-Storm runoff estimation — sewer appurtenances — corrosion in sewers — prevention and control — sewage pumping-drainage in buildings-plumbing systems for drainage Primary Treatment of Sewage

Objectives — Unit Operations and Processes — Selection of treatment processes — Onsite sanitation — Septic tank- Grey water harvesting — Primary treatment — Principles, functions and design of sewage treatment units — screens — grit chamber-primary sedimentation tanks — Construction, Operation and Maintenance aspects.

UNIT–V

Objectives — Selection of Treatment Methods — Principles, Functions, — Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor (SBR) — Membrane Bioreactor — UASB — Waste Stabilization Ponds — Other treatment methods -Reclamation and Reuse of sewage — Recent Advances in Sewage Treatment — Construction, Operation and Maintenance aspects.

Disposal of Sewage

Standards for– Disposal — Methods — dilution — Mass balance principle — Self purification of river - Oxygen sag curve — de-oxygenation and re-aeration — Streeter– Phelps model — Land disposal — Sewage farming — sodium hazards — Soil dispersion system.

Text books :

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – McGraw-Hill Book Company, New Delhi, 1985.
2. Water Supply Engineering. Dr. P.N. Modi, Standard Book House, Delhi.

Reference books:

1. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd.
2. Water Supply Engineering.– Dr. B.C. Punmia, A.K. Jain and A.K. Jain. Laxmi Publications
3. Water Supply and Sanitary Engineering – G.S. Birdie and J.S. Birdie

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P2A		3	0	0	3
GROUND IMPROVEMENT TECHNIQUES							

Course Learning Objectives: The objective of this course is:

1. To make the student appreciate the need for different ground improvement methods adoptedforimprovingthepropertiesofremoldedandin-situsoilsbyadoptingdifferent techniques such as in situ densification and dewatering methods.
2. To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
3. To enable the students to know how geotextiles and geo synthetics can be used to improve the engineering performance of soils.
4. To make the student learn the concepts, purpose and effects of grouting.

Course Outcomes:

1. By the end of the course, the student should be able to possess the knowledge of various methods of ground improvement and their suitability to different field situations.
2. The student should be in a position to design are in forced earth embank ment and check its stability.
3. The student should know the various functions of Geosynthetics and their applications in Civil Engineering practice.
4. The student should be able to understand the concepts and applications of grouting.
5. Analyze soil stabilization, dewatering, and densification methods for improving ground performance.
6. Apply modern ground improvement methods considering sustainability, safety, and practical constraints.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	2	1	–	2	–	–	–	2
CO2	3	3	3	–	2	–	–	–	–	–	2
CO3	3	2	2	–	2	–	–	–	–	–	2
CO4	2	2	2	–	3	–	–	–	–	2	2
CO5	3	3	3	2	2	–	2	–	–	2	2
CO6	2	2	2	2	3	–	3	–	–	3	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	2	–
CO4	2	–
CO5	2	2
CO6	3	3

UNIT-I

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – insitu densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT-II

Dewatering–sumps and interceptor ditches –single and multi-stage well points–vacuum well points, horizontal wells – criteria for choice of filler material around drains – electro osmosis.

UNIT- III

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization–use of industrial wastes like fly a shand granulated blast furnace slag. Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting–hydraulic fracturing in soils and rocks –post grouttests. Introduction to Liquefaction & its effects & applications.

UNIT-IV

Reinforce earth–principles–components of reinforced earth–design principles of reinforced earth walls – stability checks – soil nailing.

UNIT-V

Geosynthetics–geotextiles–types–functions, properties and applications – geogrids, geomembranes and gabions - properties and applications.

Text books:

1. Ground Improvement Techniques' by Purus Hotham Raj, Laxmi Publications, New Delhi.
2. Ground Improvement Techniques' by Nihar Ranjan Patro,Vikas Publishing House(p) limited ,New Delhi.
3. An introduction to Soil Reinforcement and Geosynthetics' by G.L.Siva Kumar Babu, Universities Press.

Reference books:

1. 'Ground Improvement 'by MP Moseley, Blackie Academic and Professional, USA.
2. 'Designing with Geosynethetics 'by RM Koerner, Prentice Hall

III	Year	I	Semester	L	T	P	C
Course Code:		BT24CE32P2B		3	0	0	3
REPAIR AND REHABILITATION OF STRUCTURES							

Course objectives:

1. To understand the mechanisms of deterioration and durability issues in concrete structures.
2. To impart knowledge of field investigation, monitoring, and non-destructive evaluation techniques for concrete structures.
3. To develop the ability to design and recommend appropriate repair and strengthening methods, including the use of composite materials.
4. To assess the serviceability and residual life of existing concrete structures for effective rehabilitation and sustainable use.

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

1. Recognize the mechanisms of degradation of concrete structures and to design durable Concrete structures.
2. Conduct field monitoring and non-destructive evaluation of concrete structures.
3. Design and suggest repair strategies for deteriorated concrete structures including
4. Repairing with composites
5. Understand the methods of strengthening methods for concrete structures
6. Assessment of the service ability and residual life span of concrete structures by Visual inspection and in situ tests

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	1	–	–	–	2	2
CO2	3	3	1	2	1	1	–	–	–	3	2
CO3	3	2	2	2	1	1	2	–	–	2	2
CO4	3	2	2	2	1	2	1	–	–	2	2
CO5	3	3	2	2	1	2	2	–	–	3	2
CO6	3	2	2	2	1	2	2	–	–	2	2

CO	PSO1	PSO2
CO1	**2**	**–**
CO2	**2**	**–**
CO3	**2**	**–**
CO4	**2**	**–**
CO5	**3**	**3**
CO6	**3**	**3**

UNIT:I

Materials for repair and rehabilitation-Admixtures-types of admixtures-purposes of using admixtures-chemical composition-Natural admixtures-Fibers-wraps-Glass and Carbon fiber wraps-Steel Plates-Nondestructive evaluation :Importance-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –Visual investigation- Acoustical emission methods-Corrosion activity measurement- chloride content–Depth of carbonation-Impact echo methods-Ultra sound pulse velocity methods- pull out tests.

UNIT:II

Strengthening and stabilization-Techniques-design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening-Connection stabilization and strengthening, Crack stabilization.

UNIT:III

Bonded installation techniques-Externally bonded FRP-Wetlay upsheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding-CDC debonding-plate end de bonding-strengthening of floor of structures post grout tests. Introduction to Liquefaction & its effects & applications.

UNIT:IV

Fiber reinforced concrete-Properties of constituent materials-Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete-applications of fiber reinforced concretes-Light weight concrete-properties of light weight concrete-No fines concrete-design of light weight concrete-Fly ash concrete-Introduction-classification of fly ash-properties and reaction mechanism of fly ash-Properties of fly ash concrete in fresh state and hardened state-Durability of fly ash concretes

UNIT:V

High performance concretes-Introduction-Development of high-performance concretes- Materials of high-performance concretes-Properties of high-performance concretes-Self Consolidating concrete-properties-qualifications.

Text books:

1. Maintenance Repair Rehabilitation & Minor works of Buildings -P.C.Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures–P.I.Modi,C.N.Patel, PHI Publications
3. Rehabilitation of Concrete Structures-B.Vidivelli,Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation-V.K.Raina, Shroff Publishers and Distributors.

Reference books:

1. Concrete Technology Theory and Practice-M.S.Shetty,SChand and Company
2. Concrete Repair and Maintenance illustrated-Peter Hemmons

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P2C		3	0	0	3
VALUATION AND QUANTITY SURVEY							

Course Objectives

1. To introduce basic concepts of estimation, quantity surveying, contracts, and valuation related to civil engineering works.
2. To develop the ability to interpret drawings, specifications, and standard data for estimation and rate analysis.
3. To impart skills in preparing detailed measurements, bar bending schedules, and bills of quantities for civil engineering projects.
4. To enable students to assess the valuation of land and buildings using standard valuation methods.

Course Outcomes

1. Define basic terms related to estimation, quantity surveying and contract document
2. Interpret the item of work from drawings and explain its general specification and unit of measurement
3. Make use of given data from CPWDDAR/DSR for calculating the unit rate of different items of work associated with building Construction
4. Develop detailed measurement (including BBS) and BoQ of a various work like buildings, earth work for road, sanitary and water supply work
5. Explain various basic terms related to valuation of land and Building
6. Develop valuation of buildings using different methods of valuation.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	2	–	–	2	2
CO2	3	3	–	2	1	1	2	–	–	3	2
CO3	3	–	–	2	2	2	2	–	–	–	2
CO4	3		2	2	3	1	1	–	–		2
CO5	3	3	–	2	1	1	2	–	–	3	2
CO6	3	2	2	–	–	–	–	–	–	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	3	–
CO3	2	–
CO4	3	–
CO5	3	3
CO6	3	3

UNIT I

Introduction- Quantity Surveying- Basic principles, Role/responsibility of Quantity surveyor at various stages of construction. Estimate-Details required, Type of estimate, purposes. Contingencies, Work-charge establishment, Tools and Plant, centage charge, Day work, Prime cost, Provisional sum & provisional Quantity, Overhead charges, Cost index, Contract documents (Brief description only)Bill of Quantity-Typical format-use Item of works- Identifyvariousitemofworkfromthedrawings-unitsofmeasurementofvarious materials and works (focus may give to RCC residential building) General rule & method of measurement with reference to Indian Standard Specifications- IS1200.

UNIT II

Introduction to the use of CPWD schedule of rates as per latest DSR and Analysis of rate as per latest DAR. Specifications-Generalspecificationofallitemsofaresidentialbuilding.Detailed specification (CPWD specifications) of major item of work like Earth work excavation in foundation, masonry, Reinforced cement concrete, finishing of building work Analysis of rates for Earth work in excavation for foundation, mortars, reinforced cement concrete Works, finishing work, masonry work, stone works, flooring with reference to latest DSR and latest DAR (Data should be given).

UNIT III

Detailed Estimate- Preparation of detailed measurement using Centre line method & Short wall long wall (separate wall) method for RCC single storied building (Flat roof) including stair cabin-Residential/office/school building. BOQ preparation of a single storied RCC building work. Material quantity calculation of the items of work (Rubble, Brick work, Concrete work, Plastering) in detailed estimate prepared for building work. (Data for unit quantity should be provided from DAR)

UNIT IV.

Bar Bending Schedule- Preparation of BBS of RCC beams, slabs, Column footings, Retaining wall. Roadestimation-Estimationofearthworkfromlongitudinalsectionmetaledroad.Estimation of sanitary and water supply work -Water tank, Septic tank, Manhole (No Detailed estimate needed-concept of item of work, its general specification and unit of measurement).(Valuation – purpose, factor affecting, introduction to terms-Value, Cost, Price, kinds of values Income- Gross income, net income, outgoings, annuity, sinking fund,

Year's purchase, Depreciation, obsolescence -Free hold and leasehold properties.)

UNIT V

Methods of calculating depreciation – straight line method – constant percentage method, sinking fund method and quantity survey method. Methods of valuation–rental method, direct comparison of capital cost, valuation based on profit, depreciation method. Various method of valuation of land (Brief description only)

Text Books:

1. B.N.Dutta, Estimation and costing in civil engineering, UBS publishers
2. Rangwala, Estimation Costing and Valuation, Charotar publishing house pvt.ltd
3. Dr. S. Seetha Raman, M.Chinna swami, Estimation and quantity surveying, Anuradha publications Chennai.
4. M Chakraborthy, Estimating, Costing, Specification and valuation, published by the author, 21 B, Babanda Road, Calcutta 26

Reference books:

1. BS Patil, Civil Engineering contracts and estimates, university press
2. VNVazirani & SPChandola, Civil Engineering Estimation and Costing, Khanna Publishers
3. IS1200-1968; Methods of measurement of building & civil engineering works
4. CPWDDAR2018andDSR2018orlatest
5. CPWDSpecificationsVol1&2(2019orlatestedition)

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P3A		3	0	0	3
FINITE ELEMENT METHOD							

Course Objectives

1. To introduce the fundamental concepts and formulation procedures of the finite element method.
2. To develop the ability to formulate and solve simple engineering problems using FEM.
3. To familiarize students with stiffness matrices, system equations, and interpretation of FEM results.
4. To impart practical exposure to finite element software for structural, thermal, and modal analysis.

Course Outcomes

1. Develop finite element formulations for single degree of freedom problems and solve them.
2. Use finite element software to perform stress, thermal, and modal analyses.
3. Compute stiffness matrices of different finite elements and assemble system matrices.
4. Interpret displacements, strains, and stress resultants obtained from finite element analysis.
5. Analyze planar structural systems using finite element modelling techniques.
6. Apply advanced finite element concepts such as iso-parametric elements, numerical integration, and convergence checks.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	–	–	–	–	–	–
CO2	2	2	2	2	3	–	–	–	–	–	1
CO3	3	3	3	2	1	–	3	–	–	–	–
CO4	2	3	2	3	1	3	2	–	2	–	–
CO5	3	3	3	2	2	2	3	–	2	–	2
CO6	2	2	2	2	3	–	1	–	–	–	2

CO	PSO1	PSO2
CO1	**2**	**–**
CO2	**2**	**–**
CO3	**3**	**2**
CO4	**2**	**3**
CO5	**3**	**3**
CO6	**3**	**3**

UNIT I

Introduction: Review of stiffness method-Principle of Stationary potential energy-Potential energy of anelastic body-Rayleigh-Ritz method of functional approximation-variational approaches-weighted residual methods

UNIT II

Finite Element formulation of truss element: Stiffness matrix-properties of stiffness matrix – Selection of approximate displacement functions-solution of a planetruss-transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports-Galerkin's methodfor1-Dtruss– Computation of stress in a truss element.

UNIT III

Finite element formulation of Beam elements: Beam stiffness-assemble age of beam stiffen matrix-Examples of beam analysis for concentrated and distributed loading-Galerkin's method – 2 Darbitrarily oriented beam element–inclined and skewed supports–rigid plane frame examples

UNIT IV

Finite element formulation for plane stress, plane strain and axi symmetric problems Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems-comparison of CST and LST elements–convergence of solution-interpretation of stresses

UNIT V

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element-shape functions, evaluation of stiffness matrix, consistent modal load vector- Gauss quadrature-appropriate order of quadrature–element and mesh instabilities–spurious zero energy modes, stress computation-patch test.

Textbooks:

1. A first course in the Finite Element Method–Daryl L.Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis–Robert D.Cook, Michael EPlesha, JohnWiley & Sons Publications

Reference books:

1. Introduction to Finite Elements in Engineering-Tirupati R.Chandrupatla, Ashok D. Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers)Wail N Rifaie, Ashok K Govil.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P3B		3	0	0	3
BRIDGE ENGINEERING							

Course Learning Objectives:

The objective of this course is to:

1. Familiarize students with different types of Bridges and IRC standards
2. Equip student with the concepts and design of Slab Bridges,T Beam Bridges,Box Culverts
3. Understand concepts of design of Plate Girder Bridges
4. Familiarize with different methods of inspection of bridges and their maintenance

Course Outcomes:

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

1. Explain different types of Bridges with diagrams and Loading standards
2. Carry out analysis and design of Slab bridges, T Beam bridges, Box culvers and suggest structural detailing
3. Carry out analysis and design of Plate girder bridges
4. Organize for attending inspections and maintenance of bridges and prepare reports.
5. Select suitable bridge type, site, foundation, and bearings based on functional and economic considerations.
6. Apply codal provisions, sustainability, and safety principles in bridge design and maintenance practices.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	–	1	1	–	–	2	1
CO2	3	3	3	2	2	2	2	–	–	2	1
CO3	3	3	3	2	2	1	1	–	–	3	1
CO4	2	2	3	3	1	1	2	–	–	1	1
CO5	3	2	2	1	1	2	2	–	–	2	2
CO6	2	2	1	2	3	2	3	–	–	2	3

CO	PSO1	PSO2
CO1	1	1
CO2	2	2
CO3	3	3
CO4	2	2
CO5	3	3
CO6	3	3

SYLLABUS:

UNIT-I

General Introduction to types of Bridges- (Slab bridges, TBeam, Arch bridges, Cable Stayed bridges, pre stressed concrete bridges, Truss Bridges, Culverts) - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading

UNIT-II

Slab bridges- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs-dispersion length-Design of interior panel of slab-Guyon's–Massonet Method–Hendry-Jaegar Methods- Courbon's theory- Pigeaud's method

UNIT-III

T-Beam bridges- Analysis and design of various elements of bridge–Design of deck slab, longitudinal girders, Secondary beams- Reinforcement detailing

UNIT-IV

Plate Girder Bridges: Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing.

UNIT-V

Box Culverts: Loading–Analysis and Design-Reinforcement detailing.

Inspection and Maintenance of Bridges: Procedures and methods for inspection–Testing of bridges- Maintenance of Sub Structures and Super structures-Maintenance of bearings-Maintenance Schedules.

Text books:

1. 'Essentials of Bridge Engineering 'by Johnson Victor D
2. 'Design of Bridge Structures' by T.R. Jagadeesh, M.A. Jayaram, PHI
3. 'Design of RC Structures' by B. C.Punmai, Jain & Jain, Lakshmi Publications

Reference books:

1. 'Design of Concrete Bridges' by Aswini, Vazirani,Ratwani
2. 'Design of Steel Structures' by B.C.Punmai, Jain & Jain, Lakshmi Publications
3. 'Design of Bridges' by Krishna Raju

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32P3C		3	0	0	3
WATER RESOURCES ENGINEERING							

Course Learning Objectives:

The course is designed to make the students,

1. Learn the types of irrigation systems.
2. Understand the concepts of planning and design of irrigation systems.
3. Study the relationships among soil, water and plant and their significance in planning an irrigation system.
4. Understand design principles of erodible and non-erodible canals.
5. Know the principles of design of weirs on permeable foundations.
6. Know the concepts for analysis and design of storage head works.
7. Learn design principles of canal structures.

Course Outcomes

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

1. Estimate irrigation water requirements.
2. Design irrigation canals
3. Design irrigation canal structures
4. Plan and design diversion head works
5. Analyze stability of gravity and earth dams.
6. Design hydraulic ogee spillways

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	1	2	–	–	–	2	1
CO2	3	3	3	2	1	1	2	–	–	3	2
CO3	3	3	3	2	2	2	2	–	–	–	3
CO4	3	2	2	2	3	1	2	–	–	–	1
CO5	3	3	3	2	1	2	3	–	–	3	1
CO6	3	2	2	2	1	2	3	–	–	2	2

CO	PSO1	PSO2
CO1	1	–
CO2	3	2
CO3	3	3
CO4	2	3
CO5	3	3
CO6	3	3

SYLLABUS:

UNIT-I

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT-II

Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

UNIT- III

Canal Structures:

Falls: Types and location, design principles of Sarda type fall and straight glacis fall. (Description only)

Regulators: Head and cross regulators, design principles (Description only)

Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and super passage. (Description only)

Outlets: Types, proportionality, sensitivity and flexibility **River**

Training: Objectives and approaches

UNIT-IV

Diversion Head Works: Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT-V

Reservoir Planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.

Dams: Types of dams, selection of type of dam, selection of site for a dam.

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis.

Earth Dams: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters.

Spillways: Types, design principles of Ogee spillways, types of spillways crest gates.

Textbooks:

1. 'Irrigation and Waterpower Engineering' by Punmia B C, P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi
2. 'Irrigation and Water Resources Engineering' by Asawa G L (2013), New Age International Publishers
3. 'Irrigation Engineering' by Raghunath H.M (2012), Wiley India.
4. 'Irrigation Water Resources and Waterpower Engineering' by Modi P N (2011), Standard Book House, New Delhi

Reference books:

1. 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
2. 'Irrigation Engineering' by Sharma R.K. and Sharma, T. K (2012), S. Chand & Co Publishers.
3. 'Water Resources Engineering' by Satyanarayana Murthy Challa (2008), New Age International Publishers.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32O2A		3	0	0	3
DISASTER MANAGEMENT							

Course Learning Objectives: The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.'
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

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

1. Affirm the usefulness of integrating management principles in disaster mitigation work
2. Distinguish between the different approaches needed to manage pre- during and post- disaster periods
3. Explain the process of risk management
4. Relate and apply concepts of risk transfer and financial management in disaster scenarios.
5. Analyze the role of technology, RS & GIS, and infrastructure systems in disaster mitigation and preparedness.
6. Apply community-based disaster management and resilience-building principles for sustainable disaster risk reduction.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	–	–	1	2	–	–	–	2
CO2	2	3	2	1	–	2	2	–	2	–	2
CO3	3	3	2	2	1	2	3	–	–	2	2
CO4	2	2	2	1	–	2	2	–	1	2	3
CO5	3	2	2	2	3	2	2	–	–	–	1
CO6	2	2	2	1	1	2	3	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	3
CO6	3	3

SYLLABUS:

UNIT-I

Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II

Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III

Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV

Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V

Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

Text books:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Punblishers & Distributors Pvt.Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt.Ltd.

Reference books:

1. 'Disaster Management' edited by H K Gupta (2003), Universities press.
2. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universities press. R. Nishith, Singh AK,
3. "Disaster Management in India: Perspectives, Issues and strategies" New Royal Book Company."

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32O2B		3	0	0	3
SUSTAINABILITY IN ENGINEERING PRACTICES							

Course Objectives

1. To introduce the concepts of sustainable development and international environmental agreements and protocols.
2. To create awareness of environmental issues arising from human activities and the role of renewable energy resources.
3. To understand local and global environmental challenges and strategies for sustainable urban and industrial development.
4. To impart knowledge of renewable energy technologies and green practices for achieving environmental sustainability.

Course Outcomes

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

1. Explain sustainable development and different environmental agreements and protocols.
2. Discuss real-time activities causing environmental issues and methods of utilizing renewable energy resources.
3. Explain local and global environmental issues.
4. Differentiate carbon emissions of regular and sustainable cities and explain practices to move industries towards sustainability.
5. Discuss renewable energy resources and explain methods to implement green technologies.
6. Explain the cconventional and non- conventional forms of energy, solar energy, fuel cells, wind energy

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	2	2	2	–	–	2	3
CO2	3	3	2	2	2	3	3	2	–	3	2
CO3	3	2	2	2	2	3	2	2	–	2	2
CO4	3	2	2	–	2	3	2	2	2	–	3
CO5	3	3	3	2	1	3	3	–	2	3	2
CO6	3	2	2	2	2	2	2	–	–	2	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	–
CO5	3	–
CO6	3	3

UNIT-I

Introduction to Sustainable Engineering- Sustainable development, concepts of sustainable development: three pillar model, egg of sustainability model, Atkisson's pyramid model, prism model, principles of sustainable development, sustainable engineering, threats for sustainability.

Environmental Ethics and Legislations – Environmental ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India – The Water Act, The Air Act, The Environment Act.

UNIT-II

Local Environmental Issues- Solid waste, impact of solid waste on natural resources, zero waste concept and three R concept, waste to energy technology: thermo-chemical conversion, biochemical conversion.

Global Environmental Issues- Resource degradation: deterioration of water resources, land degradation, air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

UNIT-III

Tools for Sustainability - Environmental management System (EMS), concept of ISO14000, life cycle assessment (LCA): basic components, advantages, disadvantages, case study. Environmental impact assessment (EIA), environmental auditing, bio mimicking, case studies.

UNIT-IV

Sustainable Habitat - Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment(GRIHA),leader ship in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable pavements, case studies in sustainability engineering: Green building, sustainable city, sustainable transport system.

Sustainable Industrialization and Urbanization – Sustainable urbanization,

industrialization, material selection, pollution prevention, industrial ecology, industrial symbiosis, poverty reduction.

UNIT-V

Renewable energy resources- Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydroplants, biogas systems, biofuels, energy from ocean, geothermal energy, conservation of energy**.**

Green technology and Green Business: Sustainable business, green technology, green energy, green construction, green transportation, green chemistry, green computing

Text Book:

1.R.L. Ragand Lekshmi Dinachandran Remesh. Introduction to Sustainable Engineering. 2nd Edition, PHI Learning Pvt. Ltd., 2016.

Reference books:

1. D.T.Allenand D.R.Shonnard. Sustainability Engineering: Concepts, Design and Case Studies, 1st Edition, Prentice Hall, 2011.
2. A.S.Bradley,A.O.Adebayo,P.Maria. Engineering applications in sustainable design and development, 1st Edition, Cengage learning, 2016.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE32O2C		3	0	0	3
WATER SUPPLY SYSTEMS							

Course Objectives

1. To introduce the importance of water and its various uses in daily life.
2. To understand the origin, characteristics, and treatment requirements of natural waters.
3. To impart knowledge of non-potable water utilization and water supply systems.
4. To understand the characteristics and significance of wastewater in environmental engineering.

Course Outcomes

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

1. Outline the various facets of water usage in daily life.
2. Explain the origin of natural waters and methods to make them suitable for regular use.
3. Discuss the utilization of non-potable water.
4. Describe the water supply system from a reservoir.
5. Explain the characteristics of wastewater.
6. Explain the quality, sources and characteristics of waste water

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	–	–	–	–	2	2
CO2	3	3	–	2	1	1	2	2	–	3	2
CO3	3	–	–	2	–	–	2	2	–	2	2
CO4	3	2	2	2	–	–	2	2	–	2	2
CO5	2	2	–	3	2	–	–	2	2	2	2
CO6	2	3	2	3	2	1	2	2	–	2	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	–
CO6	3	3

UNIT-I

WATER AND LIFE: Necessity of water – Domestic demand – Public demand – Irrigation – Transportation – Sanitation – Dilution of waste waters – Dust palliative – Recreation – Fire protection.

UNIT-II

SOURCES OF WATER: Surface sources – Ground sources – Water from atmosphere – Desalination – Recycling of waste water – Recharging of aquifers.

UNIT-III

DUAL SUPPLY OF WATER: Potable and non-potable water – Protected water – Grey water – Black water – Water bornediseases – water related diseases – Sewage Irrigation.

UNIT-IV

DISTRIBUTION OF WATER: Based on topography – Gravity distribution – Direct pumping – Combined pumping and gravity flow. Service Reservoirs – Continuous supply – Intermittent supply – Networks of distribution– Emergency water supply as in case of fire accidents – Valves, hydrants and meters.

UNIT-V

INDUSTRIAL WATER: Location of Industry with reference to surface sources of water – Quality of water required for industrial operations – characteristics of waste water produced – Standards for letting industrial effluents into sources of water.

Text books:

1. K.N. Duggal, "Elements of Environmental Engineering", 7thEdition, S. Chand Publishers, 2010.
2. Hammer and Hammer "Water and wastewater Technology", 4th Edition, Prentice hall of India, 2003.
3. Howard S. Peavy, Donand P. Rowe, George Technobanoglous, "Environmental Engineering", 1stEdition Mc Graw –Hill Publications, Civil Engineering Series, 1985.

Reference books:

1. B.C.Punmia, "Water Supply Engineering", Vol. 1, "Waste water Engineering Vol. II", 2nd Edition, Ashok Jain &Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi, 2008.
2. Fair, Geyer and Okun, "Water and Waste Water Engineering", 3rdEdition, Wiley, 2010.
3. Metcalf and Eddy, "Waste Water Engineering", 3rd Edition, Tata Mc Graw Hill, 2008.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3204		0	0	3	1.5
ENVIRONMENTAL ENGINEERING LAB							

Learning Objectives:

The course will address the following:

- Estimation of some important characteristics of water and wastewater in the laboratory
  It also gives the significance of the characteristics of the water and wastewater

Outcomes:

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

1. Estimate some important characteristics of water and wastewater in the laboratory
2. Draw some conclusion and decide whether the water is suitable for construction or not, drinking or not; ultimate disposal as per effluent standards or not.
3. Decide whether the water body is polluted or not with reference to the state parameters in the list of experiments
4. Estimate and study the strength of the raw and treated effluents in terms of BOD, COD, P^H, TDS and chloride of the neutralization tank treating effluents from Chemistry lab or Environmental Engineering Laboratory
5. Determination of chlorine demand
6. Determine the optimum coagulant dose.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	–	–	–	–	–	–	2	2
CO2	3	3	3	2	2	–	3	–	3	3	2
CO3	3	2	2	2	2	–	2	–	–	–	2
CO4	3	2	2	2	2	2	2	–	–	–	2
CO5	3	2	2	–	–	2	2	–	–	–	–
CO6	3	2	2	–	–	2	–	–	–	–	–

CO	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	–	–
CO4	–	–
CO5	3	–
CO6	3	–

SYLLABUS:

List of Experiments

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium & Magnesium.
3. Determination of Alkalinity/Acidity
4. Determination of Chlorides in water and soil
5. Determination and Estimation of Total Solids, Organic Solids and Inorganic Solids and Settleable Solids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter &Wrinklers Method and B.O.D.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Colour, Odour, Turbidity, Taste.
10. Determination of C.O.D.
11. Determination of Optimum coagulant dose.
12. Determination of Chlorine demand.
13. Presumptive Coliform test.
14. Visit a Water Treatment Plant and give a technical report.

NOTE: At least 10 of the above experiments are to be conducted.

List of Equipments

1. pH meter
2. Turbidity meter
3. Conductivity meter
4. Hot air oven
5. Muffle furnace
6. Dissolved Oxygen meter
7. U–V visible spectrophotometer
8. COD Reflux Apparatus
9. Jar Test Apparatus
10. BOD incubator
11. Autoclave
12. Laminar flow chamber
13. Hazen's Apparatus

Textbooks

- Standard Methods for Analysis of Water and Waste Water – APHA
- Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, New Delhi

Reference book:

1. Relevant IS Codes. Chemistry for Environmental Engineering by Sawyer and Mc. Carty

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3205		0	0	3	1.5
HIGHWAY ENGINEERING LAB							

Course Learning Objectives:

The objectives of this course are:

1. To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bituminous mix
4. To carry out surveys for traffic volume, speed and parking.

Course outcomes:

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

1. Test aggregates and judge the suitability of materials for the road construction
2. Test the given bitumen samples and judge their suitability for the road construction.
3. Obtain the optimum bitumen content for Bituminous Concrete
4. Determine the traffic volume, speed and parking characteristics.
5. Draw highway cross sections and intersections.
6. Determine the earthwork calculations.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	–	1	–	–	–	2
CO2	3	2	2	2	1	–	1	–	–	–	2
CO3	3	3	2	2	–	–	2	–	–	2	2
CO4	3	3	2	2	–	2	2	–	–	3	3
CO5	2	1	1	1	–	–	2	–	–	3	3
CO6	3	2	1	1	–	–	–	–	–	3	3

CO	PSO1	PSO2
CO1	3	–
CO2	3	–
CO3	3	3
CO4	2	2
CO5	3	3
CO6	2	3

SYLLABUS:

I. ROAD AGGREGATES:

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

III. BITUMINOUS MIX:

1. Marshall Stability test.

TRAFFIC SURVEYS:

2. Traffic volume study at mid blocks.
3. Traffic Volume Studies (Turning Movements) at intersection.
4. Spot speed studies.
5. Parking study.

DESIGN & DRAWING

6. Earthwork calculations for road works
7. Drawing of road cross sections
8. Rotary intersection design

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup. 9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

Textbooks:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veera raghavan, Neam Chan Brothers New Chand Publications, New Delhi.

Reference books:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24CE3206		0	1	2	2
CAD LAB							

Course Objectives: The objectives of the course are to

1. Learn the usage of any fundamental software for design
2. Create geometries using pre-processor
3. Analyze and Interpret the results using post processor
4. Design the structural elements

Course Outcomes

After the completion of the course student should be able to

1. Model the geometry of real-world structure Represent the physical model of structural element/structure
2. Perform analysis
3. Interpret from the Post processing results
4. Design the structural elements and a system as per IS Codes
5. Analysis & Design of Roof Trusses
6. Detailing of RCC beam and RCC slab

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	3	–	–	–	–	2	2
CO2	3	3	3	2	3	–	–	–	2	3	2
CO3	3	3	2	2	2	3	–	–	2	3	3
CO4	3	3	3	–	2	2	–	–	2	2	2
CO5	2	1	3	–	–	2	–	–	–	3	2
CO6	3	2	2	–	–	–	–	–	–	2	3

CO	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	3
CO4	2	3
CO5	3	3
CO6	2	3

LISTOFEXPERIMENTS

Analysis & Design determinate structures using a software

1. Analysis &Design of fixed &continuous beams using a software
2. Analysis & Design of Plane Frames
3. Analysis & Design of space frames subjected to DL & LL
4. Analysis & Design of residential building subjected to all loads (DL, LL,WL,EQL)
5. Analysis & Design of Roof Trusses
6. Design and detailing of built up steel beam
7. Developing a design program for foundation using EXCEL Spread Sheet
8. Detailing of RCC beam and RCC slab
9. Detailing of Steel built up compression member

Note: Drafting of all the exercises is to be carried out using commercially available designing software.

III	Year	II	Semester	L	T	P	C
Course Code:		BT24HS3201		2	0	0	-
AUDIT COURSE TECHNICAL PAPER WRITING & IPR							

Course Objective:

1. The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Course Outcomes

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

1. Compose clear and effective technical sentences and reports using appropriate structure, transitions, and tenses.
2. Plan and organize technical documents by identifying the audience, purpose, format, and required sections, including minutes of meetings.
3. Draft, revise, and proofread technical reports to improve clarity, grammar, readability, and adherence to plain English principles.
4. Prepare summaries and present technical reports effectively through written and verbal communication, including proposal writing basics.
5. Use word processing tools proficiently to manage document features such as table of contents, references, citations, tracking changes, document comparison, and security settings.
6. Explain intellectual property concepts including patents, copyrights, designs, trademarks, and understand the patenting process and international IP frameworks.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	–	–	–	–	1	–	–	2	2	3	2
CO2	–	–	–	–	2	–	–	3	3	3	3
CO3	–	–	–	–	3	–	–	2	1	3	2
CO4	–	–	–	–	2	–	–	3	2	3	3
CO5	–	–	–	–	3	–	–	1	2	2	1
CO6	–	–	–	–	1	–	–	2	2	2	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	–	–
CO6	–	–

Unit I: Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.
Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II: Drafting report and design issues: The use of drafts, Illustrations and graphics.
Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III: Proofreading and summaries: Proofreading, summaries, Activities on summaries.
Presenting final reports: Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

Unit IV: Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V: **Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

Text Books:

1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

Department of Civil Engineering

Honors Degree Courses

S.No	Course Name	Code
1	Introduction to earthquake engineering	BT24CEH01
2	Structural dynamics	BT24CEH02
3	Traffic engineering and management	BT24CEH03
4	Advanced hydrology	BT24CEH04
5	Geosynthetics engineering: in theory and practice	BT24CEH05
6	Environmental geotechnics	BT24CEH06
7	Seismic analysis of structures	BT24CEH07
8	Environmental air pollution	BT24CEH08
9	Soil dynamics	BT24CEH09
10	Advanced transportation engineering	BT24CEH10

Minors Degree Courses

S.No	Course Name	Code
1	Surveying	BT24CEM01
2	Mechanics of solids	BT24CEM02
3	Soil mechanics	BT24CEM03
4	Fluid mechanics	BT24CEM04
5	Civil engineering- building materials and construction	BT24CEM05
67	Building planning and drawing	BT24CEM06
7	Estimation and costing	BT24CEM07
8	Sustainable materials and green building	BT24CEM08
9	Safety in construction	BT24CEM09
10	Construction planning and management	BT24CEM10

Note: Students can opt any course in Honors and Minors through NPTEL/MOOCs/JNTUK, Kakinada University approved courses.

Department of Civil Engineering

(DR24)

Syllabus for Honors

HONORS		L	T	P	C
Course Code:	BT24CEH01	3	0	0	3
INTRODUCTION TO EARTHQUAKE ENGINEERING					

Course outcomes:

1. Explain the fundamentals of engineering seismology, seismic waves, earthquake mechanisms, and Indian seismicity.
2. Interpret seismic design concepts, load paths, structural configurations, and code provisions (IS 1893 & IS 13920).
3. Analyze earthquake loads and understand 3D structural modeling concepts for seismic analysis.
4. Design and detail ductile RC structural elements (beams, columns, shear walls) following seismic design philosophy.
5. Evaluate cyclic behavior of structural systems and assess modern seismic protection systems such as base isolation and adaptive systems.
6. Assess earthquake-induced damage and propose appropriate retrofitting and restoration techniques for buildings.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	1	1	–	–	–	–	2
CO2	3	3	2	–	2	2	–	–	–	–	1
CO3	3	3	3	2	3	2	–	–	–	–	2
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	3	2	–	–	–	–	2
CO6	2	3	2	3	3	3	1	–	–	–	3

CO	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	3
CO4	3	3
CO5	2	3
CO6	3	2

UNIT - I

Introduction to seismology: Engineering seismology– rebound theory – plate tectonics – seismic waves- earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects.

UNIT – II

Seismic design concepts: EQ load on simple building –load path–floor and roof diaphragms – seismicresistantbuildingarchitecture–planconfiguration–verticalconfiguration– pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames (MRF) – ductility of MRF – Infill wall – Non- structural elements.

UNIT - III

Calculation of loads: EQ load – 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing of shear walls.

UNIT-IV

Earthquake loads: Cyclic loading behavior of RC, steel and pre- stressed concrete elements - modern concepts-Base isolation – Adaptive systems – case studies.

UNIT-V

Concept of damages: Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

Text books:

1. Agrawal, P. and Shrikhande, M. (2006), "Earthquake resistant design of structures", Prentice Hall of India, Inc.
2. Chopra, A.K. (2007), "Dynamics of structures: Theory and application to earthquake engineering", 2nd edition, Prentice Hall of India.
3. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentice – Hall of India, 2007, New Delhi.
4. Bullet K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

Reference books:

1. Chowdhary, I. and Dasgupta, S.P. (2009). "Dynamics of structure and foundation – A unified approach : 2 Applications", CRC Press, Balkema.
2. Clough, R. W. and Penzien, J. (1993). "Dynamics of structures", McGraw Hill, Inc., New York.
3. Datta, T. K. (2010). "Seismic analysis of structures", John Wiley & Sons (Asia) Pte Ltd. Singapore.
4. Hart, G. C. and Wong, K. (2000). "Structural dynamics for structural engineers", John Wiley & Sons, Inc.,

HONORS		L	T	P	C
Course Code:	BT24CEH02	3	0	0	3
STRUCTURAL DYNAMICS					

Course outcomes:

1. Explain the basic concepts of structural dynamics, prescribed loads, degrees of freedom, and vibration parameters such as frequency, period, and amplitude.
2. Analyze the free and forced vibration response of single degree of freedom (SDOF) systems with and without damping under harmonic and dynamic excitation.
3. Develop mathematical models for multi degree of freedom (MDOF) systems and determine natural frequencies and mode shapes using analytical methods.
4. Apply mode superposition and stiffness matrix concepts for dynamic analysis of shear buildings, beams, frames, and trusses.
5. Evaluate the earthquake response of SDOF and MDOF systems using response spectra and seismic provisions of IS 1893.
6. Interpret seismic design concepts and codal provisions for earthquake-resistant design of building structures.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	1	1	–	–	–	2	1
CO2	3	3	2	2	2	1	–	–	–	3	1
CO3	3	3	3	2	2	1	–	–	–	3	2
CO4	3	3	3	2	3	1	–	–	–	2	2
CO5	2	3	2	2	3	2	–	–	–	3	2
CO6	2	3	2	3	3	3	–	–	–	3	3

CO	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	3	2
CO4	3	3
CO5	2	3
CO6	3	2

UNIT – I

Introduction to Structural Dynamics – Types of prescribed Loads – Analysis of Dynamical behaviour of structures – Mathematical and Analytical Models – Degrees of Freedom. Single degree freedom – Un-damped and Damped Systems - Free body diagram – Solution of Differential equation of Motion – Frequency, Period and Amplitude – Logarithmic decrement – Simple Problems.

UNIT – II

Free Vibration of SDOF Systems – Response of SDOF System to Harmonic Excitation, Dynamic Excitation – Rayleigh's method- Vibration measuring instruments, Types of Damping Systems – Response Spectra.

UNIT – III

Mathematical model of MDOF Systems – Vibration of Un-damped two Degrees of Freedom system Simple Problems – Free Vibration of MDOF System – Natural Frequencies & Mode shapes – Mode Superposition method as per IS 1893 Code of Provisions.

UNIT – IV

Shear Building – Free Vibration of Shear Building – Dynamic Analysis of Simple Beam, Plane Frame

and Plane Truss – Equation of Motion – Formulation of Element Stiffness Matrix only.

UNIT – V

Introduction to Earth Quake Response of Structures – Response of SDOF and MDOF systems to earthquake excitation – Simple problems on SDOF System - Concept on Seismic Design – IS 1893 (1984) – Provisions for Seismic Design of Buildings.

Text books :

1) Dynamics of Structures by R.W. Clough & J. Penzien
2) Dynamics of Structures by Anil . K. Chopra
3) Earth quake Engineering by A.R. Chandrasekharn & Jaikrishna

HONORS		L	T	P	C
Course Code:	BT24CEH03	3	0	0	3
TRAFFIC ENGINEERING AND MANAGEMENT					

Course Outcomes :

1. Explain the roles and responsibilities of a traffic engineer, traffic system components, road user behavior, vehicle characteristics, and traffic data collection methods.
2. Analyze traffic volume, speed, density, capacity, level of service, peak hour factor, and accident data for traffic system evaluation.
3. Evaluate parking characteristics and design on-street and off-street parking facilities based on traffic and demand studies.
4. Analyze traffic control and regulation systems including signs, markings, unsignalised and signalised intersections, and signal coordination techniques.
5. Explain Intelligent Transportation Systems (ITS), public transport systems, congestion management strategies, and environmental impacts of traffic.
6. Assess highway safety issues, accident causes, and apply engineering, enforcement, educational measures, and road safety audit principles.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	1	1	–	2	–	–	–
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	2	1	–	–	–	–	1
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	3	2	2	–	–	–	2
CO6	2	3	2	3	3	3	2	1	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	3	3
CO5	2	3
CO6	3	2

UNIT-I

Traffic Engineer Responsibility, Ethics & Liability; Modern Problems Components of traffic & characteristics: Road users: Visual, Perception-Reaction Time, Pedestrian, Impacts of Drugs, Alcohol & Aging, Psychological & Personality related factors. Vehicle: Concept of Design Vehicle, Turning, Braking & acceleration Characteristics Traffic measurement: Volume: Volume, Demand & Capacity; Volume Patterns & Characteristics. Presentation; Peak Hour Factor Speed: Spot Speed Studies, Uses, Measurement; Travel-Time Studies, Volume, Speed, Density Relation Accidents: Data Collection, Site Analysis-Collision & Condition Diagram, IRC accident data forms.

UNIT-II

Definition of Capacity – Importance of capacity – Factors affecting Capacity- Concept of Level of Service- Different Levels of Service- Concept of Service Volume- Peak Hour Factor. Parking studies: Types of parking facilities – On street and Off Street Parking Facilities; Parking Studies- Parking Inventory Study – Parking Survey by Patrolling Method- Analysis of Parking Data and parking Characteristics, Accumulation & Duration –Design Aspects- parking dimensions- Multi Story Car Parking Facility-Design standards

UNIT-III

Traffic control & regulation: Level I Control: Basic Rules of the road, Level II Control: Yield and stop control, Level III: Traffic Control Signals–Advantages, Disadvantages, Warrants-Phase & Ring Diagram Unsignalised Intersection: Conflicting Volume, Critical Gap, Follow-Up Time, Potential Capacity, Shared-Lane Capacity, Estimating Control Delay & Queue Length; Roundabout. Signalised Intersection: Design by Webster & IRC Method, Signal Coordination: Time-Space Diagram for One-way & Two-way streets, Shock Waves. Vehicle Actuated Signals: Introduction, Advantages, Disadvantages.

UNIT-IV

ITS Application, Network optimization, Sensing with Detectors, In- Vehicle Routing and personal route information, The Smart Car, Electronic Toll Collection, The Smart Card, Congestion Pricing, Dynamic Assignment, Bus Transit & Paratransit-Emerging Issues. Detrimental effect of traffic on environment – Air Pollution –Pollutants due to Traffic – Measures to reduce Air Pollution due to Traffic- Noise Pollution – Measures to reduce Noise Pollution.

UNIT-V

Types of Traffic Signs- Cautionary, Regulatory and Informative Signs- Specifications- Pavement markings- Types of Markings – Lane markings and Object markings- Standards and Specifications for Road MarkingsProblem of Highway Safety – Types of Road accidents- Causes – Engineering Measures to reduce Accidents- Enforcement Measures – Educational Measures- Road Safety Audit- Principles of Road Safety Audit.

Text Books:

- Kadiyali L.K, "Traffic Engineering and Transportation Planning", 3rd Edition, Khanna Publishers", 2004.
- Mannering and Kilareski, "Highway Engineering and Traffic Analysis", 3rd Edition, John Wiley Publications, 2007.
- Roger P.Roess, Elena S. Prassas, William R. McShane, "Traffic Engineering", 3rd Edition, Prentice Hall, 2004.

Reference books:

- Khisty C. J., "Transportation Engineering – An Introduction", 3rd Edition, Prentice Hall, 2010.
- Papacostas C.S., "Fundamentals of Transportation Engineering", 2nd Edition, Prentice Hall of India, 2005.
- Partha Chakroborthy and Animesh Das, "Principles of Transportation Engineering", 2nd Edition, Prentice Hall of India, 2005.

HONORS		L	T	P	C
Course Code:	BT24CEH04	3	0	0	3
ADVANCED HYDROLOGY					

Course Outcomes

1. Explain complex storm hydrographs and apply unit hydrograph (UH), synthetic UH, and instantaneous unit hydrograph (IUH) concepts.
2. Analyze runoff estimation using SCS curve number method and evaluate snow hydrology processes including snowmelt and snowmelt hydrograph synthesis.
3. Apply flood routing techniques for reservoirs and channels using hydrologic routing models for flood control studies.
4. Explain fluvial geomorphology, hydrologic abstraction processes, arid zone hydrology, and estimation of probable maximum precipitation (PMP).
5. Develop and analyze catchment models incorporating various hydrologic components.
6. Analyze hydrologic time series data, generate synthetic hydrologic data, and evaluate the role of forest hydrology in watershed response.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	1	1	–	–	–	–	–
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	2	2	–	–	–	–	2
CO4	2	3	2	2	1	2	2	–	–	–	1
CO5	2	3	3	2	3	1	–	–	–	–	2
CO6	2	3	2	3	3	2	2	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	2
CO5	3	3
CO6	2	3

UNIT-I

Complex storm hydrograph; Synthetic UH generation techniques; IUH generation techniques; UH generation from IUH.

UNIT II

SCS runoff curve number method; Snow hydrology; Snow formation and accumulation; Melting of snowpack; Snowmelt indices; Effect of snowpack condition on runoff; Snowmelt hydrograph synthesis.

UNIT III

Flood routing; Attenuation, Prism and wedge storage; Reservoir/ storage routing – Modified Pul, Goodrich, Runge Kutta, etc.; Channel routing – Muskingum, Clark's IUH, Nash, Convex, Muskingum Cunge, etc; Flood control.

UNIT IV

Fluvial geomorphology, Models for hydrologic abstraction processes, Aspects of arid zone hydrology; Probable maximum precipitation – Estimation.

UNIT V

Types of catchment model components and Construction; Analysis of time series data – Generation of synthetic hydrologic data; Forest hydrology, etc.

Text Books:

1. Urban Hydrology: A Multidisciplinary Perspective: Timothy R. Lazaro, CRC Press
2. Applied Hydrology: R. K. Linsley Jr., MA Kohler, and JLH Paulhus, McGraw-Hill Book Co.
3. Environmental Hydrology: Andy D. Ward and Stanley W. Trimble, Le

HONORS		L	T	P	C
Course Code:	BT24CEH05	3	0	0	3
GEOSYNTHETICS ENGINEERING: IN THEORY AND PRACTICE					

Course Outcomes

1. Explain the fundamentals, types, functions, properties, manufacturing techniques, and testing methods of geosynthetic materials.
2. Select appropriate geosynthetics based on functional requirements such as separation, reinforcement, filtration, drainage, containment, and protection.
3. Analyze the mechanisms and design considerations of geosynthetic-reinforced soil structures using suitable design methodologies.
4. Apply geosynthetics in roadway and railway engineering projects considering design, construction practices, and performance benefits.
5. Evaluate geoenvironmental and hydraulic applications of geosynthetics for liners, covers, canals, reservoirs, and containment systems.
6. Assess innovations, standards, environmental impacts, long-term performance, and future trends in geosynthetic engineering.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	2	1	–	–	–	–	–
CO2	3	3	2	1	2	2	–	–	–	–	1
CO3	3	3	3	2	2	2	–	–	–	–	2
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	3	3	2	–	–	–	2
CO6	2	3	2	3	3	2	2	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	3	3
CO5	3	3
CO6	2	3

UNIT-I

Introduction to Geosynthetics; Basic description of geosynthetics; Types and functions of geosynthetics; Engineering properties of geosynthetics and their evaluation; Testing of geosynthetic materials; Design methodologies with geosynthetics; Geotechnical applications: bearing capacity, settlement, stability analysis, retaining walls, embankments; Manufacturing techniques for different types of geosynthetics. Physical, mechanical, and hydraulic properties. Standard testing methods and specifications.

UNIT-II

General applications in civil engineering projects Case studies highlighting successful applications Functions of Geosynthetics Separation, reinforcement, filtration, drainage, containment, and protection. • Design methodologies for each function. Selection criteria for geosynthetics based on project requirements. Geosynthetic Reinforcement: Mechanisms of soil reinforcement. Design considerations for reinforced soil structures.

UNIT-III

Geosynthetics in Roadway Applications: Use of geotextiles and geogrids in pavement design. Benefits in terms of durability and cost-effectiveness. Geosynthetics in Railways: Applications in track stabilization and drainage.Case studies of geosynthetics in railway projects. Design and Construction: Design considerations for roadway and railway projects.

UNIT-IV

Geoenvironmental applications: covers and liners of landfills; Hydraulic applications: liners for ponds, canals, and reservoirs. Applications in water reservoirs, canals, and ponds. Design considerations for containment systems. Analysis of successful environmental projects using geosynthetics.

UNIT-V

Innovations in geosynthetic materials and manufacturing. New applications and emerging technologies. Environmental impact of geosynthetics. Long-term performance and durability studies. International and national standards for geosynthetics. Regulatory requirements for various applications. Future directions in geosynthetics.

Text books:

1. Sanjay Kumar Shukla and Jian-Hua Yin, Fundamentals of Geosynthetic Engineering, CRC Press 2. Moseley, M.P. and Kirsch, K. Ground Improvement, Spon Press, Taylor and Francis Group
2. Robert M. Koerner., Designing with Geosynthetics, Pearson Prentice Hall.
3. Rao G. V. and Rao, G. V. S. Text Book on Engineering with Geotextiles, Tata McGraw Hill

HONORS		L	T	P	C
Course Code:	BT24CEH06	3	0	0	3
ENVIRONMENTAL GEOTECHNICS					

Course Outcomes

1. Explain the role of geoenvironmental engineering, soil–waste interactions, contaminant types, risk assessment, and engineered landfill design concepts.
2. Conduct site investigation for geoenvironmental problems and evaluate soil and waste properties through sampling, characterization, and mineralogical analysis.
3. Analyze soil behavior related to pollution such as pore size distribution, swell–shrink behavior, and cracking under environmental loading.
4. Evaluate soil remediation techniques including physical, chemical, electro-kinetic, thermal, and biological methods based on site conditions.
5. Analyze contaminated site case studies and apply containment principles including liners, barriers, and carbon dioxide sequestration techniques.
6. Apply ground improvement and containment methods such as grout curtains, ground freezing, compacted liners, geosynthetic clay liners, and comply with environmental laws and regulations.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	1	3	2	–	–	1	1
CO2	3	3	2	2	2	2	–	–	–	2	1
CO3	3	3	2	2	2	2	–	–	–	2	1
CO4	3	3	3	2	3	3	–	–	–	3	2
CO5	2	3	2	3	2	3	3	–	–	1	2
CO6	2	3	3	2	3	3	2	2	–	2	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	2	3
CO6	2	3

UNIT-I

Role of Geoenvironmental Engineering – Soil phase systems - Basic concepts related to soil pollution – Evolution of waste materials – Risk assessment - potential reusewaste disposal methods – Types and impact of contaminants – soil - waste interaction – design of Engineered Landfill- types.

UNIT-II

Site investigation for geoenvironmental problems - Soil sampling - sample handling, transportation, characterization, preservation and storage – Soil properties - Mineralogical characterization of soil and waste - pore size distribution- swell and shrink cycle – cracking

UNIT-III

Soil remediation - need and approach, Techniques – Basis of selection of techniques- soil washing, Chemical surfactants - permeable reactive barriers, solidification, Soil air sparging- vacuum extraction, electro-kinetic remediation with mechanisms, thermal desorption- soil fracturing- Bioremediation – microbial transformations -phytoremediation.

UNIT-IV

Case studies on polluted sites and issues related to the environment – Containment systems and basic principles – carbon dioxide sequestration,

UNIT-V

Grout curtains, Ground freezing, Compacted soil liners, Geosynthetic clay liners - Environmental laws and regulations.

References books:

1. Reddi L.N. and Inyang, H. I., "Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, 2000.
2. Hari D. Sharma and Krishna R. Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004.
3 Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London, 1993.

HONORS		L	T	P	C
Course Code:	BT24CEH07	3	0	0	3
SEISMIC ANALYSIS OF STRUCTURES					

Course Outcomes

1. Explain physical and mathematical modelling approaches, principles of dynamics, and vibration behavior of SDOF and 2DOF systems.
2. Describe the internal structure of the earth, plate tectonics, fault mechanisms, earthquake characteristics, and seismic wave propagation.
3. Apply the provisions of IS 1893 (Part 1) for seismic analysis of buildings using equivalent static and response spectrum methods.
4. Identify and evaluate the effects of plan and vertical irregularities in buildings and their influence on seismic response.
5. Apply ductile design principles and detailing requirements for RC beams, columns, and shear walls as per IS 13920.
6. Interpret seismic design provisions related to structural separation and special construction features as per IS 4326.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	–	–	–	–	2
CO2	3	2	2	1	1	3	–	–	–	3	2
CO3	3	3	3	2	3	2	–	–	–	2	2
CO4	2	3	2	2	2	3	–	–	–	3	2
CO5	3	3	3	2	3	2	–	–	–	3	3
CO6	2	2	2	1	2	3	–	–	–	2	2

CO	PSO1	PSO2
CO1	2	1
CO2	2	2
CO3	3	2
CO4	2	3
CO5	2	3
CO6	2	3

UNIT – I

Physical and Mathematical Modelling – Discrete and continuum Modelling. Laws of Equilibrium – Newton's Law of Motion – D'Alembert's Principle and Principle of virtual displacement. - Types of Dynamic Loading. Single Degree of Freedom System (SDOF) – Undamped Free Vibrations – Damped Free Vibrations (concept only). Two Degree of Freedom System (2DOF) – Undamped Free Vibrations – Determination of Natural frequencies and Mode shapes.

UNIT – II

: Introduction- Internal structure of earth – Chemical properties – Physical properties – Continental drift theory – Plate tectonics – Movement of plate Boundaries – Movement of Indian plate – Faults – Types of faults – Elastic Rebound theory. Earthquakes – Earthquake terminology – Classification of Earthquakes – Causes and effects of Earthquakes –Earthquake waves – Quantification of Earthquakes – Intensity and Magnitude – Recording Earthquakes.

UNIT – III

Reviews of latest I.S : 1893 (Part 1) provisions for buildings - General principles and design criteria – Assumptions – Design Acceleration spectrum – Horizontal seismic coefficient – Design acceleration – Seismic zones of India – Importance factor – Response reduction factor – Design lateral force – Design imposed loads for Earthquake force calculation –Seismic weight – Analysis by Equivalent Static Method and Dynamic Method (Response Spectrum Method) – Storey drift limitation.

UNIT – IV

Introduction – Regular and Irregular Buildings. Plan Irregularities – Torsion Irregularity – Re-entrant corners - Floor slabs having excessive cutouts or openings- Out of plane offsets in Vertical Elements – Non-parallel Lateral Force system. Vertical Irregularities – Stiffness Irregularity (soft storey) – Mass Irregularity – Vertical Geometric Irregularity – In-plane discontinuity in Vertical Elements resisting lateral force – strength Irregularity (weak storey) – Floating or stub columns – Irregular Modes of Oscillation in two Principle Plan Directions.

UNIT – V

DUCTILE DESIGN AND DETAILING: Review of Latest IS: 13920 provisions General specifications – Beams – Columns – Shear walls. Special confining reinforcement. Review of Latest IS: 4326 provisions - General principles – Special Construction features relating to separations of structures (above ground only).

Text books:

1. A.K. Jain “Dynamics of Structures with Mat Lab Applications” Pearson India Education Series Pvt.Ltd., Delhi, 2016
2. Pankaj Agarwal & Manish Shrikhande, “Earthquake Resistant Design of Structures”, 5th Edition Prentice Hall of India, New Delhi, 2011.
3. S.K.Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press, 1st Edition, 2012.

References books:

1. Chopra A.K., “Dynamics of Structures”, 5thEdition, Pearson Education, Indian Branch, Delhi, 2007.
2. Mario Paz, “Structural Dynamics - Theory and Computations”, 6thEdition, Pearson Education, 2005.
3. IS 456: 2000 Indian Standard Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).
4. IS 4326: 2013 Indian Standard “Earthquake Resistant Design and Construction of Buildings - Code of Practice, Bureau of Indian Standard.

HONORS		L	T	P	C
Course Code:	BT24CEH08	3	0	0	3
ENVIRONMENTAL AIR POLLUTION					

Course Outcomes

1. Explain the structure and composition of the atmosphere, sources and effects of air and noise pollutants, air quality standards, emission inventories, and global environmental issues.
2. Analyze ambient, stack, and noise sampling techniques, meteorological influences on pollutant dispersion, and air pollution modeling concepts.
3. Select and analyze particulate air pollution control equipment based on working principles, design equations, performance, and operational considerations.
4. Analyze gaseous air pollution control technologies including absorption, adsorption, condensation, biological treatment methods, and indoor air quality control.
5. Evaluate vehicular and indoor air pollution sources, emissions, control measures, noise pollution standards, and preventive strategies.
6. Assess real-world air pollution case studies and apply pollution control measures considering environmental regulations and public health impacts.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	1	1	3	3	–	–	–	1
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	3	2	–	–	–	–	2
CO4	3	3	3	2	3	2	–	–	–	–	2
CO5	2	3	2	2	2	3	2	–	–	–	2
CO6	2	3	2	3	3	3	2	2	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	–	–
CO5	2	–
CO6	3	–

UNIT-I

Structure and composition of Atmosphere – Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation and animals, Materials structures – Effects of air pollutants on the atmosphere, soil and water bodies – Long term effects on the planet – Global climate change, Ozone holes – Ambient air quality and emission standards – Air pollution indices – Emission inventories. - Greenhouse effect–Major contributions of air pollutant-Noise Pollution-Sources, classification-Monitoring techniques for noise pollution-Legislation and regulations - Noise quality management in India.

UNIT-II

Ambient and stack sampling- Analysis of particulate and gaseous pollutants -Effects of meteorology on Air pollution - Fundamentals, atmospheric stability, inversion-Wind profiles and stack plume patterns- Transport and dispersion of Air pollutants – Modeling techniques – Air pollution climatology-Ambient noise quality and emission standards-Noise pollution indices.-Manmade sources - Types of noise pollutant - effects on human health.

UNIT-III

factors affecting selection of control equipment – Gas particle interaction – Working principle, design and performance equations of gravity separators, cyclones-Fabric filters-Particulate scrubbers- Electrostatic precipitators – Operational considerations - Process control and monitoring – Costing of APC equipment – Case studies for stationary and mobile sources - Active personal particulate monitor.

UNIT-IV

Factors affecting selection of control equipment – Working principle, design and performance equations of absorption, adsorption, condensation- Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Case studies for stationary and mobile sources- Air pollution control measures - Basics of pollution control- Particulate control methods - Settling chambers, - cyclone separation, - Wet collectors-fabric filters-electrostatic precipitators- Removal of gaseous pollutants by adsorption, absorption,-Biological air pollution control technologies,-Indoor air quality-control

UNIT-V

Vehicular Pollution, automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution-Noise Pollution- Sources and Effects of Noise Pollution - Measurement - Standards -Control and Preventive measures- Sources types and control of indoor air pollutants, sick building syndrome types-Case studies on Air pollution

Text Books:

1.C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2020.
2.M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2013
3.Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2012.
4.Noel De Nevers, “Air pollution control Engineering”, McGraw Hill International Edition
5. Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 5 th Edition, 2013.

HONORS		L	T	P	C
Course Code:	BT24CEH09	3	0	0	3
SOIL DYANMICS					

Course Outcomes

1. Explain the fundamentals of free and forced vibrations of single degree of freedom systems, resonance phenomena, transmissibility, and soil–foundation natural frequency concepts.
2. Describe elastic wave propagation in soils and evaluate field and laboratory methods for determining dynamic soil properties.
3. Analyze design criteria for machine foundations considering permissible amplitudes, bearing pressures, and vibration modes of block foundations.
4. Analyze two degree of freedom systems under free and forced vibrations and apply IS code provisions for reciprocating and impact machine foundations.
5. Select suitable vibration isolation materials and methods based on dynamic performance and material properties.
6. Apply soil dynamics principles for safe and efficient design of machine foundations subjected to dynamic loads.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	–	–	–	2	1
CO2	3	2	1	2	2	1	–	–	–	1	2
CO3	3	3	3	2	2	2	–	–	–	3	2
CO4	3	3	3	2	3	2	–	–	–	3	3
CO5	2	2	2	1	3	1	–	–	–	2	1
CO6	3	3	3	2	3	3	–	–	–	1	3

CO	PSO1	PSO2
CO1	3	2
CO2	2	2
CO3	3	2
CO4	3	3
CO5	2	3
CO6	3	3

UNIT – I

Basic definitions- Free and Forced vibrations with and without damping for Single degree freedom system- Resonance and its effect – Magnification

– Logarithmic decrement – Transmissibility, Natural frequency of foundation soil system Barkan's and IS methods – Pressure bulb concept

UNIT – II

Elastic waves in Rods Waves in elastic Half space, Field and Laboratory methods of determination – Uphole, Down hole and Cross hole methods – Cyclic plate load test – Block vibration test.

UNIT – III

Design criteria, Permissible amplitudes and Bearing pressure, Degrees of freedom - Analysis under different modes of vibration of block foundation.

UNIT – IV

Analysis of Two Degree freedom systems under free and forced vibrations -Principles of Design of Foundations for reciprocating and impact machines as per IS code.

UNIT – V

Types and methods – Isolating materials and their properties.

Text books:

1. Barkan, D., "Dynamics of Bases and Foundations", 2nd Edition McGraw Hill Publishing, 1970.
2. Shamsher Prakash, "Soil Dynamics", 3rd Edition, John Wiley, 2000.

Reference book:

1. Shamsher Prakash, Soil Dynamics, McGraw - Hill, 1981.
2. Sreenivasalu and Varadarajan, Handbook of Machine Foundations, Tata McGraw -Hill, 2007.
3. IS 2974 -Part I and II,
4. Design Considerations for Machine Foundations

HONORS		L	T	P	C
Course Code:	BT24CEH10	3	0	0	3
ADVANCED TRANSPORTATION ENGINEERING					

Course outcomes:

1. Explain the principles, scope, and policies of highway geometric design as per IRC and AASHTO, including primary and dependent design controls.
2. Analyze human and vehicle factors influencing geometric design and evaluate different types of sight distance and their applications.
3. Design horizontal and vertical alignment elements, cross-sections, and super elevation considering safety, comfort, and efficiency.
4. Apply principles of highway location and alignment design including trial alignments, impact evaluation, and alignment optimization.
5. Design intersections and interchanges considering driver expectancy, turning movements, channelization, and geometric controls.
6. Use highway design software tools to evaluate alignment, sight distance, super elevation, intersections, and interchanges.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	1	1	–	–	–	–	–
CO2	3	3	2	2	2	2	–	–	–	–	1
CO3	3	3	3	2	2	2	–	–	–	–	2
CO4	3	3	3	2	2	2	–	–	–	–	2
CO5	2	3	3	2	3	2	–	–	–	–	2
CO6	2	2	2	2	3	1	–	–	–	–	3

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	3	3
CO5	2	3
CO6	3	3

UNIT – I

Introduction to highway geometric design: Development IRC and AASHTO geometric design polices, Definition and scope of geometric design, Primary and dependent design controls.

UNIT – II`

Human and vehicle factors: Concepts and application of human factors in design and typical vehicle factors used in geometric design. Sight distance: Overview of different type of sight distance, sight distance index, scaling and recording sight distance from plans, sight distance profile.

UNIT – III

Longitudinal Features of Horizontal and Vertical Profile: Factors influencing profile selection, horizontal curve, vertical curve, curves for special situation, characteristics of highway alignment, general principles of horizontal and vertical profile coordination and technique, elements of highway cross sections, developing cross sections, methods of attaining super elevation and graphical development of super elevation. Highway location and alignment design: Location study, developing trial alignment, evaluating impacts, translating graphical alignment to mathematical component, single line sketching technique.

UNIT – IV

Principles of intersection and interchange design: Design objectives, driver expectancy, geometric design controls, alignment and profile, lane width, design for turning movements, treatments for right turns, unconventional intersection and interchange design, channelization, intersection design templates, interchange design templates.

UNIT – V

Introduction to highway design software: Developing sight distance profile for highway alignment, Evaluating existing horizontal and vertical curves, Super elevation development, Intersection design, Interchange design.

Text books:

1. A policy on geometric design of highways and streets, American Association of State Highway Officials, 2011.
2. Geometric design standards for urban roads in plains (IRC: 86- 1983), The Indian Roads Congress, 1983.
3. Geometric design standards for rural (non-urban) highways (IRC: 73-1980), The Indian Roads Congress, 1980.
4. Guidelines for expressways – Part I, Ministry of Road Transport & Highways, 2010.

Department of Civil Engineering

(DR24)

Syllabus for Minors

MINORS		L	T	P	C
Course Code:	BT24CEM01	3	0	0	4.5
SURVEYING					

Course outcomes:

CO1 Apply the principle and methods of surveying and measuring of horizontal and vertical- distances and angles

CO2 Identify the source of errors and rectification methods

CO3 Apply surveying principles to determine areas and volumes

CO4 Setting out curves and using modern surveying equipment

CO5 Apply the basics of Photogrammetry Surveying in field

CO6 Determination of photographic mapping using different instruments

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	2	1	3	-	3	3	3	1
CO2	3	2	-	2	2	2	-	2	2	2	2
CO3	3	1	-	1	1	1	-	1	2	2	2
CO4	3	3	-	3	3	1	-	1	1	1	2
CO5	3	1	-	3	3	1	-	1	1	1	2
CO6	3	2	-	2	3	1	-	1	1	1	2

CO/ PSO	PSO1	PSO2
CO1	1	1
CO2	2	-
CO3	3	1
CO4	1	3
CO5	3	2
CO6	2	2

UNIT-I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, surveying accessories. Introduction to Compass, leveling and Plane table surveying.

Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections. Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination, and dip – systems and W.C.B and Q.B systems of locating bearings.

UNIT II

Leveling- Types of levels, methods of levelling, and Determination of levels, Effect of Curvature of Earth and Refraction. Contouring - Characteristics and uses of Contours, methods of contour surveying. Areas-Determination of areas consisting of irregular boundary and regular boundary.

Volumes - Determination of volume of earth work in cutting and embankments for level section, capacity of reservoirs.

UNIT III

Theodolite Surveying: Types of Theodolites, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical leveling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Introduction to Omitted measurements.

UNIT IV

Curves: Types of curves and their necessity, elements of simple, compound, reverse curves. Introduction to Tachometric Surveying.

Modern Surveying Methods: Principle and types of E.D.M. Instruments, Total station- advantages and Applications. Introduction to Global Positioning System. Introduction to Drone survey and LiDAR Survey (Light Detection and Ranging).

UNIT V Photogrammetry Surveying

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo-plotting instruments, mosaics, map substitutes.

Text Books:

1 Surveying (Vol – 1 & 2) by Duggal S K, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 5th edition, 2019.

2 Textbook of Surveying by C Venkatramaiah, Universities Press 1st Edition, 2011.

Reference books:

1 Surveying (Vol–1), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi, 18th edition 2024.

2 Surveying (Vol – 2), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain Laxmi Publications (P) ltd., New Delhi 17th 2022.

MINORS		L	T	P	C
Course Code:	BT24CEM02	3	0	0	4.5
MECHANICS OF SOLIDS					

Course outcomes:

CO1 To understand the basic materials behavior under the influence of different External loading conditions and the support conditions.

CO2 To draw the diagrams indicating the variation of the key performance features like axial forces, bending moment and shear forces in structural members.

CO3 To acquire knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams

CO4 To analyze the deflections due to various loading conditions.

CO5 To assess stresses across section of the thin, thick cylinders and columns to arrive at optimum sections to withstand the internal pressure using Lame's equation

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11
CO1	3	2	-	2	-	-	-	-	-	2	1
CO2	2	1	-	1	-	-	-	-	-	1	1
CO3	2	2	-	1	-	-	-	-	-	2	1
CO4	1	2	-	1	-	-	-	-	-	2	1
CO5	2	1	-	2	-	-	-	-	-	1	1

CO/ PSO	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	2
CO4	3	3
CO5	3	2

UNIT – I:

Simple Stresses and Strains:

Elasticity and plasticity – Types of stresses and strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – stresses in composite bars – Temperature stresses.

Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

UNIT – II:

Shear Force and Bending Moment:

Definition of beam – Types of beams – Concept of shear force and bending moment – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

UNIT – III:

Flexural and shear Stresses in beams:

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R, Neutral axis – Determination bending stresses – section modulus of rectangular beam sections. **Shear Stresses:** Derivation of formula – Shear stress distribution across various beam sections likerectangular, circular, I, T Angle sections.

UNIT – IV:

Deflection of Beams:

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic curve of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr's theorems – Moment area method – application to simple cases of cantilever.

UNIT – V:

Thin and Thick Cylinders:

Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses –hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders. **Thick cylinders:** Introduction: Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses.

Text books:

1. A Textbook of Strength of Materials, by R. K. Rajput, SI Units S.Chand & Co, New Delhi
2. Strength of materials by R. K. Bansal, Lakshmi Publications.

Reference books:

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers
2. Mechanics of Solids – E P Popov, Prentice Hall.

MINORS		L	T	P	C
Course Code:	BT24CEM03	3	0	0	4.5
SOIL MECHANICS					

Course Outcomes:

Upon successful completion of this course, student will be able to

1: Understand soil formation, its index properties and classification.

2: Understand soil moisture and flow of water through soils and its effects.

3: Understand stress distribution in soils.

4: Understand Compressibility characteristics under partially saturated and fully saturated conditions.

5: Understand shear strength of soil at different loading & drainage conditions for different oils.

6: Analyse the stress strain of soils with different mechanisms

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	2	–	–	1	–	–	–	3
CO2	3	2	–	2	–	2	2	–	–	–	2
CO3	3	3	–	2	2	2	–	–	–	–	2
CO4	3	3	–	2	2	–	–	–	–	2	3
CO5	3	3	–	2	–	–	–	–	–	2	1
CO6	3	2	-	2	–	–	–	–	–	–	2

	PSO1	PSO2
CO1	3	–
CO2	–	–
CO3	3	–
CO4	–	–
CO5	2	2
CO6	3	2

UNIT – I

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density. **Index Properties of Soils:** Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

UNIT –II

Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability – Permeability of layered systems.

Geostatic Stresses: Total, neutral and effective stresses –quick sand condition Seepage: 2-D flow and Laplace's equation-Seepage through soils–Flow nets: Characteristics and Uses.

UNIT – III

Stress Distribution In Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method.

UNIT – IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soilproperties - compaction control.

Consolidation: Compressibility of soils –e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (cv) - Over consolidated and normally consolidated clays.

UNIT – V

Shear Strength of Soils: Basic mechanism of shear strength -Mohr – Coulomb Failure theories – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions.

Text books:

1. Gopal Ranjan and A.S.R.Rao,"Basic and Applied Soil Mechanics", New Age International Publishers.
2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", CBS publishers
3. M.Palani Kumar, "Soil Mechanics", PHI Learning

Reference books:

1. D.W.Taylor, "Fundamentals of Soil Mechanics", Wiley.
2. Holtz and Kovacs, "An introduction to Geotechnical Engineering" Prentice Hall
3. Donald P. Coduto, Man-chu Ronald Young and William A. Kitch.

MINORS		L	T	P	C
Course Code:	BT24CEM04	3	0	0	4.5
FLUID MECHANICS					

Course outcomes:

CO1 Understand the principles of fluid statics, kinematics and dynamics

CO2 Apply the laws of fluid statics and concepts of buoyancy

CO3 Understand the fundamentals of fluid kinematics and differentiate types of fluid flows

CO4 Apply the Principle of conservation of energy for flow measurement.

CO5 Analyze the losses in pipes and discharge through pipe network.

CO6 Analyze the flow and total energy in the pipes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	2	1	-	-	-	3	2	2
CO2	2	2	-	2	1	-	-	-	3	3	3
CO3	2	2	-	2	1	-	-	-	3	2	2
CO4	1	2	-	-	3	-	-	-	3	2	2
CO5	2	1	-	-	-	-	-	-	3	2	2
CO6	2	1	-	-	-	-	-	-	3	2	2

CO/ PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	1	-
CO5	1	-
CO6	2	-

UNIT I Basic concepts and definitions

Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; Variation of viscosity with temperature, Newton law of viscosity; Vapor pressure, Boiling point, Surface tension, Capillarity, Bulk modulus of elasticity, Compressibility

UNIT-II Fluid statics

Fluid Pressure: Pressure at a point, Pascal‘s law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U- Tube Differential Manometer. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies

UNIT-III Fluid kinematics

Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three - Dimensional continuity equations in Cartesian coordinates.

UNIT-IV Fluid Dynamics

Surface and body forces; Equations of motion - Euler‘s equation; Bernoulli‘s equation – Derivation; Energy Principle; Practical applications of Bernoulli‘s equation : Venturimeter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number;

UNIT-V Analysis Of Pipe Flow

Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length – Pipes in Parallel and Series.

Text Books:

1 P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House 22nd, 2019.

2 K. Subrahmanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2nd edition 2018

References:

1 R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications(P) Ltd., New Delhi 11th edition, 2024.

2 N. Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.

MINORS		L	T	P	C
Course Code:	BT24CEM05	3	0	0	4.5
CIVIL ENGINEERING- BUILDING MATERIALS AND CONSTRUCTION					

Course outcomes:

CO1 Handle various linear and angular measuring instruments

CO2 Measure the linear and angular measurements

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

CO4 Handle modern equipment such as total station

CO5 Prepare field notes from survey data

CO6 Damp and waterproofing of buildings

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	2	1	-	-	-	3	2	2
CO2	2	2	-	2	1	-	-	-	3	3	3
CO3	2	2	-	2	1	-	-	-	3	2	2
CO4	1	2	-	-	3	-	-	-	3	2	2
CO5	2	1	-	-	-	-	-	-	3	2	2
CO6	2	2	-	-	-	-	-	-	2	2	2

CO/ PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	1	-
CO5	1	-
CO6	2	-

UNIT – I

Stones: Classification of Stones–Properties of stones in structural requirements.
Bricks: Composition of good brick earth, various methods of manufacturing of bricks.
Tiles: Characteristics of good tile–Manufacturing methods, Types of tiles.
Wood: Structure– Properties–Seasoning of timber–Classification of various types of woods used in buildings – Defects in timber Paints: White washing and distempering, Constituents of paint – Types of paints – Painting of new and old wood – Varnish.

UNIT – II

Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls.

WOOD: Structure – Properties- Seasoning of timber-Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiver – Reinforced Plastics, Steel, aluminum.

UNIT – III

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime. Cement Supplementary materials like Silica fume, Fly ash, GGBS, Rice husk ash used and properties.

UNIT – IV

Lintels, arches, vaults, staircases – types. Different types of floors – Concrete, Mosaic, and Terrazzo floors, Pitched, flat roofs, Lean-to roof, Coupled Roofs. Trussed roofs–King and Queen post Trusses, R.C.C Roofs, Madras Terrace and Prefabricated Roofs.

UNIT - V

Damp Proofing and waterproofing materials and uses – Plastering, Pointing, white washing, and distempering – Paints: Constituents of paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings.

Textbooks:

1. Building Materials by S.S.Bhavikatti, Vices publications House private ltd.
2. Building Materials by B.C.Punmia, Laxmi Publications private ltd

Reference books:

1. Building Materials by S.K.Duggal, New Age International Publications.
2. Building Materials by P.C. Verghese,P HI learning (P)ltd.

MINORS		L	T	P	C
Course Code:	BT24CEM06	3	0	0	4.5
BUILDING PLANNING & DRAWING					

CO1 Plan various buildings as per the building by-laws.

CO2 Distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings.

CO3 Draw signs and bonds

CO4 Draw different building units

CO5 Learn the skills of drawing building elements and plan the buildings as per requirements.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	2	-	-	3	3	2	-	2	2
CO2	1	1	2	-	-	3	2	-	-	2	1
CO3	1	1	2	-	-	3	3	2	-	2	2
CO4	1	1	2	-	-	3	3	2	-	2	2
CO5	1	1	2	-	-	3	3	2	-	2	2

CO/ PSO	PSO1	PSO2
CO1	3	3
CO2	-	-
CO3	3	3
CO4	3	3
CO5	3	3

List of Drawings:

1. Detailing & Drawing of Sign Conventions.
2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.
4. Detailing & Drawing of Doors & Windows.
5. Detailing & Drawing of Staircase.
6. Detailing & Drawing of Ventilators & Roofs.
7. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.
8. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building.
9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

Text Books:

1. "Planning, designing and Scheduling", Gurcharan Singh and Jagdish Singh
2. "Building planning and drawing" by M. Chakraborti.
3. "Building drawing", M G Shah, C M Kale and S Y Patki, Tata McGraw Hill, New Delhi.

Reference Books:

1. "National Building" Code 2016 (Volume- I & II).
2. "Principles of Building Drawing", M G Shah and C M Kale, Trinity Publications, New Delhi.
3. "Civil Engineering drawing and House planning", B. P. Verma, Khanna publishers, New Delhi.
4. "Civil Engineering Building practice", Suraj Singh: CBS Publications, New Delhi, and Chennai
5. "Building Materials and Construction", G. C Saha and Joy Gopal Jana, McGrawHill Education (P) India Ltd. New Delhi.

MINORS		L	T	P	C
Course Code:	BT24CEM07	3	0	0	4.5
ESTIMATION AND COSTING					

Course Outcomes:

Upon the successful completion of this course:

1. Explain types of contracts, contract documents, conditions of contract, valuation of buildings, and modern procurement methods.
2. Apply principles of quantity take-off and prepare approximate estimates for building works.
3. Perform rate analysis for various items of work including earthwork, RCC, and reinforcement.
4. Prepare bar bending schedules and estimate material requirements for building and road works.
5. Prepare detailed estimates of buildings using the individual wall method.
6. Prepare detailed estimates of buildings using the centre line method and standard estimation software.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	1	2	–	–	2	2
CO2	3	3	2	2	1	1	3	–	–	2	2
CO3	3	2	2	2	2	1	2	–	–	2	2
CO4	3	3	2	2	2	2	3	–	–	2	2
CO5	3	3	3	2	1	1	3	–	–	3	2
CO6	3	2	2	–	–	1	2	–	–	2	2

CO	PSO1	PSO2
CO1	2	–
CO2	2	–
CO3	2	–
CO4	2	3
CO5	3	2
CO6	3	3

UNIT – I

Contracts – Types of contracts – Contract Documents – Conditions of contract – Tendering process – Valuation of buildings - concepts of e-procurement and reverse auctions – Standard specifications for different items of building construction – Environment Social Governance'

UNIT – II

General items of work in Building – Standard Units – Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating.

UNIT – III

Rate Analysis – Working out data for various items of work over head and contingent charges –Use of Schedule of Rates – Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules

UNIT – IV

Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings – Common errors and best practices.

UNIT – V

Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

Text books:

1. 'Estimating and Costing' by B.N.Dutta, UBS publishers, 2000.
2. 'Civil Engineering Contracts and Estimates' by B.S.Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.

Reference books:

1. 'Standard Schedule of rates and standard data book' by public works department.
2. IS1200 (PartsItoXXV-1974/ Method of Measurement of Building & Civil Engg Works– B.I.S.)
3. 'Estimation, Costing and Specifications' by M.Chakraborthi; Laxmi publications. 4. National Building Code

MINORS		L	T	P	C
Course Code:	BT24CEM08	3	0	0	4.5
SUSTAINABLE MATERIALS AND GREEN BUILDING					

Course Outcomes:

1 Explain the fundamentals of sustainability, carbon cycle, ecological footprint, bio-capacity, embodied energy, and the role of materials in sustainable development.

2 Analyze sustainability aspects of cement production, alternative fuels, supplementary cementitious materials, and life-cycle energy of concrete.

3 Evaluate recycled aggregates, clay bricks, brick kilns, and energy concepts related to crushing, grinding, and thermal properties of materials.

4 Assess the ill-effects of building materials, emissions, radiation, urban heat island effect, and apply energy-efficient building design principles.

5 Apply ECBC, OTTV methodology, solar energy systems, and green building strategies for energy-efficient construction.

6 Compare and select sustainable construction systems such as AAC blocks, insulated formwork, tunnel form, and modular construction techniques.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	–	–	2	3	–	–	–	3
CO2	3	3	2	2	–	2	3	–	–	–	2
CO3	3	3	2	2	2	–	2	–	–	–	3
CO4	2	3	2	2	2	3	3	2	–	–	3
CO5	2	3	3	–	2	2	3	–	–	–	3
CO6	2	2	3	–	2	2	3	–	2	–	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	3
CO6	3	3

UNIT – I

Basics of Material Sustainability: Ecological footprint, bio-capacity, global hectare, planet equivalent, earth natural system, CO_2 emissions, basics of the carbon cycle, factors affecting the carbon cycle, urban environment, fundamentals of sustainability, life cycle assessment, role of materials and primary energy, secondary energy, embodied energy, energy analysis, factors affecting material sustainability, ecological footprint and bio-capacity calculation, equivalent factor, yield factor, role of cement in sustainability, and chemical exergy calculation.

UNIT – II

Sustainability in Cement Usage: Fuel required for cement production, cementitious/supplementary cementitious materials and their characterization, strength of concrete, types of composite cements, alternative fuel for cement, life cycle embodied energy and concrete sustainability, use of admixtures, curing methods, and use of wastewater for mixing and curing.

UNIT – III

Recycled Aggregates and Clay Bricks: Processing and classification of recycled aggregates, crushing and grinding of aggregates, Bond's law, operational energy, thermal conductivity models, thermal diffusivity, types of clay bricks, and comparison of various types of brick kilns.

UNIT – IV

Ill-effects of Building Materials and Radiation: Carbon balance, paints, adhesives, sealants, health hazards of building materials, emission models and testing, energy-efficient design of buildings, design optimization, urban heat island effect, radiation concepts, and evapotranspiration theory and models.

UNIT – V

Energy Conservation and Formwork Basics: Energy Conservation Building Code (ECBC 2007), ECBC-compliant methodology, OTTV methodology, solar energy and solar PV cells, solar water heating, green design strategies, green building rating systems, Autoclaved Aerated Concrete (AAC), insulated precast systems and forms, insulated concrete form, tunnel form, and modular construction.

Textbooks:

1. Newman, J. and Choo, Ban Sang, Advanced Concrete Technology – Processes, 1st Edition, Elsevier, 2003.
2. Kubba, S., LEED Practices, Certification, and Accreditation Handbook, 1st Edition, Elsevier, 2010.
3. Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1st Edition, Nabhi Publication, 2008.
4. Andrew H. Buchanan and Brian G., Energy and Carbon Dioxide Implications of Building Construction, Energy and Buildings, 20, 205–217, 1994.

Reference books:

1. Green Building Basics, California Integrated Waste Management Board https://www.ciwmb.ca.gov/GREENBUILDING/Basics.htm#What
2. Venkatarama Reddy, B.V. and Jagadish, K.S., Embodied Energy of Common and Alternative Building Materials and Technologies, Energy and Buildings, 35, 129–137, 2003.
3. Ministry of Power, Energy Conservation Building Code 2018, Revised Version, Bureau of Energy Efficiency, 2018.

MINORS		L	T	P	C
Course Code:	BT24CEM09	3	0	0	4.5
SAFETY IN CONSTRUCTION					

Course outcomes:

1 Explain the structure of the construction industry, safety issues, human factors, ergonomics, and the roles of stakeholders in ensuring construction safety.

2 Identify and analyze safety requirements and standards for construction operations such as excavation, scaffolding, tunneling, blasting, demolition, and temporary structures.

3 Apply safe practices for handling, storage, and stacking of construction materials at construction sites.

4 Demonstrate knowledge of safety measures in the operation of construction equipment, lifting devices, tools, and temporary power supply systems.

5 Interpret Indian Standards and National Building Code provisions related to construction safety and apply them in practical situations.

6 Understand and explain construction labor laws, welfare regulations, statutory provisions, and penalties applicable to construction workers.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	–	–	2	3	–	–	–	2
CO2	3	3	2	2	–	2	3	–	–	–	2
CO3	3	3	2	2	2	–	2	–	–	–	–
CO4	2	3	2	2	2	3	3	2	–	–	3
CO5	2	3	3	–	2	2	3	–	–	–	3
CO6	2	2	3	–	2	2	3	–	2	–	2

CO	PSO1	PSO2
CO1	–	–
CO2	–	–
CO3	–	–
CO4	2	3
CO5	3	3
CO6	3	3

UNIT – I

Introduction to the Construction Industry and Safety Management: Introduction to the construction industry – Safety issues in construction – Human factors in construction safety – Roles of various groups in ensuring safety – Framing contract conditions related to safety – Relevance of ergonomics in construction safety.

UNIT – II

Safety in Construction Operations and Standards: Safety in excavation, underwater works, underpinning, and shoring – Ladders and scaffolds – Tunneling – Blasting – Demolition – Pneumatic caissons – Confined spaces – Temporary structures – Indian Standards and National Building Code provisions on construction safety.

UNIT – III

Safety in Material Handling and Storage: Safety practices in handling construction materials – Safety in storage and stacking of materials at construction sites.

UNIT – IV

Safety in Construction Equipment Usage: Safe use of vehicles, cranes, tower cranes, lifting gears, hoists, lifts, wire ropes, pulley blocks, mixers, conveyors – Pneumatic and hydraulic tools – Safety in temporary power supply.

UNIT – V

Construction Labor Laws and Welfare Regulations: Contract Labor (Regulation & Abolition) Act and Central Rules – Definitions – Registration of establishments – Licensing of contractors – Health and welfare provisions – Penalties and wage rules. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998 – Applicability – Administration – Welfare Board and Fund – Worker training – General safety, health, and welfare provisions – Penalties.

Text Books:

1. R.K. Jain and Sunil S. Rao, Safety, Health and Environment Management Systems, Khanna Publishers.
2. V. J. Davies and K. Tomasin, Construction Safety Handbook, Thomas Telford Ltd., 1996.
3. Dr. R. Chudley, Construction Technology, Volumes 1–4, Pearson Education.

Reference Books:

1. National Building Code of India 2016, Bureau of Indian Standards.
2. IS Codes related to Construction Safety, Bureau of Indian Standards.
3. Contract Labor (R&A) Act, 1970 with Central Rules, 1971
4. Building and Other Construction Workers (RE&CS) Act, 1996 and Rules, 1998

MINORS		L	T	P	C
Course Code:	BT24CEM10	3	0	0	4.5
CONSTRUCTION PLANNING AND MANAGEMENT					

Course Outcomes:

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

CO1 Appreciate the importance of construction planning and project management techniques.

CO2 Understand the functioning and selection of earth moving and construction equipment.

CO3 Know the methods of production of aggregates and concreting operations.

CO4 Apply construction management knowledge to project planning, scheduling, and execution.

CO5 Analyze construction methods, equipment productivity for efficient project delivery.

CO6 Apply principles of quality control, safety engineering, and BIM in construction projects.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	–	–	–	1	–	–	–	1
CO2	3	2	2	1	–	–	2	1	–	–	2
CO3	3	3	2	2	–	–	2	2	–	–	2
CO4	3	3	–	2	–	–	2	2	–	–	1
CO5	2	2	1	2	–	–	3	–	–	–	2
CO6	3	2	2	2	3	1	3	–	–	–	2

CO	PSO1	PSO2
CO1	3	–
CO2	2	–
CO3	3	–
CO4	2	3
CO5	2	3
CO6	2	3

UNIT – I

Construction Project Management: Construction project management and its importance – Qualities of a good project manager – Project planning, coordination, scheduling, and monitoring – Bar charts – Milestone charts – Critical Path Method (CPM).

UNIT – II

Project Evaluation and Resource Management: Project Evaluation and Review Technique (PERT) – Cost analysis – Project crashing for optimum cost and resources – Resource allocation – Introduction to project management software – Application of PRIMAVERA or equivalent tools.

UNIT – III

Earthmoving and Material Handling Equipment: Construction equipment and economic considerations – Earthwork equipment – Trucks and handling equipment – Rear dump trucks – Capacity and productivity calculations – Compaction equipment – Rollers and types – Hoisting and earthwork equipment: hoists, cranes, tractors, bulldozers, graders, scrapers, draglines, clam shell buckets.

UNIT – IV

Concreting Equipment and Techniques: Concrete production: Batching plants, mobile units (e.g., AJAX), mixers – Mixing, placing, consolidating, and finishing of concrete – Equipment used in concreting operations.

UNIT – V

Construction Methods and Safety: Construction methods: Earthwork, piling, concrete placement, formwork, fabrication and erection – Quality control – Safety engineering – Introduction to BIM (Building Information Modelling) for civil engineering applications.

Text Books:

1. Peurifoy, Schexnayder, Shapira, Construction Planning, Equipment and Methods, Tata McGraw Hill.
2. Kumar NeerajJha, Construction Project Management: Theory and Practice, Pearson, 2011.
3. Subir K. Sarkar and Subhajit Sarasvati, Construction Technology, Oxford University Press.

Reference Books:

1. Peter Fewings, Construction Project Management – An Integrated Approach, Taylor and Francis.
2.Trefor Williams, Construction Management: Emerging Trends and Technologies, Cengage Learning.