COEP Technological University Pune

(A Unitary Public University of Govt. of Maharashtra)

School of Engineering and Technology

Curriculum Structure & Detailed Syllabus

T. Y. B. Tech.

Civil Engineering

(Effective from: A.Y. 2026-27)

Program Educational Objectives (PEOs)

After the completion of the program,

I. Student will be employable in the diversified sectors of the industry, government organizations, public sector and research organizations.

II. Student will pursue higher education in engineering or other fields of their interests, at institutes of repute and high ranking.

III. Student will demonstrate effective communication, lifelong learning ability, integrity, teamwork, leadership qualities, concern to environment and commitment to safety, health, legal and cultural issues in the fields they choose to pursue.

Program Outcomes (POs):

Engineering Graduate will be able to:

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

PO2: Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science, and engineering sciences.

PO3: Design/Development Solution: Design solution for complex engineering problems and design system component or process that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, social and environmental conditions.

PO4: Conduct Investigation of Complex Problem: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusion.

PO5: Method, Tool Usage: Create, select and apply appropriately technique, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with understanding the limitation.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to access societal health, safety, legal and cultural and consequent responsibility relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solution in societal and environmental context, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principle and commitment to professional ethics and responsibilities and norms of the engineering practices.

PO9: Individual and Team Work: Function effectively as an individual, and as the member or leader in diverse team and multidisciplinary setting.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, and being able to comprehend and

write effective reports and design documentation and effective presentation and give and receive clear instructions.

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

PO12: Lifelong Learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in broadest context of technological change.

T. Y. B. Tech.
Civil Engineering

List of Abbreviations

Abbreviation	Title	No of Courses	Credits	% of Credits
BS	Basic Science Course	-	-	-
ESC	Engineering Science Course	-	-	-
PCC	Programme Core Course (PCC)	07	22	51.16
PEC	Programme Elective Course (PEC)	02	06	13.95
OE/SE	Open/School Elective (OE/SE) other than particular program	01	02	4.65
MDM	Multidisciplinary Minor (MDM)	02	08	18.61
VSEC	Vocational and Skill Enhancement Course (VSEC)	-	-	-
HSMC	Humanities Social Science and Management	-	-	-
IKS	Indian Knowledge System (IKS)	-	-	-
VEC	Value Education Course (VEC)	-	-	-
RM	Research Methodology (RM)	-	-	-
--	Internship	01	01	2.33
--	Project	02	04	9.30
CEA	Community Engagement Activity (CEA)/Field Project	-	-	-
CCA	Co-curricular & Extracurricular Activities (CCA)	-	-	-
	Total	**16**	**43**	**100**

T.Y. B. Tech. Civil Engineering

Semester -V

Sr. No	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme				
									Theory			Laboratory	
									MSE	TA	ESE	CIE	ESE
1	PCC	CE-25001	Design of Steel Structures	3	0	2	1	4	30	20	50	60	40
2	PCC	CE-25002	Transportation Engineering	3	0	2	1	4	30	20	50	60	40
3	PCC	CE-25003	Engineering Geology	2	0	2	1	3	30	20	50	60	40
4	PCC	CE-25004	Internship – I	0	0	2	0	1	-	-	-	50	50
5	PCC	CE-25005	Project – I	0	0	4	0	2	-	-	-	50	50
6	PEC - I	CE(PE)-25001	Matrix Analysis of Structures	3	0	0	1	3	30	20	50	-	-
		CE(PE)-25002	Advanced Geotechnical Engineering										
		CE(PE)-25004	Advanced Surveying										
7	OE	OEC-25002	Open Elective – I Environmental Pollution	2	0	0	1	2	30	20	50	-	-
8	MDM	CE(MDM)-25001	Multidisciplinary Minor – II Green Building	4	0	0	1	4	30	20	50	-	-
			Total	**17**	**0**	**12**	**06**	**23**					

Semester -VI

Sr. No	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme				
									Theory			Laboratory	
									MSE	TA	ESE	CIE	ESE
1	PCC	CE-25006	Construction Management	3	0	0	1	3	30	20	50	-	-
2	PCC	CE-25007	Design of Reinforced Concrete Structures	3	0	2	1	4	30	20	50	60	40
3	PCC	CE-25008	Hydrology and Water Resources Engineering	3	0	0	1	3	30	20	50	-	-
4	PCC	CE-25009	Sustainable Construction Practices	0	0	2	1	1				60	40
5	PCC	CE-25010	Project – II	0	0	4	0	2	-	-	-	50	50
6	MDM	CE(MDM)-25002	Multidisciplinary Minor – II	4	0	0	1	4	30	20	50	-	-
7	PEC	CE(PE)-25005	Green Building Practice	3	0	0	1	3	30	20	50	-	-
		CE(PE)-25006	Computational Methods in Civil Engineering										
		CE(PE)-25005	Watershed Management										
			Total	**16**	**00**	**08**	**06**	**20**					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits ISE-In-Semester-Evaluation, ESE-End-Semester-Evaluation, MSE-Mid-Semester Evaluation, TA-Teachers' Assessment, CIE-Continuous-Internal-Evaluation

Exit option to qualify for Advanced Diploma:

- Quantity Surveying and Valuation (3 Credits)
- Environmental Pollution (4 Credits)

Semester - V

Design of Steel Structures						
Course Code	CE-25001		**Examination Scheme**			
Teaching Scheme	3-0-1-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	CIE: 60	ESE: 40	--

Course Outcomes: Students will be able to:

1. Analyze different components of a steel structure.
2. Design bolted and welded connections.
3. Design tension members.
4. Design compression members.
5. Design laterally restrained and laterally unrestrained beams.
6. Design columns and their foundations.

Unit 1: Introduction to Structural Design **[8 Hrs]**

Introduction to Design of Steel Structures, Limit State Design, Types of Limit States. Simple Connections, Riveted, Bolted and Welded Connections.
Types, assumptions, Design of Fillet Welds, Butt Welds, Failure of Welds, Comparison of different fasteners.

Unit 2: Design of Tension members: **[7 Hrs]**

Introduction to roof trusses, loads acting on trusses, Analysis of simple roof truss.
Tension members Behavior, Design of tension members, Design of single and double angle sections as tension member.

Unit 3: Design of Compression members: **[7 Hrs]**

Compression Members in truss and buildings, Modes of failure, Classification of cross section, Effective length, slenderness ratio, Design of Compression members in trusses.

Unit 4: Design of beams: **[7 Hrs]**

Loads acting on beams, buckling behavior, sections used, laterally restrained and unrestrained simply supported beams, Shear strength of beams, Web Buckling and Web Crippling, IS Code limits for Deflections, Design of Simple and Built-Up Beams, Introduction to Castellated Beams.

Unit 5: Design of steel column **[7 Hrs]**

Loads acting on columns, sections used, Design of columns subjected to axial load, single section, built up column sections, Design of Laced column, Design of Battened columns, Design of Column bases: Slab base, Design of foundation, Introduction to design of Gusseted base. Introduction to Design and Detailing for Earthquake Loads.

Self-Study: **[6 Hrs]**

Advantages of steel as a structural material, Types of structural steel, Mechanical properties of steel, various rolled steel sections (including cold-formed sections, structural pipe (tubes)) sections and their properties, Types of loads acting on structure, Study of IS Codes and specifications: IS875. Plastic Analysis, Shape factor,

Textbooks:

[1]	N. Subramanian (2009), "Design of Steel Structures", Oxford University Press.
[2]	Dr. V.L. Shah, Dr. S. R. Karve, Prof. Veena A. Gore (2015), "Limit State Design of Steel Structures", Structures Publications
[3]	S.S. Bhavikatti (2012), "Design of Steel Structures by Limit State Method", I. K. International Publishing House Pvt. Ltd., 3rd Edition Limit State Design of Steel Structures

Reference Books:

[1]	Edwin Gaylord and Charles Gaylord (2010), "Design of steel structures", Tata McGraw Hill Publishing company Ltd., New Delhi (3rd Edition)
[2]	Robert Engle Kirk (2003), "Steel structures: controlling behavior through design", John Wiley and Sons.
[3]	SP: 6 (1995): Handbook for Structural Engineers

Indian Standard Codes:	
[1]	IS 800 (2007) General Construction in Steel — Code of Practice
[2]	IS 808 (1989) Dimensions for Hollow Rolled Steel Beam, Column, Channel and Angle Sections
[3]	IS 875 (Part-I)-1997 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 1: Dead Loads — Unit Weights of Building Materials and Stored Materials (Reaffirmed 1997)
[4]	IS 875 (Part-II)-1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 2: Imposed Loads (Reaffirmed 1997)
[5]	IS 875 (Part-III)-1987 – Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures Part 3: Wind Loads (Reaffirmed 2003)

Design of Steel Structures Laboratory
Course Outcomes: Students will be able to:
1. Analyze the given structure considering practical approach. 2. Design different parts of the given structure using relevant IS codes. 3. Prepare the structural drawings suitable for fabrication. 4. Correlate the practical and theoretical design aspects.
Batch will be divided into groups. Each group will have maximum three students, and will perform following lab works.

The laboratory work should include the following:	
A. Report of a site visit mentioning structural details with relevant sketches of structural connections.	
B. Design of any ONE of the following structures as per IS 800- 2007 1. Industrial building with roof supported by steel trusses (Angle sections/ Tubular Sections). Some parts of building may be of (G+1) system. 2. Pedestrian steel bridge (Through type or Deck type) 3. Design of Conventional (truss) structure 4. Design of PEB Structure	
For A and B above, the report should include 1. Brief Technical design project report involving: Introduction, assumptions, load calculations, analysis, detailed design. 2. Drawings: Structural plan and detailed structural drawings, on half empirical sheets or A3 size good quality paper.	

Indian Standard Codes:	
[1]	SP: 6 (1995): Handbook for Structural Engineers
[2]	IS 800 (2007) General Construction in Steel — Code of Practice
[3]	IS 808 (1989) Dimensions for Hollow Rolled Steel Beam, Column, Channel and Angle Sections
[4]	IS 875 (Part-I)-1997 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 1: Dead Loads — Unit Weights of Building Materials and Stored Materials (Reaffirmed 1997)
[5]	IS 875 (Part-II)-1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 2: Imposed Loads (Reaffirmed 1997)
[6]	IS 875 (Part-III)-1987 – Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures Part 3: Wind Loads (Reaffirmed 2003)

Transportation Engineering						
Course Code	CE-25002		**Examination Scheme**			
Teaching Scheme	3-0-1-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	CIE: 60	ESE: 40	--
Course Outcomes: Students will be able to:						
1. Formulate the fundamentals of highway, airport, bridge and railway engineering. 2. Demonstrate the components of bridge sub-structure and super-structure, various hydraulics design forces, IRC loadings. 3. Analyze various aspects of airport planning, layout, components of airport, runway, taxiway, heliport, etc.						

4. Interpret the knowledge of railway construction, materials used and components, signaling systems.
5. Design the geometrical aspect of Highways and Airports.

Unit 1: Highway Engineering: **[6 Hrs]**

Role of transportation, scope of road transportation, Highway development in India. Necessity of highway planning and development plans e.g., Nagpur Plan, Bombay plan, Lucknow plan. Classification of Roads Star and grid road pattern, planning and preparation of master plan based on saturation system, determination of road length. Highway alignment and Geometric Design Basic requirement of an ideal alignment and factors controlling it, Engineering survey for highway location, special requirement for hill roads, Design controls and criteria for geometric design, cross sectional element, sight distance requirements, stopping sight distance, overtaking sight distance, overtaking zones with IRC recommendations, attainment of super elevation, radius of horizontal curves, methods of introduction of extra widening, widening of pavement on horizontal curves, Horizontal transition curves, Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curves, vertical curves, S.S.D. and O.S.D. requirements.

Unit 2: Highway Materials and Quality Control: **[6 Hrs]**

Importance and properties of sub-grade and pavement component materials, Behavior of materials interaction, tests on aggregate, bituminous materials and bituminous mixes, Marshall stability test. Pavement Design Requirements, factors influencing the flexible and rigid pavement, Flexible pavement 11 design by Group Index Method and C.B.R. method, rigid pavement design, Westergaards analysis of wheel load stresses and temperature stresses in rigid pavement. I.R.C. recommendations. Pavement failure, Construction and maintenance and Quality control, repairs and maintenance. Highway Drainage Importance of drainage, Subsurface and surface drainage systems and their design.

Unit 3: Bridge Engineering **[6 Hrs]**

Definition of a bridge, basic components of a bridge, selection of bridge site, factors to be considered while deciding upon the type of structure for a particular bridge site, sub surface investigation, determination of flood discharge, vertical clearance above HFL, scour depth, afflux, approach used to carry out assessment of design discharge at bridge sites, economic span, abutment pier, recommended design discharge, bridge classification, parameters governing choice of superstructure, span ranges for different type of bridge superstructures usually followed in India.

Importance of bridge economics in selection of a particular type of superstructure, characteristics and design aspects of various types of superstructures, reference codes, scope of various bridge codes used for reference, forces to be accounted for in the analysis for the design of a bridge , IRC Class AA Loading, IRC Class A Loading, IRC Class B Loading, IRC Class 70R Loading, general points to be taken into account during live load analysis for bridge design Bridge substructure and foundation, choice of type of foundation, general design procedure for design of substructure of a bridge, types of piers and their design aspects, general design procedure for the design of abutments , bearings for bridges, types of bearings, types of bearings recommended for various spans lengths and support, expansion joints for bridge superstructures and their types.

Unit 4: Airport Engineering **[10 Hrs]**

Advantage and limitation of air transportation, Aeroplane component parts and important terms Airport planning Aircraft characteristics; which influence Judicious and scientific planning of airports selection of site, survey and drawings to be prepared for airport planning, Major Terminal Components, Functional Relationships of Terminal Components, Objectives in Selecting Terminal Concepts, Airport Master Plan, Factors influencing Terminal Configuration and Size, Forecasts, Terminal Apron Areas. Airport layout: Characteristics of good layout, runway configuration, imaginary surfaces, location of terminal buildings, aprons and hangers, Zoning requirements regarding permissible heights of construction and landing within the airport boundary, planning aspect of important

airports in the world. Runways and Taxiways Runway Location and orientation, wind coverage, use of wind, rose diagram, Basic runway length, corrections for elevation, temperature and gradient as per I.C.A.O and FAA recommendation, Airport classification by I.C.A.O basic recommendation for geometric design standards regarding length, width, longitudinal and transverse gradients and width of safety area, Taxiway System and Aprons, Exit Taxiways, By Pass Taxiways, sight-distance, turning radius and rate of change of longitudinal gradients, Airport Lighting and Markings, VFR Approach and Departure Paths. Heliport Characteristics of helicopter, Nature of helicopter transport, site selection for heliport, Touch Down and Lift off Area, Final Approach and Take off Area, Heliport Markers and Markings.

Unit 5: Railway Engineering **[10 Hrs]**

History of Indian Railways, Component parts of railway track, recent development in railways specifically w. r. t. track structure, Organizational structure of Indian railways, railway lines classification based on speeds such as A, B, C, D, E, Q, R and S routes. Permanent way Component Parts Types of rail sections, Coning of wheels, Rail creep, Rail defects, Rail joints, welding of rails, short welded rail (SWR), long welded rail (LWR) & continuously welded rail (CWR), sleepers requirement, Sleeper density, spacing, and types, Rail fittings, Elastic fastenings, bearing plates, anti-creep devices, check and guard rails, Ballast requirements and specification, Formation, Different cross sections of Track in cutting & embankment, suitability of drainage. Points, crossing and turnouts Functions, various types of track junction & their configurations, listing of types of Turnouts. Signaling & Interlocking Objects, classification, control of train movements and monitoring, types of signals, principal of interlocking, Modernization in Railways and 23 railway tracks, High speed tracks.

Self-Study **[4 Hrs]**

Modern Railway Systems & Urban Transit

- **High-Speed Rail:** Basics of Maglev technology and Bullet trains (e.g., Mumbai-Ahmedabad HSR corridor).
- **Urban Mobility:** Introduction to Metro Rail, Mono Rail, and Light Rail Transit (LRT) systems; importance of Multi-modal Integration.

Textbooks:

[1]	S. K. Khanna, C.E.G. Justo, Nem Chand and Bros, Roorkee (U.A), 8th Edition,2
[2]	S. K. Khanna, C.E.G. Justo, Highway Material Testing, Nem Chand and Bros, Roorkee (U.A)
[3]	S.K. Khanna, M.G. Arora, S.S. Jain, Airport Planning and Design, Nem Chand and Bros
[4]	S.P. Bindra, Bridge Engineering
[5]	S.C. Rangawala, Principals of Railway Engineering - Charotkar Publishing House.

Reference Books:

[1]	O'Flaherty, C.A.: Highways Vol 2, Edward Arnold, London.
[2]	Planning and Design of Airports: 4th Edition, by Robert Horonjeff and Francis McKelvey, McGraw-Hill, 1994.
[3]	Airport Systems: Planning, Design and Management, by Richard DeNeufville and Amedeo Odoni, McGraw-Hill, 2003
[4]	S. Ponnuswamy (2008) Bridge Engineering, Tata McGraw-Hill Publishing Co. Ltd, New Delhi
[5]	Yang H. Huang (2008) Pavement Analysis and Design, Pearson Education, Delhi.
[6]	J.S. Mundrey, Railways Track Engineering - Tata McGraw Hill, New Delhi.

Note:

[1]	To measure CO1, questions may be of the type- define, identify, state, match, list,
[2]	name etc.
[3]	To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.

[4] [5]	To measure CO3, questions will be based on applications of core concepts. To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc. To measure CO5, some questions may be based on self-study topics and comprehension of unseen passages.

Transportation Engineering Laboratory	
Course Outcomes: Students will be able to:	
1. Analyze the transportation engineering materials considering practical approach. 2. Evaluate the performance of transportation engineering materials 3. Demonstrate various field experiments related to highway engineering 4. Correlate the practical and theoretical design aspects [PEO2][PO3, PSO3]	
The laboratory work should include the following experiment (any 10).	
1. Aggregate impact value 2. Los Angeles abrasion Test 3. Flakiness and elongation index 4. California Bearing Ratio Test 5. Bitumen Penetration 6. Softening Point 7. Centrifuge extraction Test 8. Flash Point & Fire point test 9. Ductility test 10. Viscosity of bitumen 11. Specific gravity of bitumen 12. Marshall stability test 13. Demonstration of Benkelman Beam Apparatus	

14. Demonstration of NDT concrete test Hammer 15. Relative Viscosity of Bitumen 16. Demonstration of Core cutting and grinding machine	
Reference:	
MORTH "Ministry of Road Transport and Highways" -5th Revision	

Engineering Geology						
Course Code	CE-21003		**Examination Scheme**			
Teaching Scheme	2-0-1-1		**Theory**	TA: 20	MSE:30	ESE:50
Credits	3		**Laboratory**	CIE: 60	ESE: 40	--

Course Outcomes: Students will be able to:

1. Know the fundamental concepts leading to formation of the Earth; Rocks and Minerals
2. Develop the ability to perform basic engineering geological assessments and analysis.
3. Understand the relevance of Engineering Geology in complex projects which will strengthen their practical understanding of the subject.
4. Develop a native construction plan incorporating all relevant aspects of geology
5. To know the various types of Geological and Natural hazards.

Unit 1. General Geology & Physiographic **[6 Hrs]**

Introduction, Object, Scope & Sub-divisions, General Geology, Surface features, External & Internal Agents modifying the earth, weathering, decomposition, earth movements, metamorphism, General principles of stratigraphy, Age of the earth and divisions of the Geological time. Physiographic divisions of India and their characteristics. Geological history of Peninsula. Study of formations in Peninsula and the significance of their structural characters in major Civil engineering activities. Rock and minerals. Silicate and non-silicate minerals, rock forming minerals, primary and secondary minerals, essential and accessory minerals.

Unit 2. Petrology	**[6 Hrs]**
Mineral composition of Igneous Rocks, Textures & textural variation, conditions of cooling of plutonic, hypabyssal and volcanic rocks. Classification of igneous rocks. Secondary Rocks processes and products of decomposition and disintegration. Transport and deposition, Classification of Sedimentary Rocks. Agents of transportation. Welding and cementation. Grain size classification. Agents and types of metamorphism, Metamorphic textures, Contact cataclastic, dynamothermal and plutonic metamorphism. Study of common rock types of Igneous, Sedimentary, Metamorphic rocks as prescribed in practical work.	
Unit 3. Geomorphology andStructural Geology	**[6 Hrs]**
Geological action of running water, river valley development, normal cycle of river erosion, Regional cycle of river erosion, waterfalls, ox-bow lakes, flood plain deposits, delta, Rejuvenation and Resulting features such as canyons, river terraces and incised meanders, Economic minerals. Outcrop. Dip and strike. Conformable series. Unconformity and overlap. Different types of Faults and folds in rocks. Inlier and Outlier. Modes of occurrence of igneous rocks. Joints Fractures and their engineering characters. Mountains- Mountain building activity, orogenic and epirogenic processes	
Unit 4. Ground water, Building Stones and Stability of Slopes	**[4Hrs]**
Types of Ground water, Water table and depth zones of saturation. Influence of textures and Structures of rocks on groundwater storage and movement, Pervious and impervious rocks. Geological work of groundwater, effects of solution and deposition. Requirements of good building stone. Dependence of strength, durability, Ease of dressing, availability of blocks of suitable size and appearance on mineral composition Textures and field structures. Suitability of common rocks as building stone. Causes, Role of water, stability of slopes in consolidated material, influence of dip and slope, safe and unsafe slopes, Prevention of landslides, keeping slopes free from water, retaining walls Vegetation, slope treatment, Precautions to be taken while aligning roads etc. across hills and making cuts in hill slides. Case histories	
Unit 5. Preliminary Geological Explorations& Rock Mechanics	**[8Hrs]**
Verification of surface data by subsurface exploration- Drill holes, test pits, trenches, exploratory tunnels, shafts, adits, drifts, etc. Compilation and interpretation of information obtained from these, Correlation of surface data with results of subsurface exploration. Limitations of drilling. Comparative reliability of data obtained by drilling and excavation. Engineering significance of Geological structures such as stratification, dips, folds, faults, joints, Fractures, crush zones, fault zones, dykes, etc. Case histories. Introduction to Rock Mechanics in Engineering Geology, Classification of Rocks and Rock Masses Strength and deformability of jointed rock mass, Stability of rock slopes	
Unit 6. Tunneling, Dams, Reservoirs, Bridges and Remote Sensing	**[8 Hrs]**
Influence of geological conditions on design and construction methods, Preliminary Geological investigations for tunnels. Unlined tunnels. Case histories. Dependence of strength, stability and water tightness of foundation rocks and their physical Characters and Geological structures. Influence of geological condition on the choice of type and design of dams. Preliminary geological work on dam sites. Favorable and unsuitable Geological conditions for locating a dam. Case histories Precaution to be taken to counteract unsuitable Condition, Treatment of leaky rocks faults, dykes, crush zones, joints, fractures, unfavorable Dips, etc. Preliminary geological work on Bridge sites. Favorable and unsuitable Geological conditions for locating a Bridge.	

Preliminary geological work on Reservoir sites. Dependence of water tightness on physical properties and structure of rocks. Geological Conditions suitable and unsuitable for reservoir sites. Conditions likely to cause leakage through reservoir rims. Importance of ground water studies and effects of raising of the water table. Case histories. Earth movements, Earthquakes, Earth quakes in regions of dams, Interior of the Earth, earthquake zones, Geological considerations for choosing sites of building in seismic area.	
Textbooks:	
[1]	R.B. Gupte: A Text Book of Engineering Geology (New Edition) ISBN:8185825033. – P.V.G. Publications, Pune
[2]	N. Chenna Kesavulu: A Text book of Engineering Geology. 2nd Edition, Macmillan Publishers India Ltd, 2009.
[3]	Parbin B Singh: Engineering and General Geology. 7thedition, S K Kataria & Sons. New Delhi, 2010.
[4]	G.B. Mahapatra: Text book of Physical Geology. CBS Publishers and Distributors India Pvt Ltd 2018.
Reference Books:	
[1]	R. Legget: Geology and Engineering – McGraw Hill Book Co., London
[2]	FGH Blyth, and M.H. De Freitas, Geology for Engineers, ELBS. ISBN 9780415502917
[3]	Engineering Geology and Construction; Fred G. Bell ;1st Edition2004 Taylor & Francis London.
[4]	Fundamentals of Rock Mechanics, Fourth Edition, April 2007; John Conrad Jaeger, Neville G. W. Cook, Robert Zimmerman ISBN: 978-0-632-05759-7 April 2007 Wiley-Blackwell.

Engineering Geology Laboratory
Course Outcomes: Students will be able to:
1. Identify different types of rocks 2. Carry field investigations based on the identification of Igneous, Sedimentary and Metamorphic rocks. 3. Interpret structural geological map. 4. Apply the given Geological knowledge and make its effective use in various projects of Civil Engineering in Preliminary Geological Explorations, Tunnelling, Dams and Reservoirs 5. Carry out Geological Core Logging.
The laboratory work should include the following:
1. Megascopic Identification of Rock Forming Minerals (Silicates) 2. Megascopic Identification of Rock Forming Minerals (Non-Silicates) 3. Megascopic Identification of Economic Minerals. (Non-Metallic) 4. Megascopic Identification of Economic Minerals. (Metallic) 5. Megascopic Identification of Igneous Rocks. (Volcanic) 6. Megascopic Identification of Igneous Rocks. (Plutonic) 7. Megascopic Identification of Igneous Rocks. (Hypabyssal) 8. Megascopic Identification of Sedimentary Rocks. (Clastic) 9. Megascopic Identification of Sedimentary Rocks. (Non-Clastic) 10. Megascopic Identification of Metamorphic Rocks. (Foliated) 11. Megascopic Identification of Metamorphic Rocks. (NON-Foliated) 12. Practical Core Logging and Recording of Data. (preparation of Litholog/Core Log and Geological sections, interpreting geological features without drawing section, etc. based on geological data)
This is a representative list of practical's/exercises. The instructor may choose experiments as per his/her requirements (so as to cover entire contents of the course) from the list or otherwise
Detailed List-
1. **Identification of the following minerals in hand specimens:** Quartz and its varieties, common varieties of cryptocrystalline and amorphous silica, orthoclase, plagioclase, muscovite, biotite, zeolites, calcite, Iceland spar, Gypsum, Satinspar, fluorite, barites, tourmaline, beryl, graphite, asbestos, talc, kyanite, garnet, galena, magnetite, haematite, limonite, iron pyrites, chromite, bauxite, azurite, malachite, psilomelane. 2. **Identification of the following rock types in hand specimens:**

Igneous Rocks Granites, syenites, diorites, gabbros, rhyolites, trachytes, andesites, basalts, varieties of Deccan trap rocks, volcanic breccias, pegmatites, dolerites, graphic granites. Sedimentary Rocks Laterites, bauxites, conglomerates, breccias, sandstones, quartzites, grits, arkose, shales, mudstone. Chemical and organic limestones. Metamorphic Rocks Marbles, quartzites, varieties of gneisses, slates, phyllites and varieties of schists.

3. Core Logging and preparation of Litholog/Core Log and Geological sections, interpreting geological features without drawing section, etc. based on geological data.
4. A field visit to site of Geological work is mandatory for gaining field knowledge of the subject and a report to be submitted as a part thereof.

Note:

CIE – Continuous Internal Assessment shall be based on practical record and knowledge/skill acquired. The performance shall be assessed exercise wise using continuous assessment in form of assignment's/Quiz etc.

ESE -The End Semester Exam for Practical shall be based on actual Practical's performance in Laboratory and viva-voce

Reference:

1. https://nptel.ac.in/courses/105/105/105105170/

<table>
<tr><th colspan="7">Internship – I</th></tr>
<tr><td>Course Code</td><td colspan="2">CE-25005</td><td colspan="4">Examination Scheme</td></tr>
<tr><td>Teaching Scheme</td><td>0-0-1-0</td><td></td><td>Theory</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Credits</td><td>1</td><td></td><td>Laboratory</td><td>-</td><td>MSE: 50</td><td>ESE: 50</td></tr>
<tr><td colspan="7">Course Outcomes: Students will be able to:</td></tr>
<tr><td colspan="7">CO:1 Demonstrate practical knowledge in their field of study.
CO:2 Exhibit improved professional and interpersonal skills.
CO:3 Relate academic concepts to industry practices.
CO:4 Prepare for advanced internships and career opportunities.</td></tr>
<tr><td colspan="7">Objective:
1. To expose students to professional practices and organizational culture.
2. To apply theoretical knowledge to practical problems.
3. To develop communication, teamwork, and problem-solving skills.
4. To encourage independent learning and professional responsibility.</td></tr>
<tr><td colspan="7">Duration:
1. Conducted during the summer vacation after the completion of the second year.
2. Minimum duration: 4–6 weeks.</td></tr>
<tr><td colspan="7">Deliverables:
1. Internship Report: A detailed document outlining the work undertaken, methodologies applied, outcomes achieved, and reflections on learning.
2. Presentation: A formal presentation summarizing the internship experience, highlighting key contributions, challenges faced, and skills acquired.</td></tr>
<tr><td colspan="7">Evaluation Weightage (suggested):</td></tr>
<tr><td colspan="7">Report (50 Marks): Assessed on clarity, depth of analysis, technical content, and overall presentation of the document including the certificate of internship to be attached in report.

Presentation (50 Marks): Evaluated on communication skills, organization of content, ability to answer questions, and demonstration of learning outcomes.</td></tr>
</table>

<table>
<tr><th colspan="7">Project – I</th></tr>
<tr><td>Course Code</td><td colspan="2">CE-25005</td><td colspan="4">Examination Scheme</td></tr>
<tr><td>Teaching Scheme</td><td>0-0-4-0</td><td></td><td>Theory</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Credits</td><td>02</td><td></td><td>Laboratory</td><td>-</td><td>MSE: 50</td><td>ESE: 50</td></tr>
<tr><td colspan="7">Course Outcomes: Students will be able to:</td></tr>
<tr><td colspan="7">CO 1: Formulate innovative solutions to complex civil engineering problems considering sustainability and societal impact.
CO 2: Integrate multidisciplinary knowledge to design, analyze, and evaluate engineering systems or structures.
CO 3: Apply research methodologies, experimental techniques, and advanced tools to validate project outcomes.
CO 4: Exhibit professional ethics, responsibility, and awareness of environmental and economic factors in engineering practice.
CO 5: Communicate project deliverables clearly to diverse audiences using professional documentation and presentations.
CO 6: Demonstrate readiness for industry or higher studies through independent problem-solving and critical thinking.</td></tr>
<tr><td colspan="7">Objective: Introduce students to research methodology, project ideation, and planning.</td></tr>
<tr><td colspan="7">Content for Evaluation:
• Problem Identification & Relevance
• Selection of topic aligned with civil engineering domains.
• Justification of problem statement with literature support.
• Literature Review
• Survey of existing work, identification of research gaps.
• Objectives & Scope
• Clear articulation of project goals and boundaries.
• Methodology Proposal
• Proposed approach, tools, and techniques.
• Feasibility & Resources
• Preliminary cost, time, and resource estimation.
• Presentation & Report
• Structured synopsis submission and oral presentation.</td></tr>
<tr><td colspan="7">Evaluation Weightage (suggested):</td></tr>
<tr><td colspan="7">Problem definition & literature review – 30%
• Objectives & methodology – 30%
• Presentation & report quality – 40%</td></tr>
</table>

Matrix Analysis of Structures						
Course Code	CE(PE)-25001		**Examination Scheme**			
Teaching Scheme	3-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	3		**Laboratory**	-	-	--

Course Outcomes: Students will be able to:

1. Understand basic concepts of matrix methods, DOF, and stiffness and flexibility approaches.
2. Formulate stiffness matrices for structural elements.
3. Assemble global stiffness matrix and solve structural equations.
4. Analyze beams, trusses, and frames using the stiffness method.
5. Apply modelling considerations and computational methods in structural analysis.

Unit 1: Introduction to Matrix Methods and Stiffness Approach **[6 Hrs]**

Classification of structures, degrees of freedom, force–displacement relationships, introduction to flexibility and stiffness approaches, comparison between flexibility and stiffness methods, review of matrix algebra, stiffness and flexibility matrices, concept of displacement vectors and generalized coordinates.

Unit 2: Element Stiffness Matrices **[6 Hrs]**

Stiffness matrix for spring, bar element under axial force, torsional members, beam element including member stiffness matrix and fixed end forces, introduction to frame and grid element stiffness, properties of stiffness matrix.

Unit 3: Coordinate Transformation and Assembly **[6 Hrs]**

Local and global coordinate systems, transformation matrices, assembly of global stiffness matrix and load vector, application of boundary conditions, solution of simultaneous equations using Gauss elimination and basic concept of Cholesky decomposition.

Unit 4: Analysis of Structures using Stiffness Method **[7 Hrs]**

Analysis of spring assemblies, bar assemblies, continuous beams without and with support settlements, and plane trusses without and with effects of temperature change and lack of fit, plane frames subjected to joint loads, determination of nodal displacements and member forces, analysis under axial loads.

Unit 5: Plane Frames and Modelling Considerations **[6 Hrs]**

Stiffness formulation for plane frames, inclined supports, member end releases, initial joint displacements, effects of temperature change, lack of fit and support settlements, introduction to shear deformation and finite size joints.

Unit 6: Space Structures and Computational Aspects **[7 Hrs]**

Analysis of space trusses, space frames and grid structures, bandwidth of stiffness matrix, static condensation and substructuring techniques, basic concept of constraint equations, algorithm and flowchart for stiffness method.

Self-Study **[4 Hrs]**

Introduction to computer implementation using MATLAB/Python, Analysis of continuous beam/plane truss/plane frame using MATLAB, brief introduction to finite element method.

Textbooks:

[1]	Godbole, P.N., Sonparote, R.S. and Dhote, S.U., 2014. *Matrix methods of structural analysis*. PHI Learning Pvt. Ltd.
[2]	Aslam, K., 1999. *Matrix Analysis of Structures*. Brooks/Cole Publishing Co.
[3]	Cheng, F.Y., 2017. *Matrix analysis of structural dynamics: applications and earthquake engineering*. CRC Press.
[4]	Martin, H.C., 1996. *Introduction to Matrix Method of Structural Analysis*. McGraw Hill Book Co.
[5]	Gere, W. and Weaver, J.M., 1990. *Matrix Analysis of Structures*. 3rd ed. New York: Van Nostrand Reinhold.
[6]	Bathe, K.J., 2006. *Finite element procedures*. Klaus-Jurgen Bathe.

Advanced Geotechnical Engineering						
Course Code	CE(PE)-25002		**Examination Scheme**			
Teaching Scheme	3-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	3		**Laboratory**	-	-	--
Course Outcomes: Students will be able to:						
1. Explain the behavior of different types of clay minerals.						

2. Analyze consolidation and compressibility characteristics of soils.
3. Interpret shear strength parameters through advanced testing and relate them to critical state concepts.
4. Conduct advanced laboratory testing of soils and effectively communicate the results through structured technical reports.
5. Apply artificial intelligence and machine learning techniques to solve geotechnical problems.

Unit 1: Soil Behavior and Engineering Properties	**[7 Hrs]**
Soil composition and mineralogy (Kaolinite, Illite, Montmorillonite), Soil structure and fabric, Clay–water interaction, Index properties and their significance, Effective stress principle, Stress paths in soil mechanics.	
Unit 2: Consolidation and Compressibility of Soils	**[7 Hrs]**
Compressibility parameters (e_0, Cc, Cr), Terzaghi's 1D consolidation theory, Laboratory oedometer test, Degree and rate of consolidation, Primary and secondary consolidation, Consolidation under varying load conditions.	
Unit 3: Shear Strength and Critical State Concepts	**[7 Hrs]**
Mohr-Coulomb failure criterion, Drained vs undrained shear strength, Stress-strain behaviour of clays and sands, Critical state soil mechanics (introductory), Pore pressure parameters.	
Unit 4: Advance soil testing	**[6 Hrs]**
Introduction to Advanced Soil Testing, Consolidation Testing (Oedometer Test), Shear Strength Testing – Triaxial Test, Overview of Laboratory Reporting and Quality Control.	
Unit 5: Soil Exploration and field exploration	**[7 Hrs]**
Introduction and Planning of Soil Exploration, Methods of Boring and Soil Sampling, In-Situ Tests, Geophysical Methods, Reporting and Interpretation.	
Unit 6: Artificial Intelligence in Geotechnical Engineering	**[7 Hrs]**
Introduction to AI and Machine Learning Concepts, Basics of Data Processing in Geotechnical Applications, Regression Models for Soil Property Prediction, Classification Algorithms for Soil Behavior, Software Tools and Case Studies.	
Self-Study (SS):	

1. Basic soil properties, Field testing details.
2. Stress strain behavior of various soil
3. Concepts in MATLAB

Textbooks:

[1]	B.M. Das – Principles of Geotechnical Engineering
[2]	Braja M. Das & Khaled Sobhan – Advanced Soil Mechanics
[3]	Terzaghi, Peck & Mesri – Soil Mechanics in Engineering Practice
[4]	J.E. Bowles – Foundation Analysis and Design
[5]	Ranjan and Rao – Basic and Applied Soil Mechanics

Reference Books:

[1]	T. W. Lambe & R. V. Whitman – Soil Mechanics
[2]	J. Atkinson – The Mechanics of Soils: An Introduction to Critical State Soil Mechanics
[3]	Gopal Ranjan & A.S.R. Rao – Laboratory Manual in Soil Mechanics
[4]	Pijush Samui, Dookie Kim, Sarat Das (Eds.) – Artificial Intelligence in Geotechnical Engineering

Advanced Surveying						
Course Code	CE(PE)-25004		**Examination Scheme**			
Teaching Scheme	3-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	3		**Laboratory**	-	-	--

Course Outcomes: Students will be able to:

1. Use advanced instruments for surveying.
2. Make survey for large area.
3. Apply corrections to field data.
4. Analyze data on software.

Unit 1: Triangulation Adjustment **[7 Hrs]**

Kinds of errors, Laws of weights, Determination of Most probable values [MPV] of conditioned and independent quantities, Method of least squares, probable error and its determination, Distribution of error to the field measurement. Normal equation, Method of correlates, station adjustment and figure adjustment of Geodetic triangle [without central station] and Geodetic Quadrilateral [without central station], Spherical triangle, calculations of spherical excess and sides of spherical triangle.

Unit 2: Hydro-graphic Surveying **[7 Hrs]**

Objects, Establishing controls, Shoreline survey, soundings, Equipments for measuring soundings and method of locating soundings, Reduction of soundings, Plotting of soundings, Three point problem and its solution by Analytical and Graphical methods. Tides and tide gauges, Nautical sextant and its use.

Unit 3: Remote Sensing **[7 Hrs]**

Basic principles, Electromagnetic spectrum, Interaction mechanism and image formation, Classification of remote sensing systems, platforms for sensing different types of data products, Applications to Civil Engineering, concept of global positioning systems [GPS] and differential GPS.

Unit 4: GIS and GPS **[10 Hrs]**

Components of GIS- data acquisition, spatial and attribute data, pre-processing, storage and management; Data structures- raster and vector data; GIS analysis functions; Errors and corrections; Data presentation and generation of thematic maps; Applications.
Detailed discussion on various generations of GPS satellites, trilateration techniques, GPS signals, anti-spoofing, concept of standalone positioning and GNSS receivers.

Unit 5: Modern Surveying Instruments: **[7 Hrs]**

Electromagnetic waves and their properties, phase, phase comparison, Modulation, Types of Electromagnetic Distance Meters [E.D.M.]–Geodimeter, Tellurometer, Distomat. Total Station and its uses.

Self-Study: Drone (UAV) Surveying **[4 Hrs]**

Technology: Basic components of a Survey-grade Drone (Unmanned Aerial Vehicle).
Photogrammetry: Introduction to "Structure from Motion" (SfM) processing; generating Orthomosaics and 3D point clouds from drone imagery.
Regulations: Brief overview of Drone Rules in India (Digital Sky platform) for surveying.

Textbooks:

[1]	T. P. Kanetkar & S. V. Kulkarni, “Surveying and Leveling Vol. II”, Pune Vidhyarthi Gruha.
[2]	Dr. B.C. Punmia, “Surveying Vol. II & III”, Laxmi Publications (P) Ltd., New Delhi.

[3]	Dr. K. R. Arora, “Text book in Surveying Vol. II & II”, McMillan Publication
Reference Books	
[1]	J. Uren and W. F. Price, “Surveying for Engineer”, McMillan Publication
[2]	Anderson, “Introduction to Surveying”, McGraw Hill Publication.
[3]	Paul R Wolf, “Elements of Photogrammetry”, McGraw Hill Publication.
[4]	J. M. Kennie and M. C. Matthews, “Remote Sensing in Civil Engineering”, McGraw Hill Publications.

Open Elective 2- Environmental Pollution						
Course Code	OEC-25002		**Examination Scheme**			
Teaching Scheme	2-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	2		**Laboratory**	--	--	--
Course Outcomes: Students will be able to:						
1. Identify local and global effects of pollution and suggest control measures.						

2. Identify atmospheric stability conditions and relate them to the transport of air pollutants.
3. Collect data and analyse the problem of noise, odour pollution & solid waste management.
4. Understand the importance & preparation stages of Environmental Impact Assessment.
5. Determine the flow diagram of the water and wastewater treatment process and decide on the domestic wastewater treatment processes.

Air Pollution: **[6 Hrs]**

Environment and its interaction with human activities: Environmental imbalances, Factors Contributing to Urban Pollution in India. Air pollution: Definition, sources of air pollution, types and classification of air pollutants, Primary and Secondary air pollutants and their importance, Atmospheric stability, mixing heights. Photochemical smog reactions involved in its formation; Factors influencing these reactions. Effects of Air Pollution: Effects on man, animals, vegetation, and property, Episodes, Global effects of air pollution Air Pollution control by using Equipments. Land use planning: As a method of air pollution control.

Solid Waste Management **[6 Hrs]**

Solid Waste Management: Sources, classification, issues related to SWM, treatment techniques. Odors: Sources, measurement, and control.

Noise Pollution and EIA **[6 Hrs]**

Noise Pollution: Sources, Noise characteristics, measurement of noise, Effects of noise, Control of noise. Environmental Impact Assessment: Definition, Broad Goals, Objectives, Phases in EIA, Contents of Application form, Advantages & Disadvantages of EIA, Environmental management plan, Environmental Impact of Industries, Urbanization and Agricultural activities. Case studies.

Water Pollution **[6 Hrs]**

Water and Wastewater Treatment: Sources of water, Physical, Chemical and biological quality of water, Standards for drinking water. Flow diagram of water treatment process. Flow diagram of wastewater treatment process. Centralized sewage treatment systems, Objectives and Advantages of small and decentralized wastewater treatment systems.

Self-Study (SS):

Energy efficiency and renewable energy, Green practices in industries, Environmental regulations basics, Smart technologies in environmental monitoring, Waste-to-energy and case studies, Interdisciplinary engineering case studies for sustainability

Textbooks:

[1]	M.N. Rao, Air Pollution, Tata McGraw Hill, 1989 edition.
[2]	Environmental Engineering – H.S. Peavy, D.R. Row & G. Tchobanoglous
[3]	Environmental Engineering Fundamentals Sustainability Design – James R. Mihelcic & Julie B. Zimmerman
[4]	Elements of Environmental Pollution Control – O.P. Gupta

Reference Books:

[1]	Air Pollution Control Engineering – N. de Nevers
[2]	Wastewater Engineering Treatment and Reuse – Metcalf & Eddy
[3]	Solid Waste Management Principles and Practice – R. Chandrappa & D.B. Das
[4]	Wastewater Engineering – B.C. Punmia & Ashok Jain
[5]	Sewage Disposal and Air Pollution Engineering – S.K. Garg

Multidisciplinary Minor II - Green Buildings

Course Code	CE(MDM)-25001		**Examination Scheme**			
Teaching Scheme	4-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	-	-	--

Course Outcomes: Students will be able to:

1. Explain the environmental impact on buildings and its assessment.
2. Interpret green building planning policies for implementation.
3. Apply Green Building practices.
4. Evaluate green building material practices for national rating systems.

5. Assess water and energy efficiency in the green building.

Unit 1: Sustainable Development and Planning	**[7 Hrs]**
Concept, perspectives, need and importance, Environmental impact of building sector, current situation of environmental policies for building sector, concept and elements of sustainable planning for building industry (NBC 2016), past perspectives on planning, situating sustainable planning within planning theory, Planners roles, Concept of green building, Environmental & Economic issues of conventional buildings, benefits of green buildings, objectives of Green Building, Passive and active architecture, Natural ventilation and air conditioning, Hybrid system of active and passive refrigeration and air-conditioning.	
Unit 2: Sustainable site selection	**[7 Hrs]**
Sustainable site selection orientation, building envelop, building plan layout, design of doors and windows, natural ventilation, solar energy, energy conservation through planning and modelling as per climatic zones of India, use of solar energy for water heating, solar concentrators, solar photovoltaic panels, direct and indirect lighting.	
Unit 3: Green Building Materials	**[7 Hrs]**
Operational and Embodied energies in Conventional Materials, Role of Material: Carbon from Cement, alternative cement and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete; Energy in buildings; Alternative building materials and technologies; Energy audit of building.	
Unit 4: Water efficiency and Indoor Environment Quality	**[6 Hrs]**
Water efficiency, Water Efficient Landscaping- Rain water harvesting, potable water and bore well recharging, minimization of water use, dual flush, Waterless urinals, Smart controlled water tabs, Recycling of treated waste water for different non potable use, Domestic solid waste –segregation, green materials, Water audit; Indoor environment Quality low-VOC emitting materials. Adhesive and sealants, Paints and coatings.	
Unit 5: Recycling Techniques	**[7 Hrs]**
Recycling of building materials, Exiting walls, roofs and floors, Internal non-structural element, Construction waste management, Materials use, Recycled content, Use of fly ash, foundry sand and other inert solid wastes in building, life cycle analysis, Construction phase, Operation phase, demolition and land use.	
Unit 6 : Green building rating systems	**[7 Hrs]**
Concept, tools at international and national level, process of green building certification, comparison of different tools like LEED INDIA, GRIHA, IGBC, SB Tool etc.	
Self-Study (SS):	**[6 Hrs]**
Case studies on green building development and assessment tools.	

Textbooks:

[1]	Michael Bauer, Peter Mösle and Michael Schwarz, "Green Building – Guidebook for Sustainable Architecture" Springer Publication, ISBN 978-3-642-00634-0, 2010
[2]	IGBC green building rating system, <http://igbc.in/site/igbc/testigbc.jsp?desc=115708&event=115679>
[3]	Green Rating for Integrated Habitat Assessment (GRIHA). 〈http://www.grihaindia.org, 2019
[4]	Kibert, C. J. "Sustainable construction: Green building design and delivery", Wiley, Hoboken, NJ, 4th Edition. May 2016
[5]	B.V. Venkatarama Reddy, K.S. Jagadish, K.S. Nanjunda Rao "Alternative Building Materials and Technologies". Er. V. K. Jain, "Automation Systems in Smart and Green Buildings",2009

Reference Books:

[1]	LEED for homes green building rating system – U.S. green building council, <http://www.usgbc.org/leed/homes>
[2]	Building research establishment's environmental assessment method. Design and procurement pre-assessment estimator BREEAM
[3]	Eco Housing green building rating system. <http://portal.mcgm.gov.in/irj/portalapps/com.mcgm.ecohousing/docs/Eco_housing_Construction.pdf>

[4]	Comprehensive assessment system for building environmental efficiency. CASBEE for new construction: technical manual 2004 edition. <http://www.ibec.or.jp/CASBEE>
[5]	ASHRAE Standard 62-1999 Ventilation for Acceptable Indoor Air Quality
[6]	ASTM E1903-19, 2019
[7]	ASHRAE IESNA Standard: 90.1-2022
[8]	Jensen, John R. “Remote sensing of the environment: An earth resource perspective” 2/e. Pearson Education India, 2009.
[9]	National Building Code 2016
[10]	T E Glavinich, Green Building Construction, Wiley, New Jersey, 2008.

Semester – VI

Construction Management						
Course Code	CE-25006		**Examination Scheme**			
Teaching Scheme	3-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	3		**Laboratory**	-	-	-
Course Outcomes: Students will be able to:						
1. Learn various basic concepts like safety, laws, and site layout related to Construction Management. 2. Understand important aspects of managing the construction project with the help of various networking techniques like Bar Chart/ Milestone Chart, CPM, PERT, Crashing and updating 3. Apply various material management theories like ABC, EOQ, HML, VED, SDE, etc 4. Understand economic analysis and financial management concepts to know the economic feasibility of a construction project.						
Unit 1: Time Management						**[8 Hrs]**
Introduction, role of construction management, steps in Project Management work break down structure, Bar Chart, Milestone chart, Gantt Chart, Activity on Arrow and Activity on Node.						

Introduction to PERT: Concept of probability, normal and Beta Distribution, Time estimates and calculations of project duration, critical path, slack.	
Unit 2: Network Analysis	**[6 Hrs]**
Critical Path Method (CPM): Introduction, Time estimates, floats, critical path, Network Crashing, Least Cost and optimum duration, Updating of networks-needs, steps, project duration, calculation for updated network	
Unit 3: Resource Management and Financial Management	**[10 Hrs]**
Human Resource allocation smoothening and levelling, Material Management- Objectives, Role, Functions, Qualities of material manager, Inventory Control- Necessity, Techniques such as ABC, EOQ, HML, VED, SDE etc., lead-time, safety stocks, Management Information System. Introduction to Engineering Economics, importance, demand and supply, types of costs, Types of interest, such as simple, compound, continuous, and effective. Value of Money, time and equivalence, tangible and intangible factors, introduction to inflation. Cost time relationship, Earned Value Analysis.	
Unit 4: Economic Analysis	**[8 Hrs.]**
Economic comparisons, Discounting methods: Present worth method, equivalent annual cost method, capitalised cost method, net present value, and internal rate of return, Breakeven Analysis, Balance sheet.	
Unit 5: Software Applications in Construction Management	**[8 Hrs]**
Importance and benefits of software in construction management; Role of software in construction lifecycle; Introduction to MS Project, Primavera P6, Revit, Navisworks; Scheduling using MS Project and Primavera P6; BIM Basics using Revit/ Navisworks; Interlinking schedule and BIM for better project visualisation.	
Self-Study (SS):	**[2 Hrs]**
Lean Construction principles, Introduction to Digital Twin technology and its integration with BIM in construction projects. BOCW Act 1996, Factories Act, 1948; Workmen's Compensation Act, 1923; Contract Labour (Regulation and Abolition) Act, 1970; Environment Protection Act, 1986	
Textbooks:	
[1]	K.N. Jha, "Construction Project Management", Pearson Education, 3rd Edition, March 2025.
[2]	Sengupta B. and Guha H. "Construction Management and Planning", Tata McGraw-Hill Publication
[3]	Srinath L. S. "PERT &CPM: Principles and Applications", Affiliated East West Press, Delhi
[4]	B. C. Punmia, "Project Planning and Control with PERT and CPM", Laxmi Publications (P) Ltd.
[5]	R. Paneerselvam, “Engineering Economics”, Prentice Hall India Learning Private Limited, 2nd Edition.
Reference Books:	
[1]	S. Seetharaman, "Construction Engineering and Management", Umesh Publications
[2]	KK Chitkara, "Construction Project Management," Tata McGraw-Hill Education
[3]	K. S. Menon, "Purchasing and Inventory Control", A. H. Wheeler Publishing Company Limited
[4]	Gopalkrishnan and Sundaresan," Materials Management: An Integrated Approach", PHI Learning Pvt. Ltd.
[5]	L.C. Jhamb, "Inventory management", Everest Publishing House, Pune, 1987
[6]	Riggs, J., Bedworth, D. D., and Randhawa S. U., "Engineering Economics" Tata McGraw-Hill Education
[7]	M. K. Rustogi, "Production and Operation Management", University Science Press

Design of Reinforced Concrete Structures						
Course Code	CE-25007		**Examination Scheme**			
Teaching Scheme	3-0-1-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	CIE: 60	ESE: 40	--
Course Outcomes: Students will be able to:						
1. Understand the design philosophy/ fundamental background and principles of reinforced concrete structures. 2. Analyze reinforced concrete structural elements under gravity loads. 3. Design the structural elements as per IS code provisions. 4. Gain the skill and learning approach through comprehensive design project.						
Unit 1:						**[8 Hrs]**
Design philosophies of R.C structures (WSM, LSM), Structural elements, loads on structures, and structural properties of concrete, Role of structural engineer. R.C. sections in flexure, theory & analysis, singly, doubly reinforced rectangular and flanged sections.						
Unit 2:						**[6 Hrs]**
One-way and two slabs - simply supported, cantilever and continuous. Design of staircase: Dog legged /open well.						
Unit 3:						**[8 Hrs]**
Design of beams - simply supported, continuous, cantilever -for flexure, shear, bond and torsion, redistribution of moments.						
Unit 4:						**[8 Hrs.]**
Design of Column, axially loaded, short & long, uni-axial & biaxial moments.						

Unit 5:	**[6 Hrs.]**
Isolated column footing, axial load, uni-axial and biaxial moments. Eccentric footing. Footing in difficult soil conditions	
Unit 6: Self Study	**[6 Hrs]**
Concept of building frame design, Design of cantilever Retaining wall.	
Textbooks:	
[1]	Punmia, Jain and Jain, "Comprehensive Design of RC Structures", Standard Book House – New Delhi
[2]	De. V. L Shah and Dr. S. R. Karve, "Limit State Theory and Design", Pune Vidyarthi Publication
Reference Books:	
[1]	Limit State Analysis and Design: P. Dayaratnam – Wheeler Publishing Company
[2]	Sinha, "RCC Analysis and Design Vol. I and II,", S. Chand and Co. New Delhi.
Note:	
[1]	To measure CO1, questions may be of the type- define, identify, state, match, list, name etc.
[2]	To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.
[3]	To measure CO3, questions will be based on applications of core concepts.
[4]	To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.
[5]	To measure CO5, some questions may be based on self-study topics and comprehension of unseen passages.

Design of Reinforced Concrete Structures Laboratory
Course Outcomes: Students will be able to:
1. Adopt general procedure for design of simple RCC structures using relevant IS Codes. 2. Design and draw detailing of RCC elements in the building frame.
Design Assignments Shall Consist of Following
1. Design of RC building up to 12 m height above GL for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group) 2. Report of a site visit related to RC building structure under construction 3. To the scale sketching would be done in the sketch book by hand and then the drawings would be drafted using Drafting Package/ Auto Cad. Four full size drawing sheets would be drawn using drafting software/ Auto CAD 4. Bar bending schedule & detailing of reinforcements as per standard professional practice and relevant IS codes **5.** Emphasis would be given on structural detailing of reinforcement considering the earthquake effects **6.** RCC design assignments shall preferably be accepted same/similar to the layout of the building studied in the course Building Design and Drawing.

Hydrology and Water Resources Engineering						
Course Code	CE-25008		**Examination Scheme**			
Teaching Scheme	3-0-1-1		**Theory**	TA: 20	MSE:30	ESE:50
Credits	3		**Laboratory**	-	-	--

Course Outcomes: Students will be able to:

1. Demonstrate the features of the primary hydrological processes and explain various terms related to irrigation engineering and ground water.
2. Evaluate average rainfall, runoff, evaporation loss and other losses from a reservoir/watershed,
3. Compute crop water requirement, reservoir capacity, canal capacity.
4. Eestimate peak flood, specific yield of well,
5. Compute the trial section of gravity dam, earthen dam, and apply stability checks.

Unit 1: Surface Water Hydrology: Hydrological Process **[7 Hrs]**

Introduction to Hydrology, Hydrological cycle. Precipitation, Types of Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves, and concept of depth area duration analysis, frequency analysis. Elementary concepts of evaporation, transpiration, evapotranspiration and infiltration

Unit 2: Surface Water Hydrology: Hydrometery **[7Hrs]**

Selection of site, various methods of discharge measurements, Runoff- Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph theory, use of unit hydrograph.
Floods- Estimation of peak flow, rational formula and other methods,

Unit 3: Ground water hydrology **[7Hrs]**

Occurrence and distribution of ground water, specific yield of aquifers, movements of ground water, Darcy's law, Equation of motion Dupits. Hydraulics of well.

Unit 4: Irrigation Engineering **[6Hrs]**

Definition, functions, advantages and necessity. Water requirement of crops, soil moisture and crop water relationship, factors governing consumptive use of water, principal Indian crops, their season and water requirement, agriculture practices. Cropping pattern, Design of canal.

Causes of water logging, preventive and curative measures, Lift irrigation schemes - Various components and their design principles (Only concepts)	
Unit 5: Dams and Reservoirs	**[7Hrs]**
Types of Dam, Choice of dam, various components of dam, forces acting on gravity dam, design of gravity Dams, low and high gravity dams, construction of gravity dam. Earth dam: Causes of failure of earth dam, stability analysis by Swedish Slip Circle Method. **Reservoir:** Types, selection of site, reservoir sedimentation, reservoir	
Unit 6: Introduction to Hydraulic structures	**[7Hrs]**
Types of spillways and energy dissipaters, weirs and barrages, Cross drainage works: need, types, design considerations, General features of Hydro-power, general layouts of different types, main components of Hydro-power schemes.	
Self-Study (SS):	
1. S-curve hydrograph, synthetic unit hydrograph 2. Open wells. 3. Energy dissipaters	
Textbooks:	
[1]	K. Subramanya, "Engineering hydrology", Tata McGraw-Hill, New Delhi, (6th Edition)
[2]	P. N. Modi, "Irrigation, water resources and water power Engineering", Standard book House.
[3]	Garg, S.K., "Irrigation Engineering and Hydraulic Structures", Khanna Publications.
[4]	Asawa, G.L., "Irrigation Engineering", New Age International Publishers (2nd Edition).
[5]	Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co (1999).
Reference Books:	
[1]	Ven Te Chow, David R. Maidment, Larry W. Mays "Applied Hydrology" Tata McGraw-Hill, New Delhi.
[2]	Ralph A. Wurbs, Wesley P. James, "Water Resources Engineering", Prentice Hall of India.
[3]	H.M. Raghunath" Ground Water", New Age International Publishers.
[4]	Dilip Kumar Majumdar, "Irrigation Water Management (Principles & Practices)", Prentice Hall of India (P), Ltd.

Sustainable Construction Practices						
Course Code	**C**E-25009		**Examination Scheme**			
Teaching Scheme	**0-0-1-0**		**Theory**	**TA:**	**MSE:**	**ESE:**
Credits	**1**		**Laboratory**	**CIE: 60**	**ESE: 40**	

Course Outcomes: Students will be able to:

1. Explain fundamental concepts of sustainable construction
2. Analyze and compare sustainable construction materials
3. Apply sustainability principles in building planning
4. Evaluate green building codes and rating systems
5. Interpret modern sustainable construction practices
6. Assess innovative technologies for real-world applications

LIST OF ASSIGNMENTS

Assignment 1: Basics of Sustainable Practices

- Sustainability concepts and importance
- Environmental impacts of construction
- Sustainable practices and site observation

Assignment 2: Sustainable Construction Materials

- Study of sustainable material
- Properties, manufacturing, and applications
- Environmental and economic analysis
- Comparison with conventional materials

Assignment 3: Sustainable Construction Planning

- Site planning, orientation, zoning
- Natural lighting and ventilation
- Water and energy-efficient strategies
- Conceptual building drawings

Assignment 4: Green Building Codes & Rating Systems

- Study of GRIHA / IGBC / LEED / ECBNBC
- Components and comparison
- Indian applicability and case study

Assignment 5: Sustainable Practices in Modern Construction

- Study of modern construction techniques
- Applications, advantages, and case studies

Assignment 6: Innovative Sustainable Technologies

- Study of innovative technologies
- Performance, market study, and applications

Textbooks:	
[1]	Sustainable Construction: Green Building Design and Delivery – Charles J. Kibert
[2]	Construction Materials, Methods, and Techniques: Building for a Sustainable Future – Nunnally
[3]	Green Building: Principles and Practices in Residential Construction – Mehta et al.
Reference Books:	
[1]	Sustainable Construction: Green Building Design and Delivery – Charles J. Kibert, 5th Ed., John Wiley & Sons, 2022.
[2]	Green Building: An Engineering Approach to Sustainable Construction – Christian M. Carrico, 1st Ed., Elsevier, 2025.
[3]	Sustainable Construction Engineering and Management – Zavadskas et al., 1st Ed., MDPI, 2021.
[4]	The Shape of Green: Aesthetics, Ecology, and Design – Lance Hosey, 1st Ed., Island Press, 2012.

MULTIDISCIPLINARY MINOR III: CLIMATE CHANGE						
Course Code	CE(MDM)-25002		**Examination Scheme**			
Teaching Scheme	4-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	4		**Laboratory**	-	-	-

Course Outcomes: Students will be able to:

1. Define matrices, linear equations, and determinants, recall basic matrix algebra, limits, continuity and derivatives of functions of single variable.
2. Solve a system of linear equations using matrices, verify MVTs, find Critical points and Monotonicity of functions of single variable.
3. Calculate eigen values, eigen vectors, rank of a matrix, find extreme values of functions.
4. Apply concepts of calculus to find extrema of functions, including real life problems.
5. Apply concepts of Matrix Algebra and Calculus to various problems including real life problems.

Unit 1: Atmosphere and Climate	**[7Hrs]**
Atmospheric structure and composition; Solar radiation and global energy budget; External and internal forcing; Climate Feedbacks.	
Unit 2: Global Climate -Past, Present and Future	
Account of past climate; Environmental indicators and instrumental records; Human Footprints on global warming; Predicting future climates; Temperature regime; Extreme climate events	
Unit 3: Climate Change Impacts	
Impact of climate change on agriculture; Impact of climate change on Livestock; Impact of climate change on biodiversity; Impact of climate change on water resources; Impact of climate change on livelihood; Impact of climate change on human health; Climate change vulnerability assessment; Life Cycle Assessment; Geoinformatics in Climate Change Studies; Concept of mitigation and adaptation; Climate smart agriculture; Soil carbon sequestration; Biofuels; Climate Refugees; Climate Justice; Climate Change and Gender	
Unit 4: Modelling the Climate System	
Introduction to climate modelling; Expressing a zero-dimensional energy model as a linear equation; Zero –dimensional (0d) -EBM demonstration; Estimating climate sensitivity	
Unit 5: Conventions on Climate Change	7 Hrs.
International Initiatives; National Level Action Plan; State Level Action Plan; roles of national, sectoral and sub-national institutions in climate change planning; Five-step methodology for preparing a low-emission climate-resilient development strategy.	
Self-Study (SS): Introduction to Planning for Climate Change	
· Overview of planning processes · Different dimensions of climate change planning (environmental, economic, social) · Entry points for climate change planning · Basic concept of low-emission climate-resilient development	
Textbooks:	

[1]	Barry RG and Chorley RJ. (2010). Atmosphere, weather and climate. 8th Edition. Routledge, New York. pp.421 2. Burroughs WJ (2007) Climate Change: A multidisciplinary approach. 2nd Edition. Cambridge University Press. Pp.390. ISBN: 978
[2]	Burroughs WJ (2007) Climate Change: A multidisciplinary approach. 2nd Edition. Cambridge University Press. Pp.390. ISBN: 978
[3]	Dessler A (2016) Introduction to Modern Climate Change. 2nd Edition. Cambridge University Press. ISBN: 978-521-17315-5
[4]	Fletcher C (2018) Climate Change: What the science tells us. 2nd Edition. John Wiley & Sons. Pp.336. ISBN: 978-1-118-79306-0
[5]	Houghton JT (2015) Global Warming: The complete briefing. 5th Edition. Cambridge University Press. Pp.456. ISBN: 978-0-521-70916.
[6]	IPCC (2023) Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
Reference Books:	
[1]	Archer D (2011) *Global Warming: Understanding the Forecast*. 2nd Edition. Wiley-Blackwell. ISBN: 978-1444339251
[2]	Neelin J D (2011) *Climate Change and Climate Modeling*. Cambridge University Press. ISBN: 978-0521602438

Project - II						
Course Code	CE-25010		**Examination Scheme**			
Teaching Scheme	1-0-0-1		**Theory**	-	-	-
Credits	01		**Laboratory**	-	MSE: 50	ESE: 50

Course Outcomes: Students will be able to:

1. Formulate innovative solutions to complex civil engineering problems considering sustainability and societal impact.
2. Integrate multidisciplinary knowledge to design, analyze, and evaluate engineering systems or structures.
3. Apply research methodologies, experimental techniques, and advanced tools to validate project outcomes.
4. Exhibit professional ethics, responsibility, and awareness of environmental and economic factors in engineering practice.
5. Communicate project deliverables clearly to diverse audiences using professional documentation and presentations.
6. Demonstrate readiness for industry or higher studies through independent problem-solving and critical thinking.

Objective:

1. Introduce students to research methodology, project ideation, and planning.
2. Develop technical solutions, conduct experiments/simulations, and analyze results.

(Objective 1 should be complete in project-I)

Content for Evaluation:

- Implementation of Methodology
- Experimental setup, data collection, or software modeling.
- Technical Depth
- Application of codes, standards, and engineering principles.
- Data Analysis & Interpretation
- Use of statistical/analytical tools, validation of results.
- Mid-term Progress Review
- Demonstration of partial outcomes.
- Teamwork & Project Management
- Task allocation, time management, documentation.
- Interim Report & Presentation
- Draft report with results and discussion.

Evaluation Weightage (suggested):

- Implementation & technical work – 40%
- Data analysis & interpretation – 30%
- Report & presentation – 30%

Green Building Practices						
Course Code	CE(PE)-25005		**Examination Scheme**			
Teaching Scheme	3-0-0-1		**Theory**	TA: 20	MSE: 30	ESE: 50
Credits	3		**Laboratory**	-	-	--

Course Outcomes: Students will be able to:

1. Explain the environmental impact on buildings and its assessment.
2. Interpret green building planning policies for implementation.
3. Apply Green Building practices.
4. Evaluate green building material practices for national rating systems.
5. Assess water and energy efficiency in the green building.

Unit 1: Sustainable Development and Planning **[7 Hrs]**

Concept, perspectives, need and importance, Environmental impact of building sector, current situation of environmental policies for building sector, concept and elements of sustainable planning for building industry (NBC 2016), past perspectives on planning, situating sustainable planning within planning theory, Planners roles, Concept of green building, Environmental & Economic issues of conventional buildings, benefits of green buildings, objectives of Green Building, Passive and active architecture, Natural ventilation and air conditioning, Hybrid system of active and passive refrigeration and air-conditioning.

Unit 2: Sustainable site selection **[7 Hrs]**

Sustainable site selection orientation, building envelop, building plan layout, design of doors and windows, natural ventilation, solar energy, energy conservation through planning and modelling as per climatic zones of India, use of solar energy for water heating, solar concentrators, solar photovoltaic panels, direct and indirect lighting.

Unit 3: Green Building Materials **[7 Hrs]**

Operational and Embodied energies in Conventional Materials, Role of Material: Carbon from Cement, alternative cement and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete; Energy in buildings; Alternative building materials and technologies; Energy audit of building.

Unit 4: Water efficiency and Indoor Environment Quality **[6 Hrs]**

Water efficiency, Water Efficient Landscaping- Rain water harvesting, potable water and bore well recharging, minimization of water use, dual flush, Waterless urinals, Smart controlled water tabs, Recycling of treated waste water for different non potable use, Domestic solid waste –segregation, green materials, Water audit; Indoor environment Quality low-VOC emitting materials. Adhesive and sealants, Paints and coatings.

Unit 5: Recycling Techniques **[7 Hrs]**

Recycling of building materials, Exiting walls, roofs and floors, Internal non-structural element, Construction waste management, Materials use, Recycled content, Use of fly ash, foundry sand and other inert solid wastes in building, life cycle analysis, Construction phase, Operation phase, demolition and land use.

Unit 6: Green building rating systems **[7 Hrs]**

Concept, tools at international and national level, process of green building certification, comparison of different tools like LEED INDIA, GRIHA, IGBC, SB Tool etc.

Self-Study (SS): **[6 Hrs]**

Case studies on green building development and assessment tools.

Textbooks:

[1] Michael Bauer, Peter Mösle and Michael Schwarz, “Green Building – Guidebook for Sustainable Architecture” Springer Publication, ISBN 978-3-642-00634-0, 2010

[2]	IGBC green building rating system, <http://igbc.in/site/igbc/testigbc.jsp?desc=115708&event=115679>
[3]	Green Rating for Integrated Habitat Assessment (GRIHA). 〈http://www.grihaindia.org, 2019
[4]	Kibert, C. J. "Sustainable construction: Green building design and delivery", Wiley, Hoboken, NJ, 4th Edition. May 2016
[5]	B.V. Venkatarama Reddy, K.S. Jagadish, K.S. Nanjunda Rao "Alternative Building Materials and Technologies". Er. V. K. Jain, "Automation Systems in Smart and Green Buildings",2009
Reference Books:	
[1]	LEED for homes green building rating system – U.S. green building council, <http://www.usgbc.org/leed/homes>
[2]	Building research establishment's environmental assessment method. Design and procurement pre-assessment estimator BREEAM
[3]	Eco Housing green building rating system. <http://portal.mcgm.gov.in/irj/portalapps/com.mcgm.ecohousing/docs/Eco_housing_Construction.pdf>
[4]	Comprehensive assessment system for building environmental efficiency. CASBEE for new construction: technical manual 2004 edition. <http://www.ibec.or.jp/CASBEE>
[5]	ASHRAE Standard 62-1999 Ventilation for Acceptable Indoor Air Quality
[6]	ASTM E1903-19, 2019
[7]	ASHRAE IESNA Standard: 90.1-2022
[8]	Jensen, John R. "Remote sensing of the environment: An earth resource perspective" 2/e. Pearson Education India, 2009.
[9]	National Building Code 2016
[10]	T E Glavinich, Green Building Construction, Wiley, New Jersey, 2008.

Watershed Management

Course Code	CE(PE)-25007		Examination Scheme			
Teaching Scheme	3-0-0-1		Theory	TA: 20	MSE: 30	ESE: 50
Credits	3		Laboratory	--	--	--

Course Outcomes: Students will be able to:

1. demonstrate different terminologies related to watershed management.
2. select suitable structure in a particular situation for water conservation.
3. apply the various concepts of watershed planning, modeling, monitoring and evaluation.
4. assess land erosion, sedimentation.
5. estimate magnitude of storm water, and flood.

Unit 1: Introduction and Basic Concepts of Watershed **[6 Hrs]**

Watershed, need of watershed concept, introduction to watershed management, principles and objectives of watershed management, characteristics: size, shape, physiography, slope, climate and drainage, different stakeholders and their relative importance, role of watershed management in developing solutions to natural resource problem.

Unit 2: Watershed Modeling and Soil Erosion Modeling and Sedimentation **[11 Hrs]**

Standard modeling approaches and classification, system concept for watershed modeling, structure of watershed model, modeling of rainfall runoff process, subsurface flows and groundwater flow.

Soil Erosion, estimation of soil erosion, sources of sediments, sedimentation in streams and reservoirs.

Unit 3: Storm Water and Flood Management **[7 Hrs]**

Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies of flood damage.

Unit 4: Water Harvesting and Storage Structures **[7 Hrs]**

Water harvesting, techniques for preparing water harvesting catchments, storage of harvested water, traditional methods of water harvesting, objectives and functions of water storage structures, different structures and their suitability, losses of stored water, control of losses of stored water, conjunctive use of water

Unit 5: Monitoring and Evaluation of Watershed Projects **[7 Hrs]**

Need of monitoring, types of monitoring, monitoring systems, phases, selection of indicators, criteria for performance evaluation, outcomes and lessons learnt from monitoring and evaluation of watershed projects.

Self-Study: **[4 Hrs]**

Writing report on a case study of “Watershed Development Program”

Textbooks:

[1]	Rajvir Singh, "Watershed Planning and Management", Yash Pulishing House, Jaipur, India 3rd Edition 2016
[2]	J V S Murty, “Watershed Management”, New Age International Publisher, Daryaganj New Delhi, Second Edition 2013
[3]	Madan Mohan Das and Mimi Das Saikia, “Watershed Management”, PHI Learning Private Limited New Delhi, Edition 2013

Reference Books:

[1]	E.M. Tideman," Watershed Management: Guidelines for Indian Conditions", Omega Scientific Publishers.
[2]	Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall India.
[3]	V. P. Singh and Donald K. Frevert, “Watershed Models", Taylor & Francis

COMPUTATIONAL METHODS IN CIVIL ENGINEERING						
Course Code	CE(PE)-25007		Examination Scheme			
Teaching Scheme	3-0-0-1		Theory	TA: 20	MSE: 30	ESE: 50

Credits	3		**Laboratory**	--	--	--

Course Outcomes: Students will be able to:

1. Mathematically model a physical system.
2. Identify appropriate numerical method to find solutions of simulated physical system.
3. Apply the numerical methods to solve Civil Engineering problems.
4. Use computer program to get solution of problems in Civil Engineering.

Unit 1: Introduction	**[8 Hrs]**
Basic concepts of Numerical Methods: Mathematical modelling; accuracy and precision; errors analysis	
Unit 2: Roots of Equation	**[8 Hrs]**
Graphical Methods; Bisection Method; Secant Method, Newton-Raphson Method; Multiple Roots	
Unit 3: Linear Algebraic Equations:	**[8 Hrs]**
Numerical Solution of Linear and Nonlinear Simultaneous Equations: Gauss- Elimination, Gauss-Jordan Method, L-U Decomposition Method, Gauss- Seidel Method	
Unit 4: Curve Fitting	**[6 Hrs]**
Least Square Regressions, Interpolation by Newton's Formulae, Lagrange Interpolating Polynomials, Spline Interpolation	
Unit 5: Numerical Integration and Ordinary Differential Equation	**[8 Hrs]**
Numerical Integration using Newton-Cotes formulae, Gauss-Quadrature, Double Integration, Taylor's Series method; Euler's method; Modified Euler's method, Runge-Kutta method (Second and Fourth Order)	
Self-Study	**[4 Hrs]**
Applications of the above Numerical methods for different Civil Engineering problems using software such as MS-EXCEL/MATLAB	

Textbooks:

[1]	Chapra, Cannale, "Numerical Methods for Engineers", McGraw-Hill Int. 8th Edition, 2021
[2]	Sastry S. S., "Introductory Methods of Numerical Analysis", Prentice Hall of India Delhi, 5th edition, 2012.
[3]	N Krishna Raju Ku Muthu, Numerical Methods for Engineering Problems, Macmillan Children'S Books, 2nd edition, 2000.

Reference Books:

[1]	Amos Gilat, "Numerical Methods for Engineers and Scientists", 3rd Edition, Wiley International, 2014.
[2]	Ascher, U.M. and Greif, C., "A First Course in the Numerical Methods", SIAM Publication, 2011
[3]	Khoury, Richard, Harder, Douglas Wilhelm, "Numerical Methods and Modelling for Engineering", Springer International Publishing, 2016.