

<b>B. E. CIVIL ENGINEERING</b>			
<b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b>			
<b>SEMESTER - V</b>			
<b>CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP</b>			
Course Code	<b>18CV51</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p><b>Course Learning Objectives:</b> This course will enable students to</p> <ol style="list-style-type: none"> <li>1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.</li> <li>2. Inculcate Human values to grow as responsible human beings with proper personality.</li> <li>3. Keep up ethical conduct and discharge professional duties.</li> </ol>			
<b>Module -1</b>			
<p><b>Management:</b> Characteristics of management, functions of management, importance and purpose of planning process, types of plans.</p> <p><b>Construction Project Formulation:</b> Introduction to construction management, project organization, management functions, management styles.</p> <p><b>Construction Planning and Scheduling:</b> Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, PERT method, concept of activity on arrow and activity on node.</p>			
<b>Module -2</b>			
<p><b>Resource Management:</b> Basic concepts of resource management, class of labour, Wages &amp; statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.</p> <p><b>Construction Equipments:</b> classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance</p> <p><b>Materials:</b> material management functions, inventory management.</p>			
<b>Module -3</b>			
<p><b>Construction Quality , safety and Human Values:</b></p> <p>Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management</p> <p><b>HSE: Introduction</b> to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.</p> <p><b>Ethics :</b> Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.</p>			
<b>Module -4</b>			
<p><b>Introduction to engineering economy:</b> Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.</p> <p><b>Interest and time value of money:</b> concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.</p> <p><b>Comparison of alternatives:</b> Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.</p>			
<b>Module -5</b>			

<p><b>Entrepreneurship:</b> Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.</p> <p>Micro, Small &amp; Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC.</p> <p><b>Business Planning Process:</b> Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.</p>
<p><b>Course Outcomes:</b> After studying this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.</li> <li>2. Understand labour output, equipment efficiency to allocate resources required for an activity / project to achieve desired quality and safety.</li> <li>3. Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.</li> <li>4. Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.</li> </ol>
<p><b>Question paper pattern:</b></p> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. P C Tripathi and P N Reddy, “Principles of Management”, Tata McGraw-Hill Education</li> <li>2. Chitkara, K.K, “Construction Project Management: Planning Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi.</li> <li>3. Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education</li> <li>4. Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.</li> <li>5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:</li> </ol>
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education</li> <li>2. Harold Koontz, Heinz Wehrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, New Delhi</li> <li>3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell</li> <li>4. Mike Martin, Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill Education</li> <li>5. Chris Hendrickson and Tung Au, “Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pittsburgh</li> <li>6. James L. Riggs, David D. Bedworth , Sabah U. Randhawa “ Engineering Economics” 4</li> </ol>

<b>B. E. CIVIL ENGINEERING</b>			
<b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b>			
<b>SEMESTER - V</b>			
<b>ANALYSIS OF INDETERMINATE STRUCTURES</b>			
Course Code	<b>18CV52</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to			
<ol style="list-style-type: none"> <li>1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.</li> <li>2. Identify, formulate and solve problems in structural analysis.</li> <li>3. Analyze structural system and interpret data.</li> <li>4. use the techniques, such as stiffness and flexibility methods to solve engineering problems</li> <li>5. communicate effectively in design of structural elements</li> </ol>			
<b>Module-1</b>			
<b>Slope Deflection Method:</b> Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy $\leq 3$ .			
<b>Module-2</b>			
<b>Moment Distribution Method:</b> Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy $\leq 3$ .			
<b>Module-3</b>			
<b>Kani's Method:</b> Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway.			
<b>Module-4</b>			
<b>Matrix Method of Analysis ( Flexibility Method) :</b> Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy $\leq 3$ .			
<b>Module-5</b>			
<b>Matrix Method of Analysis (Stiffness Method):</b> Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy $\leq 3$ .			
<b>Course Outcomes:</b> After studying this course, students will be able to:			
<ol style="list-style-type: none"> <li>1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope deflection method</li> <li>2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.</li> <li>3. Construct the bending moment diagram for beams and frames by Kani's method.</li> <li>4. Construct the bending moment diagram for beams and frames using flexibility method</li> <li>5. Analyze the beams and indeterminate frames by system stiffness method.</li> </ol>			
<b>Question paper pattern:</b>			
<ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b>			
<ol style="list-style-type: none"> <li>1. Hibbeler R C, “ <b>Structural Analysis</b>”, Pearson Publication</li> <li>2. L S Negi and R S Jangid, “<b>Structural Analysis</b>”, Tata <i>McGraw-Hill</i> Publishing Company Ltd.</li> <li>3. D S Prakash Rao, “<b>Structural Analysis: A Unified Approach</b>”, Universities Press</li> <li>4. K.U. Muthu, H. Narendra et al, “<b>Indeterminate Structural Analysis</b>”, IK International Publishing Pvt. Ltd.</li> </ol>			
<b>Reference Books:</b>			

1. Reddy C S, "**Basic Structural Analysis**", Tata McGraw-Hill Publishing Company Ltd.
  2. Gupta S P, G S Pundit and R Gupta, "**Theory of Structures**", Vol II, Tata McGraw Hill Publications company Ltd.
  3. V N Vazirani and M MRatwani, "**Analysis Of Structures** ", Vol. 2, Khanna Publishers
  4. Wang C K, "**Intermediate Structural Analysis**", McGraw Hill, International Students Edition.
  5. S.Rajasekaran and G. Sankarasubramanian, "**Computational Structural Mechanics**", PHI Learning Pvt. Ltd.
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<b>B. E. CIVIL ENGINEERING</b>			
<b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b>			
<b>SEMESTER - V</b>			
<b>DESIGN OF RC STRUCTURAL ELEMENTS</b>			
Course Code	18CV53	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to			
<ol style="list-style-type: none"> <li>1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.</li> <li>2. Follow a procedural knowledge in designing various structural RC elements.</li> <li>3. Impart the usage of codes for strength, serviceability and durability.</li> <li>4. Provide knowledge in analysis and design of RC elements.</li> </ol>			
<b>Module-1</b>			
<b>Introduction to working stress and limit State Design:</b> Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section. Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.			
<b>Module-2</b>			
<b>Limit State Analysis of Beams:</b> Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.			
<b>Module-3</b>			
<b>Limit State Design of Beams:</b> Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.			
<b>Module-4</b>			
<b>Limit State Design of Slabs and Stairs:</b> Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.			
<b>Module-5</b>			
<b>Limit State Design of Columns and Footings:</b> Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.			
<b>Course outcomes:</b> After studying this course, students will be able to:			
<ol style="list-style-type: none"> <li>1. Understand the design philosophy and principles.</li> <li>2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.</li> <li>3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.</li> <li>4. Owns professional and ethical responsibility.</li> </ol>			
<b>Question paper pattern:</b>			
<ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<ul style="list-style-type: none"> <li>• The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.</li> </ul>			
<b>Textbooks:</b>			
<ol style="list-style-type: none"> <li>1. Unnikrishnan Pillai and Devdas Menon, “ <b>Reinforced Concrete Design</b>” , McGraw Hill, New Delhi</li> <li>2. Subramanian, “ <b>Design of Concrete Structures</b>” , Oxford university Press</li> <li>3. H J Shah, “<b>Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)</b>” , Charotar Publishing House Pvt. Ltd.</li> </ol>			
<b>Reference Books:</b>			

1. P C Varghese, "Limit State design of reinforced concrete" , PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publishers.
3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications.
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press.
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - V**

**BASIC GEOTECHNICAL ENGINEERING**

Course Code	<b>18CV54</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assess the improvement in mechanical behaviour by densification of soil deposits using compaction.
5. Model and measure strength-deformation characteristics of soils.

**Module-1**

**Introduction:** Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.

Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis (sieve and Hydrometer analysis)

Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

**Module-2**

Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering

**Compaction of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

**Module -3**

**Flow through Soils:** Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.

**Seepage Analysis:** Laplace equation, assumptions, limitation and its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section.

Unconfined flow, phreaticline (Casagrande's method-with and without toe filter), flow through dams, design of dam filters.

**Effective Stress Analysis:**

Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.

**Module -4**

**Shear Strength of Soil:** Concept of shear strength, Mohr-Coulomb Failure Criterion, Modified Mohr-Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.

**Module-5**

**Consolidation of Soil:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumptions and limitations. Governing differential Equation and solution (No derivation).

Consolidation characteristics of soil ( $C_c$ ,  $a_v$ ,  $m_v$  and  $C_v$ ). Laboratory one dimensional consolidation test, characteristics of  $e$ -log ( $\sigma'$ ) curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils.

Determination of consolidation characteristics of soils- compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

**Course outcomes:** On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India.

**Reference Books:**

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.



<b>B. E. CIVIL ENGINEERING</b>			
<b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b>			
<b>SEMESTER - V</b>			
<b>MUNICIPAL WASTEWATER ENGINEERING</b>			
Course Code	<b>18CV55</b>	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p><b>Course Learning Objectives:</b> This course will enable students to;</p> <ol style="list-style-type: none"> <li>1. Understand the various water demands and population forecasting methods.</li> <li>2. Understand and design different unit operations and unit process involved in wastewater treatment process</li> <li>3. Understand the concept and design of various physicochemical treatment units</li> <li>4. Understand the concept and design of various biological treatment units</li> <li>5. Understand the concept of various advanced waste water and low cost treatment processes for rural areas.</li> </ol>			
<b>Module-1</b>			
<p><b>Introduction:</b> Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors affecting dry and wet weather flow on design of sewerage system, estimation of storm water flow, time of concentration flow, numericals.</p> <p><b>Sewer appurtenances:</b> Manholes, catch basins, oil and grease traps. P, Q and S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers basic principles of house drainage.</p>			
<b>Module-2</b>			
<p><b>Design of sewers:</b> Hydraulic formula to determine velocity and discharge. Self cleansing and non scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.</p> <p><b>Waste water characteristics:</b> sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water</p> <p>Treatment unit operations and process. Estimation of BOD. Reaction kinetics (zero order, 1<sup>st</sup> order and 2<sup>nd</sup> order).</p>			
<b>Module-3</b>			
<p><b>Treatment of municipal waste water:</b> Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks.</p> <p><b>Disposal of effluents:</b> Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps equation.</p>			
<b>Module-4</b>			
<p><b>Biological Treatment Process:</b> Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors.</p> <p>Principle of stabilization ponds, oxidation ditch, Sludge digesters(aerobic and anaerobic), Equalization., thickeners and drying beds.</p>			
<b>Module-5</b>			
<p><b>Advanced Wastewater Treatment:</b> Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advanced oxidation processes (AOPs), Electro coagulation.</p> <p><b>Rural sanitation:</b> Low cost treatment process: Working principle and design of septic tanks for small community in rural and urban areas, two-pit latrines, eco-toilet and soak pits.</p>			
<p><b>Course outcomes:</b> After studying this course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Select the appropriate sewer appurtenances and materials in sewer network.</li> <li>2. Design the sewer network and understand the self purification process in flowing water.</li> <li>3. Design the various physico-chemical treatment units</li> <li>4. Design the various biological treatment units</li> <li>5. Design various AOPs and low cost treatment units.</li> </ol>			
<p><b>Question paper pattern:</b></p> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub-questions) from each module.</li> <li>• Each full question will have sub-question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks</b>			

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. B C Punmia, "Environmental Engineering vol-II", Laxmi Publications 2<sup>nd</sup>, 2016
3. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3<sup>rd</sup>. Edition, 2017
4. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28<sup>th</sup> edition and 2017

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**Reference Books**

1. CPHEEO manual on sewage treatment, Ministry of Urban Development, Government of India, New Delhi, 1999
2. Mark.J Hammer, "Water & Waste Water Technology" John Wiley & Sons Inc., New York, 2008
3. Benefield R.D., and Randal C.W, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Cliffs, New Jersey 2012
4. Metcalf and Eddy Inc, "Wastewater Engineering - Treatment and Reuse", Publishing Co. Ltd., New Delhi, 4th Edition, 2009.

<b>B. E. CIVIL ENGINEERING</b>			
<b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b>			
<b>SEMESTER - V</b>			
<b>HIGHWAY ENGINEERING</b>			
Course Code	<b>18CV56</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p><b>Course Learning Objectives:</b> This course will enable students to;</p> <ol style="list-style-type: none"> <li>1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.</li> <li>2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).</li> <li>3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.</li> <li>4. Understand pavement and its components, pavement construction activities and its requirements.</li> <li>5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.</li> </ol>			
<b>Module -1</b>			
<p><b>Principles of Transportation Engineering:</b> Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.</p> <p><b>Highway Development and Planning:</b> Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4th twenty year road development plans and Policies, Present scenario of road development in India (NHDP &amp; PMGSY) and in Karnataka (KSHIP &amp; KRDC) Road development plan - vision 2021.</p> <p><b>Highway Alignment and Surveys:</b> Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location &amp; detailed survey, Reports and drawings for new and re-aligned projects.</p>			
<b>Module -2</b>			
<p><b>Highway Geometric Design of horizontal alignment elements:</b> Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Radius of curve, Transition curve, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.</p>			
<b>Module -3</b>			
<p><b>Pavement Materials:</b> Sub grade soil - desirable properties-HRB soil classification-determination of CBR and modulus of sub grade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.</p>			
<b>Module -4</b>			
<p><b>Pavement Construction:</b> Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base iii) WMM base,iv) Bituminous Macadam v) Dense Bituminous Macadam vi) Bituminous Concrete,vii) Dry Lean Concrete sub base and PQC viii) concrete roads.</p>			
<b>Module -5</b>			

**Highway Drainage:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

**Highway Economics:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

**Course Outcomes:** After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K. P.Subramaniam, "Transportation Engineering", SciTech Publications, Chennai.

**Reference Books:**

1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoR T&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - V**

**SURVEYING PRACTICE**

Course Code	18CVL57	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

**Course Learning Objectives:** This course will enable students to

1. Apply the basic principles of engineering surveying and measurements
2. Follow effectively field procedures required for a professional surveyor
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.  
b) Setting out perpendiculars. Use of cross staff, optical square.

2. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.

3. Determination of distance between two inaccessible points using compass and

4. Determination of reduced levels of points using dumpy level/auto level (simple

5. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling).

6. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error.

7. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale.

8. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.

9. Determination of horizontal distance and vertical height to a base in accessible object using theodolite by single plane and double plane method.

10. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.

11. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule and Bowditch rule.

12. To locate the points using Radiation and Intersection method of Plane table surveying.

13. To solve three point problem in plane table using Bessel's graphical solution.

14. Demonstration of Minor instruments like Clinometer, Ceylon Ghat tracer, Box sextant, Hand level, Planimeter, nautical extant and Penta graph.

**Course Outcomes:** After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying and for linear and angular measurements.
2. Comprehend effectively field procedures required for a professional surveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

**Question paper pattern:**

- All are individual experiments.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

**Textbooks:**

1. B.C.Punmia, "Surveying Vol.1", Laxmi Publications pvt.Ltd., New Delhi- 2009.
2. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune Vidyarthi Griha Prakashan, 1988.

**Reference Books:**

1. S. K. Duggal, "Surveying Vol.1", Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. 2009.
2. K.R.Arora, "Surveying Vol.1" Standard Book House, New Delhi.-2010.

**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - V**

**CONCRETE AND HIGHWAY MATERIALS LABORATORY**

Course Code	<b>18CVL58</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

**Course Learning Objectives:** This course will enable students

1. To learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
2. To learn the procedure of testing bituminous materials as per standard code recommendations.
3. To relate material characteristics to various application of construction.

**Modules**

**Part A: Concrete Lab**

1. Tests on Cement:

- a. Normal Consistency
- b. Setting time
- c. Compressive strength
- d. fineness by air permeability test
- e. specific gravity

2. Tests on Concrete:

- a. Design of concrete mix as per IS-10262
- b. Tests on fresh concrete:
  - i. slump,
  - ii. compaction factor and
  - iii. Vee Bee test
- c. Tests on hardened concrete:
  - i. compressive strength test,
  - ii. split tensile strength test,
  - iii. flexural strength test
- d. NDT tests by rebound hammer and pulse velocity test.

3. Tests on Self Compacting Concrete:

- a. Design of self compacting concrete, As per IS 10262:2019
- b. slump flow test,
- c. V-funnel test,
- d. J-Ring test,
- e. U Box test and
- f. L Box test

**Part B: Highway materials Lab**

1. Tests on Aggregates

- a. Aggregate Crushing value
- b. Los Angeles abrasion test
- c. Aggregate impact test
- d. Aggregate shape tests (combined index and angularity number)

2. Tests on Bituminous Materials

- a. Penetration test
- b. Ductility test
- c. Softening point test
- d. Specific gravity test
- e. Viscosity test by tarviscometer
- f. Bituminous Mix Design by Marshall Method (Demonstration only)

3. Tests on Soil

- a. Wet sieve analysis
- b. CBR test

**Course Outcomes:** During this course, students will develop expertise in

1. Able to interpret the experimental results of concrete and highway materials based on laboratory tests.
2. Determine the quality and suitability of cement.
3. Design appropriate concrete mix Using Professional codes.
4. Determine strength and quality of concrete.
5. Evaluate the strength of structural elements using NDT techniques.
6. Test the soil for its suitability as sub grade soil for pavements.

**Question paper pattern:**

- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

**Reference Books:**

1. M. L. Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand &Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual", Nem Chand Bros, Roorkee.
7. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.



**B.E IN CIVIL ENGINEERING(CV-2018-19)**  
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**  
**SEMESTER – V**

**ENVIRONMENTAL STUDIES**

Course Code	<b>18CIV59</b>	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

**Module - 1**

**Ecosystems** (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.

**Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

**Module - 2**

**Advances in Energy Systems** (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.

**Natural Resource Management** (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

**Module - 3**

**Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

**Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

**Module - 4**

**Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

**Module - 5**

**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.

**Field work:** Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

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

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

**Question paper pattern:**

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
<b>Textbook/s</b>				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2 <sup>nd</sup> Edition, 2012

2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3 <sup>rd</sup> Edition' 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
<b>Reference Books</b>				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2 <sup>nd</sup> Edition, 2005
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11 <sup>th</sup> Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, AnoopSingh& PiyushMalaviya	Acme Learning Pvt. Ltd. New Delhi.	1 <sup>st</sup> Edition