

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
QUANTITY SURVEYING AND CONTRACT MANAGEMENT			
Course Code	18CV71	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p>Course Learning Objectives: This course will enable students to;</p> <ol style="list-style-type: none"> 1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project 2. Understand and apply the concept of Valuation for Properties 3. Understand, Apply and Create the Tender and Contract document. 			
Module -1			
<p>Quantity Estimation for Building: study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by Short wall and long wall method - centre line method. Estimate of R.C.C structures including Slab, beam, column, footings.</p>			
Module -2			
<p>Estimate of Steel truss, manhole and septic tanks and slab culvert. Quantity Estimation for Roads: Computation of volume of earthwork fully in banking, cutting, partly cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods.</p>			
Module -3			
<p>Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings and roads. Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.</p>			
Module-4			
<p>Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture. Contract Forms: FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC.</p>			
Module -5			
<p>Contract Management-Post award :Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism, Contract management and administration. Valuation: Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.</p>			
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works. 2. Prepare detailed and abstract estimates for various road works, structural works and water supply and sanitary works. 3. Prepare the specifications and analyze the rates for various items of work. 4. Assess contract and tender documents for various construction works. 5. Prepare valuation reports of buildings. 			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • 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. Datta B.N., “Estimating and costing”, UBSPD Publishing House, New Delhi.
2. B.S. Patil, “Civil Engineering Contracts and Estimates”, Universities Press.
3. M. Chakraborti; “Estimation, Costing and Specifications”, Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi.

Reference Books:

1. Kohli D.D and Kohli R.C, “Estimating and Costing”, 12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, “Estimating and costing”, Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , “ Estimating Construction Costs” – 5ed , Tata McGraw-Hill , New Delhi.
7. David Pratt, “Fundamentals of Construction Estimating” – 3ed, Edition.
8. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms.
9. B.S. Ramaswamy “Contracts and their Management” 3ed, Lexis Nexis(a division of Reed Elsevier India Pvt Ltd).

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
DESIGN OF RCC AND STEEL STRUCTURES			
Course Code	18CV72	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			
<ol style="list-style-type: none"> 1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures 2. Identify, formulate and solve engineering problems in RC and Steel Structures 3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder. 4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures. 5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations. 			
Module -1			
<p>Footings: Design of rectangular slab, slab-beam type combined footing. Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall. Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. As per IS: 3370 (Part IV). Design of portal frames with fixed and hinged based supports.</p>			
Module -2			
<p>Roof Truss: Design of roof truss for different cases of loading, forces in members to given. Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks Gantry Girder: Design of gantry girder with all necessary checks.</p>			
Course Outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Students will acquire the basic knowledge in design of RCC and Steel Structures. 2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members. 			
Question Paper Pattern:			
<ul style="list-style-type: none"> • Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary. • One full question should be answered from each module. • Each question carries 50 marks. • Code books – IS 456, IS 800, IS 3370 (Part IV), SP-16, SP (6) – Steel Tables, shall be referred for designing. The same will be provided during examination. 			
Textbooks:			
<ol style="list-style-type: none"> 1. N Krishna Raju, “Structural Design and Drawing of Reinforced Concrete and Steel”, University Press 2. Subramanian N, “Design of Steel Structures”, Oxford university Press, New Delhi 3. K S Duggal, “Design of Steel Structures”, Tata McGraw Hill, New Delhi 			
Reference Books:			
<ol style="list-style-type: none"> 1. Charles E Salman, Johnson & Mathas, “Steel Structure Design and Behavior”, Pearson Publications 2. Nether Cot, et.al, “Behavior and Design of Steel Structures to EC -III”, CRC Press 3. P C Verghese, “Limit State Design of Reinforced Concrete”, PHI Publications, New Delhi 4. S N Sinha, “Reinforced Concrete Design”, McGraw Hill Publication 			

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

THEORY OF ELASTICITY

Course Code	18CV731	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. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials in to more general, two and three-dimensional problems.
2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
3. Introduction to the stress–strain relationship, basic principles and mathematical expressions involved in continuum mechanics. Also solution of problems in 2-dimensional linear elasticity.

Module-1

Rigid and deformable bodies, body and surface forces, concept of stress, state of stress at a point, Cartesian stress components, Cauchy's stress formula, stress transformation, principal stresses and principal planes, stress invariants, equations of equilibrium in 2D and 3D (Cartesian coordinates).

Module-2

Types of strain, strain displacement relations, state of strain at a point, strain tensor, strain transformation, strain along a linear element, principal strains, strain invariants, octahedral strains, spherical and deviatoric strains.

Module-3

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only). Equations of equilibrium in polar coordinate, compatibility equation, stress function.

Module-4

Axisymmetric stress distribution - Rotating discs, Lamé's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

Module-5

Torsion: Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections.

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

1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum.
2. Ability to formulate boundary value problems; and calculate stresses and strains.
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints.
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

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 P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 2012.
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford & IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003.

Reference Books:

1. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York, 1953.
2. G. W. Housner and T. Vreeland, Jr., "The Analysis of Stress and Deformation", California Institute of Tech., CA, 2012. [Download as per user policy from <http://resolver.caltech.edu/CaltechBOOK:1965.001>].
3. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", Prentice Hall, 2003.
4. Abdel-Rahman Ragab and Salah Eldinin Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press, 1998.

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
AIR POLLUTION AND CONTROL			
Course Code	18CV732	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			
<ol style="list-style-type: none"> 1. Study the sources and effects of air pollution 2. Learn the meteorological factors influencing air pollution. 3. Analyze air pollutant dispersion models 4. Illustrate particular and gaseous pollution control methods. 			
Module-1			
Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.			
Module-2			
Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.			
Module-3			
Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM _{2.5} , PM ₁₀ , SO _x , NO _x , CO, NH ₃). Development of air quality models-Gaussian dispersion model-Including Numerical problems.			
Module-4			
Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP - Including Numerical problems. Site selection for industrial plant location.			
Module-5			
Air pollution due to automobiles, standards and control methods. Noise pollution- causes, effects and control, noise standards. Environmental issues, global episodes. Environmental laws and acts.			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Identify the major sources of air pollution and understand their effects on health and environment. 2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models. 3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants. 4. Choose and design control techniques for particulate and gaseous emissions. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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:			
<ol style="list-style-type: none"> 1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication. 2. H. C. Perkins, "Air pollution". Tata McGraw Hill Publication. 3. Mackenzie Davis and David Cornwell, "Introduction t o Environmental Engineering" McGraw-Hill Co. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Noel De Nevers, "Air Pollution Control Engineering", Waveland Pr Inc. 2. Anjaneyulu Y, "Text book of Air Pollution and Control Technologies", Allied Publishers. 			

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

PAVEMENT MATERIALS AND CONSTRUCTION

Course Code	18CV733	CIE Marks	40
Teaching Hours/Week	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

1. Expose students to different materials which are used in pavement construction, impart knowledge about the engineering properties required.
2. To train students to perform various types of bituminous mix designs as per the guidelines (MORTH).
3. Student will get knowledge about different highway construction equipment with their suitability and adaptability in various field scenarios.
4. Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavement as per the required specifications (MORTH).
5. To introduce students to possible improvisation in various layers of pavement to increase the structural strength by the use of non basic materials (DLC, polythene sheets).

Module-1

Pavement Materials

Aggregates- Origin, Classification, Requirements, properties and tests on Road aggregates, Concepts of size and gradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.
Bitumen and Tar- Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements.

Module-2

Bituminous emulsion and Cutbacks- Preparation, Characteristics, uses and test. Adhesion of bitumen binders to road aggregates, Adhesion failure, Mechanism of stripping, tests and methods of improving adhesion.

Module-3

Bituminous mixes: Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveemstabilo meter and Hubbar- field tests) bituminous mixes, Design methods using Rothfutch's method only and specification, Marshall mix design criteria, voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Problems on above.

Module-4

Equipments in highway construction: Various types of equipments for excavation, grading and compaction- their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

Sub grade: Earthwork grading and Construction of embankments and cuts for roads, Preparation of subgrade, quality control tests.

Module-5

Flexible Pavements: Specifications of materials, Construction method and field control checks for various types of flexible pavement layers.

Cement Concrete Pavements: Specifications and method of cement concrete pavement construction (PQC, importance of providing DLC as sub base and polythene thin layer between PQC and sub base). Quality control tests, Construction of various types of joints.

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

1. Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
2. Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
3. Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction.
4. Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

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. Highway Engineering- Khanna, S.K., and Justo, C.E.G.: Nem Chand and Bros. Roorkee.
2. Construction Equipment and its Management- Sharma, S.C.:Khanna Publishers.
3. Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

Reference Books

1. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. Relevant IRC codes and MoRT& H specifications.

Web links and Video Lectures:

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. VTU EDUSAT PROGRAMME - 20

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
GROUND WATER HYDRAULICS			
Course Code	18CV734	IA Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	Exam Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives: This course will enable students			
<ol style="list-style-type: none"> 1. To characterize the properties of ground water and aquifers. 2. To quantify the ground water flow. 3. To locate occurrence of ground water and augment ground water resources. 4. To synthesize ground water development methods. 			
Module -1			
Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.			
Module -2			
Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, anisotropic layered soils.			
Module -3			
Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; theis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory.			
Module -4			
Ground Water Exploration: Seismic method, electrical resistivity method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.			
Module -5			
Ground Water Development: Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.			
Ground Water Recharge: Artificial recharge, Rainwater harvesting for ground water recharge.			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Find the characteristics of aquifers. 2. Estimate the quantity of ground water by various methods. 3. Locate the zones of ground water resources. 4. Select particular type of well and augment the ground water storage. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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:			
<ol style="list-style-type: none"> 1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi. 2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi. 3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi. 			
Reference Books:			
<ol style="list-style-type: none"> 1. GargSatyaPrakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi. 2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi. 3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi. 			

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
MASONRY STRUCTURES			
Course Code	18CV735	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			
<ol style="list-style-type: none"> 1. Understand properties of masonry units, strength and factors affecting strength. 2. Understand design criteria of various types of wall subjected to different load system. 3. Impart the culture of following the codes for strength, serviceability and durability as an ethics. 4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations. 			
Module-1			
<p>Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units-strength, modulus of elasticity and water absorption of masonry materials-classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.</p> <p>Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.</p>			
Module-2			
<p>Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.</p> <p>Design Considerations: Effective height of wall and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.</p>			
Module-3			
Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.			
Module-4			
<p>Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.</p> <p>Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads –Problems on centrally loaded solid walls, cavity walls, walls with piers.</p>			
Module-5			
<p>Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.</p> <p>Introduction to reinforced brick masonry, lintels and slabs.</p> <p>In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.</p>			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Select suitable material for masonry construction by understanding engineering properties. 2. Compute loads, load combinations and analyze the stresses in masonry. 3. Design masonry under compression (Axial load) for various requirements and conditions. 4. Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions. 5. Assess the behavior of shear wall and reinforced masonry. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. Dayaratnam P, "Brick and Reinforced Brick Structures", Scientific International Pvt. Ltd.
2. M. L. Gambhir, "Building and Construction Materials", McGraw Hill education Pvt. Ltd.

Reference Books:

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd.,1990.
2. IS 1905-1987 "Code of practice for structural use of un-reinforced masonry- (3rd revision) BIS, New Delhi.
3. SP20(S&T)-1991, "Hand book on masonry design and construction(1st revision) BIS, New Delhi.

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

EARTHQUAKE ENGINEERING

Course Code	18CV741	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 learn about

1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Module -1

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake).

Module -2

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

Module -3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

Module -4

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

Module -5

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings

Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

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

1. Acquire basic knowledge of engineering seismology.
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry

structures thorough exposure to different IS-codes of practices.

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. Pankaj Agarwal and Manish Shrikande, “Earthquake resistant design of structures”, PHI India.
2. S.K. Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press
3. Anil K. Chopra, “Dynamics of Structures: Theory and Applications to Earthquake Engineering”, Pearson Education, Inc.
4. T. K. Datta, “Seismic Analysis of Structures”, John Wiley & Sons (Asia) Ltd.

Reference Books:

1. David Dowrick, “Earthquake resistant design and risk reduction”, John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, “Some Concepts in Earthquake Behaviour of Buildings”, Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

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

DESIGN CONCEPT OF BUILDING SERVICES

Course Code	18CV742	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. Learn the importance of sanitation, domestic water supply, and plumbing and fire services.
2. Understand the concepts of heat, ventilation and air conditioning.
3. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply and its Services.

Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit.

Module -2

Heat Ventilation and Air Conditioning (HVAC):

Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

Module -3

Electrical and Fire Fighting Services:

Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice, planning electrical wiring for building, Main and distribution boards, Principles of illumination.

Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Provisions of NBC.

Module -4

Plumbing and Fire Fighting Layout of Simple Buildings:

Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

Module -5

Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.

Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,

Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

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

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings.

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.

Reference Books:

1. National Building Code.
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & D L Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
4. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
5. M. David Egan, Concepts in Building Fire Safety.
6. O. H. Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom.
7. V. K. Jain, Fire Safety in Building 2edition, New Age International Publishers.
8. E. G. Butcher, Smoke control in Fire-safety Design.
9. E. R. Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York.
10. Handbook for Building Engineers in Metric systems, NBC, New Delhi.

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

REINFORCED EARTH STRUCTURES

Course Code	18CV743	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. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module -1

Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven & non-woven, Raw materials – Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics.

Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties.

Module -2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

Module -3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

Module -4

Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes.

Module -5

Geosynthetics - filter, drain and landfills: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anti clogging, survivability and durability (No Numerical Problems)

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems).

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

1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;
2. understand the laboratory testing concepts of Geo synthetics
3. design RE retaining structures and Soil Nailing concepts
4. Determine the load carrying capacity of Foundations resting on RE soil bed.
5. asses the use of Geo synthetics in drainage requirements and landfill designs

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. Koerner. R.M, “Design with Geo synthetics”, Prince Hall Publications
2. Koerner. R.M. &Wesh, J.P, “Construction and Geotechnical Engineering using synthetic fabrics”, Wiley Inter Science, New York,.
3. Sivakumar Babu G. L., “An introduction to Soil Reinforcement and Geo synthetics”, Universities Press, Hyderabad
4. Swami Saran, “Reinforced Soil and its Engineering Applications”, I. K. International Pvt. Ltd, New Delhi
5. Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, “Engineering with Geo synthetics”, Tata McGraw Hill publishing Company Limited., New Delhi.

Reference Books:

1. Jones, “Earth reinforcement and Soil structure”, CJEP Butterworths, London
2. Ingold, T.S. & Millar, K.S, “Geotextile Hand Book”, Thomas, Telford, London.
3. Hidetoshi Octial, Shigenori Hayshi& Jen Otani, “Earth Reinforcement Practices”,Vol. I, A.A. Balkema, Rotterdam
4. Bell F.G, “Ground Engineer’s reference Book”, Butter worths, London
5. Ingold, T.S, “Reinforced Earth”, Thomas, Telford, London.
6. Sarsby R W- Editor, “Geo synthetics in Civil Engineering”, Wood head Publishing Ltd & CRC Press, 2007

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
DESIGN OF HYDRAULIC STRUCTURES			
Course Code	18CV744	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
CREDITS –03			
Course Learning Objectives: This course will enable students to;			
<ol style="list-style-type: none"> 1. Analyze and design gravity dams. 2. Find the cross-section of earth dam and estimate the seepage loss. 3. Design spillways and aprons for diversion works. 4. Design CD works and chose appropriate canal regulation works. 			
Module -1			
Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.			
Module -2			
Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande’s method. Estimation of seepage.			
Module -3			
Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices. Diversion Headworks: Design of aprons- Bligh’s and Koshla’s theory, Simple Problems.			
Module -4			
Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.			
Module -5			
Canal Regulation Works: Introduction, Function of a regulator.			
Canal falls: Necessity and types.			
Canal outlets: Necessity and types.			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Check the stability of gravity dams and design the dam. 2. Estimate the quantity of seepage through earth dams. 3. Design spillways and aprons for various diversion works. 4. Select particular type of canal regulation work for canal network. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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:			
<ol style="list-style-type: none"> 1. S. K. Garg, “Irrigation Engineering and Hydraulic Structures”, Khanna Publishers, New Delhi. 2. Punmia and Pandey Lal, “Irrigation and Water Power Engineering” Lakshmi Publications, New Delhi. 3. K. R. Arora. “Irrigation, Water Power and Water Resources Engineering” Standard Publications, New Delhi. 			
Reference Books:			
<ol style="list-style-type: none"> 1. R. K. Sharma, “Text Book of Irrigation Engineering and Hydraulic Structures”, Oxford and IBH, New Delhi. 2. P. N. Modi, “Irrigation, Water Resources and Water Power”, Standard Book House, New Delhi. 			

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
URBAN TRANSPORT PLANNING			
Course Code	18CV745	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;			
<ol style="list-style-type: none"> 5. Understand and apply basic concepts and methods of urban transportation planning. 6. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning. 7. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem. 8. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns. 			
Module -1			
Urban transport planning: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.			
Module -2			
Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.			
Module -3			
Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. Problems on above.			
Module -4			
Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. Problems on above.			
Module -5			
Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 5. Design, conduct and administer surveys to provide the data required for transportation planning. 6. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning. 7. Develop and calibrate modal split, trip generation rates for specific types of land use developments. 8. Adopt the steps that are necessary to complete a long-term transportation plan. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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:			

4. Kadiyali. L. R., 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi.
5. Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
6. Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
7. Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

Reference Books:

3. Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
4. Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
5. Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
FINITE ELEMENT METHOD			
Course Code	18CV751	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;			
<ol style="list-style-type: none"> 1. Develop analytical skills. 2. Learn principles of analysis of stress and strain. 3. Develop problem solving skills. 4. Understand the principles of FEM for one and two dimensional problems. 			
Module -1			
Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.			
Module -2			
Discretisation; finite representation of infinite bodies and discretisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.			
Module -3			
2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisymmetric Element.			
Module -4			
Isoparametric concepts; isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.			
Module -5			
Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques. Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.			
Course outcomes: The student will have the knowledge on advanced methods of analysis of structures.			
Question paper pattern:			
<ul style="list-style-type: none"> • 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:			
<ol style="list-style-type: none"> 1. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill 2. Desai C & Abel J F., "Introduction to Finite element Method" , East West Press Pvt. Ltd., 3. Cook R D et.al. "Concepts and applications of Finite Element analysis", John Wiley. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Daryl L Logan, "A first course on Finite element Method", Cengage Learning. 2. Bathe K J - "Finite Element Procedures in Engineering analysis"- Prentice Hall. 			

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
NUMERICAL METHODS AND APPLICATIONS			
Course Code	18CV752	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 aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology			
Module -1			
Solution of Equations and Eigen value Problems: Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method.			
Module -2			
Interpolation and Approximation: Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.			
Module -3			
Numerical Differentiation and Integration: Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.			
Module -4			
Initial Value Problems for Ordinary Differential Equations : Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.			
Module -5			
Boundary Value Problems in Ordinary and Partial Differential Equations: Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.			
Course Outcomes: After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from Industry, management and other engineering fields.			
Question paper pattern:			
<ul style="list-style-type: none"> • 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:			
<ol style="list-style-type: none"> 1. Grewal. B.S. and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi 2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Chapra. S.C. and Canale. R. P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi. 3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi. 			

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
ENVIRONMENTAL PROTECTION AND MANAGEMENT			
Course Code	18CV753	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 gain knowledge in Environmental protection and Management systems			
Module -1			
Environmental Management Standards: Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.			
Module -2			
Environmental Management Objectives: Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.			
Module -3			
Environmental Management System: EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.			
Module -4			
Environmental Audit: Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.			
Module -5			
Applications: Applications of EMS, Waste Audits and Pollution Prevention Control: Textile, Sugar, Pulp & Paper, Electroplating, , Tanning industry. Hazardous Wastes - Classification, characteristics Treatment and Disposal Methods, Transboundary movement, disposal.			
Course outcomes: After studying this course, students will be able to: 1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards. 2. Lead pollution prevention assessment team and implement waste minimization options. 3. Develop, Implement, maintain and Audit Environmental Management systems for Organizations.			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Reference Books:			
1. Christopher Sheldon and Mark Yoxon, “Installing Environmental management Systems – a step by step guide” Earthscan Publications Ltd, London, 1999. 2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International			

Organisation for Standardisation, 2004

3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice, McGraw- Hill International, Boston, 2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
COMPUTER AIDED DETAILING OF STRUCTURES			
Course Code	18CVL76	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			
<ol style="list-style-type: none"> 1. Be aware of the Scale Factors, Sections of drawings, 2. Draft the detailing of RC and Steel Structural member. 			
Module -1 Detailing of RCC Structures			
<ul style="list-style-type: none"> • Beams – Simply supported, Cantilever and Continuous. • Slab – One way, Two way and One-way continuous. • Staircase – Doglegged • Cantilever Retaining wall • Counter Fort Retaining wall • Circular Water Tank, Rectangular Water Tank. 			
Module -2 Detailing of Steel Structures			
<ol style="list-style-type: none"> 1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections. 2. Built-up Columns with lacings and battens 3. Column bases and Gusseted bases with bolted and welded connections. 4. Roof Truss – Welded and Bolted 5. Welded Plate girder 6. Gantry Girder 			
Course outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Prepare detailed working drawings 			
Question paper pattern:			
<ol style="list-style-type: none"> 1. Two questions shall be asked from each Module. 2. One full question should be answered from each Module. 3. Each question carries 50 marks. 			
Textbooks:			
<ol style="list-style-type: none"> 1. N Krishna Raju, “Structural Design and Drawing of Reinforced Concrete and Steel”, University Press 2. Krishna Murthy, “Structural Design and Drawing – Concrete Structures”, CBS Publishers, New Delhi 			
Reference Books:			
<ol style="list-style-type: none"> 1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards. 2. IS 13920, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard. 			

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
GEOTECHNICAL ENGINEERING LABORATORY			
Course Code	18CVL77	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;			
<ol style="list-style-type: none"> 1. To carry out laboratory tests and to identify soil as per IS codal procedures 2. To perform laboratory tests to determine index properties of soil 3. To perform tests to determine shear strength and consolidation characteristics of soils 			
Modules			
1. Field identification of soil, Specific gravity test (pycnometer and density bottle method).Water content determination by oven drying and Pycnometer method, rapid moisture meter method.			
2. Grain size analysis <ol style="list-style-type: none"> i. Sieve analysis ii. Hydro meter analysis 			
3. In-situ density tests <ol style="list-style-type: none"> i. Core-cutter method ii. Sand replacement method 			
4. Consistency limits <ol style="list-style-type: none"> i. Liquid limit test(by Casagrande's and cone penetration method) ii. Plastic limit test iii. Shrinkage limit test 			
5. Standard compaction test (light and heavy compaction)			
6. Co-efficient of permeability test <ol style="list-style-type: none"> i. Constant head test ii. Variable head test 			
7. Shear strength tests <ol style="list-style-type: none"> i. Unconfined compression test ii. Direct shear test iii. Triaxial test (unconsolidated undrained test only) 			
8. Consolidation test :To determine pre consolidation pressure only(half an hour per loading-test).			
9. Laboratory vane shear test			
10. Demonstration of Swell pressure test, Standard penetration test and boring equipment			
Course outcomes: Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine			
<ol style="list-style-type: none"> 1. Physical and index properties of the soil 2. Classify based on index properties and field identification 3. To determine OMC and MDD, plan and assess field compaction program 4. Shear strength and consolidation parametersto assess strength and deformation characteristics 5. In-situshear strength characteristics(SPT-Demonstration) 			
Question paper pattern:			
<ul style="list-style-type: none"> • All experiments are to be included in the examination except demonstration exercises. • Candidate to perform experiment assigned to him. • Marks are to be allotted as per the split up of marks shown on the cover page of answer script. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Punmia B C, Soil Mechanics and Foundation Engineering-(2017),16th Edition, Laxmi Publications co., New Delhi. 2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi. 3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press 4. Bowles J.E., "Engineering Properties of Soil and Their Measurements", -McGraw Hill Book Co. New York. 5. Relevant BIS Codes of Practice: IS-2720 series 			