Course Title: ENVIRONMENTAL ENGINEERING LABORATORY
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VII

Subject Code	**18CVL67**	**IA Marks**	**40**
Number of Lecture Hours/Week	**1I+2P**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students,

4. To learn different methods of water & waste water quality
5. To conduct experiments to determine the concentrations of water and waste water
6. To determine the degree and type of treatment
7. To understand the environmental significance and application in environmental engineering practice

Revised Bloom's Taxonomy (RBT) Level **L1,L2,L3**

1. Determination of pH, Acidity and Alkalinity
2. Determination of Calcium, Magnesium and Total Hardness.
3. Determination of Dissolved Oxygen.
4. Determination of BOD.
5. Determination of Chlorides
6. Determination of percentage of available chlorine in bleaching powder,
7. Determination of Residual Chlorine
8. Determination of Solids in Sewage:
   - I) Total Solids,
   - II) Suspended Solids,
   - III) Dissolved Solids,
   - IV) Volatile Solids, Fixed Solids,
   - V) Settle able Solids.
9. Determination of Turbidity by Nephelometer
10. Determination of Optimum Dosage of Alum using Jar test apparatus.
11. Determination of sodium and potassium using flame photometer.
12. Determination Nitrates by spectrophotometer.
13. Determination of Iron & Manganese.
14. Determination of COD. (Demonstration)
15. Air Quality Monitoring (Ambient, stack monitoring , Indoor air pollution) (Demonstration)
16. Determination of Sound by Sound level meter at different location(Demonstration)

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

1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.
3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental

stream.

Program Objectives:

1. Evaluation of the test results and assesses the impact on water and waste water treatment.
2. Train student to undertake student project work in 8th semester in the field of environmental engineering.

Question paper pattern:

1. Two experiments shall be asked from the above set

2. One experiment to be conducted and for the other student should write detailed procedure.

Reference Books:

1. Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal
2. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science" , McGraw-Hill Series in Civil and Environmental Engineering

Course Title: EXTENSIVE SURVEY PROJECT /CAMP
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**18CVEP68**	**IA Marks**	**40**
Number of Practice Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Practice Hours	**50**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

3. NEW TANK PROJECTS: The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
d. Design and preparation of drawing with report.

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

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
c. Preparation of village map by using total station.
d. Survey work required for laying of water supply and UGD
e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
f. Design of all elements and preparation of drawing with report.

5. HIGHWAY PROJECT: The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

6. RESTORATION OF AN EXISTING TANK: The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
d. Design of all elements and preparation of drawing with report.

7. TOWN/HOUSING / LAYOUT PLANNING: The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Detailed survey required for project execution like contour surveys
c. Preparation of layout plans as per regulations
e. Centerline marking-transfer of centre lines from plan to ground
f. Design of all elements and preparation of drawing with report as per regulations

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

1. Apply Surveying knowledge and tools effectively for the projects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
3. Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
4. Professional etiquettes at workplace, meeting and general
5. Establishing trust based relationships in teams & organizational environment
6. Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Reference Books:

Training manuals and User manuals
Relevant course reference books

Course Title: QUANTITY SURVEYING AND CONTRACTS MANAGEMENT
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VIII

Subject Code	**18CV71**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks- 100**	

Course objectives: This course will enable students to;

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

Quantity Estimation for Building; study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method.

Estimate of R.C.C structures including Slab, beam, column, footings, with bar bending schedule.

L2,L3

Module -2

Estimate of Steel truss, manhole and septic tanks.

Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads.

L1,L2,L3

Module -3

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings,

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.

L1,L2,L3

Module-4

Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, 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, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub

Contracting.
Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC

L1,L2,L3

Module -5

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, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation, valuation for mortgage, valuation of land.

L1,L2,L3

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

1. Prepare detailed and abstract estimates for roads and building.
2. Prepare valuation reports of buildings.
3. Interpret Contract document's of domestic and international construction works

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

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. Chakraborthi; "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 ,
8. PWD Data Book ,CPWD Schedule of Rates (SoR). and NH SoR – Karnataka
9. FIDIC Contract forms
10. B.S. Ramaswamy " Contracts and their Management" 3ed , Lexis Nexis (a division of Reed Elsevier India Pvt Ltd)

Course Title: DESIGN OF RCC AND STEEL STRUCTURAL ELEMENTS
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	**18CV72**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

6. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
7. Identify, formulate and solve engineering problems in RC and Steel Structures
8. 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.
9. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
10. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

Footings: Design of rectangular slab 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.

L1,L2,L3

Module -2

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

L1,L2,L3

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

6. Students will acquire the basic knowledge in design of RCC and Steel Structures.
7. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- 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 40 marks.

3. Code books – IS 456, IS 800, IS 3370 (Part IV), SP (6) – Steel Tables, shall be referred for designing
4. The above charts shall be provided during examinations

Text Books:

4. N Krishna Raju, **"Structural Design and Drawing of Reinforced Concrete and Steel"**, University Press
5. Subramanian N, **"Design of Steel Structures"**, Oxford university Press, New Delhi
6. K S Duggal, **"Design of Steel Structures"**, Tata McGraw Hill, New Delhi

Reference Books:

1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behaviour"**, Pearson Publications

2. Nether Cot, et.al, **"Behaviour 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

TITLE OF THE COURSE: THEORY OF ELASTICITY

B.E., VII Semester, Civil Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CV731**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

3. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials into more general, two and three-dimensional problems.
4. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
5. 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

Concepts of continuum, Stress at a point, Components of stress, Differential equations of equilibrium, Stress transformation, Principal stresses, Maximum shear stress, Stress invariants.

Strain at a point, Infinitesimal strain, Strain-displacement relations, Components of strain, Compatibility Equations, Strain transformation, Principal strains, Strain invariants, Measurement of surface strains, strain rosettes

L1,L2,L3

Module-2

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).

L1,L2,L3

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, compatibility equation, stress function.

L3,L4

Module-4

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

L3,L4

Module-5

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

L3,L4

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.

Text Books:

1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publish ers, 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:

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

TITLE OF THE COURSE: AIR POLLUTION AND CONTROL
B.E., VII Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CV731**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

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.

L1,L2

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. Development of air quality models-Gaussian dispersion model

L1,L2,L3

Module-3

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)

L2,L3,L4

Module-4

Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP.

L3,L4

Module-5

Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards. Environmental issues, global episodes, laws, acts, protocols

L3,L4,L5,L6

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

1. Identify the major sources of air pollution and understand their effects on health and environment.
2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air

quality models.

3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
4. Choose and design control techniques for particulate and gaseous emissions.

Text Books:

1. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell, “Introduction t o Environmental Engineering” McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, “Air Pollution Control Engineering” , Waveland Pr Inc.
2. Anjaneyulu Y, “Text book of Air Pollution and Contr ol Technologies”, Allied Publishers

Course Title: GROUND WATER & HYDRAULICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**18CV734**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS – 03		**Total Marks-100**	

Course objectives: This course will enable students

- To characterize the properties of ground water and aquifers.
- To quantify the ground water flow.
- To locate occurrence of ground water and augment ground water resources.
- 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.

L1, L2

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, unisotropic layered soils, steady one dimensional flow: cases with recharge.

L2, L3

Module -3

Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory.

L2, L3, L4

Module -4

Ground Water Exploration: Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.

L2, L3

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, groundwater runoff

L2, L3

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

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.

Program Objectives:

3. Engineering knowledge
4. Problem analysis
5. Interpretation of data

Text Books:

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:

1. Garg Satya Prakash, “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.

TITLE OF THE COURSE: MASONRY STRUCTURES

B.E., VII Semester, Civil Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CV735**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: This course will enable students to

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

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 o f mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

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.

L1,L2,L3

Module-2

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.

Design Considerations: Effective height of walls 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.

L1,L2,L3

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.

L1,L2,L3

Module-4

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.

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

L2,L3,L4,L5

Module-5

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.

Introduction to reinforced brick masonry, lintels and slabs.

In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

L2,L3,L4,L5

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

1. Explain engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.
2. Summarize various formulae's for finding compressive strength of masonry units.
3. Explain permissible stresses and design criteria as per IS: 1905 and SP-20.
4. Design different types of masonry walls for different load considerations.

Text Books:

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd., 1990.
2. Dayaratnam P, "Brick and Reinforced Brick Structures", Oxford & IBH, 1987.
3. M. L. Gambhir, "Building and Construction Materials", Mc Graw Hill education Pvt. Ltd.

Reference Books:

1. IS 1905–1987 "Code of practice for structural use o f un-reinforced masonry- (3rd revision) BIS, New Delhi.
2. SP 20 (S&T) – 1991, "Hand book on masonry design and construction (1st revision) BIS, New Delhi.

Course Title: EARTHQUAKE ENGINEERING

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	**18CV741**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**

Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS –03	Total Marks-	100

Course 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)

L1,L2,L3

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.

L1,L2,L3

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.

L1,L2,L3

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).

L2,L3,L4

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.

L2,L3,L4

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

5. Acquire basic knowledge of engineering seismology

6. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.

7. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios

8. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.

9. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry structures thorough exposure to different IS-codes of practices.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

- Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
- S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
- Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
- 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.

Course Title: DESIGN CONCEPT OF BUILDING SERVICES
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	**18CV742**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks- 100**	

Course Objectives: This course will enable students to

4. learn the importance of sanitation, domestic water supply, plumbing and fire services
5. Understand the concepts of heat, ventilation and air conditioning
6. Develop technical and practical knowledge in Building Services.

Module -1

Water Supply, Drainage and Solid Waste Disposal:

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

Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers

Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods

L1,L2

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.

L1,L2

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.

L1,L2,L3

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.

L2,L3

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.

L1,L2,L3

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

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

Program Objectives:

4. Engineering knowledge
5. Problem analysis
6. Interpretation of data

Reference Books:

1. National Building Code
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & DL 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

Course Title: REINFORCED EARTH STRUCTURES
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	**18CV743**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course 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

L1,L2,L3

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

L1,L2,L3,L4

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.

L2,L3,L4

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

L2,L3,L4

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, anticlogging, 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)

L2,L3,L4

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 Geosynthetics
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 Geosynthetics in drainage requirements and landfill designs

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Koerner. R.M, "Design with Geosynthetics", Prince Hall Publications
2. Koerner. R.M. & Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York,.
3. SivakumarBabu G. L., "An introduction to Soil Reinforcement and Geosynthetics", 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 Geosynthetics", 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", Butterworths, London

5. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.

6. Sarsby R W- Editor, "Geosynthetics in Civil Engineering", Woodhead Publishing Ltd & CRC Press, 2007

Course Title: URBAN TRANSPORT PLANNING
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	**18CV745**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course Objectives: This course will enable students to;

3. Understand and apply basic concepts and methods of urban transportation planning.
4. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
5. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
6. 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.

L1,L2,L3

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.

L1,L2,L3

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**

L3,L4

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**

L2,L3,L4,L5

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. Introduction to land use planning models, land use and transportation interaction.

L2,L3,L4,L5

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

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.

Program Objectives:

5. Engineering knowledge
6. Problem analysis
7. Interpretation of data

Text Books:

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

Reference Books:

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

Course Title: FINITE ELEMENT METHOD
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	**18CV751**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to;

6. Develop analytical skills.
7. Learn principles of analysis of stress and strain.
8. Develop problem solving skills.
9. 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

L1,L2

Module -2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates , Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples

L1,L2

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

L1,L2,L3

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

L1,L2,L3

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.

L1,L2,L3

Course outcomes: The student will have the knowledge on advanced methods of analysis of structures

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

6. Krishnamoorthy C.S., “Finite Element analysis” -Tata McGraw Hill
7. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
8. Cook R D et.al., “Concepts and applications of Finite Element analysis ”, John Wiley

Reference Books:

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

Course Title: NUMERICAL METHODS AND APPLICATIONS
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	**18CV752**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course 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

L1,L2,L3

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.

L1,L2,L3

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.

L1,L2,L3

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.

L1,L2,L3

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.

L1,L2,L3

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.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

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:

5. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi
6. 2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi
7. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi

ENVIRONMENTAL PROTECTION AND MANAGEMENT

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER:VII

Subject Code	**18CV753**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course 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.

L1,L2,L3

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

L1,L2,L3

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.

L1,L2,L3

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

L1,L2,L3

Module -5 Applications

Applications of EMS, Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, , Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.

L1,L2,L3

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 Organisations

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in 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.

Course Title: COMPUTER AIDED DETAILING OF STRUCTURES
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	**18CVL76**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03 (1I+2D)**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –02	**Total Marks- 100**	

Course objectives: This course will enable students to

- Be aware of the Scale Factors, Sections of drawings,
- Draft the detailing of RC and Steel Structural member.

RBT LEVEL **L1,L2,L3**

Module -1 Detailing of RCC Structures

- 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

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. Beams with Bolted and Welded
6. Gantry Girder

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

4. Prepare detailed working drawings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

8. Two questions shall be asked from each Module.
9. One full question should be answered from each Module.
10. Each question carries 40 marks.

Text Books:

e. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
f. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

Reference Books:

g. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards
h. IS 13920:2016,Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard

TITLE OF THE COURSE: GEOTECHNICAL ENGINEERING LAB
B.E., VII Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CVL77**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**

RBT LEVEL L1,L2

Credits – 02

Course Objectives: This course will enable students to;

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. Visual soil classification. Water content determination by oven drying method and infrared moisture method. Specific gravity test (pycnometer and density bottle method).
2. Grain size analysis
   i. Sieve analysis
   ii. Hydrometer analysis
3. In-situ density tests
   i. Core-cutter method
   ii. Sand replacement method
4. Consistency limits
   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
   i. Constant head test
   ii. Variable head test
7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (undrained unconsolidated)
8. Consolidation test : Determination of compression index and co- efficient of consolidation
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

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 parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics (SPT- Demonstration)

Question paper pattern:

- 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:

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: 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 1 0) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1 966, IS 2720 (Part-60) 1965.

Course Title: DESIGN OF PRE STRESSED CONCRETE
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VIII

Subject Code	**18CV81**	**IA Marks**	**40**
Number of Lecture Hours/Week	**04**	**Exam Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to learn Design of Pre Stressed Concrete Elements

Module -1

Introduction and Analysis of Members: Concept of Prestressing - Types of Prestressing - Advantages - Limitations –Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.
Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete - prestressed concrete - Force concept - Load balancing concept - Kern point -Pressure line.

L1,L2

Module -2

Losses in Prestress: Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.
Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

L1,L2

Module -3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members

L1,L2,L3

Module -4

Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

L1,L2,L3

Module -5

Composite Sections: Types of composite construction - Analysis of composite sections - Deflection –Flexural and shear strength of composite sections.

L1,L2,L3

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

8. Understand the requirement of PSC members for present scenario.
9. Analyse the stresses encountered in PSC element during transfer and at working.
10. Understand the effectiveness of the design of PSC after studying losses
11. Capable of analyzing the PSC element and finding its efficiency.
12. Design PSC beam for different requirements.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

5. Krishna Raju, N. "Prestressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006

6. Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt.Ltd., New Delhi.
7. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi

Reference Books:

7. Praveen Nagarajan, "Advanced Concrete Design", Person
8. P. Dayaratnam, "Prestressed Concrete Structures", Oxford & IBH-Pubs Company, Delhi, 5th Edition
9. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York
10. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi
11. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
12. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi

Course Title: BRIDGE ENGINEERING

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VIII

Subject Code	**18CV821**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
	CREDITS –03	**Total Marks- 100**	

Course objectives: This course will enable students to understand the analysis and design of concrete Bridges.

Module -1

Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth

Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

L1,L2

Module -2

Design of Slab Bridges: Straight and skew slab bridges

L2,L3

Module -3

Design of T beam bridges(up to three girder only)

Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

L2,L3,L4

Module -4

Other Bridges:

Design of Box culvert (Single vent only)

Design of Pipe culverts

L2,L3,L4

Module -5

Substructures - Design of Piers and abutments,

Introduction to Bridge bearings, Hinges and Expansion joints.(No design)

L2,L3,L4

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

1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints and
5. Design Piers and abutments.

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Text Books:

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.