DESIGN OF RCC STRUCTURAL ELEMENTS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER –V

Subject Code	18CV51	**CIE**	50
Number of Lecture Hours/Week	04	**SEE**	50
Total Number of Lecture Hours	50	**Exam Hours**	03

CREDITS – 04

Course Objectives: This course will enable students to

1. Identify and Idealization of RC structural elements
2. Design procedure of various RC elements
3. Use of IS codes related to RC structures
4. Provide practical knowledge of RC elements.

Modules	**Teaching Hours**	**RBT Level**
Module -1		
Introduction to Limit State Design and Serviceability: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section. Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability. Importance of bond, anchorage length and lap length.	10	L1, L2
Module -2		
Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams for shear, design for combined bending and torsion as per IS-456	10	L2, L4
Module -3		
Design of Staircase: Design of dog legged and open well staircases.	10	L2, L4
Module -4		
Limit State Design of Slabs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions	10	L2, L4

Module -5		
Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.	10	L2, L4

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

1. Understand the design philosophy and principles
2. Application of design principles in actual work
3. Solve engineering problems of RC elements subjected to flexure, shear and torsion
4. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings & staircase
5. Owns professional and ethical responsibility

• The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper.

Question paper pattern:

1. The question paper will have ten questions.
2. There will be 2 full questions (with a maximum of four sub questions) from each module.
3. Each full question will have sub questions covering all the topics under a module.
4. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. H.S.Vishwanath and Dharmesh N, "Design of RC structural elements", Sapna Book house Pvt. ltd, Bangalore.
2. N Krishnaraju, "Design of Reinforced Concrete Structures", CBS Publishers.
3. H J Shah, "Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)", Charotar Publishing House Pvt. Ltd.2015.

Reference Books:

1. P C Varghese, "Limit State design of reinforced concrete" , PHI, New Delhi.
2. Devdas Menon, S Unnikrishna Pillai, "Reinforced Concrete Design" McGraw-Hill US.
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press.
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

STRUCTURAL ANALYSIS-II
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - V

Course Code	18CV52	**CIE Marks**	50
Number of Lecture Hours/Week	04	**SEE Marks**	50
Total Number of Lecture Hours	50	**Exam Hours**	03

CREDITS : 04

Course Learning Objectives: This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
2. Identify, formulate and solve problems in structural analysis.
3. Analyze structural system and interpret data.
4. use the techniques, such as stiffness and flexibility methods to solve engineering problems.
5. To study the basic principles of dynamics.
6. communicate effectively in design of structural elements

Modules	**Teaching Hours**	**RBT Level**
Module -1		
Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames with kinematic indeterminacy ≤ 3.	10	L2, L4 ,L5
Module -2		
Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including with kinematic indeterminacy ≤ 3.	10	L2, L4 ,L5
Module -3		
Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames without sway.	10	L2, L4, L5
Module -4		
Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams, plane trusses using system approach, with static indeterminacy ≤ 3. Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams , plane trusses using system approach, with kinematic indeterminacy ≤ 3.	10	L2, L4 ,L5
Module -5		
BASIC PRINCIPLES OF DYNAMICS: Basic principles of Vibrations and causes, periodic and aperiodic motion, harmonic and non-harmonic motion. Period and frequency. Forced and Free Vibration, Damping and Equations of Single Degree of Freedom System with and without damping.	10	L2, L4 ,L5

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

1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method.
2. Determine the moment in indeterminate beams and frames of no sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams and plane trusses using flexibility method.
5. Analyze the beams and plane trusses by system stiffness method.
6. Determine the single degree of freedom, multi degree of freedom system with and without damping.

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. Hibbeler R C, " Structural Analysis", Pearson Publication
2. L S Negi and R S Jangid, "Structural Analysis", Tata McGraw-Hill Publishing Company Ltd.
3. D S PrakashRao, "Structural Analysis: A Unified Approach" , Universities Press
4. K.U. Muthu, H. Narendraetal, "Indeterminate Structural Analysis", IK International Publishing Pvt. Ltd

Reference Books:

1. Reddy C S, **"Basic Structural Analysis",** *Tata McGraw-Hill* Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, **"Theory of Structures"**, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M MRatwani, **"Analysis Of Structures** ", Vol. 2, Khanna Publishers
4. Wang C K, **"Intermediate Structural Analysis",** McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, **"Computational Structural Mechanics",** PHI Learning Pvt. Ltd.,

BASIC GEOTECHNICAL ENGINEERING

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

SEMESTER –V

Subject Code	18CV53	**CIE**	50
Number of Lecture Hours/Week	04	**SEE**	50
Total Number of Lecture Hours	50	**Exam Hours**	03

CREDITS – 04

Course Objectives: This course will enable students to

1. To appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also to become familiar broadly with geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering.
2. To know the basic engineering properties and the mechanical behaviour of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils.
3. To determine the improvement in mechanical behaviour by densification of soil deposits using compaction.
4. To know how the properties of soils that can be measured in the lab

Modules	Teaching Hours	RBT Level
Module -1		
INTRODUCTION: History of soil mechanics, Definition, origin and formation of soil. Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Water content, Specific Gravity of soil solids and soil mass, Densities and Unit weights - Bulk, Dry, Saturated & Submerged and their inter relationships.relative density, activity of clay, Plasticity chart, unified and BIS soil classification.	**10**	L1, L2
Module -2		
INDEX PROPERTIES OF SOIL AND THEIR DETERMINATION: Index Properties of soil- Water content, Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, in-situ density, Activity of Clay, Laboratory methods of determination of index properties of soil: Water content (Oven Drying method & Rapid Moisture method), Specific gravity of soil solids (Pycnometer and density bottle method), Particle size distribution (Sieve analysis and Hydrometer analysis only), Liquid Limit- (Casagrande and Cone penetration methods), Plastic limit and shrinkage limit.	**10**	L2,L4
Module -3		
FLOW OF WATER THROUGH SOILS: Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepagevelocity, Superficial velocity and coefficient of percolation, quick sand phenomena, Capillary Phenomena**.** **Compaction of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control - compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.	**10**	**L1, L2, L3**

Module -4		
SHEAR STRENGTH OF SOIL: Concept of shear strength, Mohr coulomb theory, conventional and modified failure envelops, Effective stress concept- total stress, effective stress and Neutral stress, Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils, Sensitivity and Thixotropy ofclay. Measurement of shearstrength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. Total and effective stress paths.	**10**	**L2, L3**
Module -5		
Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumption and limitations. Derivation of Governing differential Equation Preconsolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils. Consolidation characteristics of soil (Cc, av, mv and Cv. Laboratory one dimensional consolidation test, characteristics of e-log(σ) curve, Determination of consolidation characteristics of soils compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.	**10**	**L1, L2, L3,**

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

1. Will acquire an understanding of the procedures to determine index properties of any type of soil, classify the soil based on its index properties
2. Will be able to determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures
3. Will be able to determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress; Also acquire ability to estimate seepage losses across hydraulic structure
4. Will be able to estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.
5. Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.

Question paper pattern:

1. The question paper will have ten questions.
2. Each full question consists of 10 marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.
5. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2000), New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering- (2012) ,LaxmiPulications.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; (2002), Fifth Edition, Thomson 25 Business Information India (P) Ltd., India

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons, 1969.
2. Donold P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi&ManojDatta, Geotechnical Engineering-. (2009), "Tata Mc Graw Hill.
4. Narasimha Rao A. V. &Venkatrahmaiah C, Numerical Problems, Examples and objective questions in Geotechnical Engineering-. (2000), Universities Press., Hyderabad.
5. Muni Budhu ,Soil Mechanics and Foundation Engg.- (2010), 3rd Edition, John Wiely& Sons

CONCRETE TECHNOLOGY
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER –V

Subject code	18CV54	**CIE**	50
Number of lecture hours per week	04	**SEE**	50
Total number of lecture hours	50	**Exam hours**	03

CREDITS 04

Course Learning Objectives: This course will enable students to:

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete.
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete. 3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.
4. To mix design concrete using IS 10262:2019.
5. To understand different types of modern concretes.

Modules	**Teaching Hours**	**RBT Level**
Module-1		
Concrete Ingredients Cement – Cement manufacturing process,chemical Composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates, Water – qualities of water. Chemical admixtures plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes and rice husk ash.	10	L1,L2,L3
Module-2		
Fresh Concrete Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing.	10	L1,L2,L3
Module-3		
Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity		

concept, testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion,	10	L1,L2,L3
Module-4		
Concrete Mix Proportioning Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019. ACI and DOE method of mix design introduction.	10	L1,L2,L3,L4,L5
Module-5		
Durability requirements as per IS-456, In situ testing of concrete, rebound hammer test, ultrasonic pulse velocity– Principal, applications and limitations. **Special Concretes** RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages.Fiber reinforced concrete - Fibers types, properties, application of FRC. Materials, requirements, properties of Geo polymer Concrete, High Strength Concrete and High Performance Concrete	10	L1,L2,L3
Course outcomes: After studying this course, students will be able to: 1. Relate material characteristics and understand their influence on microstructure of concrete. 2. Distinguish concrete behavior with respect to its fresh and hardened properties. 3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes. 4. Adopt suitable concreting making methods and placing methods based on requirement. 5. Select a suitable type of concrete based on specific application.		
Text Books: 1. M. L. Gambir, “Concrete Manual”, Danpat Rai and sons, New Delhi 2. M.S Shetty, “Concrete Technology”, S. Chand &Co. Ltd, New Delhi.		
Reference Books: 1. Mehta P.K, “Properties of Concrete”, Tata McGraw Hill Publications, New Delhi. 2. Neville AM, “Properties of Concrete”, ELBS Publications, London. 3. Relevant BIS codes.		

Computer Aided Building Planning and Drawing-LAB [As per Choice Based Credit System (CBCS) scheme] SEMESTER –V			
Subject Code	18CVL55	**CIE:**	50
Number of Lecture Hours/Week:	03	**SEE:**	50
Total Number of Lecture Hours:	40	**Exam Hours:**	03
CREDITS –01			

Course objectives: Provide students with a basic understanding
□ □ Achieve skill sets to prepare computer aided engineering drawings
□ □ Understand the details of construction of different building elements.
□ □ Visualize the completed form of the building and the intricacies of construction based on thœngineering drawings.

Modules	RBT Level/hrs
Module -1 Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962 Simple engineering drawings with CAD drawing tools : Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings.	10 Hours L1,L2
Module -2 Drawings Related to Different Building Elements: Following drawings are to be prepared for the data given using CAD Software a. Cross section of Foundation, masonry wall b. RCC columns with isolated & combined footings. c. Different types of staircases – Dog legged, Open well d. Lintel and chajja e. RCC slabs and beams f. Cross section of a pavement g. Layout plan of Rainwater recharging and harvesting system h. Cross sectional details of a road for a Residential area with provision for all services	10 Hours L2,L3,L4,L5,L6
Module -3 Building Drawings: Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.Submission drawing (sanction drawing) with access to terrace including all details and statements as per the local bye-laws Drawing of Plan, elevation and sectional elevation including electrical, plumbing and	20 Hours L2,L3,L4,L5,L6

sanitary services *using CAD software* for: a. Single and Double story residential building b. Hostel building c. School building d. Draw the Single story residential building plan, elevation, sectional and site plan with all detailed naming as per municipal corporation rules	

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

1. Gain a broad understanding of planning and designing of buildings
2. Prepare, read and interpret the drawings in a professional set up.
3. Know the procedures of submission of drawings and Develop working and submission drawings for building
4. Plan and design a residential or public building as per the given requirements

Program Objectives

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

- There will be two full questions with sub divisions if necessary from Module 2 with each full question carrying *twenty* marks. Students have to answer one question.
- There will be two full questions from Module 3 with each full question carrying *thirty* marks. Students have to one answer one question.

Text book:

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata Mc Graw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "Civil Engineering Drawing", Asian Publishers/Computech Publications Pvt Ltd.

Reference Books:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
2. IS: 962-1989 (Code of practice for architectural and building drawing)
3. National Building Code, BIS, New Delhi.

GEOTECHNICAL ENGINEERING LAB

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

SEMESTER – V

Subject Code	18CVL56	**CIE**	50
Number of Lecture Hours/Week	03(1 Hour Instruction + 2 Hours Laboratory)	**SEE**	50
Total Number of Lecture Hours	40	**Exam Hours**	03

CREDITS -01

RBT LEVEL L1,L2

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

1. Water content determination by oven drying method and infrared moisture method.
Specific gravity test (pycnometer and density bottlemethod).

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)
iv. vane shear test

8. Consolidation test : Determination of compression index and co- efficient of Consolidation

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 beallotted 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) – 1966,
IS 2720 (Part-60) 1965.

CONCRETE & HIGHWAY MATERIAL TESTING LAB
[As per Choice Based Credit System(CBCS) scheme]
SEMESTER – V

Subject code	18CVL57	**CIE**	50
Number of lecture hours per week	03	**SEE**	50
Total number of lecture hours	40	**Exam hours**	03

CREDITS- 01

Course Learning Objectives: This course will enable students to:
This course will enable students
1. To learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
2. To learn the procedure of testing bituminous materials as per standard code recommendations. 3. To relate material characteristics to various application of construction.

EXPERIMENTS

Part A: Concrete Lab

1.Tests on Cement:
a. Normal Consistency b. Setting time c. Compressive strength d. specific gravity. e. fineness of cement by Blaine's permeability test.

2. Tests on Concrete:
a. Design of concrete mix as perIS-10262
b. Tests on fresh concrete:
i. slump, ii. Compaction factor and iii. Vee Bee test
c. Tests on hardened concrete: i. compressive strength test, ii. Split tensile strength test, iii. Flexural strength test
d. NDT tests by re bound hammer

3. Tests on Self Compacting Concrete:
a. Design of self compacting concrete, As per Is 10262:2019 b. slump flow test, c. V-funnel test, d. J-Ring test, e. U Box test and f. L Box test

Part B: Highway materials Lab

1. Tests on Aggregates
a. Aggregate Crushing value b. Los Angeles abrasion test c. Aggregate impact test d. Aggregate shape tests (combined index and angularity number)
2. Tests on Bituminous Materials
a. Penetration test b. Ductility test c. Softening point test d. Specific gravity test e. Viscosity test by tar viscometer f. Bituminous Mix Design by Marshal Method (Demonstration only).

Course Outcomes: During this course, students will develop expertise in
1. Able to interpret the experimental results of concrete and highway materials based on laboratory tests and apply it to real site conditions.
2. Determine the quality and suitability of cement in making concrete.

3. Design appropriate concrete mix Using Professional codes.
4. Determine strength and quality of concrete requiring to various site conditions.
5. Evaluate the strength of structural elements using NDT techniques.

Reference Books:

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

PROFESSIONAL ETHICS
[As per Choice Based Credit System(CBCS) scheme]
SEMESTER – V

Subject code	18HSM59A	**CIE**	50
Number of lecture hours per week	03	**SEE**	50
Total number of lecture hours	10	**Exam hours**	03

CREDITS- 01

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values,
- To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

MODULES	**Teaching Hours**
MODULE -I HUMAN VALUES Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	02
MODULE- II ENGINEERING ETHICS Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories	02
MODULE-III ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	02
MODULE-IV SAFETY, RESPONSIBILITIES AND RIGHTS Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	02
MODULE-V GLOBAL ISSUES Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society	02

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003. 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011