TITLE OF THE COURSE: CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP
B.E.,VSemester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code: 21CV51	**CIE Marks: 50**
Number of Lecture/Number of tutorial Hours/Week: 02+02	**SEE Marks: 50**
Total Number of Lecture Hours: 42	**Exam Hours:03**

Credits – 03

Course Learning Objectives: This course will enable students to

1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
2. Inculcate Human values to grow as responsible human beings with proper personality. Keep up ethical conduct and discharge professional duties.

MODULE	RBT LEVELS/ HRS
Module-1 **Management:** Characteristics of management, functions of management, importance and purpose of planning process, types of plans. **Construction Project Formulation:** Introduction to construction management, project organization,management types. **Construction Planning and Scheduling:** Introduction, types of project plans, work breakdown structure, Gant Chart & Bar chart, preparation of network diagram- event and activity based and its critical path-critical path method, PERT method, uncertainty in PERT concept of activity on arrow and activity on node, Cost optimization.	**L1,L2,L3,L4 10HRS**
Module-2 **Resource Management: Concept of Resource leveling,** Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity. **Construction Equipments:** classification of construction equipment, Selection of construction equipment and basic concept on equipment maintenance, Estimation of ownership cost, operational and maintenance cost of construction equipments. estimation of productivity for: excavator, dozer, compactors, graders and dumpers. **Materials:** material management functions, inventory management.	**L1,L2,L3 08HRS**

Module-3 **Construction Quality & safety:** Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management(TQM) **HSE: Introduction** to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.	**L1,L2** **08HRS**
Module-4 **Introduction to engineering economy:** Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making. **Interest and time value of money:** concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost. **Comparison of alternatives:** Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.	**L2,L3,L4,L5** **10HRS**
Module -5 **Entrepreneurship:** Concepts of entrepreneurship, functions of an entrepreneur, central and state level financial institutions. Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC. **Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture.	**L1,L2** **08HRS**

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

1. Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.
2. Classify and allocate resources required for an activity / project.
3. Apply safety measures in construction projects.
4. Analyze the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.
5. Prepare project report and identify the funding organization .

Text Books:

1. P C Tripathi and P N Reddy, “Principles of Management”, Tata McGraw-Hill Education
2. Chitkara, K.K, “Construction Project Management: Planning Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley (India) Pvt. Ltd., Licensees of PearsonEducation
4. Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:.

Reference Books:

1. Robert L Peurifoy, Clifford J. Schexnayder, AviadShapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-HillEducation.
2. L.S Srinath " PERT and CPM: Principles and Applications" Affiliated East-West Press Private Limited, 1973
3. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, NewDelhi
4. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell
5. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw-HillEducation
6. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall,Pitsburgh
7. James L.Riggs, David D. Bedworth , Sabah U. Randhawa " Engineerng Economics" 4

Design of RCC Structures

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

SEMESTER - V

Course Code	21CV52	**CIE Marks**	50
Number of Lecture/Number of tutorial Hours/Week: 02+02		**SEE Marks**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS : 03

Course objectives: This course will enable students;

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of RC elements for the success in competitive examinations.

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. Importance of bond, anchorage length and lap length.. 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, slenderness limits of beams for stability.	09	L1,L2,L3
Module -2		
Limit State Analysis of Beams: Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.	08	L1,L2,L3
Module -3		
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-456-2000	08	L1,L2,L3,L4
Module -4		
Limit State Design of Slabs and Stairs: Introduction to one way and two-way slabs, Design of cantilever, simply supported and one-way continuous slab. Design of two-way slabs for different boundary conditions. Design of dog legged and open well staircases.	09	L2,L3,L4,L5

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 using IS-456-2000 and sp-16	08	L2,L3,L4,L5

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

1. Apply the design philosophy and principles.
2. Analysis of RCC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RCC structural elements such as able to design beams slabs, columns and footings.
4. Apply the conceptual designs of RCC structural elements such as design slabs and stairs
5. Apply the conceptual designs of RCC structural elements such as design columns and footing.

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.

Text Books: · 1. Unnikrishnan Pillai and Devdas Menon, “Reinforced Concrete Design”, McGraw Hill, New Delhi

2. Subramanian, “Design of Concrete structures”, Oxford university Press

3. H J Shah, “Reinforced Concrete Vol 1 (Elementary Reinforced Concrete)”, Charotar Publishing House Pvt. Ltd.

4. S.S Bhavikatti “Design of RCC structural elements” vol-1

5.A.K Jain “Reinforced Concrete Design”limit state design

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

STRUCTURAL ANALYSIS-II

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

SEMESTER - V

Course Code	21CV53	**CIE Marks**	50
Number of Lecture/Number of tutorial Hours/Week: 02+02		**SEE Marks**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS : 03

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 structural dynamics.

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 frames(sway and non-sway) with kinematic indeterminacy ≤ 3 .	09	L2, L3 ,L4
Module -2		
Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid frames(Sway and non-sway) including with kinematic indeterminacy ≤ 3.	08	L2, L3 ,L4
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.	08	L2, L3, L4
Module -4		
Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams using Direct stiffness approach, with static indeterminacy ≤ 3. Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams , using direct stiffness approach, with kinematic indeterminacy ≤ 3.	09	L2, L3 ,L4
Module -5		

Basic Principles of structural 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.	08	L1, L2

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

1. Analyse the moment in indeterminate beams and Analyse the frames (sway and non-sway) having variable moment of inertia and subsidence using slope defection method.
2. Analyse the moment in indeterminate beams and Analyse the frames of (sway and non-sway) using moment distribution method.
3. Analyse the beams and frames by Kani's method.
4. Analyse the beams using flexibility and stiffness matrix method
5. Basic concept of structural dyanamics..

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.,

ADVANCED GEOTECHNICAL ENGINEERING

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

Subject Code	21CV541	**CIE**	50
Number of Lecture/Number of tutorial Hours/Week: 02+02		**SEE**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS – 03

Course objectives: This course will enable students to

1. Appreciate basic and advanced concepts of soil mechanics as an integral part in the knowledge of civil engineering also to become familiar with foundation engineering terminology and understand how the principles of geotechnical are applied in the design of foundations
2. Learn introductory concepts of geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5. Study about assessing stability of slopes and earth pressure on rigid retaining structures.

Modules	Teaching Hours	RBT Level
Module -1		
Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of ground water table (GWT) (Hvorslev's method).	**09**	**L1,L2,L3**
Module -2		
Stresses in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart Foundation Settlement - Approximate method for stress distribution on a horizontal plane, Types of settlements and importance, Computation of immediate and consolidation settlement**.**	**08**	**L2, L3,L4**
Module -3		
Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction. **Stability of Slopes**: Assumptions, infinite and finite slopes, factor of safety, use of Taylor's stability charts, Swedish slip circle method for C and C-Φ soils (Method of slices), Fellineous method for critical slip circle	**08**	**L2,L3,L4**
Module -4		

Bearing Capacity of Shallow Foundation: Types of foundations, determination of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton) and BIS method (IS: 6403-1981), Presumptive bearing capacity, Effect of water table and eccentricity, field methods - plate load test and standard penetration method (SPT), settlement of foundation.	**08**	**L2,L3,L4**
Module -5		
Deep Foundations: Pile foundation: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static formula, efficiency of pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation). Well foundation: Types –Different shapes of wells –Components of wells and its functions.	**09**	**L1, L2, L3 L4**

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

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

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, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co. New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Dr K. R. Arora., Soil mechanics and foundation engineering. Standard publishers. New Delhi.
5. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India

Reference Books:

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

MASONRY STRUCTURES

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

SEMESTER - V

Course Code	21CV542	**CIE Marks**	50
Number of Lecture/Number of tutorial Hours/Week: 02+02		**SEE Marks**	50
Total Number of Lecture Hours	42	**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.

Modules	Teaching Hours	RBT Level
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.	08	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.	08	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.	09	L1,L2,L3,L4
Module -4		
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.	08	L2,L3,L4,
Module -5		

Design of Laterally 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	09	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. Able to design the masonry walls as per code permissible stresses as per IS: 1905 and SP-20.
4. Design different types of masonry walls for different load considerations.

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.

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.

Alternate Building Materials

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

Subject Code: 21CV551	CIE:50
Number of Lecture/Number of tutorial Hours/Week: 03+02	SEE: 50
Total Number of Lecture Hours:52	Exam Hours:03

CREDITS –04

Course Objectives: This course will enable students to:

1.Understand environmental issues due to building materials and the energy consumption in building materials.

2. Study of various masonry blocks, masonry motor and structural behavior of masonry under compression.

3.Study the alternative building materials in present context.

4. Understand the alternative building technologies which are followed in present construction field.

Modules	Teaching Hours	RBT Level/hrs
Module -1 **Introduction:** Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC(Indian Green Building Council) and LEED(Leadership in Energy and Environmental Design) manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.	**12**	**L1,L2,L3**
Module -2: Alternate Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.	**10**	**L1,L2,L3**
Module -3: Elements of Structural Masonry: Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks, Aerated Blocks.	**10**	**L1,L2,L3**
Module -4: Structural Masonry Mortars: Mortars, cementatious materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements	**10**	**L1,L2,L3**

of mortar, selection of mortar. Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry.		
Module -5 **Equipment for Production of Alternate Materials:** Machines for manufacture of concrete, Equipment's for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, Cost analysis: Case studies using alternatives.	**10**	**L1,L2,L3**

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

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
2. Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
3. Select appropriate type of masonry unit and mortar for civil engineering constructions.
4. Learning of different equipment's required for manufacturing of building materials and select a appropriate equipment for the selected materials.

Question Paper Pattern:

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

Text Books:

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers.

Reference Books:

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub. 3. IGBC Green Homes Rating System, CII pub. 4. Relevant IS Codes.

REPAIR AND REHABILITATION OF STRUCTURES B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]	
Subject Code: 21CV552	**CIE:** 50
Number of Lecture Hours/Week: 04	**SEE:** 50
Total Number of Lecture Hours: 52	**Exam Hours:** 03

CREDITS 04

Course objectives: The objective of this course is to

1.Make students to investigate the cause of deterioration of concrete structures,

2.Identify different repair and rehabilitation of structures.

3.Evaluate the performance of the materials for repair

Modules	Teaching Hours	RBT Level
Module-1		
General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods, Quality assurance for concrete construction, as built concrete properties strength, permeability, thermal properties and cracking.	10HRS	L1,L2,L3
Module-2		
Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.	10HRS	L1,L2,L3
Module-3		
Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance, Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure.	10HRS	L1,L2,L3
Module-4		
Materials for Repair: Special concretes and mortars, concrete chemicals, special materials for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete: Steel fiber, Glass Fibers and Carbon fibers. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.	10HRS	L1,L2,L3
Module-5		
Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for damaged structures - case studies	10HRS	L2,L3

Course outcomes: Students are able to: 1. Identify the cause of deterioration of concrete structures. 2. Know the concept of Serviceability and Durability 3. Identify develop analytical skills. 4. Summarize the principles of repair and rehabilitation of structures 5. Study the techniques for repair		

Question Paper Pattern:

• The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

• The question paper will have ten full questions carrying equal marks.

• Each full question carries 20 marks.

• There will be two full questions (with a maximum of four sub questions) from each module.

• Each full question will have sub questions covering all the topics under a module.

• The students will have to answer five full questions, selecting one full question from each module.

CIE + Assignments: 15+35=50 Marks

There will be a 3 CIE's, the average of best of 2 CIE's will be considered and there will be a 35 marks for Assignments.

Reference Books:

1. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".

2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"-Longman Scientific and Technical

3. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons

4. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL

BUILDING INFORMATION MODELING -LAB
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER –V

Subject Code	21CVL56	**CIE:**	50
Number of Lecture Hours/Week:	02	**SEE:**	50
Total Number of Lecture Hours:	28	**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 the engineering drawings.

Modules	RBT Level/hrs
Module -1 **1. Using Basic Building Components** a. Adding Doors b. Adding Window and Wall Openings **2. Using the Editing Tools** a. Working with Selection Sets b. Editing Tools c. Editing Tools II d. Grouping e. Retrieving Information about Elements **3. Datum Planes and Creating Standard Views** a. Working with Reference Planes b. Working with Levels c. Working with Grids d. Working with Project Views .	10 Hours L1,L2
Module -2 **4. Using Basic Building Components II** a. Creating Floors b. Creating Roofs c. Shape Editing Tools d. Creating Ceilings e. Adding Rooms **5. Using Basic Building Components III** a. Working with Components b. Adding Stairs	10 Hours L2,L3,L4,L5,L6

c. Adding Railings and Ramps d. Creating Curtain Walls **6. Adding Site Features** a. Working with Site Features b. Property Lines and Building Pads c. Adding Site Components **7. Using Massing Tools** a. Understanding Massing ConceptsCreating Massing Geometry b. in the Family Editor c. Creating Families	
Module -3 **8. Adding Annotations and Dimensions** a. Adding Tags b. Keynotes **9. Creating Project Details and Schedules** a. Project Detailing b. Adding Text Notes c. Working with Schedules Course Content, cont. **10. Creating Drawing Sheets and Plotting** a. Creating Drawing Sheets b. Creating Duplicate Dependent Views	20 Hours L2,L3,L4,L5,L6
Module -4 **11. Creating 3D Views** a. Three Dimensional Views **12. From Rendering to Walkthroughs** a. Working with Materials b. Rendering in Revit Architecture c. Creating a Walkthrough **13. Using Advanced Features I** a. Creating Structural Components b. Using Area Analysis Tools **14. Using Advanced Features II** a. Worksharing Concepts b. Working with Linked Models c. Project Standards and Browsers d. Revit Architecture Interoperability	
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.

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

Subject code	21CVL57	**CIE**	50
Number of lecture hours per week	02	**SEE**	50
Total number of lecture hours	28	**Exam hours**	03

CREDITS- 01

Course Learning Objectives: This course will enable students to:
This course will enable students
1. Learn the procedure of testing concrete ingredients and properties of concrete as per standard code recommendations.
2. 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) Fineness of cement by Blaine's permeability test and Sieve analysis.
d) Compressive strength.
e) Specific gravity.

2.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)

3. Tests on Concrete:

Design of concrete mix as perIS-10262
Tests on fresh concrete:

i. Slump.
ii. Compaction factor.
iii. Vee Bee test.
iv. flow table test
v. Marsh cone 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

4.Tests on Self-Compacting Concrete:

Design of self-compacting concrete, as per Is 10262:2019

a) Slump flow test.(Demo)
b) V-funnel test. (Demo)
c) J-Ring test. (Demo)
d) U Box test.

e) L Box test (Demo)

Part B: Highway Materials Lab

Tests on Bituminous Materials

a. Penetration test.
b. Softening point test.
c. Specific gravity test.
d. Flash and fire point test.
e. Marshall Mix Design (Demonstration)
f. CBR test (Demonstration)

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.

GEOTECHNICAL ENGINEERING LAB

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

SEMESTER – V

Subject Code	21CVL58	**CIE**	50
Number of Lecture Hours/Week	02	**SEE**	50
Total Number of Lecture Hours	28	**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

2. Specific gravity test (pycnometer and density bottle method)

3. Grain size analysis
   - i. Sieve analysis
   - ii. Hydrometer analysis

4. In-situ density tests
   - i. Core-cutter method
   - ii. Sand replacement method

5. Consistency limits
   - i. Liquid limit test (by Casagrande's and cone penetration method)
   - ii. Plastic limit test
   - iii. Shrinkage limit test

6. Standard compaction test (light and heavy compaction)

7. Co-efficient of permeability test
   - i. Constant head test
   - ii. Variable head test

8. Shear strength tests
   - i. Unconfined compression test
   - ii. Direct shear test
   - iii. Triaxial test (undrained unconsolidated)
   - iv. vane shear test

9. Consolidation test: Demonstration of oedometer apparatus to determine compression index and co- efficient of Consolidation

10. Demonstration of standard penetration test apparatus in the field.

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) – 1966,
IS 2720 (Part-60) 1965.

FIELD TRAINING
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER –V

Subject code	21ACV5101	**CIE**	50
Number of lecture hours per week	01	**SEE**	50
Total number of lecture hours	15	**Exam hours**	03

CREDITS 01

Course Learning Objectives: This course will enable students to:

1. Study the drawings and executive on field
2. Work properly in the construction field
3. Initiate the work at construction field

Modules	**Teaching Hours**	**RBT Level**
Module-1		
Building Plan and markouts 2D AutoCAD drawings of the centerline of column and footing layout, marking of centerline, column, and footing on site.	3	L1,L2
Module-2		
Quantity Survey of Construction Works Calculating the material requirements for execution of footing and slab works with sample examples.	3	L1,L2
Module-3		
BBS of RCC Elements: Bar bending schedule for footing, column, beam, and slab works with some sample drawings	3	L1,L2,L3
Module-4		
Construction tools and machines Introduction to construction tools and machine and their functions.	3	L1,L2
Module-5		
Site visits and case studies on buildings.	3	L1,L2,L3

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

1. Read the drawing of the centerline of RCC elements.
2. Initiate the work at the site.
3. Take safety measures at the construction site.
4. Study the steel details of RCC elements
5. Understand the Construction tools and Machines

Text Books:

1. B. C Punmia, “Building Construction” Laxmi Publication, New Delhi
2. Arun K R Jain, B.C. Punmia “R.C.C. Designs” Laxmi Publication, New Delhi
3. B.N.Dutta, “Estimation and Costing in Civil Engineering” UBS Publishers' Distributors Ltd

Reference Books:

1. S S Bhavikatti, M V Chaitawadagi, “Building planning and Drawing”, I K International Publishing House
2. M.S Shetty, “Concrete Technology”, S. Chand &Co. Ltd, New Delhi.
3. Is SP 34 Handbook on concrete reinforcement and detailing.
4. IS 456-2000