Course Title: Construction Management and Entrepreneurship
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV61	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		**Total Marks - 100**	

Course 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.
3. Keep up ethical conduct and discharge professional duties.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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 functions, management styles **Construction Planning and Scheduling:** Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node.	10 hours	L1,L2,L3
Module -2		
Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity. **Construction Equipments:** classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance **Materials:** material management functions, inventory management.	10 Hours	L1,L2,L3
Module -3		
Construction Quality , safety and Human Values: Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management **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. **Ethics :** Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.	10 Hours	L1,L2,L3
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	10 Hours	L1,L2,L3

Module -5		
Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions. **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. Introduction to international entrepreneurship opportunities , entry into international business , exporting , direct foreign investment , venture capital	10 Hours	L1,L2,L3

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

1. Understand the construction management process.
2. Understand and solve variety of issues that are encountered by every professional in discharging professional duties.
3. Fulfill the professional obligations effectively with global outlook

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.

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 Pearson Education
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, Aviad Shapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
2. Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, New Delhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill Education
5. Chris Hendrickson and Tung Au, “Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pitsburgh
6. James L.Riggs , David D. Bedworth , Sabah U. Randhawa “ Engineerng Economics” 4 ed tata Mc Graw hill.
7. S.C Sharma –“Construction Equipments and its management” – Khanna publishers

Course Title: Design of Steel Structural Elements
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV62	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		**Total Marks- 100**	

Course Objectives: This course will enable students to

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification. **Plastic Behaviour of Structural Steel:** Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.	10 hours	L1,L2,L3
Module -2		
Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip(HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) **Welded Connections:** Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member, Advantages and Disadvantages of Bolted and Welded Connections.	10 Hours	L1,L2,L3
Module -3		
Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.	10 Hours	L1,L2,L3
Module -4		
Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets. **Design of Column Bases:** Design of Simple Slab Base and Gusseted Base.	10 Hours	L1,L2,L3
Module -5		
Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behaviour of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams. Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]	10 Hours	L1,L2,L3

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

1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

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.

Text Books:

1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi

Reference Books:

1. Dayarathnam P, "Design of Steel Structures", S Chand and Company Ltd., New Delhi.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

Course Title: Highway Engineering
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		**Total Marks- 100**	

Course objectives: This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute **Highway Development and Planning:** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.	10 hours	L1,L2
Module -2		
Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects **Highway Geometric Design:** Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves	10 Hours	L2,L3,L4
Module -3		
Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material **Pavement Design:** Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples	10 Hours	L3,L4,L5
Module -4		
Pavement Construction: Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads	10 Hours	L2,L3,L4

Module -5		
Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location **Highway Economics:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts	10 Hours	L1,L2,L3

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

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

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.

Text Books:

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

Reference Books:

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

Course Title: Water Supply and Treatment Engineering
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV64	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period. Different methods of population forecasting -with merits and demerits. Numerical Problems.	10 hours	L1,L2,L3
Module -2		
Water Treatment: Objectives, Treatment flow chart – significance of each unit Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques. Water quality characteristics: Physical, Chemical and Microbiological.	10 Hours	L1,L2,L3
Module -3		
Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers. Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarriflocculators . Filtration: mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system. Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pre treatment.	10 Hours	L1,L2,L3
Module -4		
Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration. Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.	10 Hours	L1,L2,L3
Module -5		
Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures. Pumps: Types of pumps with working principles. Numerical Problems. Pipes: Design of the economical diameter for the rising main; Numerical Problems. Pipe appurtenances, Valves, Fire hydrants Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material. Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination. Visit to Intake structure, Water treatment plant and report working of each unit Design of water treatment plant units and distribution system with population forecasting for the given city	10 Hours	L1,L2,L3

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

1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

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.

Text Books:

1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010
2. Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York, 2008.

Reference Books:

1. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.
2. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000
3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

Course Title: Solid Waste Management
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV651	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems. Collection: Collection of solid waste- services and systems, equipments, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.	8 hours	L1,L2,L3
Module -2		
Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control ,Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).	8 Hours	L1,L2,L3
Module -3		
Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems. Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems	8 Hours	L1,L2,L3
Module -4		
Sources, collection, treatment and disposal of :- Biomedical waste ,E-waste ,Hazardous waste and construction waste	8 Hours	L1,L2,L3
Module -5		
Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolsis ,design criteria for incineration Energy recovery technique from solid waste management	8 Hours	L1,L2,L3

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

1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

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.

Text Books:

1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, “Integrated Solid Waste Management : Engineering principles and management issues”, M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering”, Tata Mcgraw Hill Publishing Co ltd.,

Reference Books:

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solidwaste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

Course Title: Matrix Method of Structural Analysis
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV652	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.
2. Understand flexibility and stiffness matrices to solve problems in beams, frames and trusses. 3. Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses. 4. Gain knowledge of solving problems involving temperature changes and lack of fit.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction: Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements	08 hours	L2, L4,L5
Module -2		
Element Flexibility Method: Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.	08 Hours	L2, L4,L5
Module -3		
Element Stiffness Method: Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.	08 Hours	L2, L4,L5
Module -4		
Effects of Temperature Changes and Lack of Fit: Related numerical problems by flexibility and stiffness method as in Module 2 and Module 3.	08 Hours	L2, L4,L5
Module -5		
Direct Stiffness Method: Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses	08 Hours	L2, L4,L5

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

1. Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for simple problems.
2. Identify, formulate and solve engineering problems with respect to flexibility and stiffness matrices as applied to continuous beams, rigid frames and trusses.
3. Identify, formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.

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.

Text Books:

1. Weaver W and Gere J H, **"Matrix Analysis of Framed Structures"**, CBS publications, New Delhi.
2. Rajasekaran S, **"Computational Structural Mechanics"**, PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, **"Matrix and Finite Element Analysis of Structures"**, Ane Books Pvt. Ltd.

Reference Books:

1. Godbole P N et.al, “Matrix Method of Structural Analysis”, PHI ltd, New Delhi.
2. Pundit and Gupta, “Theory of Structures Vol II”, TMH publications, New Delhi
3. A K Jain, “Advanced Structural Analysis”, Nemchand Publications, Roorkee.
4. Manikaselvam, “Elements of Matrix Analysis and Stability of Structures”, Khanna Publishers, New Delhi.
5. H C Martin, “Introduction to Matrix Methods in Structural Analysis”, International textbook company, McGraw Hill.

Course Title: Alternative Building Materials
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV653	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS –03	**Total Marks- 100**	

Course objectives: This Course will enable students to:

1. understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. understand the alternative building technologies which are followed in present construction field.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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 and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions	8 hours	L1,L2,L3
Module -2		
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. **Structural Masonry Mortars:** Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements 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: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.	8 Hours	L1,L2,L3
Module -3		
Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, 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	8 Hours	L1,L2,L3
Module -4		
Alternative Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique. **Alternative Roofing Systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes	8 Hours	L1,L2,L3
Module -5		

Equipment for Production of Alternative Materials: Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.	8 Hours	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. Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
3. Analyse 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.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

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.

Text Books:

1. KS Jagadish, BV Venkatarama Reddy and KS 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.

Course Title: Ground Improvement Techniques
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV654	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and Injection.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Formation and Development of Ground : Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits; Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes. **Compaction:** Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.	8 hours	L1, L2 , L3
Module -2		
Drainage Methods: Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains. **Pre-compression and Vertical Drains:** Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading	8 Hours	L1, L2 , L3
Module -3		
Chemical Modification-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash. **Chemical Modification-Ii:** Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.	8 Hours	L2, L3 , L4
Module -4		
Vibration Methods: Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibroflotation, sand compaction piles, stone columns, heavy tamping GROUTING AND INJECTION: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting	8 Hours	L2 , L3, L5
Module -5		
Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement, **Miscellaneous Methods (Only Concepts & Uses):** Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.	8 Hours	L1 , L3, L5

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

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

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.

Text Books:

1. Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
2. Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", Mc Graw Hill Pub. Co.

Reference Books:

1. Manfred Hausmann , "Engineering principles of ground modification", Mc Graw Hill Pub. Co.,
2. Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London.
3. Nelson J.D. and Miller D.J, "Expansive soils", John Wiley and Sons.
4. Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths

Course Title: Water Resources Management

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

SEMESTER:VI

Subject Code	15CV661	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS – 03	**Total Marks-100**	

Course objectives: This course will enable students to;

1. Judge surface and ground water resources.
2. Address the issues of water resources management.
3. Learn the principles of integrated water resources management.
4. Understand the legal framework of water policy.
5. Know the different methods of water harvesting.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Surface and Ground water Resources: Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage Medium	8 hours	L2, L3
Module -2		
Water Resources Planning and Management: Necessity, System components, planning scales, Approaches, planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.	8 Hours	L2, L3
Module -3		
Integrated Water Resources Management: Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and Forms of Private Sector Involvement.	8 Hours	L3, L4
Module -4		
Water Governance and Water Policy: Legal Framework of Water – Substance of National Water Laws – Other key issues – Changing incentives through Regulation - National Water Policy – National-Level Commissions – Irrigation Management Transfer Policies and Activities – Legal Registration of WUAs – Legal Changes in Water Allocation, – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India.	8 Hours	L2, L3
Module -5		

Water Harvesting and Conservation: Water Harvesting Techniques – Micro-catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment, Rain water Harvesting-various techniques related to Rural and Urban area.	8 Hours	L_2, L_3

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

1. Assess the potential of groundwater and surface water resources.
2. Address the issues related to planning and management of water resources.
3. Know how to implement IWRM in different regions.
4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

Program Objectives:

Engineering knowledge
Problem analysis
Interpretation of data

Question paper pattern:

1. The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
2. There will be two full questions (with a maximum of two subdivisions) from each module.
3. Each full question shall cover the topics as a module
4. 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.

Text Books:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
3. Daniel P. Loucks and Eelco van Beek, "Water Resources Systems. Planning and Management", UNESCO Publication.
4. Mollinga, P. et al, "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
5. Singh, Chhatrapati "Water Rights in India," Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi,1992.
6. 6) Dhruva Narayana, G. Sastry, V. S. Patnaik, "Watershed Management", CSWCTRI, Dehradun, ICAR Publications, 1997.

Reference Books:

1. Lal, Ruttan. " Integrated Watershed Management in the Global Ecosystem". CRC Press, New York.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.

Course Title: Environmental Protection and Management
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV662	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
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

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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.	8 hours	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	8 Hours	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.	8 Hours	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	8 Hours	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.	8 Hours	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: Numerical Methods and Applications
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CV663	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
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

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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	8 hours	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.	8 Hours	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.	8 Hours	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.	8 Hours	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.	8 Hours	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

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

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:

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

Course Title: Finite Element Method of Analysis

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VI

Subject Code	15CV664	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		**Total Marks- 100**	

Course objectives: This course will enable students to;

1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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	8 hours	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	8 Hours	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	8 Hours	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	8 Hours	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.	8 Hours	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

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.

Text Books:

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

Reference Books:

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: Software Application Lab
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	15CVL67	IA Marks	20
Number of Lecture Hours/Week	1I+2P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –02		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Use industry standard software in a professional set up.
2. understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design
3. Develop customized automation tools

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Use of civil engineering softwares: Use of softwares for: 1. Analysis of plane trusses, continuous beams, portal frames 2. 3D analysis of multistoried frame structures	18 hours	L1,L2,L3
Module -2		
1. **Project Management- Exercise on Project planning and scheduling of a building project using any project management software:** a. Understanding basic features of Project management software b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software. c. Identification of Predecessor and Successor activities with constrain d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non Critical paths, Project duration, Floats. e. Study on various View options available f. Basic understanding about Resource Creation and allocation g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project (9hrs) **1. GIS applications using open source software:** a. To create shape files for point, line and polygon features with a map as reference. b. To create decision maps for specific purpose. (3hrs)	12 hours	L1,L2,L3
Module -3		
Use of EXCEL spread sheets: Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation	10 Hours	L1,L2,L3

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

use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Program Objectives:

Engineering knowledge
Problem analysis
Interpretation of data

Question paper pattern:

The question paper will have 3 modules comprising of 6 questions.
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
Module-1: 40 Marks, Module-2: 20 Marks, Module-3: 20 Marks

The students shall answer three 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: Training manuals and User manuals and Relevant course reference books

Course Title: Extensive Survey Project /Camp

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VI

Subject Code	15CVP68	IA Marks	20
Number of Practice Hours/Week	04	Exam Marks	80
Total Number of Practice Hours	50	Exam Hours	03
	CREDITS –04	**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

1. **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.

2. **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.

3. **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.

4. **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.

5. **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