Course Title: Municipal and Industrial Waste Water Engineering

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	15CV71	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 sewerage network and influencing parameters.
2. Understand and design different unit operations involved in conventional and biological treatment process.
3. Apply the principles of Industrial effluent treatment process for different industrial wastes.
4. Evaluate self purification of streams depending on hydraulic and organic loading of sewage into receiving waters.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction, need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm flow, time of concentration flow, material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers. low-cost waste treatment; oxidation pond, septic tank, Sewer appurtenances, manholes, catch basins, basic principles of house drainage, typical layout plan showing house drainage connections,	10 hours	L1,L2
Module -2		
Design of sewers, hydraulic formula for velocity, effects of variation on velocity, regime velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions, disposal of effluents by dilution, self purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents, Streeter-Phelps equation	10 Hours	L2,L3
Module -3		
Waste water characteristics, sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water treatment, unit operations; screens, grit chambers, skimming tanks, equalization tanks Suspended growth and fixed film bio process, design of trickling filters, activated sludge process, sequential batch reactors, moving bed bio reactors, sludge digesters,	10 Hours	L1,L2,L3
Module -4		
Difference between domestic and industrial waste water, effect of effluent discharge on streams, methods of industrial waste water treatment; volume reduction, strength reduction, neutralization, equalisation and proportioning. Removal of organic, inorganic and colloidal solids, combined treatment methods; merits, demerits and feasibility, principles of discharge of raw, partially treated and completely treated wastes in to streams	10 Hours	L1,L2
Module -5		
Process flow chart, sources and characteristics of industrial waste water, treatment methods, reuse and recovery and disposal; cotton and textile industry, tanning industry, cane sugar and distilleries, dairy industry, steel and cement industry, paper and pulp industry, pharmaceutical and food processing industry.	10 Hours	L1,L2,L3

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

1. Acquires capability to design sewer and Sewerage treatment plant.
2. Evaluate degree of treatment and type of treatment for disposal, reuse and recycle.
3. Identify waste streams and design the industrial waste water treatment plant.
4. Manage sewage and industrial effluent issues.

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. Metcalf and Eddy, "Wastewater Engineering - Collection, Treatment, Disposal and Reuse", McGraw Hill Pub.Co., 2009.
2. Nelson Leonard Nemerow, "Industrial Waste Treatment", Butterworth-Heinemann, 2007**.**
3. Patwardhan A.D, "Industrial Waste Water Treatment", PHI Learning Private Limited-New Delhi
4. Hammer, M.J. and Hammer, M.J., "Water and Wastewater Technology", 7th Ed., Prentice Hall of India

Reference Books:

1. Manual on Waste Water Treatment : CPHEEO, Ministry of Urban Development, New Delhi.
2. Fair, Geyer and Okun , "Water and Wastewater Engineering" Vol-II, John Willey Publishers, New York.

Course Title: Design of RCC and Steel Structures
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	15CV72	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. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
2. Identify, formulate and solve engineering problems in RC and Steel Structures
3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Footings: Design of rectangular slab type combined footing. Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall. Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV)** Design of portal frames with fixed and hinged based supports.	25 hours	L1,L2,L3
Module -2		
Roof Truss: Design of roof truss for different cases of loading, forces in members to given. Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks Gantry Girder: Design of gantry girder with all necessary checks	25 Hours	L1,L2,L3

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

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

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
- One full question should be answered from each module.
- Each question carries 40 marks.
- Code books – IS 456, IS 800, IS 3370 (Part IV), SP (6) – Steel Tables, shall be referred for designing
- The above charts shall be provided during examinations

Text Books:

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

Reference Books:

1. Charles E Salman, Johnson & Mathas, **"Steel Structure Design and Behaviour"**, Pearson Publications
2. Nether Cot, et.al, **"Behaviour and Design of Steel Structures to EC -III"**, CRC Press
3. P C Verghese, **"Limit State Design of Reinforced Concrete"**, PHI Publications, New Delhi
4. S N Sinha, **"Reinforced Concrete Design"**, McGraw Hill Publication

Course Title: Hydrology and Irrigation Engineering

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

SEMESTER:VII

Subject Code	15CV73	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 hydrology and components of hydrologic cycle such as pricipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Hydrology: Introduction, Importance of hydrology, Global and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation. **Precipitation:** Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.	10 hours	L2, L3
Module -2		
Losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control **Evapo-transpiration:** Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation, **Infiltration:** Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.	10 Hours	L2, L3
Module -3		
Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis. **Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations	10 Hours	L2, L4

Module -4		
Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation. **Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.	10 Hours	L2, L4
Module -5		
Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method. **Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.	10 Hours	L2, L4

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

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.
4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

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) K. Subramanya, “Engineering Hydrology”, Tata McGraw Hill Publishers, New Delhi.

2) Jayarami Reddy, “A Text Book of Hydrology”, Lakshmi Publications, New Delhi.

3) Punmia and LalPandey, “Irrigation and Water Power Engineering” Lakshmi Publications, New Delhi.

Reference Books:

1) H.M. Raghunath, “Hydrology”, Wiley Eastern Publication, New Delhi.

2) Sharma R.K., “Irrigation Engineering and Hydraulics”, Oxford & IBH Publishing Co., New Delhi.

3) VenTe Chow, “Applied Hydrology”, Tata McGraw Hill Publishers, New Delhi.

4) Modi P.N “Water Resources and Water Power Engineering”-. Standard book house, Delhi.

3) Garg S.K, “Irrigation Engineering and Hydraulic Structures” Khanna publications, New Delhi.

Course Title: Design of Bridges

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	15CV741	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 understand the analysis and design of concrete Bridges.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.	8 hours	L1,L2
Module -2		
Design of Slab Bridges: Straight and skew slab bridges	8 Hours	L2,L3
Module -3		
Design of T beam bridges(up to three girder only) Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.	8 Hours	L2,L3,L4
Module -4		
Other Bridges: Design of Box culvert (Single vent only) Design of Pipe culverts	8 Hours	L2,L3,L4
Module -5		
Substructures - Design of Piers and abutments, Introduction to Bridge bearings, Hinges and Expansion joints.(No design)	8 Hours	L2,L2,L3,L4

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

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

Program Objectives:

- 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. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

Reference Books:

1. Jain and Jaikrishna, “Plain and Reinforced Concrete”, Vol.2., Nem Chand Brothers.
2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
3. “Concrete Bridges”, The Concrete Association of India

Course Title: Ground Water & Hydraulics [As per Choice Based Credit System (CBCS) scheme] SEMESTER:VII			
Subject Code	15CV742	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

1. To characterize the properties of ground water and aquifers.
2. To quantify the ground water flow.
3. To locate occurrence of ground water and augment ground water resources.
4. To synthesize ground water development methods.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.	7 hours	L_1, L_2
Module -2		
Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, unisotropic layered soils, steady one dimensional flow: cases with recharge.	8 Hours	L_2, L_3
Module -3		
Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory.	10 Hours	L_2, L_3, L_4
Module -4		
Ground Water Exploration: Seismic method, electrical resistively method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.	7 Hours	L_2, L_3
Module -5		
Ground Water Development: Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics. **Ground Water Recharge:** Artificial recharge, groundwater runoff	8 Hours	L_2, L_3
Course outcomes: After studying this course, students will be able to:		

1. find the characteristics of aquifers.
2. estimate the quantity of ground water by various methods.
3. locate the zones of ground water resources.
4. select particular type of well and augment the ground water storage.

Program Objectives:

- 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. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.

Reference Books:

1. Garg Satya Prakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

Course Title: Design Concept of Building Services
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	15CV743	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. learn the importance of sanitation, domestic water supply, plumbing and fire services
2. Understand the concepts of heat, ventilation and air conditioning
3. Develop technical and practical knowledge in Building Services.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Water Supply, Drainage and Solid Waste Disposal: Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods	8 hours	L1,L2
Module -2		
Heat Ventilation and Air Conditioning (HVAC): Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.	8 Hours	L1,L2
Module -3		
Electrical and Fire Fighting Services: Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice , planning electrical wiring for building, Main and distribution boards, Principles of illumination, Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Provisions of NBC.	8 Hours	L1,L2,L3
Module -4		
Plumbing and Fire Fighting Layout of Simple Buildings: Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.	8 Hours	L2,L3

Module -5		
Engineering Services: engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems. Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators, **Building Maintenance**: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.	8 Hours	L1,L2,L3

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

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

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

Course Title: Structural Dynamics

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	15CV744	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 behaviour of structure especially building to various dynamic loads: such as wind, earthquake, machine vibration and ambient vibration
2. Basic understanding of structural analysis and knowledge of engineering mathematics.
3. Understand response of a single degree of freedom system to dynamic excitation and Vibration Control Techniques.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction: Introduction to structural dynamics, brief history of vibration, Basic definitions, vibration of SDOF (Single Degree of Freedom) systems, undamped, Damped, Free vibrations, equivalent viscous damping, Logarithmic decrement	08 hours	L1,L2
Module -2		
Forced vibrations of SDOF system, Response of undamped and damped system subjected to harmonic loading, response to SDOF subject to harmonic base excitation, Duhamel's integral, response to general system of loading, dynamic load factor, response spectrum.	08 Hours	L1,L2,L3
Module -3		
Free vibration of MDOF (Multi Degree Freedom System), Natural frequencies, Normal modes, Orthogonality of normal modes, Eigen Values Shear buildings modeled as MDOF systems. Free vibrations, Natural frequencies,	08 Hours	L1,L2,L3
Module -4		
Forced vibrations, Motion of shear buildings, Model Superposition Method, Response to shear buildings, Base motion, Harmonic fixed excitation. Damped motion of shear buildings, Equations for damped shear buildings, uncoupled damped equations, Conditions for damping uncoupled.	08 Hours	L1,L2,L3
Module -5		
Dynamic analysis of base stuffiness matrices, Lumped mass and consistent mass formulation, Equations of motion.	08 Hours	L1,L2,L3

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

1. Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.
2. Basic understanding of fundamental analysis methods for dynamic systems
   Interpret dynamic analysis results for design, analysis and research purposes
3. Apply structural dynamics theory to earthquake analysis, response, and design 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. Anil K Chopra, **"Structural Dynamics"**, PHI Publications
2. Mukobadhyay, **"Vibrations, Structural Dynamics",** Oxford IBH Publications
3. Vinod Husur, **"Earth Quake resistant design of building structures**", WILE EASTERN India Publications

Reference Books:

1. V K Mac Subramanian, "Elementary structural dynamics", Danpatra Publications
2. Mario Poz, "Structural Dynamics", CBS publications.
3. Manik A Selvam, "Structural Dynamics", Danpatra publications

Course Title: Urban Transportation and Planning
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	15CV751	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –04		**Total Marks- 100**	

Course Objectives: This course will enable students to;

1. Understand and apply basic concepts and methods of urban transportation planning.
2. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
3. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
4. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Urban transport planning: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.	08 hours	L1,L2,L3
Module -2		
Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.	08 Hours	L1,L2,l3
Module -3		
Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above**	08 Hours	L3,L4
Module -4		
Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above**	08 Hours	L2,L3,L4,L5
Module -5		
Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Introduction to land use planning models, land use and transportation interaction.	08 Hours	L2,L3,L4,L5

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

1. Design, conduct and administer surveys to provide the data required for transportation planning.
2. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
3. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
4. Adopt the steps that are necessary to complete a long-term transportation plan.

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

Reference Books:

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

Course Title: Prefabricated Structures
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	15CV752	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 modular construction, industrialised construction
2. Design prefabricated elements
3. Understand construction methods.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
INTRODUCTION Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.	08 hours	L1,L2
Module -2		
PREFABRICATED COMPONENTS Behaviour of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels –Columns–Shear walls	08 Hours	L1,L2
Module -3		
DESIGN PRINCIPLES Disuniting of structures-Design of cross section based on efficiency of material used–Problems in design because of joint flexibility –Allowance for joint deformation.	08 Hours	L2,L3
Module -4		
JOINT IN STRUCTURAL MEMBERS Joints for different structural connections–Dimensions and detailing–Design of expansion joints	08 Hours	L1,L2,L3
Module -5		
DESIGN FOR ABNORMAL LOADS Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,-Importance of avoidance of progressive collapse.	10 Hours	L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Use modular construction, industrialised construction
2. Design prefabricated elements
3. Design some of the prefabricated elements
4. Use the knowledge of the construction methods and prefabricated elements in buildings

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. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994

Reference Books:

1. Koncz T.,"Manual of precast concrete construction", Vol.I, II and III, Bauverlag, GMBH,1976.
2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009

Course Title: Rehabilitation and Retrofitting of Structures
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	15CV753	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. Investigate the cause of deterioration of concrete structures.
2. Strategise different repair and rehabilitation of structures.
3. Evaluate the performance of the materials for repair

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.	08 hours	L1,L2
Module -2		
Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems	08 Hours	L1,L2
Module -3		
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.	08 Hours	L1,L2,L3
Module -4		
Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building	08 Hours	L1,L2,L3
Module -5		
Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, 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	08 Hours	L1,L2,L3

Course outcomes: After studying this course, students will be able to:
1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different type of structures
3. Summarize the principles of repair and rehabilitation of structures
4. Recognize ideal material for different repair and retrofitting technique

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. 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.

Reference Books:

3. R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”-Blakie and Sons
   Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL).

Course Title: Reinforced Earth Structures

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	15CV754	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. Create an understanding of the latest technique such as reinforcing the soil;
2. Analyze the concept of RE so as to ascertain stability of RE structures;
3. Understand the different reinforcing materials that can be used efficiently in soils.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil. **Geosynthetics and Their Functions:** Historical developments, Recent developments, manufacturing processwoven &non-woven, Raw materials – Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics **Properties and Tests on Materials** Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties	08 hours	L1,L2,L3
Module -2		
Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems **Soil Nailing Techniques:** Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken	08 Hours	L1,L2,L3,L4
Module -3		
Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.	08 Hours	L2,L3,L4
Module -4		
Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes	08 Hours	L2,L3,L4
Module -5		
GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS: Filter & Drain – Conventional granular filter design criteria, Geosyntheticfilter design requirements, Drain and filter properties, Design criteria – soilretention, Geosynthetic permeability, anticlogging, survivability and durability (No Numerical Problems) Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems)	08 Hours	L2,L3,L4

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

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

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

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

Reference Books:

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

Course Title: Environmental Engineering Laboratory
As per Choice Based Credit System (CBCS) scheme
SEMESTER:VII

Subject Code	15CVL76	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,
1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

Experiments	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
1. Determination of pH, Acidity and Alkalinity	02 Class	L1,L2,L3
2. Determination of Calcium, Magnesium and Total Hardness.	02 Class	L1,L2,L3
3. Determination of Dissolved Oxygen. 4. Determination of BOD.	02 Class	L1,L2,L3
5. Determination of Chlorides	01 Class	L1,L2,L3
6. Determination of percentage of available chlorine in bleaching powder, Determination of Residual Chlorine	01 Class	L1,L2,L3
7. Determination of Solids in Sewage: I) Total Solids, II) Suspended Solids, III) Dissolved Solids, IV) Volatile Solids, Fixed Solids, V) Settle able Solids. 8. Determination of Turbidity by Nephelometer 9. Determination of Optimum Dosage of Alum using Jar test apparatus.	02 Class	L1,L2,L3
10. Determination of sodium and potassium using flame photometer.	01 Class	L1,L2,L3
11. Determination Nitrates by spectrophotometer. 12. Determination of Iron & Manganese.	01 Class	L1,L2,L3
13. Determination of COD.	Demonstration	L1,L2,L3
14. Air Quality Monitoring (Ambient, stack monitoring , Indoor air pollution)	Demonstration	L1,L2,L3
15. Determination of Sound by Sound level meter at different location	Demonstration	L1,L2,L3

Course Outcomes: After studying this course, students will be able to:
1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.
3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

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

Question paper pattern:
- Two experiments shall be asked from the above set
- One experiment to be conducted and for the other student should write detailed procedure.

Reference Books:

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

Course Title: Computer Aided Detailing of Structures
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	15CVL77	IA Marks	20
Number of Lecture Hours/Week	03 (1I+2D)	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. Be aware of the Scale Factors, Sections of drawings,
2. Draft the detailing of RC and Steel Structural member.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 Detailing of RCC Structures		
1. Beams – Simply supported, Cantilever and Continuous. 2. Slab – One way, Two way and One-way continuous. 3. Staircase – Doglegged 4. Cantilever Retaining wall 5. Counter Fort Retaining wall 6. Circular Water Tank, Rectangular Water Tank.	20 hours	L1,L2,L3
Module -2 Detailing of Steel Structures		
1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections. 2. Built-up Columns with lacings and battens 3. Column bases and Gusseted bases with bolted and welded connections. 4. Roof Truss – Welded and Bolted 5. Beams with Bolted and Welded 6. Gantry Girder	20 Hours	L1,L2,L3

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

- Prepare detailed working drawings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

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

Text Books:

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

Reference Books:

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