

CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - IV			
CONCRETE TECHNOLOGY			
Course Code	18CV44	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives: This course will enable students to:			
<ol style="list-style-type: none"> 1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete 2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete. 3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures. 			
Module-1			
Concrete Ingredients Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice huskash.			
Module-2			
Fresh Concrete Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.			
Module-3			
Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.			
Module-4			
Concrete Mix Proportioning Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.			
Module-5			
Special Concretes RMC- manufacture and requirement as per QCI-RMPCPS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High Performance Concrete.			
Course outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Relate material characteristics and their influence on microstructure of concrete. 2. Distinguish concrete behavior based on its fresh and hardened properties. 3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes. 4. Adopt suitable concreting methods to place the concrete based on requirement. 5. Select a suitable type of concrete based on specific application. 			

Question paper pattern:

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

Textbooks:

1. Neville A.M. "Properties of Concrete"-4th Ed., Longman.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
4. A.R. Santha Kumar, "Concrete Technology", Oxford University Press, New Delhi (NewEdition).

Reference Books:

1. M L Gambir, "Concrete Technology", McGraw Hill Education,2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, "Concrete Technology", CENGAGE Learning,2015.
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - V			
DESIGN OF RC STRUCTURAL ELEMENTS			
Course Code	18CV53	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives: This course will enable students to			
<ol style="list-style-type: none"> 1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading. 2. Follow a procedural knowledge in designing various structural RC elements. 3. Impart the usage of codes for strength, serviceability and durability. 4. Provide knowledge in analysis and design of RC elements. 			
Module-1			
<p>Introduction to working stress and limit State Design: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method.</p> <p>Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.</p> <p>Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.</p>			
Module-2			
<p>Limit State Analysis of Beams: Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.</p>			
Module-3			
<p>Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.</p>			
Module-4			
<p>Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.</p>			
Module-5			
<p>Limit State Design of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.</p>			
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Understand the design philosophy and principles. 2. Solve engineering problems of RC elements subjected to flexure, shear and torsion. 3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings. 4. Owns professional and ethical responsibility. 			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. • Each full question will have sub- question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 			
<ul style="list-style-type: none"> • The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper. 			
Textbooks:			
<ol style="list-style-type: none"> 1. Unnikrishnan Pillai and Devdas Menon, “ Reinforced Concrete Design” , McGraw Hill, New Delhi 2. Subramanian, “ Design of Concrete Structures” , Oxford university Press 3. H J Shah, “Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)” , Charotar Publishing House Pvt. Ltd. 			
Reference Books:			

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

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - V			
MUNICIPAL WASTEWATER ENGINEERING			
Course Code	18CV55	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p>Course Learning Objectives: This course will enable students to;</p> <ol style="list-style-type: none"> 1. Understand the various water demands and population forecasting methods. 2. Understand and design different unit operations and unit process involved in wastewater treatment process 3. Understand the concept and design of various physicochemical treatment units 4. Understand the concept and design of various biological treatment units 5. Understand the concept of various advanced waste water and low cost treatment processes for rural areas. 			
Module-1			
<p>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 water flow, time of concentration flow, numericals.</p> <p>Sewer appurtenances: Manholes, catch basins, oil and grease traps. P, Q and S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers basic principles of house drainage.</p>			
Module-2			
<p>Design of sewers: Hydraulic formula to determine velocity and discharge. Self cleansing and non scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.</p> <p>Waste water characteristics: sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water</p> <p>Treatment unit operations and process. Estimation of BOD. Reaction kinetics (zero order, 1st order and 2nd order).</p>			
Module-3			
<p>Treatment of municipal waste water: Screens: types, disposal. Grit chamber, oil and grease removal. primary and secondary settling tanks.</p> <p>Disposal of effluents: Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps equation.</p>			
Module-4			
<p>Biological Treatment Process: Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors. Principle of stabilization ponds, oxidation ditch, Sludge digesters(aerobic and anaerobic), Equalization., thickeners and drying beds.</p>			
Module-5			
<p>Advanced Wastewater Treatment: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advance oxidation processes (AOPs), Electro coagulation.</p> <p>Rural sanitation: Low cost treatment process: Working principal and design of septic tanks for small community in rural and urban areas, two-pit latrines, eco-toilet and soak pits.</p>			
<p>Course outcomes: After studying this course, the students will be able to:</p> <ol style="list-style-type: none"> 1. Select the appropriate sewer appurtenances and materials in sewer network. 2. Design the sewers network and understand the self purification process in flowing water. 3. Design the various physico-chemical treatment units 4. Design the various biological treatment units 5. Design various AOPs and low cost treatment units. 			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub-questions) from each module. • Each full question will have sub-question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 			
Textbooks			

1. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2. B C Punmia, "Environmental Engineering vol-II", Laxmi Publications 2nd, 2016
3. Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3rd Edition, 2017
4. S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017

Reference Books

1. CPHEEO manual on sewage treatment, Ministry of Urban Development, Government of India, New Delhi, 1999
2. Mark.J Hammer, "Water & Waste Water Technology" John Wiley & Sons Inc., New York, 2008
3. Benefield R.D., and Randal C.W, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey 2012
4. Metcalf and Eddy Inc, "Wastewater Engineering - Treatment and Reuse", Publishing Co. Ltd., New Delhi, 4th Edition, 2009.

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
DESIGN OF STEEL STRUCTURAL ELEMENTS			
Course Code	18CV61	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives: This course will enable students to			
<ol style="list-style-type: none"> 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. 			
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 Behavior 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.			
Module -2			
Bolted Connections: Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) and bracket connections.			
Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.			
Module -3			
Design of Compression Members: Introduction, Failure modes, Behavior 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.			
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.			
Module -5			
Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior 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].			
Course Outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Possess 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. 			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. 			

- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. 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”, Scientific International Pvt. Ltd.
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.

B. E. CIVIL ENGINEERING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
DESIGN OF RCC AND STEEL STRUCTURES			
Course Code	18CV72	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives: This course will enable students to			
<ol style="list-style-type: none"> 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. 			
Module -1			
<p>Footings: Design of rectangular slab, slab-beam 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.</p>			
Module -2			
<p>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.</p>			
Course Outcomes: After studying this course, students will be able to:			
<ol style="list-style-type: none"> 1. Students will acquire the basic knowledge in design of RCC and Steel Structures. 2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members. 			
Question Paper Pattern:			
<ul style="list-style-type: none"> • 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 50 marks. • Code books – IS 456, IS 800, IS 3370 (Part IV), SP-16, SP (6) – Steel Tables, shall be referred for designing. The same will be provided during examination. 			
Textbooks:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 1. Charles E Salman, Johnson & Mathas, “Steel Structure Design and Behavior”, Pearson Publications 2. Nether Cot, et.al, “Behavior 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 			