Course Outcomes

Year/Sem: II-I

Course Name: Probability And Statistics (C.Code:211)

C211.1: Understand the concepts of sample space, events, and methods of counting outcomes. Apply probability rules, conditional probability, independence, and Bayes' theorem to solve practical problems

C211.2: Compute mean, variance, and covariance of random variables. Analyze discrete probability distributions like Binomial and Poisson for modeling real-life scenarios.

C211.3: Understand and apply continuous distributions such as Uniform and Normal, including areas under the curve. Apply sampling concepts, central limit theorem, and sampling distributions for statistical inference.

C211.4: Perform point and interval estimation for population parameters. Conduct hypothesis testing for means, proportions, and variances using classical statistical methods.

C211.5: Apply statistical tools such as curve fitting (least squares method)**,**correlation **and** regression analysis to model relationships between variables and interpret their strength and form.

Course Name: Building Materials, Construction and Planning (C.Code:212)

C212.1: Identify and classify various building materials such as stones, bricks, timber, and modern materials based on their properties and applications.

C212.2: Explain the manufacturing processes and functional roles of cement, admixtures, and mortars in construction..

C212.3: Analyze different structural components of buildings and interpret their functions in relation to building services like ventilation, plumbing, and fire safety.

C212.4: Demonstrate knowledge of construction techniques such as masonry, formwork, scaffolding, and finishing practices used in civil engineering.

C212.5: Understand and apply the principles of functional and sustainable building planning by considering site selection, building orientation, bye-laws, and green building concepts for efficient and environment-friendly design.

Course Name: Engineering Geology (C.Code:213)

C213.1: Understand the significance of geology in civil engineering, including the impact of geological conditions on site selection, construction failures, and major structures like dams, tunnels, and reservoirs.

C213.2: Identify and classify common rock-forming and economic minerals using physical properties, and explain the geological classification, texture, and structure of igneous, sedimentary, and metamorphic rocks.

C213.3: Interpret structural geological features such as folds, faults, joints, and unconformities, and assess their influence on civil engineering projects, including the role of soil types and groundwater conditions in construction and stabilization.

C213.4: Identify the earthquake prone or seismic region, landslides etc by interpreting the results of geophysical method and geological formations.

C213.5: Evaluate geological considerations in the planning and construction of dams, reservoirs, and tunnels, including site selection, structural integrity, water tightness, and the effects of tunnelling on surrounding rock and groundwater.

Course Name: Strength Of Materials – I (C.Code:214)

C214.1: Characterizing the elastic properties of mild steel and its behaviour in plastic state is studied.

C214.2: Analyse shear force and bending moment diagrams for various types of beams (cantilever, simply supported, overhanging) subjected to point loads, uniformly distributed loads (UDL), and other combinations of forces.

C214.3: Apply the theory of bending to determine the flexural stresses in different beam sections (rectangular, circular, I, T, angle, channel).

C214.4: Analyse the deflection and slope of beams subjected to different load types using methods such as double integration, Macaulay's method, and Mohr's theorems.

C214.5: Understand and analyse the concept of principle stresses and stresses on oblique plane under different loading conditions, including compound and biaxial stresses .

Course Name: Fluid Mechanics (C.Code:215)

C215.1: Understand the basic properties of fluids and the principles of fluid statics, including pressure measurement, hydrostatic forces, buoyancy, and stability of submerged and floating bodies.

C215.2: Analyze different types of fluid flow patterns and kinematics, and apply fundamental equations like Euler's and Bernoulli's equations to study ideal and real fluid behavior in motion.

C251.3: Apply the Bernoulli's and Momentum equations to measure flow parameters using venturimeters, orifice meters, pitot tubes, and analyze flow over notches and weirs**.**

C215.4: Evaluate flow through pipes by applying the Darcy-Weisbach equation and analyze pipe networks, including power transmission, siphons, branching, and water hammer effects using the Hardy Cross method**.**

C215.5: Understand the concepts **of** laminar and turbulent flow, and perform boundary layer analysis to evaluate thickness parameters, drag and lift forces, and flow separation and control mechanisms.

Course Name: Surveying Laboratory - II (C.Code:216)

C216.1: Measure horizontal and vertical angles accurately and determine distances between inaccessible points using theodolite and trigonometric surveying techniques.

C216.2: Conduct area measurement and traverse surveys efficiently using theodolite and Total Station methods.

C216.3: Determine tachometer constants and apply tachometric surveying principles for rapid distance and elevation calculations.

C216.4: Perform longitudinal and cross-section profiling, contouring, and curve layout for effective terrain and alignment analysis.

C216.5: Utilize advanced surveying tools such as Total Station and DGPS for precise stakeout, remote elevation measurement, and demonstration of modern surveying technology.

Course Name: Strength Of Materials Laboratory (C.Code:217)

C217.1: Perform and interpret results from tension, compression, bending, torsion, and shear tests on different materials to determine their mechanical properties such as strength, ductility, stiffness, and toughness.

C217.2: Evaluate the hardness and impact resistance of materials using standard testing procedures to understand material behavior under sudden or localized loads.

C217.3: Analyze the behavior of springs and structural members under static and dynamic loading conditions to determine stiffness and energy absorption characteristics.

C217.4: Apply strain measurement techniques using electrical resistance strain gauges and verify classical theories like Maxwell's Reciprocal Theorem through experimental validation.

C217.5: Determine deflection and deformation in cantilever, simply supported, and continuous beams under various loading conditions to assess structural performance and validate theoretical predictions.

Course Name: Computer Aided Civil Engineering Drawing (C.Code:218)

C218.1: Understand the fundamentals of computer-aided drafting and apply different coordinate systems for creating 2D drawings.

C218.2: Develop 2D drawings of regular shapes and building components using both command-line (Editor mode) and GUI-based tools.

C218.3: Use various drawing and modification tools effectively to create and edit technical drawings with layers, dimensions, and annotations.

C218.4: Create detailed plans of residential buildings, including floor plans, elevations, and sections using appropriate CAD standards.

C218.5: Demonstrate the ability to convert 2D plans into 3D models and apply AutoCAD skills in interdisciplinary fields like surveying and mechanical drafting.

Course Name: Constitution Of India (C.Code:219)

C219.1: Understand the history, making, and role of the Drafting Committee in framing the Indian Constitution.

C219.2: Comprehend the philosophy, preamble, and salient features of the Indian Constitution.

C219.3: Analyze the fundamental rights, duties, and directive principles, and their significance in ensuring justice, liberty, equality, and democracy.

C219.4: Understand the composition, powers, functions, and roles of Parliament, Executive, President, Governor, Council of Ministers, and Judiciary in India.

C219.5: Examine the structure, roles, and functioning of local administration (municipalities and panchayats) and the Election Commission, including welfare bodies for SC/ST/OBC and women.

Course Name: Constitution Of India (C.Code:2110)

C2110.1: Understand the meaning and principles of constitutional law and constitutionalism**,** and examine the historical background and salient features of the Indian Constitution.

C2110.2: Explain the scheme and significance of Fundamental Rights, Fundamental Duties, and the Directive Principles of State Policy in the Indian constitutional framework.

C2110.3: Analyze the federal structure of India, including the distribution of powers between the Union and States, and understand the role of the President in a parliamentary form of government.

C2110.4: Understand the constitutional amendment process and evaluate the historical development and importance of constitutional amendments**,** especially in the context of democratic governance.

C2110.5: Interpret key provisions related to emergencies, local self-governments**,** and core fundamental rights under Articles 14, 19, and 21, including the Right to Equality, Freedom, and Personal Liberty**..**

Year&Sem: II/II

Course Name: Basic Electrical And Electronics Engineering   (C.Code:221)

C221.1: To analyze and solve AC and DC electrical circuits using network laws and theorems

C221.2: To introduce components of Low Voltage Electrical Installations

C221.3: To study the working principles of Electrical Machines and analyze magnetic circuits

C221.4: Identify and characterize diodes and various types of rectifiers and filters

C221.5: Identify and characterize various types of transistors.

Course Name: Concrete Technology (C.Code:222)

C222.1: Understand the properties, grading, and quality of aggregates including conventional, manufactured, and recycled materials, and their impact on concrete performance.

C222.2: Analyze the workability and fresh properties of concrete, including mixing, vibration, setting times, and the effects of environmental and material factors.

C222.3: Evaluate the strength characteristics of hardened concrete through compression, tension, flexure, and non-destructive testing, and understand factors affecting concrete strength and curing.

C222.4: Apply concepts of elasticity, creep, and shrinkage to predict long-term behavior and deformation of concrete structures.

C222.5: Select suitable admixtures and design concrete mixes for desired durability, quality, and performance, including special concretes like lightweight, high-performance, and fiber-reinforced concretes.

Course Name: Strength Of Materials – II   (C.Code:223)
C223.1: Understanding the concepts and principles of theory of torsion and springs subjected to direct loading.
C223.2: Analyzing the behaviour of long and short columns subjected to various end conditions.
C223.3: Analyze strength and stability of structural members subjected to Direct and bending stresses.
C223.4: Determining the behaviour of thin cylinders and thick cylinder.
C223.5: Illustrate the un-symmetrical bending and shear centre for various channel sections.

Course Name: Hydraulics And Hydraulic Machinery (C.Code:224)
C224.1: Explain the fundamentals of open channel flow, including uniform ,non-uniform, and critical flow concepts, and analyze problem using appropriate formulas..
C224.2: Analyze the characteristic of gradually varied and rapidly varied flows such as hydraulic jumps and surges, and apply suitable method for computing water surface profiles.

C224.3: Apply the principles of dimensional analysis and hydraulic similitude to design and interpret models, and evaluate performance parameters in fluid flow problem.

C224.4: Illustrate the working principles, velocity diagrams, efficiency and selection criteria hydraulics turbines and pumps and evaluate their performance characteristic.

C224.5: Integrate the knowledge of hydraulic machines and hydro-power principles to select appropriate machinery for civil engineering applications.

Course Name: – Structural Analysis – I (C.Code:225)

C225.1: Analyze determinate pin-jointed plane frames using method of joints, sections and tension coefficient method to determine tension force under various loading conditions.

C225.2: Compute deflection of beam and pin jointed frame using strain-energy methods and interpret results or serviceability.

C225.3: Analyze propped cantilever and fixed beams subjected to various types of loads by determining statics and kinematics indeterminacy.

C225.4: Solve statically indeterminate beams (propped cantilevers, fixed and contentious beams) using three moment and slope deflection methods, including effects of variable EI, support settlement and rotation.

C225.5: Construct influence line diagram for beams and truss members and determine critical positions of moving loads to obtain maximum shear force and bending moment.

Course Name: Hydraulics and Hydraulic Machinery Lab (C.Code:226)

C226.1: Using principles of Continuity energy and momentum for various flow measuring devices are designed and calibrated.

C226.2: Using Darcy Weishbach equation for friction factors of various pipes are estimated.

C226.3: The rate of flow in open channels is estimated with the help of notches, Weirs and Venturi flue.

C226.4: Demonstrate the experiments on various hydraulic turbines and evaluate their performances under various conditions.

C226.5: Demonstrate the experiments on various hydraulic pumps and evaluate their performances under various conditions.

Course Name: Basic Electrical And Electronics Engineering Laboratory(C.Code:227)

C227.1: To analyze and solve AC and DC electrical circuits using network laws and theorems.

C227.2: To introduce components of Low Voltage Electrical Installations.

C227.3: To study the working principles of Electrical Machines and analyze magnetic circuits

C227.4: Identify and characterize diodes and various types of rectifiers and filters.

C227.5: Identify and characterize various types of transistors.

Course Name: CONCRETE TECHNOLOGY LAB (C.Code:228)

C228.1: Evaluate the quality of cement through soundness and compressive strength tests to ensure suitability for concrete production.

C228.2: Determine specific gravity, bulking, and grading of fine and coarse aggregates to assess their suitability and influence on concrete properties.

C228.3: Apply IS 10262 method for mix design of normal concrete, considering factors like workability, strength, and durability for practical construction applications.

C228.4: Assess workability and consistency of fresh concrete using slump cone, compacting factor, and Vee-Bee consistometer tests to ensure proper placement and compaction.

C228.5: Determine compressive and tensile strength, modulus of elasticity, and perform non-destructive testing to evaluate the structural performance and durability of hardened concrete.

Year&Sem: III/I

Course Name: Structural Analysis - II (C.Code:311)

C311.1: Analyze two-hinged arches and indeterminate beams/frames using moment distribution method.

C311.2: Apply Kani's method for the analysis of continuous beam and portal frames with and without side sway, and analyze cables and suspension brides under point and uniformly distributed loads.

C311.3: Use approximate analysis method such as the portal method, cantilever method, factor method, substitute frame methods or evaluating multi-storey frames under lateral and gravity loads.

C311.4: Formulate and solve structural problems using matrix method (flexibility and Stiffness approaches) for continuous beams.

C311.5: Construct influence line diagram for indeterminate beams and propped cantilevers

to determine maximum shear forces and bending moment due to moving loads.

Course Name: Geotechnical Engineering (C.Code:312)

C312.1: Understand and classify soils based on their physical and index properties using laboratory and filed test, and apply soil classifications systems for engineering purposes.

C312.2: Analyze soil permeability and seepage characteristics using Darcy's law flow-net concepts and effective stress principles to predicts groundwater behavior in soil structures..

C312.3: Evaluate stress distribution within soil masses using Business and westergaard's theories, apply New mark's chart for estimating verticals stresses and understand soil compaction behavior for field applications.

C312.4: Determine consolidation parameters and estimate primary and secondary Settlement of clay soil using Terzaghi's theory and laboratory test results.

C312.5: Assess the shear strength of soils under different drainage conditions using Laboratory testing methods and failure theories to analyze the stability of soil structures

Course Name: Structural Engineering -I (RCC) (C.Code:313)

C313.1: Recall the fundamental concepts of limit state design and code provisions for design of concrete members, Design and detail beams

C313.2: Analyze reinforced concrete sections to determine the ultimate capacity in bending, shear and compression

C313.3: Analyze and design various types of slabs (One-way, Two-way, and Continuous Slabs).

C313.4: Design and detail columns using IS code and SP 16 design charts

C313.5: Design and detailing of footings.

Course Name: Business Economics And Financial Analysis (C.Code:314)

C314.1 : The various Forms of Business and the impact of economic variables on the Business.

C314.2 : Identify the role of Demand and supply analysis.

C314.3 : Understand the varies, Cost, Market Structure, Pricing aspects are learnt.

C314.4 : The firm's financial position by analyzing the Financial Statements of a Company.

C314.5 : To analyse the financial statements of a company through Ratio's.

Course Name: – Transportation Engineering (C.Code:315)

C315.1: Understand the importance of transportation system, highway planning, alignment, and preparation of project reports for effective road networks development.

C315.2: Apply principles of geometries design to determine sight distance, curves, gradients, and other highway components according to IRC Standards.

C315.3: Analyze traffic characteristic and design traffic control measures including signals intersection, parking facilities and evaluate roadway safety.

C315.4: Evaluate the engineering properties of highway materials such as soil, aggregate, and bitumen and perform tests for quality control in pavement construction.

C315.5: Design flexible and rigid pavement us standard method and assess the suitability of different pavement types for various traffic and soil conditions.

Course Name: Hydrology And Water Resources Engineering (C.Code:316)

C316.1: Explain the hydrologic cycle and analyze precipitation data using various methods for hydrologic design and water resource assessment.

C316.2: Evaluate abstractions from precipitation such as evaporation, infiltration, and runoff using empirical and analytical methods, and apply them to estimate basin yield and flow characteristics.

C316.3: Construct and interpret hydrographs, unit hydrographs, and perform flood hydrograph analysis for hydrologic modelling and prediction.

C316.4: Analyze groundwater flow using Darcy's Law, evaluate aquifer properties, and **assess** crop water requirements based on soil-water-plant relationships for sustainable irrigation planning.

C316.5: Design canal systems and irrigation channels using Kennedy's and Lacey's theories, evaluate canal losses and outlet types, and propose appropriate measures to control water logging and enhance irrigation efficiency through canal lining.

Course Name: TRANSPORTATION ENGINEERING LABORATORY (C.Code:317)

C317.1: Perform and analyze aggregate tests (Impact, Crushing, Los Angeles Abrasion, and Shape tests) to assess their suitability for road construction.

C317.2: Determine important bitumen characteristics such as penetration, softening point, ductility, viscosity, and temperature susceptibility (flash & fire points).

C317.3: Gain practical knowledge of preparing and testing Marshall Stability specimens to evaluate the strength and stability of bituminous mixes.

C317.4: Carry out field traffic studies like volume counts, speed measurements (spot and moving car method), and parking surveys to assess road usage and performance.

C317.5: Interpret data from geometric design and road safety audits to suggest improvements for efficient and safe traffic flow.

Course Name: Geotechnical Engineering Laboratory (C.Code:318)

C318.1: Student will be able to Classify and evaluate the behavior of the soils subjected to various loads.

C318.2: Able to perform the soil tests for classification and understand the basic soil behavior.

C318.3: Understand the strength testing procedure using Direct shear test.

C318.4: Calculate the consolidation coefficient with time method .

C318.5: Perform compaction test to understand the relation between density and OMC.

Year&Sem: III/II

Course Name: Environmental Engineering (C.Code:321)

C321.1: Explain the causes and control of waterborne diseases, analyze water demand, population forecasts, and evaluate various water sources and intake structures for protected water supply systems.

C321.2: Design and analyze the components of water treatment plants including sedimentation, coagulation, filtration, and disinfection units, and develop layouts for water distribution systems with appropriate pipe appurtenances

C321.3: Describe sewage characteristics and design sewer systems and appurtenances, including house drainage, and evaluate wastewater and storm-water collection and disposal methods.

C321.4: Develop flow diagrams and design units of wastewater treatment plants including

biological treatment systems, sludge handling, septic tanks, and oxidation ponds.

C321.5: Identify sources and types of air pollutants, **assess** their effects and behaviour in the atmosphere, and apply control technologies for particulate and gaseous emissions\ including automobile pollution.

Course Name: Foundation Engineering (C.Code:322)

C322.1: Explain the need for soil exploration and conduct field tests such as boring, sampling, penetration tests, and prepare soil investigation reports with bore logs.

C322.2: Analyze the stability of infinite and finite earth slopes using various methods such as Swedish slip circle, Bishop's method, and Taylor's Stability Number under different slope conditions.

C322.3: Apply earth pressure theories (Rankine's and Coulomb's) to determine active, passive, and at-rest pressures, and evaluate the stability of different types of retaining walls.

C322.4: Determine the bearing capacity and settlement of shallow foundations using Terzaghi's and IS code methods, SPT, and plate load tests, and select suitable foundation types and depths.

C322.5: Calculate the load-carrying capacity of single and group piles using static, dynamic, and empirical methods, and analyze settlement and negative skin friction effects on pile foundations.

Course Name: Structural Engineering –II (Steel Structures) (C.Code:323)

C323.1: Explain the mechanical properties of structural steel and the principles of Limit State Design, and analyze the behaviour of steel members under various loading conditions, including local buckling and serviceability requirements. Design bolted and welded connections, including eccentric, beam-column, and framed connections, considering strength, prying action, and joint efficiency.

C323.2: Design tension and compression members, including built-up members, laced and battened columns, splices, and base connections, considering buckling and slenderness effects.

C323.3: Apply plastic analysis techniques to continuous beams and design laterally supported and unsupported beams, including built-up sections and beam splices, based on strength and buckling considerations.

C323.4: Design welded plate girders by considering economic depth, main section

design, stiffeners, splices and connections between web and flange as per codal provisions.

C323.5: Design industrial structures such as roof trusses and gantry girders, including all structural components like stiffeners, splices, purling, and wind load considerations.

Course Name: Smart Cities Planning And Management (PE-1)(C.Code:324)

C324.1: Understand the concept, dimensions, and global as well as Indian perspectives of smart cities, including national policies like the "100 Smart Cities Mission."

C324.2: Explain the planning and development aspects of smart communities integrating technologies such as IoT, AI, blockchain, and smart governance for sustainable urban living.

C324.3: Analyze smart urban energy systems by comparing conventional and green energy approaches, assessing energy demand, and applying solar-based smart communication solutions.

C324.4: Evaluate photovoltaic (PV) technologies, smart grids, and related energy efficiency policies for sustainable power management in smart cities.

C324.5: Explore smart urban transportation systems involving intelligent transport technologies, autonomous vehicles, ride-sharing, and smart roadway infrastructure.

Course Name: DATA STRUCTURES (C.Code:325)

C325.1 Ability to select the data structures that efficiently model the information in a problem

C325.2 Ability to assess efficiency trade-offs among different data structure implementations or combinations.

C325.3 Implement and know the application of algorithms for sorting and pattern matching.

C325.4 Design programs using a variety of data structures, including hash tables

C325.5   Binary and generaltree structures, search trees, tries, heaps, graphs, and AVL-trees.

Course Name: Environmental Engineering Lab (C.Code:326)

C326.1: Determine fundamental physical and chemical parameters of water such as pH, electrical conductivity, total solids, acidity, and alkalinity using standard laboratory procedures.

C326.2: Analyze water hardness, chloride content, and residual chlorine to assess water suitability for domestic and industrial purposes..

C326.3: Conduct experiments to determine optimum coagulant dosage for water treatment and **evaluate** the effectiveness of coagulation and flocculation

C326.4: Estimate critical water quality indicators like BOD, COD, and Dissolved Oxygen (DO) using appropriate biochemical and chemical methods.

C326.5: Measure environmental pollution indicators such as microbial load (total count) and noise levels, and interpret the results for environmental health assessment..

Course Name: Computer Aided Design Laboratory (C.Code:327)

C327.1: Perform analysis and design of determinate and indeterminate structures including fixed and continuous beams using structural analysis software.

C327.2: Analyze and design plane frames and space frames subjected to various load combinations (dead, live, wind, earthquake) using appropriate software tools.

C327.3: Develop and apply spreadsheet-based programs for foundation design calculations to enhance automation and accuracy.

C327.4: Design and detail steel structural elements such as built-up beams and compression members, ensuring compliance with relevant codes.

C327.5: Prepare detailed drawings and reinforcement layouts for RCC beams, Slabs column and footing ,integrating structural design and detailing for construction.

Course Name: Advanced English Communication Skills Laboratory (C.Code:328)

C328.1: Enable the development in sharing information about family and friends.

C328.2: Strengthen general comprehending skills and present lucid skills in free reading..

C328.3: Develop flair for any kind of writing with rich vocabulary and proper syntax..

C328.4: Proficiency in writing technical articles and presenting papers on any topic of any genre.

C328.5: Understand the basic grammar techniques and utilize it in enhancing language development.

Course Name: Environmental Science (C.Code:3210)

C3210.1: Understanding the structure, function, and energy flow of ecosystems, and explain biogeochemical cycles along with ecological concepts such as bioaccumulation and biomagnification.

C3210.2: Evaluate natural resources and evaluate the impacts of their utilization, including water, mineral, land, and energy resources, highlighting environmental concerns and sustainable use.

C3210.3: Explain the importance of biodiversity, identify threats to biodiversity, and **assess** conservation strategies including legal frameworks like the National Biodiversity Act.

C3210.4: Analyzing various types of environmental pollution and analyze control technologies for air, water, soil, noise, and solid waste pollution, along with global environmental challenges and international protocols.

C3210.5: Applying environmental policies, legislation, and environmental impact assessment (EIA) processes, and propose strategies for sustainable development and environmental management.

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Year&Sem: IV/I

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Course Name: Quantity Survey & Valuation (C.Code:411)

C411.1: Understand the principles of estimating, different types of estimates, and methods of working out quantities for building works.

C411.2: Prepare detailed and abstract estimates for single and multi-storied buildings as per standard practices.

C411.3: Develop bar bending schedules and compute material quantities for reinforced concrete works, roads, and canals.

C411.4: Perform rate analysis for various construction items and calculate overhead and contingent charges accurately.

C411.5: Explain different types of contracts, contract documents, valuation methods, and standard specifications used in building construction.

Course Name: Project Management (C.Code:412)

C412.1: Understand the fundamentals of project management, project characteristics, life cycle, and the application of project management across various sectors.

C412.2: Analyze project planning and appraisal processes through feasibility studies, risk assessment, and social cost-benefit analysis.

C412.3: Evaluate project financing and investment decisions using financial appraisal techniques such as NPV, IRR, and Payback Period.

C412.4: Apply project planning and control techniques including scheduling, network analysis, critical path method, and modern approaches like Agile and Lean management.

C412.5: Demonstrate effective organizational behaviour in project environments by understanding leadership roles, team dynamics, stakeholder engagement, and conflict management.

Course Name: PRESTRESSED CONCRETE (PE-II)(C.Code:413)

C413.1: Explain the historical development, principles, types, and advantages of prestressed concrete, and identify appropriate materials used in prestressed concrete such as high-strength steel and concrete.

C413.2: Describe and compare various prestressing systems and methods, and evaluate different types of prestress losses in pre-tensioned and post-tensioned members.

C413.3: Analyze prestressed concrete sections for flexure and shear, considering various tendon profiles, and design PSC beams and slabs as per IS code provisions.

C413.4: Analyze the transmission of prestressing forces and design reinforcement for anchorage zones in pretensioned and posttensioned members using standard code-based methods.

C413.5: Analyze stress distribution and deflection behaviour in composite prestressed beams, and evaluate short- and long-term deflections in PSC members as per IS code guidelines.

Course Name: Ground Improvement Techniques (C.Code:414)

C414.1: Applying the need and objectives of ground modification and identify problematic soils using in-situ and laboratory tests.

C414.2: Applying mechanical ground modification techniques such as shallow and deep compaction, blasting, vibro-compaction, and compaction piles, and apply appropriate methods for soil improvement.

C414.3: Analyze hydraulic modification methods including dewatering techniques, electro-osmosis, filtration, and the use of geo-synthetics for seepage control.

C414.4: Discuss physical and chemical soil modification methods, including the use of admixtures, grouting, and thermal techniques like soil freezing.

C414.5: Applying ground reinforcement techniques including soil reinforcement with strips and grids, ground anchors, rock bolting, and soil nailing, and apply them for soil stabilization.

Course Name: – Ground Water Hydrology (PE-IV) (C.Code:415)

C415.1: Understand the occurrence, movement, and distribution of groundwater by analyzing aquifer properties, flow equations, and hydro geologic principles.

C415.2: Evaluate steady-state groundwater flow conditions and determine aquifer parameters using pumping test data for confined and unconfined aquifers.

C415.3: Analyze unsteady flow towards wells and apply non-equilibrium equations to study leaky and complex aquifer systems.

C415.4: Apply surface and subsurface investigation techniques, including geophysical methods, and utilize GIS and remote sensing for groundwater exploration and artificial recharge.

C415.5: Examine the causes, impacts, and control measures of saline water intrusion and apply basin-scale groundwater management practices through case studies.

Course Name: Software Engineering (C.Code:415)

C415.1 : Ability to translate end-user requirements into system and software requirements, using e.g.UML

C415.2 : Structure the requirements in a Software Requirements Document (SRD).

C415.3 : Identify and apply appropriate software architectures and patterns to carry out high level design of a system

C415.4 : Able to critically compare alternative choices.

C415.5 : Will have experience and/or awareness of testing problems and will be able to develop a simple testing report.

Course Name: Civil Engineering Software Lab (C.Code:417)

C417.1: Apply structural analysis and design software such as **STAAD, DESIGN BUILDER, MIDAS, and ETABS** to model, analyze, and design various civil engineering structures.

C417.2: Utilize **CIVIL 3D, ISSIM, ISSUM, and MX Road** for planning, designing, and visualizing road networks and transportation infrastructure.

C417.3: Perform **geotechnical analysis** using **Plaxis and GeoStudio** for assessing soil behavior, slope stability, and foundation performance.

C417.4: Use environmental and hydraulic modeling tools like eQuest, EPA SWMM, EPZ Suite, EPANET, QGIS, and HEC-RAS for water resources management and sustainable environmental design.

C417.5: Implement project management and BIM tools such as PRIMAVERA, TEKLA, and RS & GIS for efficient planning, scheduling, and integration of civil engineering projects.

Year&Sem: IV/II

Course Name: Air Pollution (C.Code:421)

C421.1: Define air pollution, classify air pollutants and their sources, and explain the effects of air pollution along with ambient air quality standards and monitoring techniques.

C421.2: Analyze meteorological factors affecting air pollution dispersion, including atmospheric stability, plume behaviour, and apply air quality prediction models such as the Box and Gaussian models.

C421.3: Describe particulate pollutants, their properties, and explain the working principles of particulate control devices like settling chambers, cyclones, scrubbers, fabric filters, and electrostatic precipitates.

C421.4: Explain methods and equipment used for controlling gaseous pollutants through chemical, absorption, adsorption, combustion, and condensation techniques.

C421.5: Discuss sources and effects of automobile and indoor air pollution, evaluate emission control strategies, and suggest measures to improve indoor air quality.

Course Name: Airports, Railways And Waterways (C.Code:422)

C422.1: Applying the characteristics of aircraft and design various components of an airport such as runway, taxiway, and apron, including computation and correction of runway length using wind rose diagrams.

C422.2: Analyzing the components of the railway permanent way, including types of rails, sleepers, fastenings, ballast, and sub-grade, and analyze their functions in different rail systems like LRT, Metro, and MRTS.

C422.3: Apply geometric design principles to railway tracks, including super-elevation, transition curves, grade compensation, and design curves and gradients to ensure safe train movement.

C422.4: Understand the operational aspects of railway systems, including track maintenance, stations, yards, crossings, signalling, and interlocking systems.

C422.5: Analyzing the components and classification of ports and harbors, describe harbour works and port facilities, and analyze dock systems and dredging methods used in water transportation.