B.E (Civil Engineering) Program

B.E. Program Outcomes (PO's)

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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B.E – Civil Engineering Department Vision

To strive for excellence in academics, research and consultancy in the field of Civil Engineering and contribute to the sustainable development of the country by producing quality Civil Engineers with professional and ethical values.

Department Mission

1. Maintaining high academic standards to develop analytical thinking and independent judgment among the students so that they are fit for industry and higher studies.
2. Promoting skills and values among the students to prepare them as responsible global citizens who can solve complex problems.
3. Preparing the students as good individuals and team members with professional attitude, ethics, concern for environment and zeal for lifelong learning who can contribute to society.

B.E – Civil Engineering Engineering Program Educational Objectives (PEO's):

The PEOs are to facilitate the graduating students to

1. **PEO1**: Acquire basic knowledge and expertise necessary for professional practice in Civil Engineering for higher studies and research.
2. **PEO2**: Attain and practice technical skills to identify, analyze and solve complex problems and issues related to Civil Engineering.
3. **PEO3**: Possess a professional attitude as an individual or a team member to work for the betterment of the society and environment.
4. **PEO4**: Work with professional ethics as refined technocrats with a thirst for lifelong learning.

B.E – Civil Engineering Program Specific Outcomes (PSO's):

The Graduates of this program will:

- **PSO1:** Effectively apply engineering fundamentals for the development and management of eco-friendly civil engineering systems which benefit the society at large.
- **PSO2:** Develop the ability to provide solutions to complex problems in civil engineering through individual and team work with a spirit for lifelong learning
- **PSO3:** Develop the competence to plan, build and maintain sustainable infrastructural facilities like housing, water management, transportation and geotechnical services.

Department of Civil Engineering
Course Outcomes
Academic Year 2023-2024

S. No.	Year/ Sem	Name of the Course	
1	I/I	**22MTC02 - Calculus**	
		22MTC02.1	Apply the Matrix Methods to solve system of linear equations.
		22MTC02.2	Analyze the geometrical interpretation of Mean value theorems and curvature.
		22MTC02.3	Determine the extreme values of functions of two variables.
		22MTC02.4	Find the shape of the curve, surface areas and volumes of revolution.
		22MTC02.5	Examine the convergence and divergence of infinite Series
2	I/I	**22CYC01- CHEMISTRY**	
		22CYC01.1	Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
		22CYC01.2	Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
		22CYC01.3	Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
		22CYC01.4	Classify the various methods used in treatment of water for domestic and industrial use.
		22CYC01.5	Outline the synthesis of various Engineering materials & Drugs.
3	I/I	**22EEC01- Basic Electrical Engineering**	
		22EEC01.1	Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
		22EEC01.2	Predict the steady state response of RLC circuits with AC single phase/three phase supply.
		22EEC01.3	Infer the basics of single-phase transformer
		22EEC01.4	Describe the construction, working principle of DC machine and 3-phase Induction motor.
		22EEC01.5	Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.
4	I/I	**22CSC01- PROBLEM SOLVING AND PROGRAMMING**	
		22CSC01.1	Understand real world problems and develop computer solutions for those problems.
		22CSC01.2	Understand the basics of Python
		22CSC01.3	Apply Python for solving basic programming solutions.
		22CSC01.4	Create algorithms/flowcharts for solving real-time problems.
		22CSC01.5	Build and manage dictionaries to manage data.
		22CSC01.6	Handle data using files
5	I/I	**22CYC02 - CHEMISTRY LAB**	
		22CYC02.1	Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
		22CYC02.2	Estimate the amount of chemical substances by volumetric analysis.

		22CYC02.3	Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
		22CYC02.4	Calculate the concentration and amount of various substances using instrumental techniques.
		22CYC02.5	Develop the basic drug molecules and polymeric compounds.
6	I/I	**22MBC02 - Community Engagement**	
		22MBC02.1	Gain an understanding of Rural life, Culture and Social realities.
		22MBC02.2	Develop a sense of empathy and bonds of mutuality with Local Communities.
		22MBC02.3	Appreciate significant contributions of Local communities to Indian Society and Economy.
		22MBC02.4	Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
		22MBC02.5	Utilise the opportunities provided by Rural Development Programmes
7	I/I	**22CSC02 - PROBLEM SOLVING AND PROGRAMMING LAB**	
		22CSC02 .1	Understand various Python program development Environments
		22CSC02 .2	Demonstrate the concepts of Python.
		22CSC02 .3	Implement algorithms/flowcharts using Python to solve real-world problems.
		22CSC02 .4	Build and manage dictionaries to manage data.
		22CSC02 .5	Write Python functions to facilitate code reuse.
		22CSC02 .6	Use Python to handle files and memory.
8	I/I	**22MEC37- Robotics & Drones Lab**	
		22MEC37.1	Demonstrate knowledge of the relationship between mechanical structures of robotics and their operational workspace characteristics
		22MEC37.2	Understand mechanical components, motors, sensors and electronic circuits of robots and build robots.
		22MEC37.3	Demonstrate knowledge of robot controllers.
		22MEC37.4	Use Linux environment for robotic programming.
		22MEC37.5	Write Python scripts to control robots using Python and Open CV
9	I/I	**22EEC02- Basic Electrical Engineering Lab**	
		22EEC02.1	Comprehend the circuit analysis techniques using various circuital laws and theorems.
		22EEC02.2	Analyse the parameters of the given coil and measurement of power and energy in AC circuits
		22EEC02.3	Determine the turns ration/performance parameters of single-phase transformer
		22EEC02.4	Infer the characteristics of DC shunt motor different tests.
		22EEC02.5	Illustrate different parts and their function of electrical components, equipment and machines
10	I/II	**22MTC05- Vector Calculus and Differential Equations**	
		22MTC05.1	Apply the vector differential operators to Scalars and Vector functions.
		22MTC05.2	Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
		22MTC05.3	Calculate the solutions of first order linear differential equations.
		22MTC05.4	Solve higher order linear differential equations.

		22MTC05.5	Find solution of algebraic, transcendental and ODE by Numerical Methods
11	I/II	**22PYC05-Mechanics and Materials Science**	
		22PYC05.1	Compare the various types of oscillations
		22PYC05.2	Demonstrate rotational motion of rigid body
		22PYC05.3	Classify different types of crystals and their imperfections
		22PYC05.4	Identify magnetic and dielectric materials for engineering applications
		22PYC05.5	Make use of lasers and superconductors in technological applications
12	I/II	**22CEC01- Engineering Mechanics**	
		22CEC01.1	Calculate the components and resultant of coplanar forces system and draw free body diagrams to analyze the forces in the given structure
		22CEC01.2	Understand the mechanism of friction and can solve friction problems
		22CEC01.3	Analyse simple trusses for forces in various members of a truss.
		22CEC01.4	Determine the centroid of plane areas, composite areas and centres of gravity of bodies.
		22CEC01.5	Determine moments of inertia, product of inertia of plane and composite areas and mass moments of inertia of elementary bodies
13	I/II	**22EGC01- English**	
		22EGC01.1	Illustrate the nature, process and types of communication and communicate effectively without barriers.
		22EGC01.2	Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
		22EGC01.3	Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
		22EGC01.4	Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
		22EGC01.5	Critique passages by applying effective reading techniques
14	I/II	**22PYC08 - Mechanics and Materials Science Laboratory**	
		22PYC08.1	Estimate the error in an experimental measurement
		22PYC08.2	Make use of lasers and optical fibers in engineering applications
		22PYC08.3	Recall the physical properties of dielectrics and magnetic materials
		22PYC08.4	Find the mechanical properties of solids and viscosity of liquids
		22PYC08.5	Demonstrate the motion of electrons in electric and magnetic fields
15	I/II	**22EGC02-English lab**	
		22EGC02.1	Define the speech sounds in English and understand the nuances of pronunciation in English
		22EGC02.2	Apply stress correctly and speak with the proper tone, intonation and rhythm.
		22EGC02.3	Analyze listening comprehension texts to enhance their listening skills.
		22EGC02.4	Determine the context and speak appropriately in various situations.
		22EGC02.5	Design and present effective posters while working in teams, and discuss and participate in Group discussions
16	I/II	**22MEC01- CAD and Drafting**	
		22MEC01.1	Become conversant with appropriate use of CAD software for drafting.

		22MEC01.2	Recognize BIS, ISO Standards and conventions in Engineering Drafting.
		22MEC01.3	Construct the projections of points, lines, planes, solids
		22MEC01.4	Analyse the internal details of solids through sectional views
		22MEC01.5	Create an isometric projections and views
17	I/II	**22MEC38- Digital Fabrication Lab**	
		22MEC38.1	Understand safety measures to be followed in workshop to avoid accidents.
		22MEC38.2	Identify various tools used in carpentry, house wiring and plumbing.
		22MEC38.3	Make a given model by using workshop trades like carpentry, plumbing, House wiring and 3d modeling using solid works software for Additive Manufacturing
		22MEC38.4	Perform pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
		22MEC38.5	Conceptualize and produce simple device/mechanism of their choice.
18	II/I	**22MTC10- Partial differential Equations and Statistics**	
		22MTC10.1	Calculate the Euler's coefficients for Fourier series expansion of a function.
		22MTC10.2	Solve Linear and Non-Linear PDE's
		22MTC10.3	Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
		22MTC10.4	Use the basic probability for fitting the Random phenomenon.
		22MTC10.5	Analyze the random fluctuations of probability distribution and Principles of Least Squares approximations for the given data.
19	II/I	**22CE C03- Surveying - I**	
		22CE C03.1	To select basic surveying instruments such as chains, tapes etc., to measure areas
		22CE C03.2	To Apply the principles of levelling and prepare contour maps to estimate volumes of earthwork using Simpsons and/or trapezoidal rules.
		22CE C03.3	To apply the principles of tacheometry on the field.
		22CE C03.4	To Operate modern instruments like Total Station and GPS in the field.
		22CE C03.5	To Make use of principles of trigonometric levelling for measuring elevations of required objects
20	II/I	**22CE C04 - Solid Mechanics**	
		22CE C04.1	Evaluate the strength of various materials, against structural actions such as compression, tension.
		22CE C04.2	To analyze statically determinate beams and sketch SFD and BMD.
		22CE C04.3	Able to draw variation of shear and bending stresses
		22CE C04.4	Able to evaluate direct and bending stresses, compound stresses
		22CE C04.5	To design thin and thick cylinders for resisting internal and external pressures.
21	II/I	**22CE C05- Fluid Mechanics**	
		22CE C05.1	To evaluate the various properties of fluid, analyze fluid flow and forces.
		22CE C05.2	To Apply the various laws and principles governing fluid flow to practical problems.
		22CE C05.3	To Measure pressure, velocity and discharge of fluid flow in pipes, channels, and tanks.

		22CE C05.4	To apply laws related to laminar and turbulent flow in pipes
		22CE C05.5	To Evaluate water hammer effect in pipes and to apply dimensional and model laws to fluid flow applications.
22	II/I	**22CE C06- BUILDING CONSTRUCTION PRACTICES**	
		22CE C06.1	To study about traditional building materials
		22CE C06.2	To study about new/composite building materials.
		22CE C06.3	To understand the concepts of building planning and various practices adopted
		22CE C06.4	To understand different types of roofs, doors, windows and stairs.
		22CE C06.5	To understand different types of masonry adopted in construction sites.
23	II/I	**22EG M01- Universal Human Values – II Understanding Harmony**	
		22EG M01.1	Become familiar about themselves, and their surroundings (family, society, nature).
		22EG M01.2	Develop empathy and respect for diversity by gaining an appreciation for different cultures, perspectives, and identities
		22EG M01.3	Exhibit responsible and ethical behavior by adhering to principles of integrity, honesty, compassion, and justice.
		22EG M01.4	Recognize their role as global citizens.
23	II/I	**20CE C07-Computer Aided Civil Engineering Drafting**	
		20CE C07.1	Create basic 2D geometry shapes.
		20CE C07.2	Draft elevation and sections of doors and windows.
		20CE C07.3	Develop plan, section and elevations of buildings.
		20CE C07.4	Draft plan and section of a staircase.
		20CE C07.5	Draft RCC detailing of beams and footings.
25	II/I	**22CE C08- Fluid Mechanics Lab**	
		22CE C08.1	Ability to find the co-efficient of discharge for flows through various flow measuring devices.
		22CE C08.2	To differentiate between laminar and turbulent flows and identify the governing parameters for both.
		22CE C08.3	Applies the concept of Bernoulli's energy principle.
		22CE C08.4	Applies the concept of hydrostatic forces on flat and curved surfaces.
		22CE C08.5	Ability to find the stability and metacentre of floating body.
		22CE C08.6	To differentiate between viscous and non-viscous flows and identify the governing parameters for both.
26	II/II	**22EGM01-INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES**	
		22EGM01.1	Understand the making of the Indian Constitution and its features.
		22EGM01.2	Identify the difference among Right To equality, Right To freedom and Right to Liberty.
		22EGM01.3	Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
		22EGM01.4	Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
		22EGM01.5	Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies

27	II/II	**22CE C09- Hydraulic Engineering**	
		22CE C09.1	Apply the concepts of open channel flow and design the efficient channel cross section.
		22CE C09.2	Apply the concepts of non-uniform open channel flow to the field problems.
		22CE C09.3	Interpret the basics of computation of drag and lift forces in the field of aerodynamics, boundary layer effect.
		22CE C09.4	Design the impulse turbines, run the turbines under efficient conditions.
		22CE C09.5	Design the reaction turbines, draw characteristic curves of turbines and centrifugal pump
28	II/II	**22CE C10 - Surveying II**	
		22CE C10.1	To execute setting of simple and compound curves on the field by overcoming obstructions in curve ranging
		22CE C10.2	To select suitable transition curves based on real world conditions and execute it on field
		22CE C10.3	To apply the concepts of photogrammetry for solving problems in civil engineering
		22CE C10.4	To choose appropriate remote sensing technique for data acquisition and image processing techniques for identification of ground features accurately
		22CE C10.5	To be able to adjust the errors that are cropping while carrying surveying and adopt LiDAR survey for acquiring topographic data at high speed.
29	II/II	**22CE C11- STRUCTURAL ANALYSIS-I**	
		22CE C11.1	Compute slopes and deflections in determinate beams, under various types of static loads, using a suitable method.
		22CE C11.2	Analyze the propped cantilevers and fixed beams subjected to various types of loads.
		22CE C11.3	Analyze and design circular shafts subjected a given torque and bending.
		22CE C11.4	To determine the strain energy in members under various loading situations, and to analyze various types of springs.
		22CE C11.5	Analyze various types of columns with different end conditions
30	II/II	**22CE C12- Reinforced Concrete Design - I**	
		22CE C12.1	Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS: 456 and apply the working stress method of design for rectangular beams.
		22CE C12.2	Design RC beams of rectangular and flanged sections/ for flexure using limit state method and check for serviceability.
		22CE C12.3	Design RC beams for shear, torsion and bond.
		22CE C12.4	Analyse and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
		22CE C12.5	Design RC short columns for axial loads and moments and axially loaded isolated footings.
31	II/II	**22CE C13-CONCRETE TECHNOLOGY**	
		22CE C13.1	Understand the properties of concrete making materials and production of concrete
		22CE C13.2	Analyze the properties of fresh and hardened concretes
		22CE C13.3	Design the concrete mix using various methods for a specified grade
		22CE C13.4	Evaluate durability of concrete and apply suitable admixtures in concrete making.

		22CE C13.5	Evaluate and choose appropriate concrete for field application
32	II/II	**Professional Elective-1 (PE-1)** **22CE E01- Green Building Technologies**	
		22CE E01.1	Be able to identify the fundamentals of energy use and energy processes in building.
		22CE E01.2	Be able to identify the energy requirement and its management.
		22CE E01.3	Apply the knowledge about Sun-earth relationship vis-a-vis its effect on climate.
		22CE E01.4	Be able to deal with the end-use energy requirements.
		22CE E01.5	Be familiar with the audit procedures of energy.
33	II/II	**22CE E02- Principles of Geographical Information Systems**	
		22CE E02.1	The student is able to apply the principles of GIS to various field problems and take decisions under uncertain conditions.
		22CE E02.2	The student is able to understand advantages and disadvantages of using vector GIS and raster GIS.
		22CE E02.3	The student is able to apply the methods of data Compression using GIS.
		22CE E02.4	Can perform the data modeling and analysis using GIS.
		22CE E02.5	Is able to apply the Cartographic modelling techniques for Watershed modeling, Environmental Modeling and for Watershed Management, visibility analysis.
34	II/II	**22CE E03- GROUND WATER ENGINEERING**	
		22CE E03.1	Assess groundwater potential and head.
		22CE E03.2	Estimate hydraulic conductivity and storage coefficient for time variant flow.
		22CE E03.3	Investigate groundwater availability for a given area.
		22CE E03.4	Plan and design artificial recharge.
		22CE E03.5	Construct model and analyze groundwater flow
35	II/II	**22CE E04- APPLICATIONS OF DATA ANALYTICS IN CIVIL ENGINEERING**	
		20CE E04.1	Develop different mathematical models to solve the civil engineering problems.
		20CE E04.2	Categorize variables to use in decision making process.
		20CE E04.3	Design procedures to collect data on civil engineering projects
		20CE E04.4	Identify the estimation processes for discovering patterns in civil engineering.
		20CE E04.5	Use hypothesis testing to model the civil engineering related count data.
36	II/II	**22CEC14-HYDRAULIC ENGINEERING LAB**	
		22CEC14.1	To compute the open channel rugosity coefficient in uniform flows and Froude number, energy losses in non-uniform flows.
		22CEC14.2	To differentiate between uniform, non-uniform flows and flow in curved channel.
		22CEC14.3	To determine work done by fluid jet on vane, compute work done and draw performance characteristic curves for turbines and centrifugal pumps
		22CEC14.4	To determine the coefficient of discharge of a venturi flume.
37	II/II	**22CE C15- SURVEYING AND GEOMATICS LAB**	

		22CE C15.1	To use simple as well as modern surveying instruments.
		22CE C15.2	To develop L S and C S for road works, Canal works, using Auto levels and to develop contour map of the given area.
		22CE C15.3	To use Total Station for locating ground details and plotting.
		22CE C15.4	To set simple curves using Total Station.
		22CE C15.5	To locate ground features using GPS.
38	II/I	**22CE C16- SOLID MECHANICS LAB**	
		22CE C16.1	To understand the stress strain behavior of mild steel bar under direct tension.
		22CE C16.2	To compute the modulus of elasticity of given materials by conducting deflection tests on different types of beams.
		22CE C16.3	To determine the impact/ shear strength of steel specimen.
		22CE C16.4	To determine the rigidity modulus of a given material by conducting torsion test and deflection test on helical spring
		22CE C16.5	To determine the compressive strength of brick and concrete cube.
39	III/I	**20CE C16 - Transportation Engineering**	
		20CEC16.1	Understand the types of highways, patterns, master plans, alignment finalization and components of highway projects.
		20CEC16.2	Apply various IRC Standards for the Geometric design of highways
		20CEC16.3	Organize collection of traffic related data and analyzing the data for different applications
		20CEC16.4	Apply the design concepts to flexible and rigid pavements as per IRC standards
		20CEC16.5	Execute construction of pavements as per IRC standards and evaluate of pavement condition to recommend suitable remedial measures.
40	III/I	**20CE C17 - GEOTECHNICAL ENGINEERING**	
		20CEC17.1	Identify various types of soils and determine their properties.
		20CEC17.2	Estimate coefficient of permeability, stresses in soils under various soil conditions and compute discharge in soil
		20CEC17.3	Modify the properties of soil by using various compaction methods and compute the settlement of compressible soils
		20CEC17.4	Estimate the shear strength of different soils under various loading conditions.
		20CEC17.5	Evaluate earth pressures and slope stability under different field conditions
41	III/I	**20CE C18 - Structural Analysis II**	
		20CEC18.1	Develop the ILD's for reactions, shear force and bending moment at a section, determine the maximum SF and BM for various positions of the moving point loads and uniformly distributed loads.
		20CEC18.2	Construct the ILD's for forces in the members of trusses and evaluate the maximum forces for various positions of the moving point loads and uniformly distributed loads
		20CEC18.3	Apply slope – deflection method for indeterminate beams with and without sinking of supports subjected to point loads and UDL on the entire span and analyse rigid jointed plane frames with and without lateral sway using slope deflection method.
		20CEC18.4	Apply moment distribution method for indeterminate beams with and without sinking of supports subjected to point loads and UDL on the entire

			span and analyse rigid jointed plane frames with and without lateral sway using moment distribution method.
		20CEC18.5	Apply matrix, flexibility and stiffness method to continuous beams
42	III/I	**20CE C19 - DESIGN OF STEEL STRUCTURES - I**	
		20CEC19.1	Understand the material properties, loads and design philosophies, design bolted and welded connections
		20CEC19.2	Know, how yielding & buckling takes place, design simple and built-up compression members and column bases.
		20CEC19.3	Understand the modes of failure of tension members, design tension members using limit state method, design tension and compression members using working stress method as per IS: 800-2007
		20CEC19.4	Classify structural steel sections, distinguish between laterally supported and laterally unsupported beams, design simple flexural members including secondary considerations.
		20CEC19.5	Estimate the loads on roof trusses and design purlins and members of trusses.
43	III/I	**20CE C20 - TRANSPORTATION ENGINEERING LAB**	
		20CEC20.1	Conduct various tests on bitumen, define its quality and decide its suitability for its use in pavements.
		20CEC20.2	Conduct various tests on aggregates, define its quality and decide its suitability for its use in roads
		20CEC20.3	Organize various traffic studies and analyze the data by applying statistical tools
		20CEC20.4	Prepare representative samples for various tests on aggregates
		20CEC20.5	Generate technical report based on the studies carried in the laboratory and field studies
44	III/I	**20CE C21 - GEOTECHNICAL ENGINEERING LAB**	
		20CEC21.1	Identify soils with reference to their characteristics
		20CEC21.2	Evaluate and classify soils according to IS classification
		20CEC21.3	Calculate seepage volume for different soils.
		20CEC21.4	Examine methods to improve soil stability of soils.
		20CEC21.5	Conduct tests according to IS laboratory standards and procedures
45	III/I	**20CE M01- ENVIRONMENTAL SCIENCE**	
		20CE M01.1	Identify the natural resources and realize the importance of water, food, forest, mineral, energy, land resources and effects of over utilization.
		20CE M01.2	Understand the concept of ecosystems and realize the importance of interlinking of food chains
		20CE M01.3	Contribute for the conservation of bio-diversity.
		20CE M01.4	Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
		20CE M01.5	Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.
46	III/I	**Professional Elective-2 (PE-2)** **20CE E05- Applications of Artificial Intelligence in Civil Engineering**	
		20CE E05.1	Recall fundamental knowledge on artificial intelligence.
		20CE E05.2	Understand neural networks and their types and apply neural networks in the domain of civil engineering

		20CE E05.3	Understand and apply fuzzy controllers to solve real-world civil engineering problems.
		20CE E05.4	Explain basic concepts of support vector machines and choose appropriate techniques relevant to Civil engineering
		20CE E05.5	Develop a regression model for civil engineering problems.
47	III/I	**20CE E06 - PRESTRESSED CONCRETE**	
		20CEE06.1	Understand the general mechanism of pre stressed concrete members, types of pre stressing
		20CEE06.2	Analyze and understand the behaviour of pre stressed concrete beams.
		20CEE06.3	Identify and apply design concepts for the pre stressed concrete beams under flexure and shear.
		20CEE06.4	Analyze the stresses in anchorage zones and design the end anchorages
		20CEE06.5	Understand the fundamental concepts of primary and secondary moments in continuous beams
48	III/I	**20CE E07- HAZARDS AND MANAGEMENT**	
		20CE E07.1	Identify and understand the fundamental terminologies in disaster management.
		20CE E07.2	Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and non-structural mitigation measures
		20CE E07.3	Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems
		20CE E07.4	Analyze various mechanisms and consequences of human induced disasters
		20CE E07.5	Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels
49	III/I	**20CE E08 - MASONRY STRUCTURES**	
		20CE E08.1	Explain engineering properties, uses of masonry units, defects, crack in masonry and its remedial measures and factors affecting compressive strength of masonry units.
		20CE E08.2	Explain the different masonry elements, permissible stresses, design considerations and criteria as per IS: 1905 and SP-20
		20CE E08.3	Design different types of masonry walls subjected to axial loads ; UDL and concentrated axial loads.
		20CE E08.4	Design different types of masonry walls subjected to eccentric loads, lateral loads and transverse loads
		20CE E08.5	Design infill walls of frames and implement the design principles and detailing aspects to ensure seismic safety of unreinforced and reinforced masonry walls
50	III/II	**20CE C22-Hydrology and Water Resource Engineering**	
		20CE C22.1	Understand the interaction among various processes in the hydrologic cycle and Rain Gauge networks.
		20CE C22.2	Analyze hydrograph and different irrigation efficiencies
		20CE C22.3	Estimate different aquifer parameters, yield of an open well, yield and life of a reservoir.
		20CE C22.4	Design lined and unlined canals using Kennedy's and Lacey's theory
		20CE C22.5	Design gravity dams, earth dams and understand the functioning of spillways.

51	III/II	**20CE C23- ESTIMATION SPECIFICATIONS AND COSTING**	
		20CE C23.1	Prepare detailed estimates for load bearing and RCC framed building using long and short wall method
		20CE C23.2	Prepare detailed estimates for load bearing and RCC framed building using centre line method
		20CE C23.3	Prepare the detailed estimate of steel qualities and bar bending schedule for RCC framed works.
		20CE C23.4	Estimate the earth work for – bituminous roads, WBM roads, CC roads, irrigation canals and prepare the detailed estimate of single cell rectangular box culvert, septic tank.
		20CE C23.5	Do the rate analysis for different items of works of buildings and understand the general and detailed specifications of works
52	III/II	**20CE C24- REINFORCED CONCRETE DESIGN-II**	
		20CE C24.1	Develop the plan layout, design and detail rectangular & trapezoidal combined footings
		20CE C24.2	Analyze for stability, design, the various components and detail cantilever and counter fort type retaining walls.
		20CE C24.3	Interpret the specifications from relevant codes, determine the design forces, design various components and detail rectangular and circular water tanks including hinge tanks
		20CE C24.4	Understand the clauses from relevant IRC codes, design and detail the various components of Solid slab bridge.
		20CE C24.5	Analyze the slab panels using effective width method/ Pigeaud"s curves, girders using Courbon"s method and design & detail the various components of T-Beam bridges.
53	III/II	**20CE C25 - ENVIRONMENTAL ENGINEERING**	
		20CE C25.1	Identify an appropriate population forecasting method and estimate quantity of water to be supplied and plan &design conveyance components.
		20CE C25.2	Design water treatment units for a water treatment plant
		20CE C25.3	Estimate quantity of sewage and storm water & characteristics of sewage, design sewers and plan sewer appurtenances
		20CE C25.4	Design components of waste water treatment plant and sludge digestion systems.
		20CE C25.5	Understand and judge methods for control of particulate matter and gaseous pollutants in the atmosphere, outline noise pollution control methods
54	III/II	**20CE C26-ENVIRONMENTAL ENGINEERING LAB**	
		20CE C26.1	Demonstrate skills to use equipment in conducting the test procedures
		20CE C26.2	Evaluate water quality and summarize the suitability in accordance with IS: 10500- 2012, Drinking Water specifications.
		20CE C26.3	Evaluate characteristics of wastewater and summarize the suitability for disposal/reuse as per standards
		20CE C26.4	Measure air quality and classify the level of pollution based on standards set by Pollution Control Board
		20CE C26.5	Evaluate and analyse bacteriological quality of water.
55	III/II	**20CE C27-ENGINEERING GEOLOGY LAB**	
		20CE C27.1	Identify the minerals, rocks and various
		20CE C27.2	Identify structural features like folds, faults and unconformities.

		20CE C27.3	Measure the electrical resistivity of rocks, soil etc.
		20CE C27.4	Interpret the topographic maps.
		20CE C27.5	Identify the geological and geotechnical features of given places
56	III/II	**20EG CO3 - EMPLOYABILITY SKILLS**	
		20EG CO3.1	Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
		20EG CO3.2	Write resumes, prepare and face interviews confidently
		20EG CO3.3	Be assertive and set short term and long-term goals, learn to manage time effectively and deal with stress
		20EG CO3.4	Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
		20EG CO3.5	Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.
57	III/II	**Professional Electives (PE-3)** **20CE E09- Foundation Engineering**	
		20CE E09.1	Compute the stress distribution in the ground under different loading conditions
		20CE E09.2	Estimate the bearing capacity of different soils for shallow foundation.
		20CE E09.3	Design the deep foundation by piles or wells
		20CE E09.4	Deal with the field problems in laying cofferdams and different dewatering techniques and sampling methods
		20CE E09.5	Interpret and implement the Concepts of Coffer dams, Caissons and Timbering of Excavations
58	III/II	**20CE E10– RIVER ENGINEERING**	
		20CE E10.1	Understand about river morphology
		20CE E10.2	Apply knowledge on river aggradation and degradation
		20CE E10.3	Evaluate different models of river flow hydraulics
		20CE E10.4	Analyse hydraulic geometry and execute river protection and training works
		20CE E10.5	Design river training and river bank protection
59	III/II	**20CE E11– URBAN TRANSPORTATION PLANNING**	
		20CE E11.1	Apply the fundamental knowledge for forecasting and creating the transportation infrastructure facilities scientifically and ethically by collecting the appropriate sample data.
		20CE E11.2	Identify the procedures for collecting the traffic related data for generating and validating transport demand models.
		20CE E11.3	Apply four stage transportation demand modelling by creating mathematical models to understand the travel pattern and behavior of road users
		20CE E11.4	Apply the mathematical knowledge in solving the transportation planning related problems by Analyzing transportation data
		20CE E11.5	Evaluate highway projects by using different economic methods and understand the role of computer applications in transportation planning.
60	III/II	**20CE E12– BASICS OF EARTHQUAKE ENGINEERING**	
		20CE E12.1	Apply the fundamentals of engineering seismology; classify the characteristics and effects of strong motion earthquakes

		20CE E12.2	Develop the concepts of damped and un-damped vibrations in single and multi-degrees of freedom systems
		20CE E12.3	Estimate the seismic loads on structures and analyse using seismic coefficient and response spectrum methods
		20CE E12.4	Examine the causes of damages of urban and rural buildings and interpret the design provisions from IS1893 part - I (2016) and IS - 13920(2016)
		20CE E12.5	Asses the use of various earthquake resistant devices; apply suitable construction techniques for retrofitting
61	IV/I	**20CE C28-CONSTRUCTION ENGINEERING AND MANAGEMENT**	
		20CE C28.1	Build an Organization and Select a suitable type of project delivery method for successful project implementation
		20CE C28.2	Plan the construction project, choosing a suitable technique for the construction project.
		20CE C28.3	Determine optimized project time and cost with the exercise of proper monitoring and control in construction projects
		20CE C28.4	Plan and implement suitable construction safety measures and quality management systems in construction projects
		20CE C28.5	Choose proper equipment for the execution of various operations in construction and analyze various issues of contracting.
62	IV/I	**20MB C01- ENGINEERING ECONOMICS AND ACCOUNTANCY**	
		20MB C01.1	Apply fundamental knowledge of Managerial Economics concepts and tools
		20MB C01.2	Analyze various aspects of Demand Analysis, Supply and Demand Forecasting
		20MB C01.3	Understand Production and Cost relationships to make best use of resources available
		20MB C01.4	Apply Accountancy Concepts and Conventions and preparation of Final Accounts
		20MB C01.5	Evaluate Capital and Capital Budgeting decision based on any technique.
63	IV/I	**Professional Electives-4 (PE-4)** **20CE E13- FINITE ELEMENT METHODS**	
		20CE E13.1	Apply the fundamentals of FEM, elements of theory of elasticity for 2D, 3D and axisymmetric problems.
		20CE E13.2	Apply Principle of minimum potential energy and Principle of Virtual work; analyze simple problems using Rayleigh Ritz Method and Galerkin's method.
		20CE E13.3	Formulate the local and global stiffness matrix, load matrix for 1D bar elements and 2D truss elements and analyze simple problems.
		20CE E13.4	Develop the stiffness matrix for beams and rigid jointed plane frames and solve problems with degree of freedom not exceeding three.
		20CE E13.5	Select displacement functions, formulate the stiffness matrix, load matrix for CST elements. Use Iso-parametric elements and quadrilateral elements, and evaluate definite integral by Gauss Quadrature
64	IV/I	**20CE E14-APPLICATIONS OF DATA ANALYTICS IN CIVIL ENGINEERING**	
		20CE E14.1	Define the descriptive, predictive and prescriptive models and select suitable tools or techniques for application in civil engineering problems
		20CE E14.2	Identify the discrete and continuous random variables and select appropriate mathematical models which support decision making under uncertainty
		20CE E14.3	Design data collection process required for descriptive and exploratory models for problems in civil engineering

		20CE E14.4	Relate estimators and estimates to process of estimation and thus implement the various modeling techniques to uncover the patterns in the civil engineering related data
		20CE E14.5	Formulate hypothesis and their corresponding confidence intervals for various count data based and discrete choice models along with goodness of fit measures
65	IV/I	**20CE E15-DESIGN OF HYDRAULIC STRUCTURES**	
		20CE E15.1	Design Surplus weir
		20CE E15.2	Design various components of direct sluice
		20CE E15.3	Design of glacis type canal drop
		20CE E15.4	Design of cross regulator
		20CE E15.5	Design of spillways and energy dissipaters
66	IV/I	**20CE E16-CONCRETE TECHNOLOGY AND SPECIAL CONCRETES**	
		20CE E16.1	Able to understand the physical and chemical properties of concrete and should have knowledge on tests on cement and aggregates
		20CE E16.2	Able to explain the properties of both fresh and hardened concrete
		20CE E16.3	Able to apply the knowledge on chemical and mineral admixtures of cement.
		20CE E16.4	Design the mix proportions for the specific work for required strength and workability with available materials at workplace.
		20CE E16.5	Be familiar with the special concerts used in construction for various purposes
67	IV/I	**20CE E17-RAILWAY AND AIRPORT ENGINEERING**	
		20CE E17.1	Understand the role played by various components of permanent way
		20CE E17.2	Apply engineering knowledge to geometric design of a railway track as per the standards and understand the importance and components of points and crossings
		20CE E17.3	Create facilities for railway passengers and goods, identify procedures to be followed for maintenance of track and understand various types of railway signals and their functions, need and requirements of drainage system in railway tracks
		20CE E17.4	Understand the structure of airport system, components of aircraft and airport and apply engineering knowledge for selection of airport sites.
		20CE E17.5	Plan airports and facilities as per international standards and also understand the corrections to be applied for runaway and design airports as per ICAO standards and develop the facilities required for passengers and aircrafts.
68	IV/I	**20CE C18-APPLICATION OF DATA ANALYTICS IN CIVIL ENGINEERING**	
		20CE C18.1	Gain a clear understanding of the concepts that underlie Blockchain and Blockchain and types of Blockchain.
		20CE C18.2	Understand key mechanisms like decentralization, transparency and trust, immutability.
		20CE C18.3	Understand the importance of Blockchain in construction industry apply the concepts of smart contracts using Blockchain technology.
		20CE C18.4	Understand and apply the project management systems using Blockchain technology.
		20CE C18.5	Apply the concepts of building information modelling using Blockchain technology
		20CE E19-DESIGN OF STEEL STRUCTURES-II	

69	IV/I	**20CE E19.1**	Design welded plate girders and the secondary components, understand the phenomenon of shear buckling in girders
		20CE E19.2	Estimate the loads on gantry girders, Design gantry girder including connections
		20CE E19.3	Identify the suitability of bridge type, Design Roller & Rocker bearings for railway bridges
		20CE E19.4	Develop the layout of deck type riveted plate girder bridges and design the bridges for loads including wind effects
		20CE E19.5	Choose the appropriate truss configuration, develop layout of the bridge, and design and detail truss girder bridges
70	IV/I	**20CE E20-ADVANCED ENVIRONMENTAL ENGINEERING**	
		20CE E20.1	Characterize the effluents, analyze the effects of industrial effluents on the human health & thoroughly practice environmental legislation
		20CE E20.2	Apply the methods of Industrial waste water management and treatment.
		20CE E20.3	Evaluate, monitor and analyze ambient air quality
		20CE E20.4	Apply the methods of air pollution control to field situations
		20CE E20.5	Evaluate the impact of road project, industry and a dam on the surrounding environment.
71	IV/I	**20CS O07-BASICS OF MACHINE LEARNING**	
		20CS O07.1	Define the basic concepts related to Python and Machine Learning
		20CS O07.2	Describe the feature engineering methods, regression techniques and classification methods
		20CS O07.3	Apply Python packages for data visualization, text and time series data analysis using NLP toolkit
		20CS O07.4	Evaluate and interpret the results of the various machine learning techniques
		20CS O07.5	Solve real world problems using deep learning framework.
72	IV/I	**20AD O01-INTRODUCTION TO PYTHON PROGRAMMING**	
		20AD O01.1	Explore data operations on list, tuple and dictionary in python.
		20AD O01.2	Understand deployment of models on different datasets.
		20AD O01.3	Apply supervised, unsupervised, resembling and NLP models on different datasets
		20AD O01.4	Perform data analysis using python packages.
		20AD O01.5	Build and evaluate the models using python programming
73	IV/I	**20IT O02-PRINCIPLES OF INTERNET OF THINGS**	
		20IT O02.1	Comprehend the terminology, protocols and communication models of IoT.
		20IT O02.2	Define the various IoT enabling technologies and differentiate between M2M and IoT.
		20IT O02.3	Acquire the basics of Python Scripting Language used in developing IoT applications
		20IT O02.4	Describe the steps involved in IoT system design methodology.
		20IT O02.5	Design simple IoT systems using Raspberry Pi board and interfacing sensors with Raspberry Pi.
		20CE C29- CONCRETE TECHNOLOGY LAB	
		20CE C29.1	Determine the properties of given cement sample and assess its suitability for use in construction.

74	IV/I	**20CE C29.2**	Determine the properties of fine and coarse aggregate samples to assess their suitability for use in construction works
		20CE C29.3	Measure the workability of concrete and recommend its suitability for structural works
		20CE C29.4	Design a suitable concrete mix proportion as per the code provisions for the specified grade
		20CE C29.5	Conduct destructive and non-destructive tests to evaluate the quality and strength of concrete
75	IV/I	**20CE C30- COMPUTER APPLICATIONS LAB**	
		20CE C30.1	Develop a model of framed structure and analyze using STAAD-Pro
		20CE C30.2	Design the components of a framed structure including isolated footings using STAAD-Pro and STAAD Foundation.
		20CE C30.3	Evaluate stability of slope using Slip Circle method and design a cantilever retaining wall using GEO5
		20CE C30.4	Analyze pipe networks using EPANET and sewer networks using SEWER Gems
		20CE C30.5	Develop geo-referenced thematic maps and carry out overlay analysis using ArcGIS/QGIS
76	IV/I	**20EG MO4 - GENDER SENSITIZATION**	
		20EG MO4.1	Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity
		20EG MO4.2	Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
		20EG MO4.3	Appreciate women's contributions to society historically, culturally and politically.
		20EG MO4.4	Analyse the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality
		20EG MO4.5	Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.
77	IV/I	**20CE C31- Project Part-1**	
		20CE C31.1	Identify their domain interest through critical review of literature.
		20CE C31.2	Develop the technical skill in preparing a well-structured report on the chosen topic of Civil Engineering by following ethical practices.
		20CE C31.3	Develop the skill of presenting a structured seminar using Power Point presentation tools.
		20CE C31.4	Improve communication skills.
		20CE C31.5	Defend one's presentation by healthy interactions with the participants.
78	IV/II	**20CE E21-PAVEMENT MANAGEMENT SYSTEM**	
		20CE E21.1	Differentiate among types of data required for project management system development.
		20CE E21.2	Identify the root cause of different pavement distresses and suggest suitable remedial measures for various distresses to improve the pavement surface condition.
		20CE E21.3	Interpret the field evaluation data and pavement design data with respect to present and future traffic condition.
		20CE E21.4	Analyze and design of pavements based on structural response models and choose optimum design by applying economic evaluation
		20CE E21.5	Optimize the maintenance alternatives based on the benefit and cost ratio of the project alternative and provide the feedback data for updating the pavement performance monitoring system

79	IV/II	**20CE E22-REPAIRS AND REHABILITATION OF STRUCTURES**	
		20CE E22.1	Interpret SHM as a way of monitoring the health of a structure using smart materials
		20CE E22.2	Selectandimplementanappropriatevibrationbasedtechniqueforhealthmonitoringofastructure
		20CE E22.3	Select and implement an appropriate capacitive sensing technique
		20CE E22.4	Perform condition assessment survey of damaged/existing buildings and to identify possible defects in a concrete structure and suggest necessary repairs
		20CE E22.5	Implement various health monitoring techniques for different types of structures for different situations
80	IV/II	**20CE E23-WATERSHED MANAGEMENT**	
		20CE E23.1	Identify their domain interest through critical review of literature.
		20CE E23.2	Develop the technical skill in preparing a well-structured report on the chosen topic of Civil Engineering by following ethical practices.
		20CE E23.3	Develop the skill of presenting a structured seminar using Power Point presentation tools.
		20CE E23.4	Improve communication skills.
		20CE CE23.5	Defend one's presentation by healthy interactions with the participants.
81	IV/II	**20CE E24-GROUND IMPROVEMENT TECHNIQUES**	
		20CE E24.1	Review the importance of ground improvement techniques and types, for different soils.
		20CE E24.2	Apply suitable chemical stabilization and grouting techniques to address the field problems.
		20CE E24.3	Modify the cohesionless soil properties to required degree by using suitable vibration techniques.
		20CE E24.4	Identify suitable ground improvement techniques for cohesive soils in a specific project.
		20CE E24.5	Explain different advanced stabilizing techniques for slopes.
82	IV/II	**20CE C32-TECHNICAL SEMINAR**	
		20CE C32.1	Identify their domain interest through critical review of literature.
		20CE C32.2	Develop the technical skill in preparing a well-structured report on the chosen topic of Civil Engineering by following ethical practices.
		20CE C32.3	Develop the skill of presenting a structured seminar using Power Point presentation tools.
		20CE C32.4	Improve communication skills.
		20CE C32.5	Defend one's presentation by healthy interactions with the participants.
83	IV/II	**20CE C33-PROJECT: PART-2**	
		20CE C33.1	Examine the chosen problem with a deeper insight and identify a path to problem solving while developing the skill of coordinating with the team.
		20CE C33.2	Develop and demonstrate problem solving skills through detailed Analysis/ Modeling / Simulation/ Experimental works.
		20CE C33.3	Evaluate the results based on deeper studies and draw conclusions along with scope for further studies to facilitate continuous learning.
		20CE C33.4	Develop the art of technical report writing by following ethical practices.
		20CE C33.5	Defend the work through a well-structured presentation
84	IV/II	**20CE C34 - Practical Skills in Civil Engineering**	

		20CE C34.1	Get the ability to carry out land survey and quantity survey for various structures.
		20CE C34.2	Be able to read and interpret drawings of various structures.
		20CE C34.3	Be able to handle and manage various onsite civil engineering activities.
		20CE C34.4	Acquire ability to study and interpret R.C structural drawings and also be able to assess the structural health.
		20CE C34.5	Acquire ability to study and interpret R.C structural drawings and also be able to assess the structural health.

Head (Civil)

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