



# PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

## Program Educational Objectives (PEOs): B. Tech. Civil Engineering

### Department Vision

The department of Civil Engineering will excel and lead in education, research and innovation; contributing to the advancement of design, construction and maintenance of infrastructure to enhance the quality of life for humanity in a sustainable way.

### Department Mission

**M1:** To create an outstanding learning experience through rigorous curriculum of theory and practice that develops students' technical and professional skills to succeed in a wide range of careers.

**M2:** To continually advance research a culture of discovery, creativity, and innovation to benefit the mankind.

**M3:** To serve as highly capable resources to society, the profession through professional organizations, consultancy and continuing education.

### **Program Educational Objectives (PEOs):**

The Program Educational Objectives for B. Tech. Civil Engineering program are designed to produce competent civil engineers who are ready to contribute effectively to the advancement of Civil Engineering and to fulfill the needs of the community. These objectives are as follows:

- 1) Graduates will demonstrate peer recognized technical competency in the analysis, design and construction of Civil Engineering Structures.
- 2) Graduates will demonstrate leadership and initiative to advance professional and organizational goals with commitment to ethical standards of profession, teamwork and respect for diverse cultural background.
- 3) Graduates will be engaged in ongoing learning and professional development through pursuance of higher education and self-study. Graduates will be committed to creative practice of engineering and other professions in a responsible manner contributing socio-economic development of the society.



## PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

### FACULTY OF SCIENCE & TECHNOLOGY

#### Program Outcomes (POs)

#### B. Tech. Civil Engineering

The program outcomes of B. Tech. Civil Engineering Program are summarized as following:

- 1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- 3. 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 the public health and safety, and the cultural, societal, and environmental considerations.
- 4. 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.
- 5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. 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.
- 7. 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.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- 9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with 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.
- 11. 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.
- 12. Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

## **PROGRAM SPECIFIC OUTCOMES (PSOs)**

### **B. Tech. Civil Engineering**

- 1) Students will be able to survey, conduct geo-technical investigations, plan, analyze, design, estimate and construct residences, public buildings, industrial buildings, townships and infrastructural projects by adopting appropriate construction methods.
- 2) Students will analyze and design the water resources systems, municipal and industrial waste treatment plants with due consideration to pollution free environment.
- 3) Students will use appropriate application software, develop skills necessary for professional practice as a Civil Engineer and prepare themselves for competitive examinations for higher education & for public service commissions.

## **COURSE OUTCOMES** **S. Y. B. TECH. (CIVIL ENGINEERING)-I-SEMESTER-III**

### **C211 CONCRETE TECHNOLOGY, MATERIAL TESTING & EVALUATION**

On completion of the course students will be able to:

C211.1	Carry out testing of various ingredients of concrete for mix design of concrete
C211.2	Select appropriate type of concrete, admixture and chemicals for specific requirements.
C211.3	Design a concrete mix of required strength and durability, for given field conditions, using suitable ingredients
C211.4	To evaluate properties of construction materials viz. steel, bricks, timber, tiles etc. in laboratory for the quality assurance

### **C212- SURVEYING AND GEOMATICS**

At the end of this course, students will be able to

C212.1	Carry out temporary adjustments of modern surveying equipments
C212.2	Use the surveying instruments namely levels, theodolite, EDM, total station for surveying measurements such as horizontal/ vertical/inclined distance, horizontal/ vertical angles, bearings, reduced levels, and coordinates.
C212.3	Develop plans, draw maps and draft reports for surveying projects of Civil Engineering works.
C212.4	Use the modern surveying techniques namely remote sensing, Global positioning system and Geographic information system for Civil Engineering applications.
C212.5	Demonstrate the attributes of leadership, working in the team and professional ethics while performing the surveying projects.

### **C213. BUILDING CONSTRUCTION AND DRAWING**

At the end of this course, students will be able to

C213.1	Elucidate functional requirements of buildings and types of foundation and its suitability.
C213.2	Draw neat drawings of different building components such as doors, windows, stairs etc with the suitable scale using CADD software.
C213.3	Design different types of staircases commonly used in residential and public buildings.
C213.4	Draw neat perspective view drawings of an object and given small residential building.
C213.5	Select appropriate ventilation systems and building finishes.

### **C214. INTRODUCTION TO FLUID MECHANICS**

After successful completion of the course, student will be able to:

C214.1	Comprehend technical properties of fluids, their estimations and analysis for civil engineering applications
C214.2	Apply kinematics and dynamics of flow for solving Civil engineering problems

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C214.3	Quantify water flow through orifice, mouth piece and estimate losses
C214.4	Select and apply knowledge for conveyance of water through close conduits channels
C214.5	Analyze fluid flows and design pipe networks

### **C215. ENGINEERING GEOLOGY**

At the end of this course, students will be able to

C215.1	To describe issues concerning the geological formations and geological structure of a region
C215.2	To distinguish the characteristics of the most important geological formations and problems that may arise in the various civil engineering projects in such formations.
C215.3	To interpret and explain the geological structures in the geological maps and cross sections.
C215.4	To assess and appropriately adjust the results of geological study in order to ascertain secure construction and operation of a civil engineering projects like dams, reservoirs hilly roads and railway tracks.
C215.5	To receive, analyze and evaluate data and appropriately and solve technical as well as ground water related problems.

### **C216 INTRODUCTION TO SOLID MECHANICS**

At the end of this course, students will be able to

C216.1	Employ the knowledge of structural mechanics to depict the behavior of structures.
C216.2	Identify principal planes and find principal stresses.
C216.3	Draw Shear force diagrams and bending moment diagrams of statically determinate beams.
C216.4	Evaluate bending and shear stresses in beams.
C216.5	Analyse the behavior of structure under moving load using Influence line diagrams

### **C217 ENERGY SCIENCE & ENGINEERING**

At the end of this course, students will be able to

C217.1	List and explain the main sources of energy and their primary applications nationally and internationally
C217.2	2) Understand effect of using different energy sources on the environment and climate
C217.3	3) Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.
C217.4	4) List and describe the primary renewable energy resources and technologies.
C217.5	5) Understand the Engineering involved in projects utilising these energy sources

## CV218: Lab Practice

On completion of this course, students will be able to develop and draw using CADD Software tool:

C217.1	Architectural floor plan of a small residential building
C217.2	The geometric constructions, multi-view, sectional view, dimensioning and detail drawings of typical 2-D engineered objects.
C217.3	Views like elevation, section, furniture plan for a small residential building
C217.4	Detailed formatted and dimensioned Civil Engineering drawings.

## S. Y. B. Tech. (Civil Engineering) – II, Semester- IV

### CV221: WATER SUPPLY ENGINEERING

Upon successful completion of course the student will be able to

C221.1	Plan and design water conveyance systems for a rural/urban area based on population forecasts.
C221.2	Design various water treatment units and plan their operations on the basis of raw water quality and water demand.
C221.3	Apply knowledge of advanced water treatment processes for individual water purification units.
C221.4	Plan and design water distribution systems
C221.5	Identify operation and maintenance problems in water supply systems and suggest suitable solutions.

### CV222: BUILDING PLANNING AND DESIGN

After successful completion of the course the students will be able to:

C222.1	Plan residential and public buildings, according to the prevalent building byelaws
C222.2	Prepare 'Municipal building permission drawings' of a residential buildings using CADD software tools.
C222.3	Plan appropriate building services for a building
C222.4	Design a rain water harvesting system for a building.
C222.5	Plan appropriate acoustics, sound insulation and fire fighting arrangements for a building

### CV223: Hydraulic Engineering

At the end of this course, students will be able to

C223.1	Apply their knowledge of fluid mechanics in addressing problems in open channels.
C223.2	Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
C223.3	Carry out hydraulic design of notched, weirs and spillways
C223.4	Explain the working of Pelton, Francis and Kaplan turbines and pumps along their performance parameters.
C223.5	Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics

### CV224: ICT for Development (Open Elective-I)

Students will be able to

C224.1	Use Learning Management system like MOODLE
C224.2	Prepare documents and Presentations using information processing tools.



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C224.3	Use spreadsheets & databases for problem solving in civil engineering
C224.4	Prepare reports using LaTeX.
C224.5	Create basic website using Wordpress.
C224.6	Get acquainted with Netiquettes and plagiarism.

### CV225: STRUCTURAL ANALYSIS

On completion of this course the students will be able to,

C225.1	Employ the knowledge of structural mechanics to describe the behavior of structures.
C225.2	2. Analyze determinate and indeterminate structural members subjected to different types of loadings.
C225.3	3. Discretize simple structures; identify static and kinematic degrees of freedom
C225.4	4. Analyze beams, trusses and frames for joint displacements, and forces in members, by force method and displacement method.

### CV226: ENGINEERING MATHEMATICS-III

At the end of this course, the students will be able to

C226.1	Solve higher order linear differential equation with constant coefficient
C226.2	Solve partial differential equation of first order
C226.3	Express a function in terms of sine and cosine components so as to model simple periodic functions.
C226.4	Apply Laplace and inverse Laplace transforms for solving linear differential equations.
C226.5	Find the relation between two variables for the given data using regression
C226.6	Sketch and explain various probability distribution functions

### CV227: COMPUTER PROGRAMMING AND NUMERICAL METHODS

On completion of the course, the students will be able to develop computer programs for

C227.1	Various Civil Engineering Problems
C227.2	Matrix operations, which are necessary for structural analysis.
C227.3	Calculating Roots of equation, Numerical Integration, ordinary differential equations and their various applications in Civil Engineering.
C227.4	Carrying out statistical analysis of data for various statistical methods, with applications from Civil Engineering domain

## T.Y. B. Tech (Civil Engineering)- I-Semester-V

### C311. DESIGN OF STEEL STRUCTURES

**Upon successful completion of the course the students will be able to:**

C311.1	Select appropriate load combinations for 'Limit State' design of various elements of steel structures for strength and serviceability
C311.2	Analyze and design Tension members, Compression members, flexural members and their connections.
C311.3	Analyze beams and portal frames by plastic analysis approach
C311.4	Analyze beams and portal frames by plastic analysis approach.
C311.5	Analyze and design a Roof truss for given loading conditions.
C311.6	Design Column, Column base for given loading conditions.

### C312 GEOTECHNICAL ENGINEERING

**By the end of this course, the student will be able to:**

C312.1	Determine various index properties and strength properties of soil in the laboratory to characterize and classify the soil.
C312.2	Estimate the permeability and seepage through soil mass by applying basic hydraulic flow principles.
C312.3	Draw stress contours in soil mass by applying stress distribution theory.
C312.4	Determine shear strength parameters of soil under various drainage conditions
C312.5	Assess compaction and consolidation settlement of soil for given loading conditions.
C312.6	Determine earth pressure for earth retaining structure.

### CV- 313 WASTE WATER ENGINEERING & AIR POLLUTION

**Upon successful completion of course the student will be able to:**

C313.1	Plan the layout of sewage collection system, matching with topography of the region and characterization of sewage.
C313.2	Select aerobic or anaerobic wastewater treatment processes and decide their sequence.
C313.3	Design of aerobic and anaerobic wastewater treatment units and disposal of treated wastewater into the streams.
C313.4	Elaborate the novel decentralized wastewater treatment systems.
C313.5	Select appropriate methods of Solid waste Disposal and Management of hazardous waste based on their characteristics.
C313.6	Analyze air pollution and adopt various measures to control air pollution.

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## CV- 314 HIGHWAY & TUNNEL ENGINEERING

After completion of the course, students will be able to

C314.1	Choose the ideal alignment for highways after thorough understanding of planning and different surveys.
C314.2	Design various geometric elements of highway as per IRC standards.
C314.3	Describe the different steps in highway construction and select appropriate drainage system.
C314.4	Determine the highway economic cost by different methods of highway projects and explain highway financing.
C314.5	Select appropriate method of tunnel construction in different types of soils.

## CV- 315 HYDROLOGY AND WATER RESOURCES ENGINEERING

After studying this subject the students will be able to

C315.1	Estimate runoff, based on rainfall data and watershed characteristics.
C315.2	Estimate design flood for a civil engineering project.
C315.3	Calculate yield of open well and tube well for various types of aquifers using knowledge of ground water hydrology.
C315.4	Elaborate National and State Water Policies.
C315.5	Select appropriate water application technique of irrigation, depending upon type of crop, soil moisture and water availability.
C315.6	Select suitable soil & water conservation techniques for particular watershed.

## SL- 31A(1). SELF LEARNING (H.S.S. COURSE)- ECONOMICS

At the end of this course, students will be able to

SLH- 31.1	Identify the Basic Economic problems, Resource Constraints
SLH- 31.2	Apply various theories of economics for economic growth
SLH- 31.3	Identify causes of Inflation consequence and remedies
SLH- 31.4	To assess the impact of International Trade, foreign exchange on Indian economy

## SL- 31A(2). SELF LEARNING (H.S.S. COURSE)- INTELLECTUAL PROPERTY RIGHTS FOR TECHNOLOGY DEVELOPMENT AND MANAGEMENT

At the end of this course, students will be able to

SLH- 31.1	Appreciate the intellectual property rights coming out of research and intellectual works
SLH- 31.2	Demonstrate their knowledge about the process of acquiring the patents and copyrights for the innovative works.
SLH- 31.3	Elaborate the role of Indian IPR system and role of WTO in protecting Intellectual Property Rights
SLH- 31.4	Avoid the plagiarism in their thesis, research papers etc. which can be questioned legally.

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## SL- 31A(3). INTRODUCTION TO SOCIOLOGY

At the end of this course, students will be able to

SLH- 31.1	Interpret the effect of various social phenomena on sociology
SLH- 31.2	Elaborate the role of urbanization on the society
SLH- 31.3	Appreciate the need of social institutions for better society.
SLH- 31.4	Assess the role of modernization, industrialization, environmental/ecological changes in the development of society.

## SL- 31A(4). STRESS AND COPING

At the end of this course, students will be able to

SLH- 31.1	Identify various sources and nature of a stress.
SLH- 31.2	Elaborate the effects of medical, psychological and behavioural stress.
SLH- 31.3	Provide social support to mitigate the stress.
SLH- 31.4	Adopt various stress management techniques.

## SL- 31A(5). PROFESSIONAL ETHICS & HUMAN VALUES

At the end of this course, students will be able to

SLH- 31.1	Inculcate the human values in their behaviour.
SLH- 31.2	Demonstrate the Engineering ethics in their professional practice.
SLH- 31.3	Practice the safety and responsibility and professional rights in their professional practice.
SLH- 31.4	Incorporate the code of ethics of Global organizations such as ASME, ASCE, and IEEE

## CV- 317 PLANNING & DESIGN OF PUBLIC BUILDING

At the end of this course, students will be able to

C316.1	Plan and design a public building according to requirements adhering to appropriate norms and standards.
C316.2	Prepare “Municipal drawing” for public buildings for obtaining building permission from competent authority.
C316.3	Prepare the building drawings by using suitable ‘Computer Aided Drawing and Design’

## T.Y. B. TECH CIVIL – II-SEMESTER-VI

### CV321 FOUNDATION ENGINEERING

At the end of this course, students will be able to,

C321.1	Evaluate bearing capacity of soil by various analytical and experimental approaches by obtaining the data from soil exploration.
C321.2	Perform geotechnical design of shallow foundation such as isolated footing, combined footing, raft foundation.
C321.3	Apply suitable ground improvement techniques for construction of footing in difficult soil.
C321.4	Perform geotechnical design of deep foundation such as Pile foundation and Caisson foundation
C321.5	Investigate slope stability of embankments

### CV322. HYDRAULIC STRUCTURES AND WATER POWER ENGINEERING

At the end of this course, students will be able to

C322.1	Plan and design the reservoirs depending upon the water resources potential.
C322.2	Analyze and design Gravity dams and Earth dams (Simple Designs).
C322.3	Elaborate the design principles of Arch dams
C322.4	Carry out Hydraulic Design of spillways
C322.5	Select appropriate method of river training depending upon river characteristics
C322.6	Estimate water power potential at a site.

### C323 PROFESSIONAL ELECTIVE-I- 323 (A) MASONRY STRUCTURES

At the end of this course, students will be able to

C323.1	Select various types of masonry units based on their properties.
C323.2	Classify defects and crack in masonry and suggest remedial measures.
C323.3	Apply various formulae for finding compressive strength of masonry units.
C323.4	Determine permissible stresses and design criteria as per IS: 1905 and SP-20.
C323.5	Design different types of masonry walls for different load considerations.

### C323 PROFESSIONAL ELECTIVE-I- 323 (B) STRUCTURAL ANALYSIS BY MATRIX METHODS

At the end of this course, students will be able to

C323.1	Describe the concepts of flexibility and stiffness method of analysis for simple problems.
C323.2	Analyze continuous beams, rigid frames and trusses by using element flexibility method.
C323.3	Analyze continuous beams, rigid frames and trusses by using element stiffness method.
C323.4	Analyze continuous beams, trusses by direct stiffness method.
C323.5	Evaluate secondary stresses.

## **C323 PROFESSIONAL ELECTIVE-I- 323 (C) STRUCTURAL DYNAMICS**

C323.1	Develop mathematical models for engineering structures using knowledge of structural Dynamics
C323.2	Apply different theories for vibration study of structures.
C323.3	Interpret dynamic analysis results for design, analysis and research purposes
C323.4	Apply structural dynamics theory to earthquake analysis and design of structures.

## **C323 PROFESSIONAL ELECTIVE-I- 323 (D) STRUCTURAL GEOLOGY**

C323.1	Explain the geometry and type of geological structures present in earth.
C323.2	Describe the features formed in rocks when subjected to stress.
C323.3	Elaborate the impact of structural geology to active tectonic settings
C323.4	Depict the micro and macro scale deformation mechanisms (viz., brittle, ductile).
C323.5	Interpret models used in structural geology to demonstrate poly-phase deformations

## **C323 PROFESSIONAL ELECTIVE-I- 323 (E) URBAN TRANSPORTATION PLANNING**

C323.1	Design and carry out surveys to provide the data required for transportation planning.
C323.2	Prepare zonal demand generation and attraction regression models.
C323.3	Prepare demand distribution models and modal split models for mode choice analysis.
C323.4	Develop and calibrate trip generation rates for specific types of land use developments.
C323.5	Compare among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization.

## **C323 PROFESSIONAL ELECTIVE-I- 323 (F) PAVEMENT DESIGN**

C323.1	List and explain the various factors affecting design and performance of pavements.
C323.2	Calculate the stresses and deflection in flexible and rigid pavements.
C323.3	Design flexible and rigid pavements.
C323.4	Design the overlay thickness for existing pavement as per IRC standards

## **C323 PROFESSIONAL ELECTIVE-I- 323 (G) METRO SYSTEMS & ENGINEERING**

C323.1	Demonstrate the knowledge of basic planning and financials of metro network systems.
C323.2	Illustrate the surveys and investigations required for construction of elevated and underground stations with safety measures.
C323.3	Present track standards and geometrical features of metro rail tracks.
C323.4	Suggest signaling, fire control and ventilation system for stations and buildings.

## **C323 PROFESSIONAL ELECTIVE-I- 323 (H) CONSTRUCTION ENGINEERING MATERIALS**

C323.1	Examine the properties of common construction materials along with their behaviors under different environments, short- or long-term.
C323.2	Assess material properties, mechanical tests and quality control tests for, concrete, masonry, glass, plastics, iron and steel, paints and protective coatings, bituminous products, gypsum products, resilient flooring, and carpeting.
C323.3	Appraise appropriateness and sustainability of materials for construction projects.
C323.4	Select the sustainable materials based on the international standard practices and certification.
C323.5	Explain about innovative sustainable construction materials and their uses in construction.

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### **C323 PROFESSIONAL ELECTIVE-I- 323 (J) INFRASTRUCTURAL PLANNING & MANAGEMENT**

C323.1	Apply Infrastructure Engineering concepts and explain Public Private Partnership in Civil Engineering.
C323.2	Explain policies, economics, operation research, and technologies prevailing in infrastructural engineering and the social aspects of infrastructure development.
C323.3	Apply the advanced infrastructure tools for successful infrastructure Management.

### **C323 PROFESSIONAL ELECTIVE-I- 323 (K) ECOLOGICAL ENGINEERING**

C323.1	Classify the structure and functioning of ecosystems.
C323.2	Analyze impacts of watershed, design of ecology and energy and mass flow through ecosystem.
C323.3	Evaluate the ecosystem services and analyze its control and feedback systems.
C323.4	Design ecosystem services by landform and stream restoration and also carry out the green infrastructure design.

### **C323 PROFESSIONAL ELECTIVE-I- 323 (L) SOLID AND HAZARDOUS WASTE MANAGEMENT**

C323.1	Develop solid waste management systems with respect to its physical properties, and associated critical considerations in view of emerging technologies.
C323.2	Select and adopt the appropriate methods for solid waste collection, transportation, redistribution and disposal.
C323.3	Identify the types of hazards and describe methods of disposal of hazardous solid waste.
C323.4	Implement legal, political and administrative considerations in design and operation of solid and hazardous waste management.

### **C323 PROFESSIONAL ELECTIVE-I- 323 (M) PHYSICO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT**

C323.1	Implement the concepts of emerging/advanced physical, chemical and biological processes for the treatment of water and wastewater.
C323.2	Evaluate the emerging/advanced hybrid physical, chemical and biological systems for the treatment of water and wastewater.
C323.3	Design the emerging/advanced physical, chemical and biological water and wastewater treatment facilities.
C323.4	Evaluate environmental and public health hazards and recommend sustainable wastewater treatment technologies and approaches.

### **C323 PROFESSIONAL ELECTIVE-I- 323 (N) HYDRAULIC MODELLING**

C323.1	Perform numerical analysis of problems in water resources engineering.
C323.2	Develop physical models.
C323.3	Model the open channel flow.
C323.4	Model the coastal processes and near shore structures.

### **C323 PROFESSIONAL ELECTIVE-I- 323 (O) URBAN HYDROLOGY AND HYDRAULICS**

C323.1	Develop intensity duration frequency curves for urban drainage systems.
C323.2	Develop design storms to size the various components of drainage systems.
C323.3	Apply best management practices to manage urban flooding.
C323.4	Prepare master drainage plan for an urbanized area.

### **C323 PROFESSIONAL ELECTIVE-I- 323 (P) INSTRUMENTATION & SENSOR TECHNOLOGIES FOR CIVIL ENGG. APPLICATIONS**

C323.1	Analyze the errors during measurements
C323.2	Specify the requirements in the calibration of sensors and instruments
C323.3	Explain the noise added during measurements and transmission, the measurement of electrical variables and the requirements during the transmission of measured signals.
C323.4	Construct instrumentation and computer networks
C323.5	Suggest proper sensor technologies for specific applications
C323.6	Design and set up measurement systems and carry out the studies

### **C323 PROFESSIONAL ELECTIVE-I- 323 (Q) OPEN CHANNEL AND RIVER HYDRAULICS**

C323.1	Demonstrate basic principles of the open channel flow.
C323.2	Analyze the various types of flows viz. uniform and non uniform flow, gradually varied flow, rapidly varied flow etc.
C323.3	Explain the mechanics of sediment transport
C323.4	Apply the knowledge of open channel hydraulics to river engineering.
C323.5	Apply the knowledge of dimensional analysis to develop different hydraulic models



## T.Y. B. Tech Civil – Part II

### C324 DESIGN OF CONCRETE STRUCTURES-I

At the end of the course, students will be able to:-

C324.1	Design appropriate type of slab for a given loading.
C324.2	Design appropriate type of slab for a given loading.
C324.3	Design beam subjected to combined bending, shear and torsion.
C324.4	Analyze and design appropriate type of column.

### CV- 325 PRINCIPLES OF MANAGEMENT AND QUANTITATIVE TECHNIQUES

Upon successful completion of the course the students will be able to:

C325.1	Demonstrate decision making and communication as a member of a team as well as Lead a team for effective management of construction projects.
C325.2	Apply the Optimization techniques for decision making in construction industry.
C325.3	Carry out ABC analysis, Break even analysis and calculate EOQ and Inventory costs for construction project.
C325.4	Create and edit master libraries in the ERP system.
C325.5	Use Statistical Methods and Control charts (X, R, p, c charts) for quality control of materials and workmanship in Civil Engineering projects.

### CV- 326 (SL32)SELF LEARNING TECHNICAL COURSES

#### SL32-(A)(1) GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES

On successful completion of this course the students will be able to:

C326.1	Identify the different types of geo textile and their suitability for the soil reinforcement structures;
C326.2	Perform the laboratory testing of Geo synthetics
C326.3	Design 'Reinforced Earth' retaining structures
C326.4	Select appropriate soil reinforcement for erosion control, drainage and filtration
C326.5	Design soil reinforcement using Geo synthetic for pavement application and landfills

#### SL32-(A)(2) RURAL ROADS

On successful completion of this course the students will be able to:

C326.1	Plan the rural roads and develop rural road network.
C326.2	Design different elements of road geometrics of rural roads.
C326.3	Apply the knowledge of using locally available materials for construction and aimat low cost rural roads.
C326.4	Design the rural road pavement as per IRC standards.
C326.5	Carry out construction and maintenance of rural roads.

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### **SL32-(A)(3) PLANNING FOR SUSTAINABLE DEVELOPMENT**

On successful completion of this course the students will be able to:

C326.1	Identify the performance criteria, resource commitment, and measurement of sustainability and integration of sustainability programs
C326.2	Explain about innovative sustainable methods and their uses in civil Engineering.
C326.3	Connect with others who can help in facilitating peace, justice, inclusion and strong institutions in their country
C326.4	Support the development of policies promoting all the pillars of sustainability and related approaches

### **SL32-(A)(4) TQM AND MIS IN CIVIL ENGINEERING**

On successful completion of this course the students will be able to:

C326.1	Compare quality control, quality assurance, total quality control and total quality management (TQM)
C326.2	Apply the TQM tools such as Six Sigma, Kaizen, Supply Chain Management
C326.3	Develop an MIS for a construction organization associated with building works
C326.4	Prepare typical checklist for concreting activity, formwork activity, steel reinforcement activity.

### **SL32-(A)(5) EARTHQUAKE RESISTANT NON-ENGINEERED CONSTRUCTION**

On successful completion of this course the students will be able to:

C326.1	Identify the type and extent of damage occurred in non-engineered construction.
C326.2	Apply the earthquake resistant concepts for non-engineered (Stone and Brick masonry) constructions.
C326.3	Incorporate the construction aspects for brick and other masonry units.
C326.4	Incorporate the features of the strengthening of masonry buildings.

### **CV- 327 PROJECT ON STEEL STRUCTURES**

Upon successful completion of the course the students will be able to:

C327.1	Design and assemble the various components of Industrial shed with roof truss or portal frame or gable Frame and prepare their detailed computer aided drawing
C327.2	Design the various components of Building frame/Foot bridge/Welded plate girder and prepare their detailed computer aided drawing
C327.3	Analyze the steel structure using standard structural engineering application software
C327.4	Create report for the structure as per Analysis and Design.

### CV- 328 FIELD TRAINING REPORT

At the end of this course, students will be able to

C328.1	Make technical communication with the Company/ Contact Person about the intent and permission for the field training
C328.2	Collect knowledge about the company and nature of work being conducted
C328.3	Observe the Safety precautions on and off the field
C328.4	Prepare the field notes
C328.5	Draft the field training reports.

## B.E. CIVIL – PART I (CBCS)

### C411. DESIGN OF CONCRETE STRUCTURES-I

**Course Outcomes:** At the end of course, students will be able to

C411.1	Use suitable design philosophy for designing RCC structural elements
C411.2	Analyze and Design of different RCC Slab actions by Limit State Method.
C411.3	Analyze and Design of different RCC Beam actions Limit State Method.
C411.4	Analyze and Design of rectangular RCC Beam subjected to combined actions including Torsion by Limit State Method.
C411.5	Analysis and Design of different types of RCC Columns by Limit State Method

### C412. QUANTITY SURVEYING & VALUATION

On completion of the course, the students will be able to:

C412.1	Write specifications and prepare estimates for various Civil Engineering works.
C412.2	Carry out analysis of rates for various items of works of construction.
C412.3	Carry out valuation of land and buildings.
C412.4	Demonstrate professional ethics in Civil Engineering sector.

### C413. EARTHQUAKE ENGINEERING

On completion of the course, the students will be able to:

C413.1	Apply the Principles of Earthquake Engineering in planning, design and construction of building.
C413.2	Demonstrate the dynamic analysis of structures under earthquake load.
C413.3	Incorporate Earthquake resistant features for various types of construction.
C413.4	Adopt the provisions of IS 1893-2016 and IS 13920- 2016 Codes.
C413.5	Incorporate Ductility features in the structures.

## C414. ENGINEERING MANAGEMENT – II

At the end of this course the students will be able to

C414.1	Plan the project and prepare Bar chart and Network to optimize the project duration and cost
C414.2	Update the network and re-evaluate the resources.
C414.3	Demonstrate the decision-making abilities based on economics in projects and to appraise alternative projects
C414.4	Analyse life cycle cost and value of the project.
C414.5	Use appropriate project management application software for planning, tracking and reporting progress of civil engineering projects

## ELECTIVE II

### 415A. OPEN CHANNEL AND RIVER HYDRAULICS(Elective-II)

At the end of course, the students will be able to

C415A.1	Demonstrate basic principles of the open channel flow.
C415A.2	Analyse the various types of flows viz. uniform flow, gradually varied flows rapidly varied flow etc.
C415A.3	Apply the knowledge of open channel hydraulics to river engineering.
C415A.4	Perform model analysis studies.

### 415B. AIR POLLUTION AND CONTROL (Elective-II)

On successful completion of this course the students will be able to

C415B.1	Identify the sources of air pollutants and their effect on human, plants and materials.
C415B.2	2. Apply knowledge of meteorology for controlling air pollution
C415B.3	3. Design air pollution controlling equipment's.
C415B.4	4. Apply knowledge of legislation for prevention and control of air pollution.

### 415C. DESIGN OF FOUNDATIONS (Elective-II)

By the end of the course students should be able to

C415C.1	Evaluate the bearing capacity of soil analytically as well as by field test such as plate load test, Standard Penetration test etc.
C415C.2	Design the different shallow foundation and deep foundation to meet the site requirement and loading conditions
C415C.3	Apply suitable soil improvement techniques such as soil isolation, Geotextiles or use of CNS soil for the give field condition.
C415C.4	Design the simple machine foundations using codal provision.

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### 415D. ADVANCED DESIGN OF CONCRETE STRUCTURES (Elective-II)

At the end of this course, students will be able to

C415D.1	Analyse and design Flat, Grid and Circular RCC Slabs.
C415D.2	Analyse and design RCC Combined Footing and Raft footing.
C415D.3	Analyse and design RCC Pile foundation with Pile cap.
C415D.4	Analyse and design RCC Deep beams.
C415D.5	Analyse and design RCC Rectangular and Circular ESR and USR.

### 415E. MANAGERIAL TECHNIQUES (Elective-II)

Upon successful completion of course the students will be able to:

C415E.1	Apply the acquainted knowledge of Work Study Methods in civil engineering industry.
C415E.2	Exhibit understanding on Total Quality management philosophies and frameworks
C415E.3	Apply quality tools and techniques in civil engineering industry
C415E.4	Apply reliability analysis principles and cost reduction technique for civil engineering works

### 415F. COMPUTER APPLICATION IN CIVIL ENGINEERING (Elective-II)

By the end of the course students should be able to

C415F.1	Write computer programmes for analysis and design of variety of structural elements.
C415F.2	Use relevant application software for the analysis of structures
C415F.3	Use computer aided design and drafting software tools using suitable application.
C415F.4	Develop elementary application software tools for Civil Engineering applications

### 415G. ADVANCED STRUCTURES (Elective-II)

By the end of the course students will be able to

C415G.1	Draw influence line diagrams for various types of beams
C415G.2	Analyse beams curved in plan and fixed arches
C415G.3	Implement approximate methods for analysis of portal frames subjected to lateral loads
C415G.4	Analyse plane frames and space trusses

### 415H. ENTREPRENEURSHIP (Elective-II)

By the end of the course the students will be able to

C415H.1	Exhibit skills necessary to craft strategies and initiatives which can enable growth and sustainability in an entrepreneurial venture.
C415H.2	Prepare preliminary and final project report
C415H.3	Exhibit higher-level critical thinking skills, evidenced by analysis, evaluation, and synthesis.
C415H.4	Demonstrate skills to establish and manage the accounting process, to employ break even and cost-volume-profit tools.

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### 415I. REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM APPLICATIONS (Elective-II)

By the end of the course students should be able to

C415I.1	Demonstrate the principles of remote sensing and digital image processing;
C415I.2	Exhibit knowledge of geographic information systems (GIS);
C415I.3	Apply remote sensing and GIS to solve problems in Civil Engineering
C415I.4	Use image processing and GIS application software.

### 416. SEMINAR

By the end of the course students should be able to

C416.1	Identify the recent developments and technology transfer taking place in the Civil Engineering domain
C416.2	Prepare and deliver the presentation on the subject chosen using recent presentation tools
C416.3	Enhance the soft skill and presentation skill.

### 417. PROJECT WORK

At the end of the course student will be able

C417.1	Develop an ability to apply the basic knowledge of mathematics, science and engineering to real-life problems.
C417.2	Identify the real-life problem and present the solution by conducting experimental/ analytical study and in and off the laboratory.
C417.3	Apply modern tools such as different application software, modern instrumentation for the most precise study of the project undertaken
C417.4	Demonstrate a commitment to teamwork while working with other students of diverse culture and different intellectual backgrounds.

## B.E. Civil – Part II (CBCS)

### 421. DESIGN OF CONCRETE STRUCTURES – II

At the end of course, students will be able to

C421.1	Analyse and Design RCC Stairs and Column Footings.
C421.2	Analyse and Design of RCC Retaining walls and Water tanks.
C421.3	Analyse Pre-stress concrete sections.
C421.4	Determine Loss of Pre-stress and Design of Pre-stress Beams.
C421.5	Analyse and Design the End Block of post tensioned PSC girder.

### 422. CONSTRUCTION PRACTICES AND TOWN PLANNING

By the end of the course students should be able to

C422.1	Prepare layout of small towns
C422.2	Identify and select various inputs for town planning
C422.3	Calculate output of construction machines
C422.4	Execute various items of construction work using construction machinery and adopt appropriate safety measures.

### 423. TRANSPORTATION ENGINEERING II

On completion of the course, the students will be able to:

C423.1	Perform geometric design for the Railway tracks.
C423.2	Evaluate engineering properties of the materials, to calculate the material quantities required for construction.
C423.3	Design simple turnout at points and crossings and describe the working principles of railway interlocking system.
C423.4	Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids.
C423.5	Describe components of Docks and Harbour and their working principles

## ELECTIVE III

### 423A. ADVANCED ENGINEERING GEOLOGY (Elective-III)

By the end of the course students should be able to

C423A.1	Demonstrate knowledge of seismic zones of India and seismic activity in Deccan trap region.
C423A.2	Undertake geological studies required for various Civil Engineering project site
C423A.3	Characterize various soils derived from different types of rocks
C423A.4	Select appropriate technique of Geophysics for site exploration
C423A.5	Identify aquifer zones in project site.

### 423B. GROUND IMPROVEMENT TECHNIQUES(Elective-III)

By the end of the course students should be able to

C423B.1	Select and apply suitable ground modification technique while dealing with complex soils.
C423B.2	Design shallow compaction system as well as deep dynamic compaction system.



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C423B.3	Design PVD system, sand drains, stone columns, dewatering systems.
C423B.4	Apply suitable stabilization techniques which suits the soil at the site.

### 423C. TRAFFIC ENGINEERING AND CONTROL(Elective-III)

On completing this course, the students will be able to

C423.C1	Undertake various traffic studies and analysis of traffic data including parking studies and calculation of parking demand.
C423C.2	Distinguish relation between flow, density, speed, concept of level of service for urban and rural area.
C423C.3	Describe the regulations on vehicle, driver and speed and Vehicle as per Motor Vehicle Rules.
C423C.4	Design intersections and signals and propose various traffic signs, road marking and lighting at various locations.
C423C.5	Apply principles of various modern instruments used in traffic studies.

### 423D. INFRASTRUCTURAL ENGINEERING(Elective-III)

Upon successful completion of course the students will be able to:

C423D.1	Apply Infrastructure Engineering concepts and a understand Public Private Partnership in Civil Engineering.
C423D.2	Apply the principles of Public private partnership in Infrastructure
C423D.3	Implement policies, economics, operation research, and technologies prevailing in infrastructural engineering.
C423D.4	Apply the Information Technology and Systems tools for successful infrastructure Management.

### 423E. PROJECT APPRAISAL(Elective-III)

By the end of the course students should be able to

C423E.1	Formulate projects and identify projects for various locations and sites.
C423E.2	Apply the financial aspect for financial analysis and proper financial management for Civil Engineering projects.
C423E.3	Apply proper methodology and various Technical, Financial and Investment Criteria, Appraisal and risk analysis for Civil Engineering projects.
C423E.4	Prepare the reports for presentation and administration the project.

### 423F. SOLID AND HAZARDOUS WASTE MANAGEMENT(Elective-III)

Upon successful completion of course, the students will be able to:

C423F.1	Implement waste reduction and resource recovery methods
C423F.2	Select and adopt the appropriate waste disposal methods for the prevailing situation.
C423F.3	Identify the types of hazards and implement the precautionary methods.
C423F.4	Implement legal, political and administrative considerations in design and operation of solid and hazardous waste management.

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## 423G. DYNAMICS OF STRUCTURES(Elective-III)

On completion of the course, the students will be able to:

C423G.1	Apply the Principles of Earthquake Engineering in planning, design and construction of building.
C423G.2	Perform the dynamic analysis of structures under earthquake load.
C423G.3	Incorporate Earthquake resistant features for various types of construction.
C423G.4	Implement the provisions of IS 1893-2016 and IS 13920- 2016 Codes.
C423G.5	Incorporate Ductility features in the structures.

## 423H. ENVIRONMENTAL MANAGEMENT(Elective-III)

Upon successful completion of course the students will be able to:

C423H.1	Demonstrate basic principles of Environmental Management System.
C423H.2	Exercise different Environmental pollution control acts.
C423H.3	Select and apply appropriate technology for management of electronic, biomedical and industrial waste
C423H.4	Perform Environmental Impact Assessment of small project

## 423I. DESIGN OF BRIDGES(Elective-III)

By the end of the course students should be able to

C423I.1	Evaluate different action loads coming on the bridges as per the IRC bridge code
C423I.2	Design the different types of Deck slabs such as Solid slab and T beam type slab for two lane and four lane bridges.
C423I.3	Verify the adequacy of the Pier and Abutments for the given data
C423I.4	Arrive at most suitable techniques for the maintenance and repair of the bridge under the given conditions

## 424. PROJECT ON R.C.C. STRUCTURES

On completion of the course, the students will be able to:

C424.1	Apply codal provisions in the analysis and design of structures in accordance with relevant IS codes.
C424.2	Prepare detailed drawing of R.C.C section of designed building.
C424.3	Perform the analysis using relevant application software.

## 425. PROJECT WORK

At the end of the course student will be able

C425.1	Develop an ability to apply the basic knowledge of mathematics, science and engineering to real-life problems.
C425.2	Identify the real-life problem and present the solution by conducting experimental/ analytical study and in and off the laboratory.
C425.3	Apply modern tools such as different application software, modern instrumentation for the most precise study of the project undertaken
C425.4	Demonstrate a commitment to teamwork while working with other students of diverse culture and different intellectual backgrounds.