

M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054



**RAMAIAH
UNIVERSITY**
OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: M.Tech. in Structural Engineering

Programme Code: 114

Programme Outcome (PO)

Programme Specific Outcome (PSO)

Course Outcomes (CO)

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Faculty of Engineering and Technology
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Faculty of Engineering and Technology (FET)

Programme Name: M.Tech. (Structural Engineering)

Programme Outcomes (POs)

M.Tech. graduates will be able to:

- PO 1. Modelling, simulation, analyses, design and validation of structural components/systems
- PO 2. Modern construction technologies and materials Selection of materials, manufacturing processes and development of structural components and systems
- PO 3. Experiments on structural components/systems and evaluate their performance
- PO 4. Use of commercially available software for analysis and design
- PO 5. General perspective and opportunities for a career in structural engineering design and analysis in industry, the public sector and non-governmental organisations
- PO 6. Teamwork, lifelong learning and continuous improvement

Programme Specific Outcomes (PSOs)

Knowledge and Understanding: After undergoing this programme, a student will be able to:

- PSO1: Recognize and understand the major features of structural engineering with the perspective of structures' safety and sustainability; explain working, theoretical principles and design of various structural systems
- PSO2: Describe the factors critical in designing structures for their structural, handling and safety requirements and approach for design to meet the requirements of national and other codes
- PSO3: Explain the design requirements for structural stability, serviceability and durability and disaster prevention in civil structural system; explain the design requirements for structures to withstand forces due to temperature, creep, cracking and imposed loads
- PSO4: Understand research techniques including information retrieval, experimental design, theoretical derivation, and/or modelling, discuss various structural materials and systems

Cognitive Skills: After undergoing this programme, a student will be able to:

- PSO5: Identify, design and analyse structural engineering problems and solve using a multidisciplinary approach
- PSO6: Analyse and propose design changes essential to balance costs, buildability, safety and environmental impact and sustainability
- PSO7: Integrate and apply professional judgements to critically evaluate different design options relevant to limitations of local, national and international standards, codes of practice and building regulations
- PSO8: Acquire and implement broad research and analytical skills related to structural engineering and arrive at innovative structural design



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Practical Skills: After undergoing this programme, a student will be able to:

PSO9: Create structural drawings, working drawings, 3D geometric models of different Stages of construction as per national and international standards, codes of practice

PSO10: Create Finite Element, CFD and static and dynamic analyses models using CAE Tools

PSO11: Conduct physical tests on structural materials and structural components

PSO12: Obtain design information relevant to the site, including carrying out of site investigation, field tests and laboratory tests for soil, wind, earthquake and/or other environmental parameters

Capability Skills / Transferrable Skills: After undergoing the programme, a student will be able to:

PSO13: Manage information, develop technical reports and make presentations

PSO14: Build, Manage and Lead a team to successfully complete a project and communicate across teams and organizations to achieve professional objectives

PSO15: Work under various constraints to meet project targets

PSO16: Adopt to the chosen profession by continuously upgrading his/her knowledge and understanding through Life-long Learning philosophy

Course Outcomes (COs)

Course Title & Code: Advanced Concrete Technology and Modern Construction Techniques (20ECS501A)

After undergoing this module students will be able to:

- CO-1. Discuss the properties of fresh and hardened concrete along with the relevant test details
- CO-2. Compare and contrast the different technologies involved in manufacture, mix design and placement
- CO-3. Apply different codal provisions and prepare mix design of concrete and recommend suitable type of concrete for a given set of conditions
- CO-4. Discuss and compare different equipment and construction techniques adopted in the construction of substructures, superstructures and special structures
- CO-5. Discuss the retrofitting, dismantling and demolition procedures adopted for existing structures

Course Outcomes (COs)

Course Title & Code: Direct Stiffness Method and Finite Element Analysis (19STC502A)

After undergoing this module students will be able to:

- CO-1. Describe basic concepts, background review, theory of elasticity, energy concepts, equilibrium, energy methods for analyzing structures concepts of discretization and element formulation for finite element analysis
- CO-2. Recognize the scope for finite element analysis in civil structural design
- CO-3. Develop Interpolation models and shape functions in generalized and natural coordinates for 1D, 2D, 3D elements and axisymmetric elements
- CO-4. Model and analyse manually 1D and 2D structures
- CO-5. Compare and contrast analyses structures by using different elements


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Course Outcomes (COs)

Course Title & Code: Structural Dynamics and Earthquake Resistant Design (19STC503A)

After undergoing this module students will be able to:

- CO-1. Describe SDoF and MDoF system.
- CO-2. Discuss the concepts of seismology.
- CO-3. Derive equation of motion for free vibration, forced vibration for both damped and undamped cases for SDoF and MDoF systems
- CO-4. Formulate equation of motion for free vibration, forced vibration and flexural vibration of continuous systems.
- CO-5. Analyze Multi-storeyed buildings for earthquake loads and design base isolation systems.
- CO-6. Model and obtain performance of the SDoF and MDoF system under dynamic loads using MATLAB and FEA packages.

Course Outcomes (COs)

Course Title & Code: Advanced Structural Mechanics (19STE511A)

After undergoing this module students will be able to:

- CO-1. Describe the concept of stiffness and flexibility method, shear centre, unsymmetrical bending and beams on elastic foundation
- CO-2. Discuss circumferential stresses and radial stresses in curved beams
- CO-3. Locate the shear centre for singly symmetrical and unsymmetrical sections
- CO-4. Analyse curved beams, beam subjected to out of plane loading, unsymmetrical bending, and beams on elastic foundation
- CO-5. Evaluate stress analysis at various cross section in curved beams
- CO-6. Validate FEA tools for analysis of structures

Course Outcomes (COs)

Course Title & Code: Geotechnical earthquake engineering (19STE512A)

After undergoing this module students will be able to:

- CO-1. Discuss the fundamental principles of seismology and wave propagation
- CO-2. Discuss the role of soil deposits in modifying the ground motion parameters
- CO-3. Calculate the various ground motion parameters
- CO-4. Perform site response analysis
- CO-5. Estimate the liquefaction potential of deposits by different methods
- CO-6. Perform seismic design of selected geotechnical structures



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Course Outcomes (COs)

Course Title & Code: Design of Masonry, Timber Structures and Form Work (19STE513A)

After undergoing this module students will be able to:

- CO-1. Understand and describe the important structural characteristics of masonry and Timber structures
- CO-2. Analyze and design unreinforced masonry structures using engineering methods
- CO-3. Understand the behavior of reinforced masonry structures, and be able to design for flexure, shear, axial forces, combined flexure and axial forces, and in-plane shear forces
- CO-4. Design of Tension (Beams) and Compression (Column) timber member in a structure
- CO-5. Design the form work for Beams, Slabs, columns, Walls and Foundations

Course Outcomes (COs)

Course Title & Code: Design of Masonry, Timber Structures and Form Work (19STE513A)

After undergoing this module students will be able to:

- CO-1. Use statistical tools to express the traffic data for better interpretation.
- CO-2. Apply probability concept to understand the vehicular flow behavior helping the planners to predict traffic flow.
- CO-3. Use appropriate statistical testing tools to check the degree of accuracy in the traffic data analysis.
- CO-4. Test the hypothesis and assess the error involved in the data analysis.
- CO-5. Use software tools like MATLAB, MINITAB etc., for analysis of traffic data and also use curve fitting techniques for predicting the performance trends.

Course Outcomes (COs)

Course Title & Code: Design of Building and Allied Services (19STE521A)

After undergoing this module students will be able to:

- CO-1. Explain the concepts of Planning, analysis and design of buildings
- CO-2. Discuss the sewage, storm water drainage and wastewater treatment systems
- CO-3. Discuss Electrification, Lighting & Acoustics for buildings
- CO-4. Design mobility, air-conditioning and sewerage systems for buildings
- CO-5. Analyse and Design all the structural components of building

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Course Outcomes (COs)

Course Title & Code: Green Construction and Alternative Building Materials (19STE522A)

After undergoing this module students will be able to:

- CO-1. Discuss the green concepts, components of sustainable design and construction, modern, green and alternate building materials
- CO-2. Discuss building economics and cost effective design for green construction
- CO-3. Apply sustainable techniques in planning and execution of construction projects
- CO-4. Compare and choose different alternate building materials and technologies suitable for a particular construction project
- CO-5. Recommend technologies and equipment for production of alternate building materials for green construction
- CO-5. Design green building and construction process explain the concepts of Planning, analysis and design of buildings

Course Outcomes (COs)

Course Title & Code: Advanced Foundation Engineering and Machine Foundations (19STE523A)

After undergoing this module students will be able to:

- CO-1. Discuss and interpret the soil behaviour relevant to foundation systems from site exploration
- CO-2. Calculate the bearing capacity of footings in layered soils and slopes
- CO-3. Discuss contact pressure and theory of subgrade reaction
- CO-4. Analyze pile foundations and retaining structures
- CO-5. Discuss the elements of vibration theory and dynamic response of foundation

Course Outcomes (COs)

Course Title & Code: Advanced Structural Materials (19STE524A)

After undergoing this module students will be able to:

- CO-1. Discuss the different types of advanced structural materials used in building construction
- CO-2. Discuss the application of fibre reinforced plastics
- CO-3. Develop and design high strength, high density and high performance concrete mix
- CO-4. Discuss the microstructure of cementitious materials and durability and deterioration of concrete structures
- CO-5. Compare and choose different structural materials and technologies suitable for a particular construction project
- CO-6. Recommend technologies for production of advanced structural materials for engineering construction



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Course Outcomes (COs)

Course Title & Code: Design of Tall structures (19STE525A)

After undergoing this course students will be able to:

- CO-1. Achieve Knowledge of design and development of problem solving skills.
- CO-2. Understand the principles of strength and stability
- CO-3. Design and develop analytical skills.
- CO-4. Summarize the behavior of various structural systems.
- CO-5. Understand the concepts of P-Delta analysis

Course Outcomes (COs)

Course Title & Code: Design of Formwork and Precast Structures (19STE526A)

After undergoing this course students will be able to:

- CO-1. D Compute different types of loads acting on formwork and check for their stability
- CO-2. Design formworks for various civil engineering structures
- CO-3. Propose suitable construction and scaffolding technology for the construction of special structures
- CO-4. Suggest a cost effective solution for usage of equipment, formwork and technology
- CO-5. Compare and contrast the different technologies involved in manufacture, mix design and placement methods of concrete
- CO-6. Classify and design precast elements

Course Outcomes (COs)

Course Title & Code: Advanced Design of RCC structures (19STC511A)

After undergoing this course students will be able to:

- CO-1. Use the design philosophies and procedures for RC structures
- CO-2. Illustrate codal provisions and their application on different types of structures
- CO-3. Design RC Structures structures based on codal provisions of different countries and produce working structural working drawings
- CO-4. Analyze and design RC structures like flat slab, chimneys, deep beams, grid floors, bunkers, silos and water tanks using suitable software
- CO-5. Validate the analysis and design of RC structures using suitable software and compare with semi-empirical method

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Course Outcomes (COs)

Course Title & Code: Theory of Elasticity and Plasticity (19STC512A)

After undergoing this course students will be able to:

- CO-1. Apply the mathematical preliminaries to understand the basics of elasticity
- CO-2. Discuss the displacements, strains, state of stress in a body and stress equilibrium
- CO-3. Calculate the general state of stress and strain at a point in the body and body forces for equilibrium
- CO-4. Discuss the theorems of limit analysis and plastic behaviour
- CO-5. Discuss the concepts of yield surfaces, hardening, hardening models and normality rule
- CO-6. Apply the concepts to understand constitutive models and predict structural behaviour

Course Outcomes (COs)

Course Title & Code: Advanced Design of Steel Structures 19STC513A)

After undergoing this course students will be able to:

- CO-1. Use the design philosophies and procedures for Steel structures
- CO-2. Illustrate codal provisions and their application on different types of Steel, light gauge and cold formed structures
- CO-3. Design Metal structures based on codal provisions of different countries and produce working structural drawings
- CO-4. Analyze and design steel structures like tubular connections, transmission tower, light gauge steel structure, industrial building, aluminum structure using suitable software
- CO-5. Validate the analysis and design of metal structures using suitable software and compare with semi-empirical method apply the mathematical preliminaries to understand the basics of elasticity

Course Outcomes (COs)

Course Title & Code: Design of RCC, PSC and Steel Bridges (19STE531A)

After undergoing this course students will be able to:

- CO-1. Discuss the different types of bridges, loads and stresses acting on bridges
- CO-2. Discuss various surveys and investigations to be conducted for bridge project
- CO-3. Discuss the suitability of RCC, PSC and Steel bridges
- CO-4. Design various types of bearings, expansion joints and foundation for a bridge structure
- CO-5. Design of all components of RCC, PSC bridges and steel bridges



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Course Outcomes (COs)

Course Title & Code: Reinforced Soil Structures (19STE532A)

After undergoing this course students will be able to:

- CO-1. Discuss basics of reinforced earth construction
- CO-2. Describe geosynthetics and their functions
- CO-3. Explain the concept of soil nailing technique
- CO-4. Apply the design philosophies and design reinforced earth retaining walls
- CO-5. Apply the design philosophies and design reinforced earth foundations and embankments foundations

Course Outcomes (COs)

Course Title & Code: Fire and Safety Engineering Design (19STE534A)

After undergoing this course students will be able to:

- CO-1. Interpret the intentions of code requirements for fire safety
- CO-2. Discuss the concepts of fire severity and fire resistance
- CO-3. Discuss the various methods of testing structures for fire resistance
- CO-4. Calculate fire resistance, Depth of temperature reached, temperature in plane and bar type structures and change in strength of structures due to temperature variations
- CO-5. Design of concrete and steel structures to resist fire exposure

Course Outcomes (COs)

Course Title & Code: Condition assessment, Repair, Rehabilitation and Artificial Intelligence (19STE541A)

After undergoing this course students will be able to:

- CO-1. Explicate characteristics of AI that make it useful to real-world civil engineering problems, different causes of structural failures of buildings, bridges and other constructed facilities, sensors
- CO-2. Discuss Artificial Neural Network (ANN), Fuzzy logic (FL) and expert systems (ES), sensors and Data acquisition systems and their applications in specialisations of civil engineering
- CO-3. Identify suitable Sensor and SHM technique for a given structure, and AI models for applications Specialisations of civil engineering
- CO-4. Design Efficient and cost-effective approaches for repair, rehabilitation and retrofitting of structures Conduct forensic investigations, issue reports and provide expert testimony during depositions and trials
- CO-5. Apply concepts of ANN, FL and ES in specializations of Civil Engineering
- CO-6. Compare and contrast different failures and recommend code standards and practices to avoid failures in the future
- CO-7. Compute different types of loads acting on formwork and check for their stability



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Course Outcomes (COs)

Course Title & Code: Theory of plates, shells and composites (19STE542A)

After undergoing this course students will be able to:

- CO-1. Explain plate, shell and composite structures
- CO-2. Discuss the classical theories of plates, shells and composites
- CO-3. Solve simply supported plates subjected to various loads and boundary conditions
- CO-4. Evaluate different types of folded plates, lamina and laminates.
- CO-5. Analyze and design spherical domes, water tanks, barrel vaults, hyperbolic paraboloid roofs and laminated structural elements
- CO-6. Analyze and design plates, shells and composite structures by using standard FEA Packages

Course Outcomes (COs)

Course Title & Code: Design of Offshore Structures (19STE543A)

After undergoing this course students will be able to:

- CO-1. Discuss the types of offshore platforms
- CO-2. Calculate the various forces acting on offshore platforms
- CO-3. Discuss fabrication, erection and maintenance of offshore structures
- CO-4. Discuss failure modes of offshore structural components
- CO-5. Design Bracings, Jacket, Piles and tubular joints of offshore structures

Course Outcomes (COs)

Course Title & Code: Internship (19STP521A)

After undergoing this course students will be able to:

- CO-1. Describe the organization structure of the industry/business
- CO-2. Identify Business objectives of the organization
- CO-3. Describe the various departments of the organization and their activities and responsibilities to meet the business objectives
- CO-4. Discuss the limitations and new opportunities for growth of the organization
- CO-5. Express the education and skill requirement of graduates to pursue their career in industry



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Course Outcomes (COs)

Course Title & Code: Group Project (19STP522A)

After undergoing this course students will be able to:

- CO-1. Work in a team and undertake a project in the area of Transportation Engineering
- CO-2. Apply Transportation Engineering methodologies and reconfigurable techniques for executing road project
- CO-3. Apply appropriate research methodology while formulating a project
- CO-4. Define Specifications, Synthesize, Analyse, Develop and Evaluate a project
- CO-5. Develop a video which explains the project, exhibit, make a presentation and document the work

Course Outcomes (COs)

Course Title & Code: Dissertation and Publication (19STP523A)

After undergoing this course students will be able to:

- CO-1. Critically review scholarly literature collected from various sources for the project purpose and formulate a research problem
- CO-2. Prepare and present a research proposal
- CO-3. Conduct research to achieve research objectives
- CO-4. Propose new ideas/methodologies or procedures for further improvement of the research undertaken
- CO-5. Create research document and write research papers for publications
- CO-6. Defend the research findings in front of scholarly audience



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