August, 2019

M.TECH- STRUCTURAL AND CONSTRUCTION ENGINEERING (2019)

The growth in infrastructure requirements has posed a definite and critical need of qualified Structural as well as Construction Engineers. The aim of this program is to impart advanced fundamental concepts related to mechanics and dynamics of the structures. These coupled with courses related to recent developments in construction materials and technologies will impart cutting edge design methodologies and implementation strategies to students in both Sub and Superstructures of various infrastructure facilities. The course will also focus on laboratory work, industry oriented project exposure and dissertation based on research for all round development of Design & Construction Engineer.

The program’s goal is to provide students with advanced technical knowledge of evolving structural systems integrated with a solid grounding of design approaches. This program is designed for students and industry professionals seeking to advance their careers, and for academics preparing for the challenges of research and teaching. The courses are designed to establish a fine balance between academic fundamentals and industry realities and requirements.

This program will be able to find many employers from Government, private corporations, public sector undertakings, and teaching and/or research institutions in the country as well as abroad. The uniqueness of this course is the blend of exposure to strong theoretical foundation, practical design & construction approaches through adequate computational, analytical and execution skill development.

Programme Educational Objectives (PEOs)

PEO1: Create man power in Structural and Construction Engineering with competence in planning, design and execution of diverse projects as well as for academia.

PEO2: Develop an attitude of lifelong learning through research and multidisciplinary studies with consideration to global requirements and issues concerning society and environment.

PEO3: Demonstrate the ability to function as ethical and responsible professionals with leadership and management skills.

Program Outcomes (POs):

After completion of the program, graduates will be able to

PO1: Ability to demonstrate a degree of mastery in order to identify, formulate and solve problems in the domains of Structural and Construction Engineering
PO2: An ability to use the techniques, skills and modern engineering tools to analyze critically, carry out safe and economical design.

PO3: An ability to independently carry out research /investigation and development work to solve practical problems.

PO4: Ability to write and present a substantial technical report/document.

PO5: Ability for professional practice; to engage in lifelong learning to gain knowledge of contemporary issues and adapt oneself to the changing needs of the society.

PO6: Competence to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.
## CURRICULUM

### First Semester

<table>
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**Credits 18**

*Non Credit Course*

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**Total Credits 65**
## List of Courses

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<td>19SC720</td>
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<td>19SC723</td>
<td>Soil Dynamics and Machine Foundations</td>
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<td>Analysis and Design of Substructures</td>
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<td>Contract Laws &amp; Regulations</td>
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<td>Formwork, Scaffolding &amp; Shoring</td>
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**Project Work**

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19MA603 LINEAR ALGEBRA, LEGENDRE EQUATIONS 3-0-0-3
AND NUMERICAL METHODS

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

- Explain salient feature of orthogonality and its importance
- Solve the differential equations with constant coefficients, variable coefficients and importance of special functions like Bessels and Legendre polynomials.
- Understand, apply and solve the problems related to Eigen values and Eigen vectors using numerical methods


TEXT BOOKS / REFERENCES:


19SC601 ADVANCED STRUCTURAL MECHANICS 2-1-0-3

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

- Analyse statically indeterminate structures using advanced methods
- Determine element stiffness through flexibility and stiffness approaches
- Analyse structures under complex system of loading

Review of the concepts: Basic concepts of structural analysis; Basis for principle of virtual work; Principle of virtual forces - standard and matrix formulation; Force method for analyzing skeletal structures; Principle of virtual displacements - standard and matrix formulation; Displacement method for analyzing skeletal structures; Extension of displacement method to the generalized stiffness method; Basic concepts associated with
computer implementation of stiffness method. - One-dimensional beam element: Basis for cross-sectional level formulation of flexibility and stiffness; Gauss quadrature numerical integration scheme; Flexibility approach for determining element stiffness; Stiffness approach for determining element stiffness; Special consideration of shear effects in stiffness approach; Consideration of torsional effects for thin-walled member; Special considerations for finite joints (both rigid and flexible); Consideration of local load (incl. temperature) effects; Formulation of geometric stiffness due to axial force; Linearised buckling analysis.

TEXT BOOKS/ REFERENCES:


19SC611 THEORY OF ELASTICITY AND PLASTICITY 2-1-0-3

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

- Idealise plane stress and plane strain problems
- Analyse the principles and governing equations in elastic stage under different loading
- Solve 2 D and 3 D elastic boundary value problems in rectangular and and polar coordinates
- Explain plasticity effects during loading

TEXT BOOKS/ REFERENCES:


19SC612 ADVANCED STRUCTURAL DESIGN 3 -1-0-4

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

- Understand and apply the basic methods and models for crack width and deflection computations.
- Design of special RCC structures using different methods or models
- Design and detail of steel members, fasteners and connections
- Understand Cold formed steel members


TEXT BOOKS/ REFERENCES:

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

- Define the project scope and identify the procurement methods.
- Formulate, monitor and update project schedules.
- Apply suitable project controls in schedule, cost and resources.


TEXT BOOKS/ REFERENCES:


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

- Analyze the characteristics of mix constituents and design a concrete mix for field applications.
- Implement various special concrete and various NDT methods based on the field conditions.
- Analyze the stress-strain behaviour of steel and concrete elements using electrical/mechanical sensors and using data acquisition system.

Concrete mix proportioning, Study of High performance concrete -Introduction to Non Destructive Test methods.- Principles of operations of hydraulic loading systems, strain
gauges, strain and force measuring devices, etc.-Utilization of Mechanical, electrical
resistance and other types of strain gauges to study the behavior of structural members.-Use of
static and dynamic data recording and processing systems. Demonstration on wind tunnel
testing.

TEXT BOOKS / REFERENCES:

1. Dalley J W and Riley W F, Experimental Stress Analysis, McGraw Hill Book

19SC602  FINITE ELEMENT ANALYSIS  2-1-0-3

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

- Understand fundamental theory of the Finite Element method
- Formulate and assess the element type, properties and its assembly
- Analyse 2 D and 3 D structural problems using finite elements both manually and with
  software.

Basic Equations of Solid Mechanics - Review of equilibrium conditions, Strain displacement
relations, Principle of Virtual work & Stationery potential energy and variational formulation. Approximate methods - RayleighRitz, Weighted residual (Galerkin) and finite difference methods (examples on plates) - Finite Element Method: Displacement model-Shape functions-Lagrange and serendipity elements, Element properties - Isoparametric elements - numerical integration, technique, Assemblage of elements and solution techniques for static analysis. -Analysis of framed Structures - 2D and 3D truss and beam elements and applications. Analysis of plane stress/strain and axisymmetric solids triangular, quadrilateral and isoparametric elements, incompatible models. Three dimensional stress analysis - Isoparametric eight and twenty noded elements. Finite element programming and FEA Software.

TEXT BOOKS/ REFERENCES:

1. Cook, R.D., Malkus, D.S., Plesha, M.E., and Witt, R.J., Concepts and Applications of
   Formulation and Linear Problems, Butterworth and Heiamann, 2005.
   India Pvt.Ltd., 2013.
5. M. Asghar Bhatti., Advanced Topics in Finite Element Analysis, Wiley India Pvt.Ltd.-
   2014.

19SC603 ADVANCED CONSTRUCTION PRACTICES  3-0-0-3
Course Outcomes: At the end of the course, students will be able to

- Identify suitability of modern construction materials for application in fieldsituations.
- Suggest the construction procedures for substructures and superstructures
- Apply the suitable construction methods for special and heavy structures.


Sub-structure construction:- Construction of diaphragm walls, H walls and basement- Shoring for deep cutting - Underpinning; Trenchless Technology; Box jacking, Pipe Jacking. Tunneling Techniques- Piling Techniques-Driving Well And Caisson-Sinking Cofferdam - Cable Anchoring and Grouting.

Super Structure Construction:- Techniques of construction for continuous concreting operation in Tall buildings of various shapes and varying sections - cooling towers, silos, chimney - erection techniques of tall structures - erection of articulated structures - aerial transporting, handling, erecting light weight components on tall structures - Large span structures - In-situ pre-stressing in high rise structures. Composite construction of steel and concrete. Rapid construction techniques.

Special Structures:- Construction sequences in sky scrapers, bow string bridges, cable stayed bridges - Launching techniques for heavy decks and box decks - support structure for heavy equipment and machinery in industries.

TEXT BOOKS/ REFERENCES:

5. Johnson,R.P., Composite Structures of Steel and Concrete, Wiley India Exclusive, 2013.

19SC615 STRUCTURAL DESIGN STUDIO 1-1-2-3

Prerequisite: A course on Advance Structural Design

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

- Design and Detailing the industrial structures with emphasis on connections, base plate and splices.
- Design and Detailing of storage structures.
Design and Detailing of Earthquake resistant multistory building in compliances with IS1893 and IS13920.


TEXT BOOKS/ REFERENCES:

5. Relevant IS Codes.

19SC616 CONSTRUCTION SOFTWARE LABORATORY 1-0-2-2

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

- Prepare construction project schedules and allocate resources.
- Monitor performance of the projects and update the schedules.
- Perform budgeting, earned value analysis, and prepare reports

Project management software - Project estimation, project planning, project scheduling, network analysis, project time reduction and optimization, resource leveling, project time, cost and finance management, earned value analysis. Visualization software – Exposure to BIM modelling.

19RM600 RESEARCH METHODOLOGY 2-0-0-2

Unit I:

Unit II:
Problem Formulation, Understanding Modeling & Simulation, Conducting Literature Review, Referencing, Information Sources, Information Retrieval, Role of libraries in Information Retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes
Unit III:
Experimental Research: Cause effect relationship, Development of Hypothesis, Measurement Systems Analysis, Error Propagation, Validity of experiments, Statistical Design of Experiments, Field Experiments, Data/Variable Types & Classification, Data collection, Numerical and Graphical Data Analysis: Sampling, Observation, Surveys, Inferential Statistics, and Interpretation of Results

Unit IV:
Preparation of Dissertation and Research Papers, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript. References, Citation and listing system of documents

Unit V:

TEXT BOOKS/ REFERENCES:

19SC617 INDUSTRIAL SEMINAR 0-0-2-1

Course outcomes: At the end of the course, students will be able to
- Understand industry environment, practices and related problems
- Improve knowledge in the domain by support of experts from industry

The objective of the Industrial seminar is to expose the students to industry environment and practices. The students can identify the problem with the support of experts from industry at the end of first year (summer vacation) and start working on it. Apart from this, experts from the Civil Engineering industry are invited to deliver lectures on field related issues and share their professional experience including aspects of Professional ethics. Each student is required to prepare a detailed report and present the same for evaluation.

ELECTIVES

19SC701 MECHANICS OF COMPOSITE MATERIALS 3-0-0-3
Course Outcomes: Upon completion of the course, students will be able to:

- Explain the mechanical behavior of layered composites compared to isotropic materials.
- Apply constitutive equations of composite materials and understand mechanical behavior at micro, macro and meso level.
- Understand mechanical behavior of composites due to variation in temperature and moisture.
- Understand the nondestructive testing and recycling of composites


TEXTBOOKS/REFERENCES:


19SC702ADVANCED CONCRETE TECHNOLOGY 3-0-0-3

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

- Explain the materials science aspects of the properties concrete.
- Proportion concrete mixtures to meet performance requirements.
- Evaluate durability related issues and suggest preventive measures.
- Apply the modern trends in concrete manufacture and placement.

Concrete as a composite material; Materials science aspects of the properties and behavior of Cement Concrete: physical and chemical aspects of cement hydration, type and morphology of hydrates; Chemical and Mineral admixtures for concrete. Rheological behaviour of fresh Concrete - Fresh and hardened concrete properties; elastic behavior, shrinkage, creep,

TEXT BOOKS/ REFERENCES:

3. A RSanthakumar, Concrete Technology Oxford University Press, 2006

19SC703 CONSTRUCTION METHODS AND EQUIPMENT 3-0-0-3

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

- Analyse equipment cost and replacement alternatives.
- Select appropriate equipment for various applications in construction projects.
- Optimise construction equipment system productivity.

Planning Process for Equipment and Methods; Cost of Owning and Operating Construction Equipment - Ownership cost, Depreciation, Operating cost, and Ownership and operating costs calculation methods; Equipment Life and Replacement Procedures - Physical, profit and economic life, Replacement analysis; Engineering Fundamentals of Moving Earth - Rolling resistance, Effect of grade on tractive effort, Effect of altitude on performance of IC engines; Earthmoving, Excavating, and Lifting Equipment Selection - Bulldozers, Front-end Loaders, Scrapers, Trucks, Excavators, Backhoes, Front shovels, Cranes, and Forklifts; Piles and Pile-Driving Equipment; Production of Crushed-stone Aggregate; Concreting Equipment; Asphalt Mix Production and Placement - Asphalt Plants, and Paving Equipment; Estimating and Optimizing Construction Equipment System Productivity - Scheduling Equipment intensive construction projects; Equipment Financing Decision - Financing methods, Rental and lease contract considerations.

TEXT BOOKS/ REFERENCES:


19SC704 STRUCTURAL DYNAMICS 3-0-0-3

Course outcomes: At the end of the course, students will be able to
- Explain the basic concepts of structural dynamics
- Develop equations of motion of single and multi-degree of freedom systems
- Perform dynamic analysis of single and multi-degree of freedom systems subjected to different type of loads
- Understand dynamic analysis of continuous systems


TEXT BOOKS/ REFERENCES:

19SC705 THEORY OF PLATES AND SHELLS3-0-0-3

Prerequisite: A course on Theory of Elasticity.

Course outcomes: At the end of the course, students will be able to
- Understand the behavior of plate and shells
- Use analytical methods for the solution of thin plates and shells.
- Apply the numerical techniques for solving complex problems in shells and plates.

Introduction – Formulation of governing equations and associated boundary conditions by equilibrium and energy methods, Rectangular plates- Solution of equation by double and single series, Circular plates – Symmetric and unsymmetric loading cases, Continuous Plates,

**TEXT BOOKS/ REFERENCES:**


**19SC706 SYSTEM INTEGRATION IN CONSTRUCTION 3-0-0-3**

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

- Select structural systems and materials for meeting functional criteria.
- Integrate Services, Safety and Maintenance requirements in construction.
- Identify appropriate Building Management System (BMS)


**TEXT BOOKS/ REFERENCES:**


**19SC707 QUALITY CONTROL AND SAFETY IN CONSTRUCTION**

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

- Apply control concepts for improving the quality of construction
- Maintain the records of quality assurance processes and audits
- Understand and implement various quality improvements techniques.
- Evaluate safety norms in construction operations.

Introduction to quality; Importance of quality; Quality transition - quality control and inspection, quality assurance, total quality management; Evolution of quality management; Planning and control of quality during design of structures; Tools and techniques for quality management; Inspection of materials and machinery; Quality assurance in construction; Formwork planning and design for quality. Systems quality management; Quality standards/ codes in design and construction; (ISO:9000); Total quality management (TQM) - principles, tools and techniques. - Introduction to safety; Safety and health programs in construction industry; Planning for safety provisions; Analysis of construction hazards and accidents; Construction hazards and safety guidelines; Prevention techniques for construction accidents; Safety requirements for scaffolding; Site management with regard to safety recommendations; Training for safety awareness and implementation; Construction safety and health manual.

**TEXT BOOKS/ REFERENCES:**

• Analyse and design prestressed concrete members under various loading conditions.
• Analyse and design for deflection and crack control of prestressed concrete members.

Introduction to prestressed concrete: types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions. - Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, and flexure combined with axial compression or tension; analysis and design for shear and torsion, code provisions. Transmission of prestress in pretensioned members; Anchorage zone stresses for post tensioned members. Composite construction with precast PSC beams and cast insitu RC slab Analysis and design, creep and shrinkage effects. Partial prestressing principles, analysis and design concepts, crack- width calculations. Analysis and design of prestressed concrete pipes, tanks and spatial structures slabs, grids, folded plates and shells.

TEXT BOOKS/ REFERENCES:


19SC709ANALYSIS AND DESIGN FOR 3-0-0-3 EARTHQUAKE FORCES

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

• Explain the importance of seismic design and the underlying principles of seismic analysis.
• Critically evaluate application of earthquake engineering concepts in the field.
• Understand the various codal provisions regarding seismic design.
• Design buildings according to earthquake design philosophy

TEXT BOOKS/ REFERENCES:

19SC710 FORENSIC ENGINEERING AND REHABILITATION OF STRUCTURES

Course Outcomes: At the end of the course, students will be able to
- Diagnose the distress through understanding of the causes and factors.
- Assess structural distress through systematic inspection.
- Suggest repairs and rehabilitation measures of the structure


TEXT BOOKS/ REFERENCES:

19SC711 GEOTECHNICS FOR INFRASTRUCTURE 3 -0-0-3
Course Outcomes: At the end of the course, students will be able to

- Understand the importance of site investigation and sampling techniques
- Explain a range of ground improvement techniques with respect to field conditions
- Suggest alternative solutions to difficult earth construction problems and evaluate their effectiveness
- Understand different types of geo-synthetics and apply in field conditions.

Site investigation for infrastructure projects; Principles of exploration; Modern methods of boring and sampling; Sampling records, Soil profiles, various types of field tests; Excavation scheme. - Engineering properties of soft, weak and compressible deposits; Methods of soil improvement using mechanical, chemical; Thermal, electrical methods; - Dynamic consolidation; Vibroflotation - Types of foundations for industrial structures; Sheet piles and cofferdams; Design of dewatering systems. Preloading and vertical drains, Introduction to Geotextiles and Geomembranes, Grouting and Injection. Recent trends in infrastructure projects like soil nailing, reinforced earth, gabion walls.

TEXT BOOKS/ REFERENCES:


19SC712 OPTIMIZATION TECHNIQUES 3-0-0-3

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

- Describe clearly a problem, identify its parts and analyze the individual functions.
- Translate the given set of conditions to that of an optimization problem and develop algorithm.
- Understand various modern techniques of optimisations using soft computing techniques


TEXTBOOKS/REFERENCES:


19SC713 SMART MATERIALS AND STRUCTURES 3-0-0-3

Course outcomes: At the end of the course, students will be able to
- Understand the concepts of functional material, smart material and smart system
- Select smart materials for specific structural applications


TEXT BOOKS/REFERENCES:


**19SC714 STABILITY OF STRUCTURES 3-0-0-3**

**Course outcomes:** At the end of the course, students will be able to
- Understand the difference between stability and instability
- Evaluate the stability of column, beam column and frames.
- Assess the influence of plate buckling feature in the design


**TEXT BOOKS/ REFERENCES:**

**19SC715 INDUSTRIAL STRUCTURES 3-0-0-3**

**Course outcomes:** At the end of the course, students will be able to
- Understand and appreciate basic concepts in planning and functional requirements.
- Analyze and design of plate girders, gantry girder, cooling tower bunker and silos
- Understand the behavior of cold form steel and design the structural component by direct strength method.

Planning and Functional Requirements: Classification of Industries and Industrial Structures – planning for layout requirements regarding lighting, ventilation and fire safety – protection against noise and vibration – guidelines from factories act – material handling systems – erection sequence and guidelines for supporting structure. Introduction to Steel structures and connection details. Design of Gantry girders, Plate girders, cooling towers, bunkers and silos. Light gauge steel structures – Direct strength method, Behaviour of Compression Elements - Effective width for load and deflection determination – Behaviour of Unstiffened and

TEXT BOOKS/REFERENCES:


19SC716 BRIDGE ENGINEERING 3-0-0-3

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

- Comprehend and appreciate the basic concepts in layout, planning and proportioning of bridges
- Understand the load distribution and IRC standards
- Analyse and design of super structure and substructure
- Design of bearing, dirt wall and crash barrier

Introduction Classification and components of bridges, historical perspective, layout and planning, investigations for Bridges, choice of type of the bridges, conceptual bridge design, bridge aesthetics. Bridge appurtenances. Loads on bridges loading standards for highway (IRC) - Analysis and design of RC and PSC bridge decks: slab culvert bridges, slab and beam bridges, load distribution in slabs and beams, bowstring girder bridges, behaviour of skew bridge decks. Behaviour, analysis and design of composite construction. Design of bearings, substructure and foundations piers and abutments of different types, shallow and deep foundations design and constructional aspects.-Modern methods of construction of concrete, steel and composite bridges, their impact on analysis and design.

TEXT BOOKS/REFERENCES:


19SC717 PREFABRICATION ENGINEERING 3-0-0-3

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

- Formulate structural schemes and choose prefabrication systems
- Analyse handling and erection stresses.
- Design and detail prefabricated units for applications.
Types of prefabrication, prefabrication systems and structural schemes- Disuniting of structures- Structural behaviour of precast structures. Handling and erection stresses- Application of prestressing of roof members; floor systems two way load bearing slabs, Wall panels, hipped plate and shell structures.-Dimensioning and detailing of joints for different structural connections; construction and expansion joints. Production, Transportation & erection- Shuttering and mould design Dimensional tolerances- Erection of R.C. Structures, Total prefabricated buildings.-Designing and detailing prefabricated units for 1) industrial structures 2) Multistorey buildings and 3) Water tanks, silos bunkers etc., 4) Application of prestressed concrete in prefabrication.

TEXT BOOKS/ REFERENCES:


19SC718 DESIGN OF OFFSHORE STRUCTURES 3-0-0-3

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

- Understand the different offshore structures and differences from onshore structures
- Find and understand important recommendations regarding environmental conditions and load estimation.
- Describe the layout of marine structures from a functional and safety requirements point of view

TEXT BOOKS/ REFERENCES:


**19SC719PAVEMENT ANALYSIS AND DESIGN 3-0-0-3**

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

- Understand different materials and factors affecting rigid and flexible pavement design.
- Comprehend mix design of flexible pavements and its theoretical underpinnings.
- Evaluate the various procedures for the design and analysis of flexible and rigid pavements.

Flexible and Rigid Pavements; Evaluation by Non-Destructive Tests. Pavement Overlays & Design.

TEXT BOOKS/REFERENCES:


19SC720 SUSTAINABLE DESIGN & 3-0-0-3
CONSTRUCTION PRACTICES

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

- Assess resource consumption by construction industry.
- Evaluate Life cycle energy of materials and products.
- Conceptualise eco-friendly constructions.
- Quantify benefits of green buildings.


TEXT BOOKS/REFERENCES:


19SC721 CHARACTERISATION OF MATERIALS 3-0-0-3

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

- Understand and describe the fundamental principles behind the methods of characterization
- Judge suitable method of characterization for a particular material problem.
- Understand the theory and methods of modern rheology.
- Apply the concepts of rheology in cement based materials.


TEXT BOOKS/REFERENCES:

19SC722 GEOTECHNICAL EARTHQUAKE ENGINEERING 3-0-0-3

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

- Develop basic competence in assessing seismic hazard and in characterizing earthquake actions
- Understand basic aspects of soil under dynamic loading and role of soil deposits.
- Perform ground response analysis using conventional approaches
- Evaluate the liquefaction potential using a range of simplified methodologies and understand the principles of mitigation measures
- Understand the behavior of soil slopes under seismic loading

Seismology and Earthquakes: Internal Structure of the Earth, Continental Drift and Plate Tectonics, Faults, Elastic rebound theory, Different sources of Seismic Activity, Geometric Notation, Location of Earthquakes, Size of Earthquakes.


Ground Response Analysis: Ground Response Analysis, One Dimensional Linear, Evaluation of Transfer Function, Uniform undamped soil on rigid rock, Uniform damped soil on Rigid Rock, Uniform damped soil on elastic rock, layered damped soil on elastic rock, Equivalent linear Approximation, Deconvolution.

Site characterization and Design: Different methods and experiments. Local site effects: ground motion amplifications, Development of response /design spectrum, Liquefaction hazard assessments, Landslide hazard assessment, Seismic slope stability analysis, Seismic Analysis and Design of Various Geotechnical Structures.

TEXT BOOKS/ REFERENCES:

1. Steven L. Kramer, Geotechnical Earthquake Engineering Prentice Hall, 2003

**19SC723 SOIL DYNAMICS AND MACHINE FOUNDATIONS 3-0-0-3**

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

- Explain the behavior and response of soil subjected to various types of dynamic or time-dependent loadings
- Understand the fundamental principles of wave propagation and apply them in engineering
- Determine dynamic properties of soils using laboratory and non-destructive field tests.
- Demonstrate the ability to design machine foundations subjected to different kinds of vibrations


Wave propagation: Types of waves, Waves in unbound media, Waves in semi-infinite media, Waves in layered media. Dynamic soil properties: Laboratory tests, Field tests, Correlation of different parameters.


**TEXT BOOKS/ REFERENCES:**


**19SC724 STATISTICAL AND PROBABILISTIC MODELING IN CIVIL ENGINEERING**

**Course Outcomes:** At the end of the course, students will be able to
- Conceptualize the knowledge of frequency paradigm in probability theory.
- Analyse various parameter properties and parameter estimation procedures.
- Carry out descriptive comparison and regression modeling of sample data.


Sample size estimation and Field data training for civil engineering studies, Sampling distribution and Point estimation of parameter, Regression models -simple linear and multiple linear models, Parameter Estimation, Least Squares Estimators of the Regression Parameters, Statistical Inferences, Distribution of the Estimators, Coefficient of Determination, NSE and MSE, Real time Case studies and Applications.

TEXT BOOKS/REFERENCES:


19SC725 WIND EFFECTS ON STRUCTURES 3-0-0-3

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

- Perceive the effects of wind on the design of structures.
- Understand the fundamental concepts of design of structures subjected to wind loads.
- Understand the building code requirements for structural systems subjected to wind loading.
- Design chimneys, roof truss, pre-engineered building and its components, transmission towers

TEXT BOOKS/ REFERENCES:

19SC726 ANALYSIS AND DESIGN OF 3-0-0-3 SUB-STRUCTURES

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

- Determine the bearing capacity of soil based on various soil conditions
- Perform geotechnical design of shallow and deep foundations using limit state design
- Suggest different types of foundations based on the type of the structure
- Understand limitations and uncertainties in geotechnical design

Foundation classification; Choice of foundations; Bearing capacity and settlement analysis of shallow foundations like footings and rafts, Deep foundations like piles, piers and Caissons; Foundations on problematic soils. Introduction to Limit State Design method; Structural design of continuous footings, individual footings, Combined footings and rafts of various
types subjected to vertical and lateral loads, and moments; Design of circular rafts; Introduction to soil structure interaction. Analysis and design of deep foundations: pile foundations, piers, well foundations. Introduction to special foundations - ring foundations, offshore foundations. Foundations for transmission line towers, storage tanks, silos, chimneys etc.

**TEXT BOOKS/ REFERENCES:**


**19SC727 CONTRACT LAWS AND REGULATIONS 3-0-0-3**

**Course Outcomes:** At the end of the course, students will be able to
- Evaluate various types of construction contracts and their legal aspects
- Identify proper dispute resolution systems.
- Oversee labour and safety regulations in construction projects.


TEXT BOOKS/REFERENCES:

19SC728 FORMWORK, SCAFFOLDING & SHORING 3-0-0-3

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

- Select proper formwork, accessories and material.
- Design the form work for beams, slabs, columns, walls and foundations.
- Evaluate the formwork failures.
- Suggest scaffolding types to meet safety requirements

Materials, Accessories and Proprietary Products - Lumber - Types - Finish - Sheathing ratio - Working stresses - Repetitive member stress - Plywood - Types and grades - Textured surfaces and strength - Reconstituted wood - Steel - Aluminium - Form lining materials
Planning - Overall Planning - Detailed planning - Standard units - Corner units - Schedule - Planning at Tender stage - Development of basic system - Planning for maximum reuse - Planning examples - Site layout plan - Crane arrangements - Recheck plan details - Planning for safety - Transporting plant - Wales and ties - Vertical transportable form work. Design considerations - Live loads and Wind pressure - Concrete pressure on form work - Concrete density - Height of discharge - Temperature - Rate of Placing - Consistency of concrete - Vibration - Hydrostatic pressure and pressure distribution - Examples - Adjustment for non-standard conditions - Basic simplification - Beam forms - Slab forms - Column forms - Wall forms - Allowable stresses - Check for deflection, bending and lateral stability - Codal provisions Examples on form designs. Building and Erecting the Framework - Location of job mill - Storage - Equipment - Form for Wall footings - Column footings - Slab on grade and paving work - Highway and Airport paving - External vibration - Prefabricated panel systems - Giant forms - Curved wall forms - Erection Practices - Column heads - Beam or girder forms - Suspended forms - Concrete Joint construction - Flying system forms.
Formwork Failures - Causes of Failures - Case studies - Finish of exposed concrete - Design deficiencies - Safety factors - Stripping sequence - Reshore installation - Advantages of reshoring. Special Formwork - Shell forms - Design considerations - Loads - Building forms - Strength requirements - Tunnel forming components - Curb and gutter forms - Invert forms - Arch forms - Concrete placement methods - Slip forms - Principles - Types - Advantages - Functions of various components - Planning - Safety in slip forms - Special structures built with slip form technique - Shuttering for Precast members and continuous casting forms. Scaffolding - Different types - Putlog and Independent scaffold - Single pole scaffolds -
Fixing ties - Spacing of ties, bracing, safety netting - General safety requirements - Working & Erection at Site: Mock up and hands on assembly for various vertical & Horizontal formwork, assembly, checking & dismantling - key considerations. (Site visits preferred)

TEXT BOOKS/ REFERENCES:

3. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 2005
4. Concrete Formwork Systems – Awad. Hanna- University of Wisconsin –Copy right Marcel Dekkel Inc.

19SC729 LIVE-IN- LAB 3-0-0-3

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

- Understand the problems faced by rural communities in India: Service to society
- Study, observe, and interact with rural populations while living in rural communities and gain a better understanding of challenges in various areas
- Undertake experiential learning opportunities, by taking theory into practice
- Generate innovative solutions, thereby facilitating critical and collaborative problem solving abilities

The interested students will get an opportunity to work in any of the villages and solve the technical problems in areas related to the course by applying the engineering knowledge they have acquired through their study. The students can visit the village and identify the problem at the end of first year (summer vacation), start working on it and complete in the third semester.

19SC798 DISSERTATION 0-0-0-8

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

- Identify structural, construction and construction management problems reviewing available literature.
- Identify appropriate techniques to analyze complex systems.
• Apply engineering and management principles through efficient handling of project.

Dissertation will have two internal review presentations and an end semester presentation. The first presentation will include identification of the problem based on the literature review on the topic referring to latest literature available. Second review presentation should be done on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data and determining solutions. The end semester presentation must bring out individuals contribution and should have a strong conclusion. The review committee can make the decision on continuation of the project in the next semester.

19SC799 DISSEMINATION 0-0-0-12

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

• Solve complex structural, construction and management related problems by applying appropriate techniques and tools.
• Exhibit good research orientation, communication and writing skill to the engineering community and society.
• Demonstrate professional ethics and work culture

This can be an extension to work on the topic identified in previous semester “Dissertation” or can be a new one based on the recommendations of review committee. Continuous assessment should be done on the work done by adopting the methodology decided involving numerical analysis/conduct experiments, collection and analysis of data, etc. After approval by the internal review committee the student has to submit the detail report and external examiner is called for the viva-voce. The student has to submit a technical paper based on the dissertation in any of the peer reviewed Scopus indexed journal.