**SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU-572105**

(A constituent College of Siddhartha Academy of Higher Education, Deemed-to-be-University)

**Scheme of Teaching and Examination (88 Credits, 2024-SCHEME)**

**FIRST YEAR MTECH (COMMON TO ALL BRANCHES), ACADEMIC YEAR 2024-25**

**1st SEMESTER MTech**

| SI No | Course Code | | Course Title | Teaching Dept. | L | T | P | Credits | CIE Marks | SEE Marks | Total Marks | Exam Hrs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | PC | 24CAD11 | Continuum Mechanics - Classical | **CIVIL** | 4 | - | - | **4** | 50 | 50 | 100 | 3 |
| **2** | PC | 24CAD12 | Computational Structural Mechanics | **CIVIL** | 4 | - | - | **4** | 50 | 50 | 100 | 3 |
| **3** | PC | 24CAD13 | Computational Structural Dynamics | **CIVIL** | 4 | - | - | **4** | 50 | 50 | 100 | 3 |
| **4** | PC | 24CAD14 | Optimum Design of Structures | **CIVIL** | 3 | - | - | **3** | 50 | 50 | 100 | 3 |
| **5** | PE | 24CAD15x | **Elective – I** | **CIVIL** | 3 | - | - | **3** | 50 | 50 | 100 | 3 |
| **6** | PE | 24CAD16x | **Elective - II** | **CIVIL** | 3 | - | - | **3** | 50 | 50 | 100 | 3 |
| **7** | PC | 24CADTS1 | Technical Seminar-I | **CIVIL** | - | | 3 | **1.5** | 50 | - | 50 | - |
| **8** | PC | 24CADLB1 | Advance Structural Analysis Laboratory | **CIVIL** | - | - | 3 | **1.5** | 50 | - | 50 | - |
| L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination | | | | **Total** | 21 | **-** | 6 | **24** | **400** | **300** | **700** | **-** |

**Elective – I**

24CAD151 Advanced Numerical Methods
24CAD152 Composite and Smart – Materials
24CAD153 Concepts of Pre Fabrication and Precast Structures

**Elective – II**

24CAD161 Advanced Mechanics of Materials
24CAD162 Advance Design of Prestressed Concrete Structures
24CAD163 Advance R C Design

Dr. M.N. Eshwarappa, Convener (CDC) Dr. Renukalatha S, Dean (Aca.) Dr. M.S. Raviprakasha, Chairman (CDC)

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **I** |
| | | | |
| **Subject: Continuum Mechanics - Classical and FE Approach** | | | |
| **Subject Code:** | **24CAD11** | **L – T – P - C:** | **4-0-0-4** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Learn the principles of Analysis of Stress and Strain |
| **2** | Evaluate the stress and strain parameters and their inter relations of the continuum. |
| **3** | Predict the stress-strain behavior of continuum |
| **4** | Evaluate the Stress strain by FE analysis |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Introduction**: Elasticity –Notation for forces and stresses-Components of stresses–components of strain–Hooke’s law. Definition of stress and strain at a point, components of stress and strain at a point in Cartesian and polar co- ordinates, constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases, Plane stress, plane strain – Definition. Analysis of Stress and Strain in Three Dimensions: Introduction – Principal stresses– Stress Ellipsoid and stress – director surface – Determination of the principal stress– Stress invariants – Determination of the maximum shearing stress. | 12 |
| II | **Plane Stress and Plane Strain:** Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams. Solution by Polynomials – End Effects, Saint – Vedant’s Principle – Determination of Displacements – bending of a Cantilever Loaded at the end – Bending of Beam by uniform load. | 10 |
| III | **Two-Dimensional Problems in Polar Coordinates** :General equation in Polar coordinates – Stress distribution symmetrical about an axis – Pure bending of curved bars – Strain components in polar coordinates – Displacements for symmetrical stress distributions – Rotating disks – Bending of a curved bar by a force at the end. | 10 |
| IV | **Solution of Axi-symmetric Problems**: The effect of circular holes on stress distribution in plates, stress concentration due to the presence of a circular hole in plates. Elementary problems of in three dimensions, Two - dimensional problems in Rectangular coordinates, twist of circular shafts, torsion of non- circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations in elasticity. | 10 |
| V | **Introduction**: Elasticity –Notation for forces and stresses-Components of stresses–components of strain–Hooke’s law. Definition of stress and strain at a point, components of stress and strain at a point in Cartesian and polar co- ordinates, constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases, Plane stress, plane strain – Definition. Analysis of Stress and Strain in Three Dimensions: Introduction – Principal stresses– Stress Ellipsoid and stress – director surface – Determination of the principal stress– Stress invariants – Determination of the maximum shearing stress. | 10 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Understand the principles of stress-strain behavior of continuum |
| **CO2** | Understand the principles of Polynomials stress functions |
| **CO3** | Understand the principles of Polar Coordinates&axis symmetric problems |
| **CO4** | Understand the concept of Finite element method |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | **3** | **2** | **2** |
| **CO2** | **2** | **1** | **3** |
| **CO3** | **3** | **3** | **2** |
| **CO4** | **2** | **2** | **3** |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Theory of elasticity | Timoshenko and Goodier, | McGraw Hill Book Company, III Edition, 2016 |
| 2 | Advanced Mechanics of Solids | L.S. Srinath | Tata McGraw-Hill Publishing Co ltd., New Delhi 2016 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Continuum Mechanics Fundamentals‖ | Valliappan C, | Oxford IBH Publishing Co. Ltd.2020 |
| 2 | Theory of Elasticity | Sadhu Singh | Khanna Publishers 2021 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **I** |
| **Subject: COMPUTATIONAL STRUCTURAL MECHANICS** | | | |
| **Subject Code:** | 24CAD12 | **L – T – P - C:** | **4-0-0-4** |

**Course Objectives:**

| Sl. No. | This course will enable the students to |
|---|---|
| 1 | This course will enable students to learn the principles of Structural analysis |
| 2 | This course will enable students to implement the principles through different methods and to analyze various types of structures. |
| 3 | This course will enable students to evaluate the force and displacement parameters of the structures. |
| 4 | This course will enable students to formulate finite element analysis for different types of structures |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Direct Stiffness Method –Trusses:** Degrees of static and kinematic indeterminacies, concepts of stiffness and flexibility, local and global coordinate system, analysis of indeterminate trusses, with and without initial strains for different types of boundary conditions such as fixed, hinged, roller, slider, elastic (spring) support, support settlement. | **12Hrs** |
| II | **Direct Stiffness Method**: Continuous beam, analysis of continuous beams, for different types of boundary conditions such as fixed, hinged, roller, slider, elastic (spring) support, and support settlement. | **10Hrs** |
| III | **Direct Stiffness Method**:2d frames: Analysis of simple 2d frames with and without sway, element stiffness matrix for 3d frames and grids. | **10Hrs** |
| IV | **Basic Concept of Finite Element Method**: Concept of FEM, formulation using principle of virtual work, principles minimum potential energy, method of weighted residuals (Galerkin's), choice of displacement function, degree of continuity. Generalized and natural coordinates. | **10Hrs** |
| V | **FE Analysis using Bar Elements:** Derivation of shape function for linear and higher order elements using inverse and Lagrange interpolation formula, element stiffness matrix two and three nodded elements. Examples with constant and varying cross-sectional areas subjected to concentrated loads, distributed body force and surface traction, and initial strains due to temperature. Isoparimetric formulation. | **10Hrs** |

**Course Outcomes:**

| Course Outcomes | At the end of the course, students will be able to |
|---|---|
| **CO1** | Achieve Knowledge of design and development of problem-solving skills. |
| **CO2** | Understand the principles of Structural Analysis |
| **CO3** | Design and develop analytical skills |
| **CO4** | Understand the concepts of finite element structural behavior |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 2 | 1 | 3 |
| **CO2** | 2 | 1 | 3 |
| **CO3** | 2 | 1 | 3 |
| **CO4** | 2 | 1 | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Computational Structural Mechanics | Rajasekaran. S, | PHI, New Delhi 2001 |
| 2 | Basic Structural Analysis | Reddy. C. S | TMH, New Delhi2001 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Concepts and Applications of Finite Element Analysis | Robert D Cook | 3rd Edition, John Wiley andSons, New York |
| 2 | Finite Element Procedures in Engineering Analysis | Bathe. K. J | PHI. New Delhi. |

**Signature of the course coordinator** **Signature of the HOD** **Signature of the Dean (Academic Affairs)**

**SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU**
**(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)**
M.Tech -CADS
Syllabus for the Academic year 2024 - 2025

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **I** |
| | | | |
| **Subject: COMPUTATIONAL STRUCTURAL DYNAMICS** | | | |
| **Subject Code:** | **24CAD13** | **L – T – P - C:** | **4-0-0-4** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| 1 | Demonstrate the ability to analyze and solve differential equations of motion for single degree of freedom (SDOF) systems. |
| 2 | Assess and interpret the response of SDOF systems to harmonic and dynamic loading using analytical methods. |
| 3 | Implement generalized coordinates and Rayleigh's method in the analysis of dynamic systems, including rods, cables, and beams. |
| 4 | Construct and utilize stiffness and mass matrices for the dynamic analysis of beams and evaluate the dynamic behavior of multistory shear buildings through modal analysis. |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Single degree of freedom system**: Degrees of freedom, undamped system, springs in parallel or in series, Newton's law of motion, free body diagram, D'Alembert's principle, solution of the differential equation of motion, frequency and period, amplitude of motion. Damped Single degree of freedom system – viscous damping, equation of motion, critically damped system, over damped system, underdamped system, and logarithmic decrement. Response of one degree of freedom system to harmonic loading – undamped harmonic excitation, damped harmonic excitation, evaluation of damping at resonance, bandwidth method (Half power) to evaluate damping, response to support motion, force transmitted to the foundation, seismic instruments | 12 |
| II | **Response to general dynamic loading**: Impulsive loading and Duhamel's integral, numerical evaluation of Duhamel's integral, undamped system numerical evaluation of Duhamel's integral, damped system. Fourier analysis and response in frequency domain Fourier analysis, Fourier co-efficient for piece-wise liner functions, exponential form of Fourier series, discrete Fourier analysis, and fast Fourier transform. | 10 |
| III | **Generalized co-ordinates and Rayleigh's method**: Principle of virtual work, generalized single degree of freedom system (rigid body and distributed elasticity), and Rayleigh's method. Multistory shear building. Free vibration – natural frequencies and normal modes, zero modes of vibration. Forced motion – modal superposition method – response of a shear building to base motion. Damped motion of shear building – equations of motions – uncoupled damped equation – conditions for damping uncoupling | 10 |
| IV | **Discretization of Continuous systems**: Longitudinal Vibration of a uniform rods. Transverse vibration of a pretension cable. Free transverse vibration of uniform beams – Rotary inertia and shear effects – the effect of axial loading. Orthogonally of normal modes. Undamped forced vibration of beams by modesuperposition. | 10 |
| V | **Dynamic analysis of beams**: stiffness matrix, mass matrix (lumped and consistent) equations of motions for the discritiesed beam in matrix form and its solutions | 10 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Understand and analyze the fundamental concepts of single degree of freedom (SDOF) systems and solving differential equations of motion. |
| **CO2** | Evaluate the response of SDOF systems to harmonic and general dynamic loading using methods such as the bandwidth method, Duhamel's integral, and Fourier analysis. |
| **CO3** | Apply generalized coordinates and Rayleigh's method to analyze SDOF systems and extend these principles to the dynamic analysis of rods, cables, and beams. |
| **CO4** | Develop stiffness and mass matrices for dynamic analysis of beams, solve equations of motion for discretized systems, and assess dynamic behavior of multistory shear buildings. |

**Course Articulation Matrix:**

| PO/PSO CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 2 | | 3 |
| **CO2** | 2 | | 3 |
| **CO3** | 3 | | 3 |
| **CO4** | 2 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Dynamics of Structures | Ray W Clough and J Penzien | 2nd Edition, McGraw-Hill,New Delhi. |
| 2 | Vibration, Dynamics and structural problems | Mukopadyaya | Oxford IBH Publishers, NewDelhi. |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Structural dynamics, Theory andcomputation | Mario Paz | 2nd Edition, CBSPublisher and Distributers, New Delhi |
| 2 | Fundamentals of Structural Dynamics | Roy R. craig,Andrew J. Kurdila | John Wiley & Sons |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **I** |
|---|---|---|---|
| | | | |
| **Subject: OPTIMUM DESIGN OF STRUCTURES** | | | |
| **Subject Code:** | **24CAD14** | **L – T – P - C:** | **4-0-0-4** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Understand the principles of Classical Optimization Techniques |
| **2** | Understand the principles of Linear Programming |
| **3** | Understand the principles of Non-Linear Optimization |
| **4** | Understand the principles of Dynamic Programming and Practical applications of Optimization in Civil Engineering |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Classical Optimization techniques**: Engineering application, Statement of Optimization problem, Classification of Optimization problems, Single variable Optimization, Simple problems which can be converted to single variable optimization. | 9 |
| II | **Linear programming**: Standard form of linear programming problem, Graphical method for two variable problem and development of simplex method, simplex problems with two and three variables fundamentals and basic theorems on Linear Programming. | 9 |
| III | **Multivariable Optimization with constraints**: semi-definite case and saddle point. Multivariable optimization with equality constraints: Solution for direct substitution for simple cases, Lagrange's multiplier method, constrained variation method. Multivariable optimization with inequality constraints- Kuhn Tucker conditions. Convex and concave functions. | 11 |
| IV | **Nonlinear programming:** Introduction to one dimensional minimization methods concept of Unimodal function, unrestricted search(search with fixed step size, search with accelerated step size), exhaustive search, dichotomous search, Fibonacci method and Golden section method | 11 |
| V | **Structural Applications and Dynamic programming**: Use of Dynamic programming in water tank design given the estimation of its component parts. Optimum design of a structural element RC simply supported solid slab. | 10 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Use Principles of Linear and Dynamic Programming |
| **CO2** | Use Classical Optimization techniques |
| **CO3** | Apply Knowledge of Optimization to Structural Engineering Problems |
| **CO4** | Use Principles of Non Linear Optimization |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 2 | | 3 |
| **CO2** | 2 | | 3 |
| **CO3** | 3 | | 3 |
| **CO4** | 2 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Engineering Optimization - Theory and Practice, New Age International, 1978. | S.S.Rao | 3rd Edition, |
| 2 | Operations Research an Introduction | Hamdy A Taha | 9th Edition, 2019 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Optimization Techniques | K.C.Jain | |
| 2 | System simulation with digital computer New Delhi – 1989. | NarsingkDeo | 3rd Edition,Prentice – Hall of India Pvt, Ltd. |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| Department: Civil Engineering-CADS | | Semester: | I |
|---|---|---|---|
| | | | |
| **Subject: ADVANCED NUMERICAL METHODS** | | | |
| **Subject Code:** | **24CAD151** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| 1 | Apply the concepts of Matrices and Linear Algebra to solve civil engineering issues. |
| 2 | Apply the linear and iterative Equations to solve civil engineering issues. |
| 3 | Apply statistical methods and numerical integrations to solve civil engineering issues. |
| 4 | Apply concepts of Differential Equations to solve civil engineering issues. |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Matrices and Linear Algebra**: Elementary Concepts of Matrices – Introduction to Matrices – special matrices – matrix equality – addition and multiplication by a scalar – Multiplication of matrices – the inverse matrix – partitioning of matrices – the trace and determinant of a matrix. | 9 |
| II | **Linear System of Equations ( Direct Methods) and Iterative Methods for Solving Linear Equation** :<br>Introduction – Cramer's Rule – Gaussian Elimination – Gauss – Jordan Method.<br>Stationary Methods: Jacobi Iteration – Computer Time Requirement for Jacobi Iteration – Gauss – Seidel Method – Relaxation Method – Condition of Convergence of Iterative Method – Summary – Exercises. | 7 |
| III | **Statistical Methods**<br>1. Sampling and Frequency Distribution : Sampling – Frequency distribution.<br>2. Discrete Probability Distributions : Introduction – Probability – discrete distributions – binomial distribution – Poisson distribution<br>3. Curve Fitting: Regression – Introduction – Linear Least Squares Fit – Nonlinear fit – Fitting a Polynomialfunction. | 8 |
| IV | **Interpolation and Numerical Integration** : Introduction – Definition – Newton's Forward difference –Remarks on Newton's forward or backward interpolation formula, Newton's divided difference, Neville Iterated Interpolation, Lagrange Interpolation, spline interpolation, summary,exercises<br>Numerical Integration : Introduction, Trapezoidal rule ,Gaussian quadrature– numerical integration using Spline Monte Carlo method for numerical integration. | 7 |
| V | The Approximation for the Solution of Ordinary First Order Differential Equations : Introduction – nth order differential equation – physical problem – taylor series – euler method or first order taylor series – modified euler method<br>– picard method of successive approximation – Runge – Kutta methods – solution of simultaneous ordinary differential equations by R K Methods. Predictor / corrector method. | **8** |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Solve the civil engineering issues by applying the concepts of Matrices and Linear Algebra linear simultaneous equations. |
| **CO2** | Solve the to civil engineering issues with the concepts of linear equations. |
| **CO3** | Impart skills of development of algorithms, and application of finite difference techniques in structural mechanics |
| **CO4** | Solve differential Equations related to civil engineering domain. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 1 | | 2 |
| **CO2** | 2 | | 3 |
| **CO3** | 3 | | 1 |
| **CO4** | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Numerical Methods: Design, Analysis and Computer Implementation of Algorithms. | A. Greenbaum and T. P. Chartier. | Princeton University Press, 2012 |
| 2 | Numerical Analysis. | L. R. Scott. | |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Advanced Numerical Methods | J. Sakthivel | Suchitra Publications |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject: COMPOSITE AND SMART – MATERIALS** | | | |
| **Subject Code:** | **24CAD152** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Learn the basic properties of composite materials. |
| **2** | Learn the manufacturing process of various composites, different classes of ceramic. |
| **3** | Learn about polymeric smart materials and their response of a system. |
| **4** | Learn about Beam modeling with strain actuator. |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Introduction to Composite materials**: Classifications and applications. Anisotropic elasticity - unidirectional and anisotropic laminate, thermo- mechanical properties, micro- mechanical analysis, characterization tests. Classical composite lamination theory, cross and angle play laminates, symmetric, antisymmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories - first fly failure, vibration and buckling analysis. Sandwich structures face and core materials, secondary failure modes environmental effects, manufacturing of composites | 9 |
| II | **Introduction-smart materials** and structures- piezoelectric materials – coupled electro-mechanical constitutive relations – depoling and coercive field – field-strain relation - hysterics – creep-strain rate effects – manufacturing. | 7 |
| III | **Actuators and sensors** – single and dual actuators – pure extension, pure bending – bending extension relations – uniform strain beam model – symmetric induced strain actuators – bond shearing force – Bernoulli-Euler (BE) beam model – embedded actuators – Asymmetric induced strain actuatorsinuniformstrainandEuler-Bernoullimodels.Uniformstrainmodel – energy principle formulation –BE model –single and dual surface bonded actuators- Extension-bending and torsion model. | 8 |
| IV | **Introductions to control systems** – open loop and close loop transfer functions stability criteria – deflection control of beam like structures - using piezoelectric sensors and actuators – shape memory alloys. | 7 |
| V | Beam modeling with strain actuator, bending extension relation. | 8 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| CO1 | Understand properties and manufacturing process alongwith their application in various industries for different types of composites. |
| CO2 | Classify different classes of ceramic and polymericsmart materials; development of actuators and sensors and Their integration into a smart structure |
| CO3 | Generate controllable force and response of asystem. |
| CO4 | Monitor the response of the system. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | | 3 |
| CO2 | 3 | | 3 |
| CO3 | 3 | | 3 |
| CO4 | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Mechanic of Composite Materials | Robert M Jones | McGraw Hill Publishing Co. |
| 2 | Analysis and Performance of Fiber Composites | Bhgwan D Agarwal and Lawrence J Brutman | John Willy and Sons |

**Refercnce Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Mechanic of Composite Materials | Autar K. Kaw CRC | Taylor & Francis 2nd Ed, 2005 |
| 2 | Stress analysis of fiber Reinforced Composites Materials | Michael W | Hyer Mc-Graw Hill International 2009 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject: CONCEPT OF PRE FABRICATION AND PRECAST STRUCTURES** | | | |
| **Subject Code:** | **24CAD153** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| **Sl. No.** | **This Course will enable the students to** |
|---|---|
| **1** | Study concepts and techniques of precast construction. |
| **2** | Select precast elements suitable for project specific requirements. |
| **3** | Design precast systems to ensure integrity and safety of the structure and to avoid progressive collapse. |
| **4** | Design ferro cement structures. |

| **Unit** | **Description** | **Hrs.** |
|---|---|---|
| I | Concept of Prefabricated construction, necessity, advantages, disadvantages, Mass produced steel, reinforced concrete and masonry systems Industrializedbuildings. | 9 |
| II | Concept of modular coordination, basic module, planning and design modules, modular grid systems, National Building Code Specifications, standardization, dimensioning of products, preferred dimensions and sizes, tolerances and deviations, layout and process. | 7 |
| III | Prefabricates classification, foundation, columns, beams, roof and floor panels,wall panels, clay units, box prefabricates, erection and assembly. | 8 |
| IV | Construction techniques, large panel construction, lift slab system, control of construction processes. Equipment for horizontal and vertical transportation. Concept and design of ferro cement. | 7 |
| V | Design of prefabricated elements, Lift point's beams, slabs, columns, wall panels, footings, design of joints to transfer axial forces, moments and shear forces. | 8 |

**Course Outcomes:**

| **Course Outcomes** | **At the end of the course students will be able to** |
|---|---|
| **CO1** | Understand the concept of prefabrication structures. |
| **CO2** | Understand about construction techniques and equipments used in construction. |
| **CO3** | Distinguish pre-engineered buildings from conventional units. |
| **CO4** | Design prefabricated elements. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 3 | | 3 |
| **CO2** | 3 | | 3 |
| **CO3** | 3 | | 3 |
| **CO4** | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Precast Concrete | Hass A.M. | 2000. |
| 2 | Precast concrete structures | Kim S Elliott | 2016. |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Plant cast, Precast and Prestressed concrete | David Sheppard | McGraw Hill; 1989. |
| 2 | Multi–Storey Precast Concrete Framed Structures | Kim S Elliott, CollinK Jolly. | 2$^{nd}$ edition 2014 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU
(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)
M.Tech -CADS
Syllabus for the Academic year 2024 - 2025

| Department: Civil Engineering-CADS | | Semester: | I |
|---|---|---|---|
| | | | |
| **Subject: ADVANCED MECHANICS OF MATERIALS** | | | |
| **Subject Code:** | **24CAD161** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to have |
|---|---|
| **1** | Knowledge on mechanics of Curved Beams. |
| **2** | knowledge of Beams on Elastic foundations |
| **3** | Analyse the Torsion and stress concentration |
| **4** | Study mechanics of shear center and torsion |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Curved Beams**: Introduction, Circumferential stress in a curved beam, Radial stresses in curved beams, Correction for circumferential stresses in curved beams having I, T, or similar cross sections, Deflections of curved beams, Statically indeterminate curved beams, Closed ring subjected to a concentrated load. | 8 |
| II | **Beams on Elastic Foundations**: General theory, Infinite beam subjected to concentrated load, Boundary conditions, Infinite beam subjected to a distributed load segment, Semi-infinite beam subjected to loads at its end, Semi-infinite beam with concentrated load near its end, Short beams | 7 |
| III | **Torsion**: Torsion of straight bars of elliptic cross section – St.Venants semi-inverse method and Prandtl’s function approach – membrane analogy – torsion of a bar of narrow rectangular cross section torsion of thin walled open cross sections – torsion of thin walled tubes. | 7 |
| IV | **Nonsymmetrical Bending of Straight Beams**: Definition of shear center in bending, Symmetrical and nonsymmetrical bending, Bending stresses in beams subjected to unsymmetrical bending, Deflections of straight beams subjected to unsymmetrical bending, Sensitivity of deep I sections | 8 |
| V | **Shear Center for Thin-Wall Beam Cross Sections**: Approximation employed for shear in thin-wall beam cross sections, Shear flow in thin-wall beam cross sections, Shear center for a channel, I and angle sections. **Stress Concentrations**: Basic concepts, Nature of stress concentration problems. Stress concentration factors, Experimental techniques, Stress gradients due to concentrated load, | 7 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Understand the curved beams and to solve the problems involving stresses on curved beams. |
| **CO2** | Understand concepts of shear center and bending of beams. |
| **CO3** | Understand the concept of Beams on Elastic Foundations. |
| **CO4** | Analyse the structures subjected to out of plane loading. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | 2 | 2 |
| CO2 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Advanced Mechanics of Materials | Arthur P. Boresi Omar M. Sidebottom | Fourth Edition,1985 |
| 2 | Advanced Mechanics of Solids and Structures | N Krishna Raju | First Edition. August 2018 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Mechanics of Materials | James M. Gere and Barry J Goodno | Eighth Edition,2012 |
| 2 | Advanced Strength of material and Applied Elasticity" | A.C. Ugural and S. K. Fenster | Sixth Edition, 2019 |

**Signature of the course coordinator**

**Signature of the HoD**

**Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **I** |
|---|---|---|---|
| | | | |
| **Subject: ADVANCED DESIGN OF PRESTRESSED CONCRETE STRUCTURES** | | | |
| **Subject Code:** | 24CAD162 | **L – T – P - C:** | 3-0-0-3 |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | To learn the design of Anchorage zone stress |
| **2** | To learn the behavior of shear and torsion in pre-stressed members. |
| **3** | To learn the behavior composite beams and tension in pre-stressed sections |
| **4** | To learn the behavior of precast elements |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Anchorage Zone stress in post-tensioned members:** Introduction to PSC, stress distribution in end block, investigations on anchorage zone stress, by IS Code method, anchorage zone reinforcement. | 7 |
| II | Shear and torsional resistance: Shear and principal stresses, ultimate shear resistance, design of shear reinforcement, torsion, design of reinforcement for torsion. | 8 |
| III | **Composite Beams:** Introduction ,types of composite beams, analysis for stress, differential shrinkage, serviceability limit state, design for flexural and shear strength | 8 |
| IV | **Tensionmembers:**Introduction,ties,Columnsprestressedconcretepiles.Slabandgridfloors-Typesoffloorslabs,designofone way two way and flat slabs. Distribution of prestressed tendons, analysis and design of grid floors. | 8 |
| V | **Precastelements:**Introduction,pre-stressedconcretepoles,manufacturingtechniques,shapesandcross-sectionalproperties,designloads,designprinciples.Railwaysleepers-classificationandmanufacturingtechniques,design loads, analysis and design principles. Pre-cast bridge girders and segmental constructions, external pre-stressing. | 8 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Understand the concept of prestressed and post-tensioned concrete |
| **CO2** | Analyze, Design and detail PSC elements |
| **CO3** | Achieve Knowledge of design and development of problem solving skills |
| **CO4** | Design and develop analytical skills. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 3 | | 3 |
| **CO2** | 3 | | 3 |
| **CO3** | 3 | | 3 |
| **CO4** | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Pre-stressed concrete | N. Krishnaraju | Tata McGraw-Hill,4rdedition,2012 |
| 2 | Design of pre-stressed concrete structures | Lin.T.YandH.Burns | John Wiley and sons,1982. |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Pre-stressed concrete structures | P. Dayaratnam | OxfordandIBH,5thedition,1991 |
| 2 | Pre-stressed concrete structures | Guyon, | ContractorsRecordbooks,1963 |
| 3 | IS:1343:2012 | | |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| Department: Civil Engineering-CADS | | Semester: | I |
|---|---|---|---|
| **Subject: ADVANCED R.C. DESIGN** | | | |
| **Subject Code:** | **24CAD163** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| 1 | Understand the concepts of the defections in beam and columns. |
| 2 | Understand the concepts of crack width in reinforced concrete members. |
| 3 | Understand the design of reinforced concrete deep beams and design of ribbed (voided) slabs and find redistribution of moments of RC beams. |
| 4 | Understand the design of reinforced concrete members for fire resistance. |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Deflection of Reinforced Concrete Beams and Slabs**<br>Introduction – Short term Deflection of Beams and Slabs – Deflection due to Imposed Loads – Short-term Deflection of Beams due to Applied Loads – Calculation of Deflection by IS 456 – Calculation of Deflection by BS 8110 – Deflection Calculation by Euro code – ACI Simplified Method – Deflection of Continuous Beams by IS 456 – Deflection of Cantilevers – Deflection Slabs | 9 |
| II | **Estimation of Crack width in Reinforced Concrete Members**<br>Introduction – Factors affecting Crack width in Beams – Mechanism of Flexural Cracking – Calculation of Crack widths – Simple Empirical Method – Estimation of Crack width in Beams by IS 457 and BS 8110 – Shrinkage and Thermal Cracking | 7 |
| III | **Redistribution of Moments in Reinforced Concrete Beams**<br>Introduction –Redistribution of Moments in a Fixed Beam – Positions of Points of Contraflexrues – conditions for Moment Redistribution – Final shape of redistributed bending moment diagram – Moment redistribution for a two- span continuous beam – Advantages and disadvantages of Moment redistribution – Modification of clear distance between bars in beams ( for limiting crack width) with redistribution – Moment – curvature ( M- ) Relation of Reinforced Concrete sections – ACI conditions for redistribution of negative moments – conclusion | 8 |
| IV | **Design of Reinforced Concrete Deep Beams and Design of Ribbed (Voided) Slabs: Introduction** – Minimum Thickness – Steps of Designing Deep beams – design by IS 456 – Design according to British practice – ACI procedure for design of deep beams – checking for local failures – Detailing of Deep beams**.**<br>Design of Ribbed (Voided) Slabs<br>Introduction – Specification regarding the slabs – Analysis of the slabs for moment and shears – Ultimate Moment of Resistance – Design for shear – Deflection – Arrangement of Reinforcements – Corrosion of Steel with Clay blocks | 7 |

| | | |
|---|---|---|
| V | **Design of Reinforced Concrete Members for Fire Resistance**: Introduction – ISO 834 Standard Heating Conditions – Grading or Classifications – Effect of High temperature on steel and concrete – Effect of High temperatures on different types of structural members – Fire resistance by structural detailing from tabulated data – Analytical determination of the ultimate bending moment capacity of reinforced concrete beams under fire – other considerations | 8 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| CO1 | Calculate the defections of beam and columns |
| CO2 | Estimate the crack width in reinforced concrete members |
| CO3 | Design of reinforced concrete deep beams and design of ribbed (voided) slabs and find redistribution of moments of RC beams |
| CO4 | Design of reinforced concrete members for fire resistance |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | | 1 |
| CO2 | 2 | | 3 |
| CO3 | 1 | | 2 |
| CO4 | 2 | | 1 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Advanced Reinforced Concrete design | P.C. Varghese | **2nd edition 2002** |
| 2 | Advanced R.C. Design | Krishna Raju | **3rd edition 2016** |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Ultimate Strength Design for Structural Concrete | Ramakrishnan, V. | **1969** |
| 2 | Limit State theory and design of Reinforced Concrete | Karve. S.R. and Shah V. | **5thedition 2010** |

**Signature of the course coordinator**
Department of Civil Engineering

**Signature of the HoD**

**Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **I** |
|---|---|---|---|
| | | | |
| **Subject: Technical seminar I** | | | |
| **Subject Code:** | **24CADTS1** | **L – T – P - C:** | **0-0-3-1.5** |

**Course Objectives:**

| **Sl. No.** | **This Course will enable the students to** |
|---|---|
| **1** | Select relevant Civil engineering topic for seminar presentation. |
| **2** | Compile a technical report and presentation material. |
| **3** | Enhance the technical and communication skills. |

| **Unit** | **Description** | |
|---|---|---|
| • | Each student shall be given a technical seminar on a topic of Civil Engineering interest. | |
| • | Each student shall submit the title of the intended topic of seminar to the seminar evaluation committee of the department. | |
| • | The seminar evaluation committee shall scrutinize the titles submitted by the students and inform the students about the approval or suggestions to be incorporated to the title of the seminar. | |
| • | Each student shall submit the seminar report conforming to the standards and format prescribed by the department. | |

**Course Outcomes:**

| **Course Outcomes** | **At the end of the course students will be able to** |
|---|---|
| **CO1** | Appraise the current civil engineering research/ techniques / developments / interdisciplinary areas |
| **CO2** | Formulate seminar topic by utilizing technical resources/ Journals/ web sources & Carry out detailed review of available literature |
| **CO3** | Compose technical report and defend the presentation to enhance the technical and communication skills. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 2 | 3 | 3 |
| **CO2** | 1 | 3 | 2 |
| **CO3** | 1 | 3 | 1 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| Department: Civil Engineering-CADS | | Semester: | I |
|---|---|---|---|
| | | | |
| **Subject: ADVANCED STRUCTURAL ANALYSIS LABORATORY** | | | |
| **Subject Code:** | **24CADLB1** | **L – T – P - C:** | **0-0-3-1.5** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| 1 | Understand and apply modeling techniques for tall structures using software, focusing on creating accurate and detailed design-based reports (DBR). |
| 2 | Perform static analysis of tall structures using software to evaluate their structural stability and identify potential issues under various load conditions. |
| 3 | Conduct dynamic analysis of tall structures using software to assess their behavior under dynamic loads such as wind and seismic forces. |
| 4 | Design fundamental structural elements using software, ensuring compliance with relevant codes and standards. |

**Description**

**EXPERIMENT 1:**
Modeling of Tall structure with DBR (Design Based Report)- using STAD PRO/ ETABS

**EXPERIMENT 2:**
Static analysis of Tall structure- using STAD PRO/ ETABS

**EXPERIMENT 3:**
Dynamic analysis of Tall structure- using STAD PRO/ ETABS

**EXPERIMENT 4:**
Design of the following structural elements- using STAD PRO/ ETABS

i) Foundation
ii) Column
iii) Beam
iv) Slab
v) Staircase

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| CO1 | Demonstrate proficiency in modeling tall structures using software, producing comprehensive design-based reports (DBR). |
| CO2 | Conduct and interpret static analysis results for tall structures using software, identifying structural stability and performance under different load conditions. |
| CO3 | Perform dynamic analysis on tall structures using software, evaluating their response to dynamic loads such as wind and seismic activities. |
| CO4 | Design and optimize key structural elements using software, ensuring structural integrity and adherence to codes and standards. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 1 | 3 | 2 |
| **CO2** | 2 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Tall Building Design: Steel, Concrete, and Composite Systems | Bungale S. Taranath | • Edition: 2nd Edition<br>• ISBN: 978-1466556207 |
| 2 | Structural Analysis and Design of Tall Buildings: Steel and Composite Construction | Bungale S. Taranath | • Edition: 1st Edition<br>• ISBN: 978-0849315692 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Design of Reinforced Concrete | Jack C. McCormac and Russell H. Brown | • Edition: 10th Edition<br>• ISBN: 978-1118879108 |
| 2 | Dynamic Analysis of Structures | Anil K. Chopra | • Edition: 4th Edition<br>• ISBN: 978-0132858038 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

**SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU-572105**

(A constituent College of Siddhartha Academy of Higher Education, Deemed-to-be-University)

**Scheme of Teaching and Examination (88 Credits, 2024-SCHEME)**

**SECOND YEAR MTECH (COMMON TO ALL BRANCHES), ACADEMIC YEAR 2024-25**

**2nd SEMESTER MTech**

| SI No | Course Code | | Course Title | Teaching Dept. | L | T | P | Credits | CIE Marks | SEE Marks | Total Marks | Exam Hrs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | PC | 24CAD21 | Stability Analysis of Structures | **CIVIL** | 4 | - | - | **4** | 50 | 50 | 100 | 3 |
| **2** | PC | 24CAD22 | Analysis of Plates and Shells | **CIVIL** | 4 | - | - | **4** | 50 | 50 | 100 | 3 |
| **3** | PC | 24CAD23 | Design of Structural Systems for Bridges | **CIVIL** | 4 | - | - | 4 | 50 | 50 | 100 | 3 |
| **4** | PC | 24CAD24 | Applications of AI and Expert Systems in Structural Engineering | **CIVIL** | 3 | - | - | 3 | 50 | 50 | 100 | 3 |
| **5** | PE | 24CAD25x | **Elective – III** | **CIVIL** | 3 | - | - | **3** | 50 | 50 | 100 | 3 |
| **6** | PE | 24CAD26x | **Elective - IV** | **CIVIL** | 3 | - | - | **3** | 50 | 50 | 100 | 3 |
| **7** | PC | 24CADTS2 | Technical Seminar-II | **CIVIL** | - | - | 3 | **1.5** | 50 | - | 50 | - |
| **8** | PC | 24CADLB2 | Advance Structural Computational Laboratory | **CIVIL** | - | - | 3 | **1.5** | 50 | - | 50 | - |
| L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination | | | | **Total** | 21 | **-** | 6 | 24 | **400** | **300** | 700 | **-** |

**Elective – III**

24CAD251 Special Concrete
24CAD252 Reliability Analysis and Reliability Based Design of Structures
24CAD253 Foundation Engineering

**Elective – IV**

24CAD261 Earthquake Resistant Design of Structures
24CAD262 Dynamics of Soil-Structure Interaction
24CAD263 Advanced Design of Steel Structures

Dr. M.N. Eshwarappa, Convener (CDC) Dr. Renukalatha S, Dean (Aca.) Dr. M.S. Raviprakasha, Chairman (CDC)

| Department: Civil Engineering-CADS | | Semester: | II |
|---|---|---|---|
| **Subject: STABILITY ANALYSIS OF STRUCTURES** | | | |
| **Subject Code:** | 24CAD21 | **L – T – P - C:** | 4-0-0-4 |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | To learn the concepts of stability in beam column |
| **2** | To learn the concepts of buckling in continuous beams and frames. |
| **3** | To learn the concepts of stability by FEM method |
| **4** | To learn the lateral buckling and plate bending in beams |

| Unit | Description | Hrs. |
|---|---|---|
| I | Beam column- Differential equation: Beam column subjected to (i) lateral concentrated load, (ii) several concentrated loads, (iii) continuous lateral load Application of trigonometric series. Euler's formulation using fourth order differential equation for pined-pined, fixed-fixed, fixed-free and fixed-pined Column. | 10 |
| II | **Buckling of frames and continuous beams**. Elastic Energy method: Approximate calculation of critical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach. Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation. Bars with varying cross section. Effect of shear force on critical load. Column subjected to pulsating forces. | 10 |
| III | **Stability analysis by finite element approach** Derivation of shape function for a two nodded Bernoulli– Euler beam element (lateral and translation of) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discretised column with different boundary condition – calculation of critical loads for a discretised (two elements) column (both ends built in). Buckling of pin jointed frames (maximum of two active DOF) – symmetrical single bay portal frame. | 12 |
| IV | **Lateral buckling of beams** Differential equation –pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin – walled bars of open cross section. Non – uniform Torsion of thin – walled bars of open cross section. | 10 |
| V | **Expression for strain energy in plate bending with in plate forces** (linear and non – linear). Buckling of simply supported rectangular plate– uniaxial load and biaxial load. Buckling of uniformly compressed rectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides. | 10 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of strength and stability |
| CO3 | Appraise the Stability analysis by finite element approach. |
| CO4 | Understand the concepts of lateral buckling of beams. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | | 3 |
| CO2 | 3 | | 3 |
| CO3 | 3 | | 3 |
| CO4 | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Theory of Elastic Stability | Stephen P.Timoshenko, James M.Gere | 2nd Edition,McGraw-Hill, NewDelhi |
| 2 | Concepts and Applications of Finite Element Analysis‖, | Robert D Cooket al, | 3rdEdition, John Wileyand Sons, NewYork |
| 3 | Computational Structural Mechanics | S. Rajashekaran, | Prentice-Hall,India |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Dynamics of Structures | Ray W Clough and J Penzien, | 2nd Edition, McGraw-Hill, NewDelhi. |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
| | | | |
| **Subject: ANALYSIS OF PLATES AND SHELLS WITH FE APPROACH** | | | |
| **Subject Code:** | **24CAD22** | **L – T – P - C:** | **4-0-0-4** |

**Course Objectives:**

| **Sl. No.** | **This Course will enable the students to** |
|---|---|
| **1** | Understand the differential equations governing cylindrical bending and pure bending of plates. |
| **2** | Analyze circular plates under symmetrical and uniformly loaded conditions with varying boundary conditions. |
| **3** | Investigate the bending behavior of rectangular plates subjected to distributed moments and different edge support conditions and apply finite difference techniques to analyze orthotropic plates on large deflections in plate bending analysis. |
| **4** | Analyze shells of double curvature, shells of revolution, and cylindrical shells using thin shell theory, and review their finite element formulation for structural analysis. |

| **Unit** | **Description** | **Hrs.** |
|---|---|---|
| I | **Differential equation for cylindrical bending of plate**s: Bending of plates subjected to uniformly distributed loads – (i) two opposite sides free and other two opposite sides simply supported (ii) two opposite sides free and other two opposite sides fixed. Pure bending of plates – slope and curvature of slightly bent plates – relations between bending moments and curvature in pure bending of plates – strain energy in pure bending. | 10 |
| II | **Circular plates**: Differential equation for symmetrical bending of laterally loaded circular plates – uniformly loaded circular plates with and without central cutouts with two different boundary conditions (simple and clamped). Centrally loaded clamped circular plate. Circular plate, exact solution for circular plate with clamped edge, rectangular plates with simple supported edges. | 10 |
| III | **Bending of rectangular simply supported plate**: Subjected to distributed moments at a pair of opposite edges. Bending of rectangular pates subjected toudl (i) two opposite edges simply supported and the other two edges clamed, (ii) three edges simply supported and one edge built-in and (iii) all edges built in. Bending of rectangular plates subjected to uniformly varying lateral load (i) all edges built-in and (ii) three edges simply supported and one edge built-in. | 10 |
| IV | **Bending of orthotropic plates: Application** of finite difference technique for the analysis of isotropic and orthotropic rectangular plates subjected to uniformly distribute lateral | 10 |

| | | |
|---|---|---|
| | loads. Large deflections of plates – approximate formulas for uniformly loaded Plate bending analysis: Basic theories of thin plates, displacement functions, plate bending elements, shear deformation in plates, Basic relationships in finite element formulation, four and eight nodded iso paramatric elements. | |
| V | **Differential geometry of curves and surfaces**: Classifications of shells – membrane action and bending action – force resultants and moment resultant in terms of mid surface strains and changes in curvatures –analysis of simple shells of revolution subjected to symmetrical loading. General bending theory of shells of double curvature, shells of revolution and cylindrical shells. Analysis of shells: Thin shell theory, review of shell elements, four and eight nodded shell element and finite element formulation. | 12 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Demonstrate proficiency in applying differential equations to analyze cylindrical bending and pure bending of plates. |
| **CO2** | Analyze circular plates under various symmetric and uniformly loaded conditions, considering different boundary conditions. |
| **CO3** | Investigate the bending behavior of rectangular plates subjected to distributed moments and diverse edge support conditions and apply finite difference techniques to analyze orthotropic plates on large deflections in plate bending analysis. |
| **CO4** | Review and apply finite element formulations for structural analysis of shells, considering their geometric complexity and material properties. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 1 | | 2 |
| **CO2** | 2 | | 3 |
| **CO3** | 3 | | 3 |
| **CO4** | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Theory of Plates and Shells | Timoshenko, S. and Woinowsky-Krieger, W. | 2nd Edition, McGraw-HillCo., New York, 1959 |
| 2 | Stress in Plates and shells | Ugural A C | 2nd edition, McGraw-Hill, 1999 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Finite Element Analysis | S SBhavaikatti | McGraw-Hill International Edition,1984. |
| 2 | Theory of Plates | Chandrashekara K | UniversityPress,Hyderabad,2001 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject: DESIGN OF STRUCTURAL SYSTEMS FOR BRIDGES** | | | |
| **Subject Code:** | **24CAD23** | **L – T – P - C:** | **4-0-0-4** |

**Course Objectives:**

| **Sl. No.** | **This Course will enable the students to** |
|---|---|
| **1** | Understand the basic concepts of bridges. |
| **2** | Understand the design of bridges and bridge bearings. |
| **3** | Understand the concept of T-Beam Bridges and design of culverts. |
| **4** | Understand the design of PSC bridges, Piers and Abutments. |

| **Unit** | **Description** | **Hrs.** |
|---|---|---|
| I | Introduction: Classification, investigations and planning, choice of type – economic span length – IRC specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations. General aspects – Design loads – Design moments, shears and thrusts – Design of critical section. | 10 |
| II | Design of Slab Bridges: Effective width of analysis – workings stress design and detailing of slab bridges for IRC loading. Bridge bearings– General features – Types of bearings – forces on bearings basis for selection of bearings – Design principles of steel rocker and roller bearings and its design – Design of elastomeric pad bearing detailing of elastomeric pot bearings | 10 |
| III | T-Beam Bridges: Introduction – wheel load analysis – B.M. in slab – Pigaud's theory –analysis of longitudinal girders by Courbon's theory working stress design and detailing of reinforced concrete T-beam bridges for IRC loading. Design of Box culverts. | 10 |
| IV | Prestressed Concrete Bridge: General features – Advantages of Prestressed concrete bridges – pretensioned Prestressed concrete bridges – post tensioned Prestressed concrete Bridge decks. Design of post tensioned Prestressed concrete slab bridge deck. | 10 |
| V | Piers and Abutments : General features – Bed block – Materials for piers and abutments – types of piers – forces acting on piers – Design of pier – stability analysis of piers – general features of abutments – forces acting on abutments – stability analysis of abutments. bridge foundations– General Aspects – Types of foundations – Pile foundations – well foundations – caisson foundations. | 12 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| CO1 | Apply the basic concepts of bridges, location and design. |
| CO2 | Design of slab bridges and bridge bearings. |
| CO3 | Apply the concept of design of T-Beam Bridges and culverts. |
| CO4 | Apply the concept of design of PSC bridges, Piers and Abutments. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | | 2 |
| CO2 | 1 | | 2 |
| CO3 | 3 | | 2 |
| CO4 | 3 | | 1 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Essentials of bridges engineering | D. Johnson Victor | Oxford & IBH publishers co Private Ltd |
| 2 | Bridge Engineering | S. Ponnuswamy. | |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Concrete Bridge Design | B Rowe, R.E | C.R.Books Ltd., London. |
| 2 | Design of Bridges | N.KrishnaRaju | Oxford & IBH |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
| **Subject: APPLICATION OF AI AND EXPERT SYSTEMS IN STRUCTURAL** | | | |
| **Subject Code:** | **24CAD24** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Use expert systems to achieve fairly high levels of performance in task areas which require a good dealof specialized knowledge and training. |
| **2** | Develop expert systems to perform tasks which are physically difficult. |
| **3** | Develop expert systems to perform tasks tedious, or expensive to have a human perform. |
| **4** | Apply the knowledge of AI in Neural networks. |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Artificial Intelligence**: Introduction: AI – Applications fields, defining the problems – state space representation – problem characteristics – production system – production system characteristics. Knowledge representation: Formal logic – predicate logic – logic programming – forward v/s backward reasoning – matching control knowledge. | 9 |
| II | **Search and control**: Concepts – uniformed / blind search: depth first search – breadth first search - bi-directional search – informed search – heuristic graph search – generate and test - hill climbing – best–first search – AND OR graph search.Non-formal knowledge – semantic networks – frames – scripts – production systems. Programming in LISP | 7 |
| III | **Expert Systems**: Their superiority over conventional software – components of an expert system – expert system life cycle – expert system developments process – nature of expert knowledge – techniques of soliciting and encoding expert knowledge. Inference: Forward chaining – backward chaining – rule valueapproach. | 8 |
| IV | **Uncertainty**: symbolic reasoning under uncertainty: logic for non-monotonic reasoning. Statistical reasoning: Probability and Bayes' theorem – certainty factor and rule based systems – Bayesian network -Dempster – Shafer theory. | 7 |
| V | **Fuzzy reasoning and Neural Networks**: Features of rule based, networks based and frame based expert systems – examples of expert systems in Construction Management and Structural Engineering. Expert systems shells. Neural Networks: An introduction – their possible applications in Civil Engineering | 8 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Identify the logical reasons in the system |
| **CO2** | know various AI search algorithms |
| **CO3** | Develop expert systems to perform tasks which are physically difficult,tedious, or expensive to have a human perform |
| **CO4** | Knowledge on the entire system of neural networks and application in the structural system |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | 3 | 2 |
| CO2 | 2 | 1 | 2 |
| CO3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Artificial Intelligence and Expert Systems | Patterson D W | Prentice-Hall, New Jersy.2019 |
| 2 | Artificial Intelligence and Expert Systems | Rich, E. and KnightK | McGraw Hill, NewYork 2020 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Principals of Artificial Intelligence | Nilsson, N.J | Narosa., New Delhi 2020 |
| 2 | Expert Systems in Constructions and Structural Engg | Adeli, H | Chapman & Hall,New York.2021 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
| **Subject: SPECIAL CONCRETE** | | | |
| **Subject Code:** | **24CAD251** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| 1 | Understand the fundamental material properties of concrete |
| 2 | Implement the principles of Mix design of Light Weight Concrete |
| 3 | Understand the principles of Ferro Cement and Fiber reinforced concrete |
| 4 | Implement the principles of High-Performance Concrete |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Components of modern concrete and developments in the process and constituent materials**: Role of constituents, Development in cement and cement replacement materials, pozzolana, fly ash, silica fume, rice husk ash, recycled aggregates, chemical admixtures. Mix proportioning of Concrete: Principles and methods. | 9 |
| II | **Lightweight concrete:** Introduction, classification, properties, strength and durability, mix proportioning, and problems. High-density concrete: Radiation shielding ability of concrete, materials for high-density concrete, mix proportioning, properties in fresh and hardened state, placement methods. | 7 |
| III | **Ferro cement**: Ferro cement materials, mechanical properties, and cracking of Ferro cement, strength and behavior in tension, compression and flexure, Design of Ferro cement in tension, Ferro cement constructions, durability, and applications. | 8 |
| IV | **Fiber reinforced concrete**: Fiber materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state, strength, and behavior in tension, compression, and flexure of steel fiber reinforced concrete, mechanical properties, crack arrest, and toughening mechanism, applications. | 7 |
| V | **High-Performance Concrete**: constituents, mix 8 Hours proportioning, properties in fresh and hardened states, applications, and limitations. Ready Mixed Concrete-QCI-RMCPC scheme requirements, Self-Compacting Concrete, Reactive powder concrete. | 8 |

**Course Outcomes:**

| Course Outcomes | At the end of the course, students will be able to |
|---|---|
| **CO1** | Students will have the ability to understand the behavior of concrete knowing the fundamental properties of ingredients |
| **CO2** | Students will have the ability to design Light Weight Concrete |
| **CO3** | Students will have the ability to design Ferro cement |
| **CO4** | Students will have the ability to design Fiber Reinforced Concretes and High-Performance Concretes |

**Course Articulation Matrix:**

| PO/PSO CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 3 | 1 | 3 |
| **CO2** | 2 | 1 | 3 |
| **CO3** | 2 | 1 | 3 |
| **CO4** | 2 | 1 | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Design of Concrete Mixes | N. Krishna Raju | 5th Edition ISBN: 978-81-239-2467-0 |
| 2 | Concrete Technology Theoryand Practice | M. L. Gambhir | 5th Edition ISBN-10 1259062554 ISBN-13 9781259062551 |
| 3 | Concrete Technology‖-Oxford University Press, New Delhi,2007 | A.R. Santhakumar, | 2nd Edition ISBN10- 0199458529 ISBN13- 978- 0199458523 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Properties of Concrete | A.M. Neville | 5th Edition2011 ISBN 978-81-317-9107-3 |
| 2 | Corrosion Of Reinforcement in Concrete Construction (Special Publications) | C.L. Page P.B. Bamforth And JW Figg | 1996 Edition |
| 3 | High-Performance Fiber Reinforced Cement Composites 6 HPFRCC 6 (RILEM Book series) | Gustavo J Parra, Montesinos | 2011 Edition |

**Signature of the course coordinator** **Signature of the HOD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject:** **RELIABILITY ANALYSIS AND RELIABILITY BASED DESIGN OFSTRUCTURES** | | | |
| **Subject Code:** | **24CAD252** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| **Sl. No.** | **This Course will enable the students to** |
|---|---|
| **1** | Understand the in depth principles of Probability and Statistics |
| **2** | Understand the principles of Level 2 Reliability Methods |
| **3** | Understand the principles of Monte Carlo Simulation |
| **4** | Understand the principles of Reliability to Structures |

| **Unit** | **Description** | **Hrs.** |
|---|---|---|
| I | **Introduction to reliability and difference in approach used in civil engineering**: Statistics for raw data and classified data. Mean Median Mode, Standard deviation and Coefficient of variation, Moments, Skewness and Kurtosis. | 9 |
| II | Curve fitting: Method of least squares linear and nonlinear non-linear. Introduction to Probability axioms of probability mutually exclusive and independent events, fundamental of set theory De Morgan's rule conditional probability probability tree diagram. | 7 |
| III | Normal distribution, Lognormal distribution and their properties, Probability and exceedance probability. Statistical sensitivity analysis, Calculation of statistic of RC beam in flexure (Ultimate Resistance) and probability of its failure, Design of a tension member for a given probability of failure when loadisnormallyandlognormallydistributed..Chisquaretest,Suitabilityof probabilistic model (Log Normal distribution) by Chi square test. | 8 |
| IV | Concepts of Reliability reliability index problems on column simply supported beam cantilever be statistical sensitivity analysis, establishing statistics of Resistance of column and simply supported beam<br>Application of Monte Carlo techniquewith Box Muller Technique, when parameters are normally distributed] for cube strength of concrete the strength, Comparison of standard deviation and mean strength of axially loaded short column obtained by simulation and theory. Obtaining the probability of failure by simulation when load of short column when all parameters are either non-random or normally distributed. | 7 |
| V | Level 2 reliability methods FOSM and AFOSM methods, determination of Cornell's Beta for steel tensile member, Column, I section. Hasofer Lind method for invariant beta, Problem on I section & steel tension member to check invariance of Beta. Fiessler's method for invariant beta, problem on short column, simply supported beam, Elastic cantilever beam for a given | 8 |

| | | |
|---|---|---|
| | deflection. Reliability based design by inverse formulation, Determination of mean depth of an I beam using Hasofer Lind method. Definitions of Nominal value, mean value, characteristic value. Finding partial safety factor for RC beam for ultimate strength, simply supported beam [RSJ]. Theory of LRFD design factors. Theory of LRFD [procedure] for Indian Standards. | |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Use Principles of Statistics and Probability to solve the civil engineering issues |
| **CO2** | Apply Level 2 Reliability methods to solve the civil engineering issues |
| **CO3** | Apply principles of Monte Carlo Simulation to solve the civil engineering issues |
| **CO4** | Analyze Structure in light of theory of reliability to solve the civil engineering issues |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 3 | | 2 |
| **CO2** | 2 | | 3 |
| **CO3** | 1 | | 1 |
| **CO4** | 2 | | 1 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Reliability Analysis and Design of Structures, NewDelhi. | R.Ranganthan, | Tata McGraw Hill Publishing Co. Ltd., |
| 2 | Basic Statistical Methods for Engineers and Scientists, | John B.Kennedy and Adam M.Neville, | Harper and Row Publishers, New York. |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Probability and Statistics in Engineering and Management Sciences | William W. Hines, Douglas C. Montgomery | 1990, 3rd Edition |
| 2 | Concepts in reliability Engineering | L.S.Srinath | 2nd Edition |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
| | | | |
| **Subject: FOUNDATIONENGINEERING** | | | |
| **Subject Code:** | 24 CAD253 | **L – T – P - C:** | 3-0-0-3 |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Gain the knowledge of shallow and deep foundation design. |
| **2** | Gain the knowledge of bearing capacity and settlement. |
| **3** | Knowledge of necessity of pile and well foundation including design. |
| **4** | Knowledge of placing of foundations in expansive soils. |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Bearing Capacity & Settlement:** Introduction to bearing capacity and settlement, Factors affecting bearing capacity. Numerical problems on bearing capacity of soils. Types and modes of settlement. Computation of settlement for cohesion and cohesion less soils. | |
| II | **Shallow Foundations**: Principles of Design o foundation, Requirements for geotechnical and structural aspects of design, Proportioning of Isolated footing, Combined Footing, Strap footing, Strip footing and Raft foundation. | |
| III | Pile Foundation: Historical Development, Necessity of pile foundations, Classification, Load carrying capacity of piles by Static formula in cohesive and cohesion less soils. Pile groups, group action of piles in sand and clay, group efficiency of piles and negative skin friction. Numerical problems on above. | |
| IV | Well Foundations: Introduction, Classification of well foundation, Components of well foundation, Forces acting on well foundation, Sinking of wells, Causes and remedies for tilts and shifts. Drilled Piers and Caissons-Construction, advantage sand disadvantages of drilled piers. Design concepts and Advantages and disadvantages of open, pneumatic and floating caissons. | |
| V | **Foundations on Expansive Soils**: Definition, Identification, Mineral Structure, Index properties of expansive soils, Swell potential and Swell pressure, Free swell Tests on expansive soils, foundation treatment for structures in expansive soil, CNS layer. | |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | To understand the concept of bearing capacity and settlement of footings. |
| **CO2** | To know the different types of foundations and their suitability. |
| **CO3** | To understand the necessity of pile and well foundation including design. |
| **CO4** | To enhance the knowledge of placing of foundations in expansive soils. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | 2 | 2 |
| CO2 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | ―Pile Design, Construction And Practice‖, Taylor And Francis Publications, New York. | Michael Tomlinson And John Woodward | 5$^{th}$ Edition, 2008 |
| 2 | ―Soil Mechanics And Foundation Engineering‖, UBS Publishers And Distributors, New Delhi. | V N S Murthy | 6$^{th}$ Edition, 2009 |
| 3 | ―Theory And Practice Of Foundation Design‖, Prentice Hall Of India, New Delhi. | Som And S CDas | 3$^{rd}$ Edition, 2009 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | ‒Soil Mechanics Fundamentals‖,John Wiley And Sons Publications, NewYork. | Muni Budhu And Wiley Blackwell | 1$^{st}$ Edition,2006 |
| 2 | ‒Pile Foundations In Engineering, Wiley Inter-Science Publications, NewYork. | Shamsher Prakash And Hari D Sharma | 2$^{nd}$ Edition, 2005 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject: EARTH QUAKE RESISTANT DESIGN OF STRUCTURES** | | | |
| **Subject Code:** | **24CAD261** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Learn principles of engineering seismology. |
| **2** | Design the reinforced concrete buildings for earthquake resistance. |
| **3** | Evaluate the seismic response of the structures. |
| **4** | Learn about the basic concept of seismic base isolation |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Seismic Hazard Assessment**: Engineering Seismology – Definitions, Introduction to Seismic hazard ,– Characteristics of strong Earthquake motion - Estimation of Earthquake parameters – Microzonation. Earthquake phenomenon – Seismotectonics and seismic zoning of India – Earthquake monitoring and seismic instrumentation. | 9 |
| II | **Earthquake Effects on Structures:** Response to ground acceleration – response analysis by mode superposition – torsional response of buildings - response spectrum analysis – selection of design earthquake – earthquake response of inelastic structures, allowable ductility demand Response Spectra / Average response Spectra - Design Response Spectra - Evaluation of earthquake forces – Effect of earthquake of on different types of structures – Lesson learnt from past earthquakes | 7 |
| III | **Concepts of Earthquake Resistant Design**: Structural Systems / Types of buildings – Causes of damage – Planning consideration / Architectural Concept ( IS 4326 –1993) ( Do's and Donts for protection of life and property ) – Philosophy and principle of earthquake resistance design – Guidelines for Earthquake Resistant Design. | 8 |
| IV | **Earthquake Resistant Earthen and Masonry Buildings**: Earthquake Resistant low strength masonry buildings, Strength and Structural properties of masonry – lateral load – Design Considerations | 7 |
| V | **Earthquake Resistant design of RCC Buildings**: Material properties – lateral load analysis – design and detailing. Basic concept of seismic base isolation – Seismic Isolation systems. | 8 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of engineering seismology. |
| CO3 | Understand the concepts of earthquake resistance of earthen masonryand reinforced concrete buildings. |
| CO4 | Design and develop analytical skills |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| CO1 | 3 | | 3 |
| CO2 | 3 | | 3 |
| CO3 | 3 | | 3 |
| CO4 | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Dynamics of structures | Chopra, A.K | Prentice-Hall of India Pvt. Ltd. New Delhi |
| 2 | Earthquake Resistant Design of Structures | Pankaj Agarwal and Manish Shrikhande | Prentice Hall of India, 2006 |
| 3 | Earthquake Resistant Design of Structures | S K Duggal | Oxford University Press, 2007 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Earthquake Resistant Design of Structures | Ghose, S.K. | SDCPL –R&D Center – NewMumbai 73 |
| 2 | Elements of Earthquake Engineering | Jaikrishna et al | South Asia Publishers, New Delhi |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject: DYNAMICS OF SOIL-STRUCTURE INTERACTION** | | | |
| **Subject Code:** | **24CAD262** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Understand the Importance of Soil-Structure Interaction (SSI) |
| **2** | Apply Structural Modeling for Dynamic SSI Analysis |
| **3** | Analyze Soil Modeling Techniques for Dynamic SSI |
| **4** | Evaluate Engineering Applications of Dynamic SSI |

| Unit | Description | Hrs. |
|---|---|---|
| I | **Introduction:** Objectives and practical significance and importance of soil structure interaction (SSI); Fixed base structure, structures on soft ground; Modeling of unbounded media. Fundamentals of Soil-Structure Interaction: Direct and substructure methods of analysis; Equation of motion for flexible and rigid base; Kinematic interaction, inertial interaction and effect of embedment | 8 |
| II | **Modeling of Structure:** Temporal and spatial variation of external loads (including seismic loads); Continuous models, discrete models (lumped mass) and finite element models. Wave Propagation for SSI: Waves in semi-infinite medium – one, two and three-dimensional wave propagation; Dynamic stiffness matrix for out-of plane and in-plane motion. | 8 |
| III | **Free-Field Response of Site:** Control point and control motion for seismic analysis; Dispersion and attenuation of waves; Half-space, single layer on half- space; Parametric studies. Modeling of Boundaries: Elementary, local, consistent and transmitting boundaries. 8 Hours Module -4 Modeling of Soil: Green’s influence functions, boundary-element method, finite element model; Dynamic stiffness coefficients for different types of foundations – surface foundation, embedded foundation, shallow (strip) foundation and deep (piles) foundations. Soil Structure Interaction in Time Domain: Direct method; Substructure method (using dynamic stiffness and Green’s functions of soil); Hybrid frequency-time domain approach | 8 |
| IV | **Nonlinear Analysis:** Material nonlinearity of soil (including plasticity and strain hardening), geometrical nonlinearity (slip and separation of foundation with soil); Nonlinear structure with linear soil considering both soil and structure nonlinearity | 8 |
| V | **Engineering Applications of Dynamic Soil-Structure Interaction:** Low-rise residential buildings, multistory buildings, bridges, dams, nuclear power plants, offshore structures, soil-pile structure interactions. | 7 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Understand the importance of Soil-Structure Interaction (SSI) in engineering, focusing on structural dynamics and stability. |
| **CO2** | Apply structural modeling for dynamic SSI analysis, considering the effects of dynamic loads on structural behavior. |
| **CO3** | Analyze soil modeling techniques to study dynamic SSI, examining how soil properties affect structural response under different loads. |
| **CO4** | Evaluate engineering applications of Dynamic Soil-Structure Interaction (SSI) to improve structural performance, manage risks, and optimize design. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 1 | | 2 |
| **CO2** | 2 | | 3 |
| **CO3** | 3 | | 3 |
| **CO4** | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Dynamic Soil-Structure Interaction | Wolf, J. P | 1985 |
| 2 | Soil-Structure Interaction | Cakmak, A.S | 1987 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Finite Element Modeling of Unbounded Media | Wolf, J.P. and SongC. | 2000 |
| 2 | Boundary Element Method for Soil-Structure Interaction | Hall, W.S. andOliveto G | 2003 |
| 3 | Geotechnical-Earthquake Engineering | Kramer, S.L., | 1996 |

**Signature of the course coordinator**
Department of Civil Engineering

**Signature of the HoD**

**Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject: ADVANCED DESIGN OF STEEL STRUCTURES** | | | |
| **Subject Code:** | **24CAD263** | **L – T – P - C:** | **3-0-0-3** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Understand the background to the design provisions for hot-rolled and cold formed steel structures, including the main differences between them |
| **2** | Proficiency in applying the provisions for design of columns, beams, beam columns. |
| **3** | Enable the design of steel structures with the knowledge of stiffened and unstiffened sections. |
| **4** | Design structural sections for adequate fire resistance. |

| Unit | Description | Hrs. |
|---|---|---|
| I | Laterally Unrestrained Beams: Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of Cantilever beams, continuous beams, beams with continuous and discrete lateral restraints, Mono- symmetric and non- uniform beams – DesignExamples. | 9 |
| II | Beam- Columns in Frames: Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, Effective Length of Columns-, Methods in IS 800 – Examples. | 7 |
| III | Steel Beams with Web Openings: Shape of the web openings, practical guide lines, and Force distribution and failure patterns, Analysis of beams with perforated thin and thick webs (Concepts), Design of laterally restrained castellated beams for given sectional properties, Structural behaviour of Vierendeel girders (Concepts). | 8 |
| IV | Cold formed steel sections: Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions, numerical examples beam design, column design. | 7 |
| V | Fire resistance: Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members-Numerical Examples, Methods of fire protection, Fire resistance ratings. | 8 |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Understand the behavior of Laterally Unrestrained Beams. |
| **CO2** | Know the concept of Beam- Columns inFrames. |
| **CO3** | Understand the concept of Steel Beams with WebOpenings. |
| **CO4** | Understand the concept of Cold formed steelsections and fire resistance. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 3 | 2 | 2 |
| **CO2** | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 2 |
| **CO4** | 2 | 2 | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Design of Steel Structures By LimitState Method | S. S. Bhavikatti | Second Edition, I KInternational Publishing House, India, 2018 |
| 2 | Design of Steel Structures | N. Subramanyam | Oxford University Press, New Delhi, india, 2022 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Design of steel structures | Rama Chandra andVirendra Gehlot, | Scientific Publishers,india , 2018 |
| 2 | Steel Structures | J.F. Baker | Vol - 1 and 2 2020 |

**Signature of the course coordinator** **Signature of the HoD** **Signature of the Dean (Academic Affairs)**

| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
|---|---|---|---|
| | | | |
| **Subject: Technical seminar II** | | | |
| **Subject Code:** | **24CADTS2** | **L – T – P - C:** | **0-0-3-1.5** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| 1 | Select relevant Civil engineering topic for seminar presentation. |
| 2 | Compile a technical report and presentation material. |
| 3 | Enhance the technical and communication skills. |

| Unit | Description | |
|---|---|---|
| • | Each student shall be given a technical seminar on a topic of Civil Engineering interest. | |
| • | Each student shall submit the title of the intended topic of seminar to the seminar evaluation committee of the department. | |
| • | The seminar evaluation committee shall scrutinize the titles submitted by the students and inform the students about the approval or suggestions to be incorporated to the title of the seminar. | |
| • | Each student shall submit the seminar report conforming to the standards and format prescribed by the department. | |

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| CO1 | Appraise the current civil engineering research/ techniques / developments / interdisciplinary areas |
| CO2 | Formulate seminar topic by utilizing technical resources/ Journals/ web sources & Carry out detailed review of available literature |
| CO3 | Compose technical report and defend the presentation to enhance the technical and communication skills. |

**Course Articulation Matrix:**

| PO/PSO<br><br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 2 | 3 | 3 |
| **CO2** | 1 | 3 | 2 |
| **CO3** | 1 | 3 | 1 |

**Signature of the course coordinator**

**Signature of the HoD**

**Signature of the Dean (Academic Affairs)**

## SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU

**(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)**

M.Tech -CADS

Syllabus for the Academic year 2024 - 2025

| | | | |
|---|---|---|---|
| **Department: Civil Engineering-CADS** | | **Semester:** | **II** |
| | | | |
| **Subject: ADVANCED STRUCTRAL COMPUTATIONAL LABORATORY** | | | |
| **Subject Code:** | **24CADLB2** | **L – T – P - C:** | **0-0-3-1.5** |

**Course Objectives:**

| Sl. No. | This Course will enable the students to |
|---|---|
| **1** | Understand and analyze 2D and 3D trusses using ANSYS/ETABS, focusing on modeling and simulating under various loading conditions. |
| **2** | Develop the ability to perform structural analysis of beams for different loading conditions using ANSYS, studying their behavior under various loads and boundary conditions. |
| **3** | Utilize SAP2000 to conduct finite element analysis of framed structures due to seismic forces, understanding their dynamic response to seismic events. |
| **4** | Explore and apply the Winkler approach for soil-structure interaction modeling using SAP2000, assessing the influence of soil properties on structural behavior. |

**Description**

**EXPERIMENT 1:**
Analysis of 2D & 3D Trusses (using ANSYS/ETABS)

**EXPERIMENT 2:**
Structural Analysis of Beam for Different Loading Conditions (using ANSYS)

**EXPERIMENT 3:**
FE Analysis of Framed Structures Due to Seismic Forces (SAP2000)

**EXPERIMENT 4:**
SSI using Winkler approach (SAP2000)

**Course Outcomes:**

| Course Outcomes | At the end of the course students will be able to |
|---|---|
| **CO1** | Demonstrate proficiency in modeling, simulating, and analyzing 2D and 3D trusses using ANSYS/ETABS, interpreting results to assess structural integrity under different loads. |
| **CO2** | Conduct detailed structural analysis of beams under various loading conditions using ANSYS, evaluating stress distribution and deflection patterns. |
| **CO3** | Perform finite element analysis of framed structures subjected to seismic forces using SAP2000, analyzing their dynamic response and resilience during seismic events. |
| **CO4** | Apply the Winkler approach to model soil-structure interaction using SAP2000, analyzing the effects of soil properties on the performance of structural foundations and superstructures. |

**Course Articulation Matrix:**

| PO/PSO<br>CO | PO1 | PO2 | PO3 |
|---|---|---|---|
| **CO1** | 1 | | 2 |
| **CO2** | 2 | | 3 |
| **CO3** | 3 | | 3 |
| **CO4** | 3 | | 3 |

**Text Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Finite Element Analysis: Theory and Application with ANSYS | Saeed Moaveni. | Edition: 3rd Edition<br>ISBN: 978-0133840803 |
| 2 | Soil-Structure Interaction: Numerical Analysis and Modelling | C. Zhang and J. L. Wang | Edition: 1st Edition<br>ISBN: 978-0415424666 |

**Reference Books:**

| Sl. No. | Text Book Title | Author | Volume & Year of Edition |
|---|---|---|---|
| 1 | Advanced structural Analysis | Devdas Menon | Edition: 1st Edition<br>ISBN: 978-0070606512 |
| 2 | Foundation Design: Principles and Practices | Donald P. Coduto, Man-chu Ronald Yeung, and William A. Kitch | Edition: 3rd Edition<br>ISBN: 978-0133411898 |

**Signature of the course coordinator**

**Signature of the HoD**

**Signature of the Dean (Academic Affairs)**