JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

R25 Regulations

M.Tech Programme

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN)

(Applicable for Batches Admitted from 2025-26)

Jawaharlal Nehru Technological University Kakinada

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

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COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

Vision and Mission of the University

Vision

The University is primarily promoting quality of education in the areas of Science, Technology, Engineering and Mathematics (STEM) as four academic pillars of education, to excel in teaching, learning, research, consultancy and placements through innovative practices with global perspective.

Mission

Design an Industry relevant curriculum from time to time with a Global perspective Promoting quality education by embracing ICT delivery mechanism with continuous pedagogy through e-learning mechanism Spread across for industry collaborations with a focus to pre-training and placements for technology transfer to society Establishing centers of excellence to promote research and innovations in multidisciplinary areas to bring in patent culture and consultancy practices International Collaborations for student outreach Facilitating international students to study in JNTUK to infuse cross culture learning practices.

Vision and Mission of the Institute

Vision and Mission of the Department

Program Educational Objectives

PEO1	Impart advanced technical knowledge and skills for specialized careers in structural Engineering and related fields that caters to the Global needs.
PEO2	Provide expertise in carrying out project works in advanced structural engineering by using state -of -art computing, numerical and experimental techniques and to develop interdisciplinary research.
PEO3	Train the students to possess good communication and presentation skills with ability to work in teams and contributing significantly to the technological development of the Nation

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I – Semester

S. No	Course Name	Category	L	T	P	C
1	Theory of Elasticity	Program Core-1	3	1	0	4
2	C++ and Data Structures	Program Core-2	3	1	0	4
3	Structural Dynamics	Program Core-3	3	1	0	4
4	Program Elective - 1		3	0	0	3
	a) Matrix Analysis of Structures					
	b) Analytical & Numerical Methods for Structural Engineering					
	c) Experimental Stress Analysis					
	d) Structural Optimization					
5	Program Elective – 2		3	0	0	3
	a) Modeling, Simulation & Computer Applications					
	b) Repair and Rehabilitation of Structures					
	c) Advanced Reinforced Concrete Design					
	d) Bridge Engineering					
6	Advanced Concrete Technology Laboratory	Laboratory-1	0	1	2	2
7	Computer Aided Design Laboratory - 1	Laboratory-2	0	1	2	2
8	Seminar-1		0	0	2	1
	Total		15	5	6	23

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II – Semester

S. No.	Course Name	Category	L	T	P	C
1	Finite Element Methods in Structural Engineering	Program Core-1	3	1	0	4
2	CAD & Computer Applications in Structural Engineering	Program Core-2	3	1	0	4
3	Stability of Structures	Program Core-3	3	1	0	4
4	Program Elective – 3		3	0	0	3
	a) Analysis of Tall Structures					
	b) Advanced Steel Design					
	c) Analysis of Shells and Folded Plates					
	d) Analysis of Offshore Structures					
5	Program Elective - 4		3	0	0	3
	a) Earthquake Resistant Design of Buildings					
	b) Precast and Prefabricated Structures					
	c) Management Information Systems					
	d) Theory of Plates and Shells					
6	Computer Aided Design Laboratory - 2	Laboratory-3	0	1	2	2
7	Advanced Structural Engineering Laboratory	Laboratory-4	0	1	2	2
8	Seminar- 2		0	0	2	1
	Total		15	5	6	23

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III Semester

S. No	Course Code	Course Title	L	T	P	C
1		Research Methodology and IPR/ Swayam 12 week MOOC course-RM & IPR	3	0	0	3
2		Summer Internship/ Industrial Training (8 -10 weeks)*	-	-	-	3
3		Comprehensive Viva#	-	-	-	2
4		Dissertation Part –A $			20	10
					20	18

* Student attended during summer / year break and assessment will be done in 3rd Sem.
# Comprehensive viva can be conducted courses completed upto second sem.
$ Dissertation – Part A, internal assessment

IV Semester

S.No	Course Code	Course Title	L	T	P	C
1		Dissertation Part –B &	-	-	32	16
		Total	-	-	32	16

& External Assesment

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COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	THEORY OF ELASTICITY	L	T	P	C
		3	1	0	4

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

CO1	Know the definition of stress and deformation and how to determine the components of the stress and strain tensors.
CO2	Apply the conditions of compatibility and equations of equilibrium.
CO3	Understand how to express the mechanical characteristics of materials, constitutive equations and generalized Hook law.
CO4	Use the equilibrium equations stated by the displacements and compatibility conditions stated by stresses
CO5	Understand index notation of equations, tensor and matrix notation and define state of plane stress, state of plane strain
CO6	Be able to analyze real problem and to formulate the conditions of theory of elasticity Applications
CO7	Determine the boundary restrictions in calculations. Solve the basic problems of the theory of elasticity by using Airy function expressed as bi- harmonic function

Detailed Syllabus:

UNIT: 1

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations - Stress function – Boundary Conditions.

UNIT: 2

Two dimensional problems in rectangular co-ordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading

UNIT: 3

Two dimensional problems in polar co-ordinates - General equations in polar co-ordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar co-ordinates– Displacements for symmetrical stress distributions - Stresses for plates with circular holes subjected to far field tension – stress concentration factor.

UNIT: 4

Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution –Reciprocal theorem.

UNIT: 5

Torsion of Prismatic bars – Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of Torsional problems by energy method.

TEXT BOOKS

1. Theory of Elasticity- Stephen Timoshenko & J. N. Goodier, Mc.Grawhill Publishers
2. Advanced Mechanics of Solids L.S. Srinath, McGraw Hill Publishers

REFERENCES

1. Elasticity: Theory, Applications and Numeric- Martin H. Sadd, Wiley Publishers
3. Theory of Elasticity -Sadhu Singh 3rd Edition, Khanna Publishers

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COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	C++ AND DATA STRUCTURES	L	T	P	C
		3	1	0	4

UNIT-I

Object oriented programming :- Procedure – oriented programming, object oriented programming paradigm, basic concepts of oop, benefits of opp. Basics of C++, key words, data types, operators, functions in C++, classes and objects.

UNIT-II

Concepts of C++:- Constructors, parameterized constructors, copy constructor, destructors, Inheritance – single, multilevel, multiple, Hierarchical, Hybrid, parameter passing methods. Sorting: Bubble sort, selection sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort. Searching: Binary Search, Linear Search.

UNIT- III

Linked Lists: - Single Linked List, Circular Linked List, Double Linked List, Circular Double Linked, insertion in to and deletion from linked list.

UNIT-IV

Stacks:- Introduction, Implementation using arrays and linked lists, applications: Arithmetic Expression, Implementation of Recursion, Towers of Hanoi,. Queues: Introduction, Implementation using arrays and linked lists, Types of queues, Applications

UNIT- V

Trees :- binary trees, representing binary trees in memory, Operations on Binary Trees, Types of trees.

TEXT BOOKS :

1. Object oriented programming with C++, “Balaguru Swamy”, Tata McGraw Hill.
2. Classic Data Structures, “D. Samantha”, PHI Learning Pvt. Ltd..
3. Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press.

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I Semester	STRUCTURAL DYNAMICS	L	T	P	C
		3	1	0	4

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

CO1	Understand the response of structural systems to dynamic loads
CO2	Realize the behavior and response of linear and nonlinear SDOF and MDOF structures with various dynamic loading
CO3	Understand the behavior and response of MDOF structures with various dynamic loading.
CO4	Possess the ability to find out suitable solution for continuous system
CO5	Understand the behavior of structures subjected to dynamic loads under free vibration
CO6	Understand the behavior of structures subjected to dynamic loads Harmonic excitation and earthquake load

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	3	1	--	1	1
CO2	--	--	3	1	--	1	1
CO3	--	--	3	1	--	1	1
CO4	--	--	3	1	--	1	1
C05	1	--	3	1	--	1	1

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Victorian representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation - Vibration Isolation -Dynamic magnification factor – Phase angle.

UNIT II

Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's Principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems : Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V

Introduction to Earthquake Analysis: Deterministic Earthquake Response: Systems on Rigid Foundations -Types of Earthquake Excitations – Lumped SDOF Elastic Systems, Translational Excitations -Generalized coordinate -SDOF Elastic Systems, Translational Excitations, Linear Static Method – Analysis for obtaining response of multi storied RC Building.

TEXT BOOKS

1. Structural Dynamics Anil K Chopra, 4edition, Prentice Hall Publishers
2. Structural Dynamics Theory & Computation – Mario Paz, CBS Publishes and Distributors
3. Elementary Structural Dynamics- V.K. Manika Selvam, Dhanpat Rai Publishers

REFERENCE:

1. Dynamics of Structures by Clough & Penzien 3e, Computers & Structures Inc.
2. Theory of Vibration -William T Thomson, Springer Science.
3. Mechanical Vibrations- S. S. Rao, 5e, Pearson Publications.
4. Structural Dynamics of Earthquake Engineering - Theory and Application using Mathematica and Matlab- S. Rajasekharan

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I Semester	MATRIX ANALYSIS OF STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1	Perform the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent displacements, force and equilibrium Methods
CO2	Perform structural analysis using the stiffness method.
CO3	Solve multiple degree of freedom two and three dimensional problems involving trusses, beams, frames and plane stress
CO4	Understand basic finite element analysis

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	3	2	1	--	1	1
CO2	--	3	2	1	--	1	1
CO3	1	3	2	1	--	1	1
CO4	--	3	2	1	--	1	1

1. **Slightly 2. Moderately 3. Substantially Detailed**

Syllabus:

UNIT: 1

Introduction of matrix methods of analysis – Static and kinematic indeterminacy – Degree of freedom– Structure idealization-stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element- Element force - displacement equations.

UNIT: 2

Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames

UNIT: 3

Stiffness method for Grid elements – development of stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams

UNIT: 4

Additional topics in stiffness methods – discussion of band width – semi band width – static condensation – sub structuring –Loads between joints-Support displacements- inertial and thermal stresses-Beams on elastic foundation by stiffness method.

UNIT: 5

Analysis of plane truss - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using *system approach*

TEXT BOOKS

1. Matrix analysis of structures, Robert E Sennet- Prentice Hall-Englewood cliffs-New Jercy
2. Advanced structural analysis, P. Dayaratnam- Tata McGraw hill publishing company limited.
3. Structural Analysis Matrix Approach - Pandit and Gupta, Mc Graw Hil Education

REFERENCES

1. Indeterminate Structural analysis, C K Wang, Amazon Publications
2. Analysis of Tall buildings by force – displacement – Method M. Smolira Mc. Graw Hill.
3. Foundation Analysis and design, J.E. Bowls, 5e, Amazon Publications.
4. Matrix Analysis of Framed Structures 3e-William Weaver, Jr, James M. Gere, Van Nostrand Reinhold, Newyork
5. Matrix Methods of Structural Analysis Madhu B. Kanchi, Wiley Publications.
6. Indeterminate Structural Analysis by K. U. Muthu, IK International Publishing house

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COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	ANALYTICAL & NUMERICAL METHODS FOR STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

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

CO1	Understand the fundamentals of the theory of elasticity
CO2	Implement the principles and techniques of photo elastic measurement
CO3	Obtain the principles and techniques of strain gage measurement
CO4	Adopt the principles and techniques of moiré analysis
CO5	Apply the principles and techniques of holographic interferometer
CO6	Apply the principles and techniques of brittle coating analysis Understand the fundamentals of the theory of elasticity

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	1	1	1	2	1	1
CO2	--	--	1	--	2	--	--
CO3	--	--	1	--	3	--	--
CO4	1	--	--	--	3	--	--
CO5	--	--	--	--	3	--	--
CO6	--	--	1	1	3	1	1

1. **Slightly 2. Moderately 3. Substantially Detailed**

UNIT-I

Transform Methods- Laplace transform methods for one-dimensional wave equation - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier transforms methods for one-dimensional heat conduction problems in infinite and semi-infinite rod

UNIT-II

Elliptic Equations-Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace equation

Calculus Of Variations- Variation and its properties - Euler's equation - Functionals dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables - Some applications - Direct methods - Ritz and Kantorovich methods

UNIT-III

Integral Equations- Fredholm and Volterra integral equations - Relation between differential and integral equations - Green's function -Fredholm equation with separable kernel - Iterative method for solving equations of second kind

UNIT-IV

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems - Richardson's extrapolation - Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations – Application to Simply Supported Beams, Columns & rectangular Plates.

UNIT-V

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation. Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method – New Marks Method and Application to Beams – Calculations of Slopes & Deflections.

TEXT BOOKS

1. Introduction to Partial Differential Equations, Sankara Rao. K, , PHI, New Delhi, 1995
2. Numerical Methods For Scientific and Engineering Computations. M. K. Jain- S. R. K. Iyengar – R. K. Jain, New Age International (p) Ltd., Publishers

REFERENCE

1. Differential Equations and Calculus of Variations Elsgolts. L, Mir Publishers, Moscow, 1966
2. Fundamentals of Mathematical Statistics Gupta. S.C, & Kapoor. V.K, Sultan Chand & Sons, Reprint 1999.
3. Higher Engineering Maths for Engg. And Sciences Venkataraman. M. K, National Publishing Company, Chennai
4. Numerical Methods for Engineering Problems N. Krishna Raju, K.U. Muthu Macmillan Publishers
5. Elements of Partial Differential Equations, Sneddon. I.N, Mc Graw Hill, 1986
6. Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers New Delhi
7. Analysis Matrix Approach - Pa
8. ndit and Guptha, Mc Graw Hil Education

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I Semester	EXPERIMENTAL STRESS ANALYSYS	L	T	P	C
		3	0	0	3

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

CO1	Understand the fundamentals of the theory of elasticity
CO2	Implement the principles and techniques of photo elastic measurement
CO3	Obtain the principles and techniques of strain gage measurement
CO4	Adopt the principles and techniques of moiré analysis
CO5	Apply the principles and techniques of holographic interferometer
CO6	Apply the principles and techniques of brittle coating analysis Understand the fundamentals of the theory of elasticity

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	1	1	1	2	1	1
CO2	--	--	1	--	2	--	--
CO3	--	--	1	--	3	--	--
CO4	1	--	--	--	3	--	--
CO5	--	--	--	--	3	--	--
CO6	--	--	1	1	3	1	1

2. Slightly 2. Moderately 3. Substantially Detailed

Syllabus:

UNIT-I

Introduction and Strain measurement methods – Model & Prototype – Dimensional analysis-Factors influencing model design – Scale factors and Model material properties – Methods of model design. Definition of strain and its relation to experimental determinations - properties of strain gauge systems – Mechanical, Optical, Acoustic and Pneumatic types

UNIT-II

Electrical resistance strain gages: Introduction – gauge construction – strain gauge adhesives - mounting methods – gauge sensitivities and gage factor – performance characteristics of wire and foil strain gauges – environmental effects. Analysis of strain gauge data – the three element rectangular rosette – the delta rosette – correction for transverse sensitivity.

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UNIT-III

Non – destructive testing: Introduction – objectives of non destructive testing. Ultrasonic pulse velocity method – Rebound Hammer method (Concrete hammer) – Acoustic Emission- application to assessment of concrete quality.

UNIT-IV

Theory of photo elasticity: Introduction – temporary double refraction – Index ellipsoid and stress ellipsoid – the stress optic law – effects of stressed model in a Polariscope for various arrangements - fringe sharpening.

UNIT-V

Two dimensional photo elasticity: Introduction – Iso-chromatic fringe patterns – isoclinic fringe patterns – compensation techniques – calibration methods – separation methods – materials for photo- elasticity – properties of photo-elastic materials.

TEXT BOOKS

1. Experimental Stress Analysis- William F. Riley and James W. Dally, Mc Graw Hill Publications
2. Advanced Mechanics of Solids 3e - L.S. Srinath, Tata Mc Graw Hill Publications

REFERENCE:

1. An Introduction to Experimental Stress Analysis – George Hamor Lee, Wiley Publishers
2. Experimental Stress Analysis- Sadhu Singh, Khanna Publishers
3. Solid Mechanics – S.M.A. Kazimi, Mc Graw Hill Publications

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COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	STRUCTURAL OPTIMIZATION	L	T	P	C
		3	0	0	3

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

CO1	Basic theoretical principles in optimization
CO2	Formulation of optimization models
CO3	Solution methods in optimization
C04	Methods of sensitivity analysis and post processing of results
C05	Applications to a wide range of engineering problems

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	--	--	--	--	1	3
CO2	1	--	---	--	1	1	3
CO3	1	--	--	1	--	1	3
CO4	1	--	--	1	1	1	3
CO5	1	--	--	1	1	1	3

1. **Slightly 2. Moderately 3.**

Substantially Detailed Syllabus:

UNIT: 1

Introduction: Need and scope for optimization – statements of optimization problems- Objective function and its surface design variables- constraints and constraint surface- Classification of optimization problems (various functions continuous, discontinuous and discrete) and function behavior (monotonic and unimodal)

UNIT: 2

Classical optimization techniques: Differential calculus method, multi variable optimization by method of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality -Fully stressed design and optimality criterion based algorithms-introduction, characteristics of fully stressed design theoretical basis-examples

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UNIT: 3

Non-Liner programming: Unconstrained minimization- Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel's method, Newton's method and Davidon Fletcher Powell's method for multivariable optimization- Constrained minimization- Cutting plane method- Zoutendjik's method- penalty function methods.

UNIT: 4

Linear programming: Definitions and theorems- Simplex method-Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame.

UNIT: 5

Introduction to quadratic programming: Geometric programming- and dynamic programming- Design of beams and frames using dynamic programming technique.

TEXT BOOKS

1. Engineering Optimization Theory and Applications – S. S. Rao, Wiley Eastern Limited, New Delhi

REFERENCES

1. Optimization Concepts and Application in Engineering- Belegundu A. D. and Chandrupatla T. R, Cambridge University Press

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I Semester	MODELING, SIMULATION & COMPUTER APPLICATIONS	L	T	P	C
		3	0	0	3

UNIT-1

System models: Concepts, continues and discrete systems, system modeling, types of models, subsystems, corporate model, and system study. **System simulation:** Techniques, comparison of simulation and analytical methods, types of simulation, Distributed log models, cobweb models.

UNIT-2

Continuous System Simulation: Nemeric solution of differential equations, Analog computers, Hybrid computers, continuous system simulation languages CSMP, system dynamic growth models, logistic curves.

UNIT-3

Probability concepts in simulation: Monte Carlo techniques, stochastic variables, probability functions, Random Number generation algorithms.

Queuing Theory: Arrival pattern distributions, servicing times, queuing disciplines, measure of queues, mathematical solutions to queuing problems.

UNIT-4

Discrete System Simulation: Events, generation of arrival patterns, simulation programming tasks, analysis of simulation output.

UNIT-5

GPSS & SIMSCRIPT, programming in GPSS: simulation programming Techniques: Data Structures, Implementation of activities, events and queues, Event scanning, simulation algorithms in GPSS and SIMSCRIPT.

TEXT/ REFERENCE BOOKS:

1. Geoffery Gordon: System Simulation, PHI.
2. Naylor, Thomas, H.Computer Simulation experiments with models of economic systems, John Wiley and sons, 1971.
3. Naylor Thomas, H and ET. AI. Computer simulation techniques, John wiley and Sons, 1966.
4. Louis Wdward Alfeld and Alan K.Graham, Introduction to Urban Dynamics, wright – Allen Press Inc., Massachusetts, 1976.
5. Richard J.Chorley and Peter haggett, Models in Geography, Methuen & Co.Ltd., 1977.

6. Hamdy A.Taha, Operations Research – An Introduction, Macmillan Company, New York, 1987.
7. Thirumurthy.A.M. Environmental Facilities and Urban development in India-A System Dynamic Model for developing countries, Academic foundations, India.

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COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1	Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures.
CO2	Conduct field monitoring and non-destructive evaluation of concrete structures.
CO3	Design and suggest repair strategies for deteriorated concrete structures including repairing with composites.
CO4	Understand the methods of strengthening methods for concrete structures
CO5	Assessment of the serviceability and residual life span of concrete structures by Visual inspection and in situ tests
CO6	Evaluation of causes and mechanism of damage
C07	Evaluation of actual capacity of the concrete structure Maintenance strategies

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	1	--	1	--	1	--
CO2	--	1	1	1	--	1	1
CO3	--	1	1	1	--	1	1
CO4	--	--	1	1	--	1	1
CO5	--	--	1	1	--	1	1
CO6	--	--	1	1	--	1	1
C07	--	--	--	2	--	1	1

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT: 1

Materials for repair and rehabilitation -Admixtures- types of admixtures-purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

UNIT: 2

Strengthening and stabilization- Techniques- design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT: 3

Bonded installation techniques- Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures

UNIT: 4

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete-Introduction- classification of flyash-properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes

UNIT: 5

High performance concretes- Introduction- Development of high performance concretes-Materials of high performance concretes- Properties of high performance concretes- Self Consolidating concrete- properties- qualifications.

TEXT BOOKS

1. Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures – P.I. Modi, C.N. Patel, PHI Publications
3. Rehabilitation of Concrete Structures- B. Vidivelli, Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, Shroff Publishers and Distributors.

REFERENCE:

1. Concrete Technology Theory and Practice- M.S. Shetty, S Chand and Company
2. Concrete Repair and Maintenance illustrated- Peter H Emmons
3. Concrete Chemical Theory and Applications- Santa Kumar A.R. , Indian Society for Construction Engineering and Technology, Madras
4. Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	ADVANCED REINFORCED CONCRETE DESIGN	L	T	P	C
		3	0	0	3

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

CO1	Estimate the deflection of Concrete beams and slabs
CO2	Estimate crack width and its affects
CO3	Design flat slabs, bunkers, silos and chimneys
CO4	Understand the thermal effect on concrete members

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	2	1	2	--	2	1
CO2	--	--	1	3	--	2	1
CO3	--	--	1	3	--	2	1
CO4	--	--	1	2	--	2	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

UNIT I

Limit Analysis of R C Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams. Inelastic Analysis of Slabs, Moment Redistribution.

UNIT II

Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions.

UNIT III

Ribbed slabs : Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456. Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels, Design of Nibs. Detailing of reinforcement.

UNIT V

Design of Slender Columns – Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns. Detailing of reinforcement.

Eccentrically Loaded columns- development of interaction Diagrams

TEXT BOOKS

1. Advanced Reinforced Concrete Design, by P.C. Varghese Prentice Hall India Limited
2. Design of Reinforced Concrete Structures by N.Subramanian, Oxford University Press.
3. Reinforced Concrete Design, by S. Unnikrishna Pillai & Devdas Menon Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.

REFERENCE

1. Limit State Theory and Design of Reinforced Concrete S. R. Karve and V.L Shah. Standard Publishers
2. Reinforced concrete structural elements – behavior, Analysis and design by P. Purushotham, Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
5. Design Reinforced Concrete Foundations P.C. Varghese Prentice Hall of INDIA Private Ltd.
6. IS 456-2000 Plain and Reinforced concrete book of Practice.
7. SP 16- Design Aids for Reinforced Concrete to IS 456
8. SP 34 - Hand Book as Concrete Reinforcement and retaining

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KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

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

CO1	Design theories for super structure and substructure of bridges
CO2	Design Culvert, R.C.C T Beam Bridge.
CO3	Understand the behavior of continuous bridges, box girder bridges.
C04	Possess the knowledge to design prestressed concrete bridges.
C05	Design Railway bridges, Plate girder bridges, different types of bearings, abutments, piers and various types of foundations for Bridges

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	1	2	1	--	1	--
CO2	--	1	2	3	--	2	2
CO3	--	1	2	3	--	2	1
CO4	--	1	2	2	--	2	1
CO5	--	1	2	3	--	2	2

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT: 1

Masonry arch Bridge design details- Rise, radius, and thickness of arch- Arch ring- Dimensioning of sub structures- Abutments pier and end connections. (Ref: IRC- SP-13)

UNIT: 2

Super Structure: Slab bridge- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- Pigeaud's method- design of longitudinal girders- Guyon-Messonet method- Hendry Jaegar method- Courbon's theory. (Ref: IRC-21), voided slabs, T-Beam bridges.

UNIT: 3

Plate girder bridges- Elements of plate girder and their design-web-flange- intermediate stiffener- vertical stiffeners- bearing stiffener-design problem

UNIT: 4

Prestressed Concrete and Composite bridges- Preliminary dimensions-flexural and torsional parameters- Courbon's Theory – Distribution coefficients by exact analysis- design of girder section- maximum and minimum prestressing forces- eccentricity- live load and dead load shear forces- cable zone in girder- check for stresses at various sections- check for diagonal tension- diaphragms and end block design- short term and long term deflections- Composite action of composite brides- shear connectors- composite or transformed section- design problem. (Ref: IRC: Section-VI)

UNIT: 5

Sub structure- Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers- Design problem(Ref: IRC-13, IRC-21, IRC-78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment-culvert entrance structure- Hydraulic design and structural design of pipe culverts- reinforcements in pipes .(Ref: IRC: SP-13)

TEXT BOOKS

1. Design of Concrete Bridges- M.G. Aswini, V.N. Vazirani, M.M Ratwani, Khanna Publishers
2. Essentials of Bridge Engineering- Jhonson Victor D, 7e, Oxford IBH Publications

REFERENCES:

1. Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2. Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications
3. IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
4. IRC 21-2009 Standard Specifications and code of practice for Road Bridges Section III

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KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	ADVANCED CONCRETE TECHNOLOGY LABORATORY	L	T	P	C
		0	1	2	2

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

CO1	Conduct various laboratory tests on Cement, Aggregates
C02	Know strain measurement
C03	Non-destructive testing
C04	Chemical analysis on concrete and Aggregate and Sand

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	--	--	3	1	1
	--	--	--	--	3	1	1
	--	--	--	--	3	1	1
	--	--	--	--	3	1	1

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

List of Experiments:

1. Study on Water / Cement Ratios Vs Workability of different concretes
2. Study on Water / Cement Ratios Vs Strength of different concretes
3. Study of variation of Coarse Aggregate to Fine Aggregates on Workability
4. Study of variation of Coarse Aggregate to Fine Aggregates on Strength
5. Strain measurement - Electrical resistance strain gauges
6. Non destructive testing- Impact Hammer test, UPV test
7. Qualifications tests on Self compaction concrete- L Box , J Box , U box and Slump tests

NOTE: A minimum of five experiments from the above set have to be conducted

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

I Semester	COMPUTER AIDED DESIGN LABORATORY	L	T	P	C
		0	1	2	2

1. Simple Programs: Prime number, Factorial of a number, conversion of integers into words, swapping of two integers, addition and multiplication of matrices.
2. Functions : Inline functions, functions with parameters
3. Objects : Objects with arrays, counting of votes
4. Analysis of cantilever, simply supported beam, fixed beams, continuous beams for different loading conditions.
5. Design of R.C.C. beams, slabs, foundations.
6. Design of steel tension Members.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING	L	T	P	C
		3	1	0	4

UNIT: 1

Introduction: Review of stiffness method- Principle of Stationary potential energy-Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation - variational approaches -weighted residual methods

UNIT: 2

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix – Selection of approximate displacement functions- solution of a plane truss- transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports- Galerkin's method for 1-D truss – Computation of stress in a truss element.

UNIT: 3

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading- Galerkin's method - 2-D Arbitrarily oriented beam element – inclined and skewed supports –rigid plane frame examples

UNIT: 4

Finite element formulation for plane stress, plane strain and axi-symmetric problems- Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems- comparison of CST and LST elements –convergence of solution- interpretation of stresses.

UNIT: 5

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature – element and mesh instabilities – spurious zero energy modes, stress computation- patch test.

TEXT BOOKS

1. A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha, John Wiley & Sons Publications
3. Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Bhatti, M.A. Wiley Publications

REFERENCES:

1. Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D. Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers) Wail N Rifaie, Ashok K Govil, New Age International (P) Limited

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	CAD & COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING	L	T	P	C
		3	1	0	4

UNIT-1

Introduction to computer aided design – Reasons for implementing CAD – Design process – Applications of computers to design – Benefits of computer Aided design.

Principles of computer graphics – Introduction, Graphic primitives, point plotting, drawing of lines, Bresenhams Algorithm, C program to draw a line, circle, ellipse using breasenhams algorithm.

UNIT-2

Transformation in Graphics – Coordinate system used lin graphics & windowing, view port, 2 – D transformations, clipping, 3-D transformation; C-graphics.

UNIT-3

Stiffness Method : Microsoft Excel procedure for stiffness method of analysis step – by step procedure using Excel, examples using Excel.

UNIT-4

Analysis of beams using stiffness method : Long hand solution of single span beams, continuous beams solution of single span beams, continuous beams using Excel.

UNIT-5

Database : Introduction, concept of a database, objectives of databases, Design of data base, design consideration of data base.

REFERENCE BOOKS :

1. C. S. Krishna Murthy & Rajiv S. – Computer Aided Design, Software & Analytical tools – Narasha publishing house India.
2. Computer Aided design in reinforced concrete – Dr L.Shah-Structures Publishers Pune.
3. IS – 456 -2000
4. Limit State Design – A.K. Jain.
5. Computer application – Boyd C. Panbou Mc Graw Hill 1997.
6. Raker D., and Rice H. Inside Aut CAD, BPD Publication, Delhi, 1986.
7. Nancy Andrews – Windows the Official guide to Microsoft Operation Environment, Micro Soft, 1986.
8. Moshi, f., Rubinstein, Matrix computer analysis of Structures, Prentice Hall 1986.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	STABILITY OF STRUCTURES	L	T	P	C
		3	1	0	4

UNIT: 1

Beam columns: Differential equation for beam columns – Beams column with concentrated loads – continuous lateral load – couples – Beam column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses

UNIT: 2

Elastic buckling of bars : Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode

UNIT: 3

In-elastic buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling. Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method –Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames

UNIT: 4

Torsional Buckling: Pure torsion of thin walled bars of open cross section – Non uniform torsion of thin walled bars of open cross section - Torsional buckling – Buckling of Torsion and Flexure

UNIT: 5

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending

TEXT BOOKS

1. Theory of Stability of Structures by Alexander ChaJes.
2. Theory of Elastic Stability by S. P. Timshenko & J.M. Gere-Mc Graw Hill Publications
3. Theory of Elastic Stability by Manikaselvam

REFERENCES:

1. Fundamentals of Structural Stability by George J Smith & Dewey H. Hodges, Elsevier Publications
2. Elastic Stability of Structural Elements, N.G.R. Iyengar Macmillan Publications

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KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	ANALYSIS OF TALL STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1	Know design principles and different types of loading
CO2	Understand various structural systems used for Tall structures.
CO3	Capable of analyzing the tall structures and design of structural elements for secondary effects
CO4	Execute stability analysis, overall buckling analysis of frames, Analysis for various secondary effects –such as Creep, Shrinkage and Temperature

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	3	1	--	1	1
CO2	--	2	2	1	--	1	--
CO3	1	2	2	2	--	2	--
CO4	1	2	2	2	--	2	--

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT: 1

Design Criteria Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete.

UNIT: 2

Gravity Loading – Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads.

UNIT: 3

Behavior of Structural Systems- Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, In-filled frames, Shear walls, Coupled Shear walls, Wall–Frames, Tubular, Outrigger braced, Hybrid systems

UNIT: 4

Analysis and Design- Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral UNIT, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

UNIT: 5

Stability Analysis- Overall buckling analysis of frames, wall–frames, Approximate methods, Second order effect of gravity loading, P–Delta Effects, Simultaneous first order and P-Delta analysis, Translational instability, Torsional Instability, Out of plumb effects, Effect of stiffness of members and foundation rotation in stability of structures.

TEXT BOOKS

1. Bryan Stafford Smith and Alex Coull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 1991.
2. Structural Design of Multistoried Buildings U.H. Varyaani, South Aisna Publishers

REFERENCE:

1.Structural Analysis and Design of Tall Buildings Bungle S. Taranath, McGraw-Hill, 1988
2.High Tise Building Structures Woflgang Shcueller, John Wiley & Sons Inc
3.Art of the Skyscraper: The Genius of Fazulur R Khan- Ali Mir, Rizzoli International Publications

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KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	ADVANCED STEEL DESIGN	L	T	P	C
		3	0	0	3

UNIT-I

Simple Connections – Riveted, Bolted Pinned And Welded Connections: Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT-II

Plastic Analysis: Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli - shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT-III

Eccentric And Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT-IV

Analysis And Design Of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings.

UNIT-V

Design Of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

TEXT BOOKS

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
2. Design of steel structures by N. Subramanian, Oxford University Press
3. Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, Scientific Publishes Journals Department..

REFERENCE

1. Design of Steel Structures. P. Dayaratnam, S. Chand, Edition 2011-12.
2. Design of Steel Structures Galyord & Gaylord, Tata Mc Graw Hill, Education, Edition 2012.
3. Indian Standard Code – IS – 800-2007.
4. Indian Standard Code – IS – 875 – Part III - 2015

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KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

IISemester	ANALYSIS OF SHELLS AND FOLDED PLATES	L	T	P	C
		3	0	0	3

UNIT-1

Equations of equilibrium: Introduction, classification, derivation of stress Resultants, Principles of membrane theory and bending theory.

UNIT-2

Cylindrical shells: Derivation of governing DKJ equation for bending theory, details of Schorers theory, Applications to the analysis and design of short shells and long shells. Introduction of ASCE manual coefficients for design.

UNIT-3

Introduction to shells of double curvature: (other than shells of revolution:) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

UNIT-4

Folded Plates: Folded plate theory, plate and slab action, Whitneys theory, Simpsons theory for the analysis of different types of folded plates (Design is not included)

UNIT-5

Shells of double Curvature-Surfaces of revolution. Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

REFERENCE BOOKS:

1. Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan Bhola Nath Nagar, shahotra, Delhi.
2. Fundamentals of the analysis and design of shell structures by Vasant S. Kelkar Robert T.S well – Prentice hall, Inc., Englewood cliffs, new Jersy -02632.
3. N. K. Bairagi, Shell analysis, Khanna Publishers, Delhi, 1990.
4. Billington, Ithin shell concrete structures, Mc Graw Hill Book company, New York, St. Louis, Sand Francisco, Toronto, London.
5. ASCE Manual of Engineering practice No.31, design of cylindrical concrete shell roofs ASC, Newyork.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	ANALYSYS OF OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1	Perform concept development of offshore structure
CO2	Find the wave force on vertical cylinder
CO3	Perform static and dynamic analysis of fixed offshore structure

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	---	--	--	1	--	1	1
CO2	--	--	2	1	--	2	1
CO3	--	--	3	3	--	2	1

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT: 1

Introduction to different types of offshore structures, Concept of fixed, compliant and floating structures, Law of floatation, fluid pressure and centre of pressure, estimation of centre of gravity, hydrostatic particulars, stability criteria of floating bodies, and motions of a floating body.

UNIT: 2

Conservation mass and momentum, Euler equation, Bernoullis Equation, Potential flow, Classification of waves, small amplitude or Linear Airy's theory, dispersion relationship, water particle kinematics, wave energy.

UNIT: 3

Wave force estimation- Wave force on small bodies-Morison equation, Estimation of wave force on a vertical cylinder, Force due to current, Effect of marine growth on vertical cylinders.

UNIT: 4

Wave force on large bodies-Froude-krylov theory, Diffraction theory.

UNIT: 5

Static and dynamic analysis of fixed offshore structures.

TEXT BOOKS

1. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
2. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.

REFERENCES

1. Hand book of offshore Engineering, Vol I, Subrata Chakrabarti, Offshore Structure Analysis, Inc., Plainfield, Illinois, USA.
2. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	EARTHQUAKE RESISTANT DESIGN OF BUILDINGS	L	T	P	C
		3	0	0	3

UNIT: I

Engineering seismology – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects

UNIT: II

Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames(MRF) – ductility of MRF – Infill wall – Non- structural elements

UNIT: III

Calculation of EQ load – 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing of shear walls

UNIT: IV

Cyclic loading behavior of RC, steel and pre- stressed concrete elements - modern concepts- Base isolation – Adaptive systems – case studies

UNIT: V

Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

TEXT BOOKS

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish ShriKhande, Prentice – Hall of India, 2007, New Delhi.
2. Earthquake Resistant Design of Structures- S.K. Duggal, Oxford Publications

REFERENCE

1. Seismic design of reinforced concrete and masonry buildings by Paulay and Priestley
2. Earthquake Resistant Design and Risk Reduction- David Dowrick
3. IS 4326 -1998: Earthquake Resistant Design and Construction of Buildings
4. IS 1893 (Part 1 to 5)- 2016: General Provisions and Building
5. IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction of Buildings
6. IS 13920-2016: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
7. IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	PRECAST AND PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

UNIT -I

Need for prefabrication – General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

UNIT -II

Prefabricated Load Carrying Members-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT -III

Joints - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

UNIT -IV

Production Technology - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT -V

Applications - Designing and detailing of precast UNIT for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TEXT BOOKS

1. Precast Concrete Structures- Kim S Elliott, CRC Press
2. CBRI, Building materials and components, India, 1990
3. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994
4. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

REFERENCES

1. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	MANAGEMENT INFORMATION SYSTEMS	L	T	P	C
		3	0	0	3

UNIT-1

Introduction to MIS – Importance of information for management decisions – systems approach and information – System Development – Information System Architecture – Quantitative Techniques and Management Information Systems interfacing.

UNIT-2

Physical design of computer sub-systems, database design, file design, input-output and procedure design and system security. MIS development – process – system development – system life cycle method. Structured development method, and prototype method – Software development.

UNIT-3

Information systems – Computers in Management – MIS office automations decision support system – Expert system.

UNIT-4

Implementation, Evaluation and maintenance of MIS – pitfalls in MIS development.

UNIT-5

System modeling for MIS system engineering methodology for MIS problem solving.

REFERENCE BOOKS :

1. Suresh K. Basandra – Computers To day, Glagotia Publishers.
2. R. G. Murdicks – Information systems for management.
3. Elias M. Award – System Analysis and Design
4. A. Senn – Analysis and design information systems.
5. Jerome Kanter – Managing with information, Prentice & Hall.
6. C. S. V. Murthy – Management information systems Text & application Himalaya Publishing house – Mumbai.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	THEORY OF PLATES AND SHELLS	L	T	P	C
		3	0	0	3

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

CO1	Have a knowledge about various plate theories due to bending
CO2	Gain the knowledge of Navier's solution, Levy's solution and solve for the rectangular and square plates
CO3	Analyze circular plates with various boundary conditions.
CO4	Focus on the finite difference method of solving plate problems.
CO5	Ability to realize the potential energy principle and find the solution of rectangular plates for various loadings
CO6	Understand the behaviour of folded plates and shells.

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5
CO1	2	--	1	1	--
CO2	--	2	2	--	--
CO3	--	--	3	--	--
CO4	--	--	3	1	--
CO5	--	1	1	--	3

1. **Slightly 2. Moderately 3. Substantially**

Detailed Syllabus:

UNIT: 1

Derivation of governing differential equation for plate– in plane bending and transverse bending effects- Rectangular plates: Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier and Levy's type of solutions for various boundary condition.

UNIT: 2

Circular plates: Symmetrically loaded, circular plates under various loading conditions, Annular plates.

UNIT: 3

Introduction to Shells- Single and double curvature- Equations of Equilibrium of Shells: Derivation of stress resultants, Principles of membrane theory and bending theory

UNIT: 4

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

UNIT: 5

Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms - Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

TEXT BOOKS

1. Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw-Hill book company, INC, New York.
2. Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications
3. Analysis of Thin Concrete Shells by K. Chandrasekhar, New Age International (P) Ltd

REFERENCES:

1. Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press
2. A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.
3. Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill,
New York

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COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	COMPUTER AIDED DESIGN LABORATORY – 2	L	T	P	C
		0	1	2	2

1. To draw a line using Bresenhams line algorithm
2. To draw a circle, Ellipse using Bresenhams line algorithm,
3. Reinforcement detailing in beam using graphics.
4. Reinforcement detailing in slabs using graphics.
5. Reinforcement detailing in foundation using graphics.

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R25 M.Tech CIVIL ENGINEERING

COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN

II Semester	ADVANCED STRUCTURAL ENGINEERING LABORATORY	L	T	P	C
		0	1	2	2

List of Experiments:

1. Study on Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced Sections
2. Study on Performance of RCC Beams designed for Bending and failing in Shear
3. Study on Performance of RCC Beams designed for Shear and failing in Bending
4. Study on Performance of RCC One way slabs
5. Study on Performance of RCC Two way slabs with simply supported edge conditions
6. Study on Performance of RCC Two way slabs with fixed edge conditions
7. Calculation of Young's Modulus of Elasticity of Concrete
8. Extraction and Study of Concrete Core samples from pavements

NOTE: A minimum of five experiments from the above set have to be conducted as demonstration to entire class.