JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE & SYLLABUS for M.Tech
COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN
Programme

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

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I - Semester

S. No	Course Name	Category	L	T	P	C	Marks
1	Theory of Elasticity	Core	3	0	--	3	100
2	C++ and Data Structures	Core	3	0	--	3	100
3	Elective I	Elective	3	0	--	3	100
	a) Matrix Analysis of Structures						
	b) Analytical & Numerical Methods for Structural Engineering						
	c) Structural Dynamics						
4	Program Elective II	Elective	3	0	--	3	100
	a) Modeling, Simulation & Computer Applications						
	b) Repair and Rehabilitation of Structures						
	c) Advanced Reinforced Concrete Design						
5	Advanced Concrete Technology		2	0	0	2	100
6	Advanced Concrete Technology Laboratory	Lab	-	--	4	2	100
7	Computer Aided Design Laboratory - 1	Lab	-	--	4	2	100
8	Audit Course –1	Audit	2	0	0	0	100
Total Credits /Marks						**18**	**800**

II – Semester

S. No.	Course Name	Category	L	T	P	C	Marks
1	Finite Element Methods in Structural Engineering	Core	3	0	--	3	100
2	CAD & Computer Applications in Structural Engineering	Core	3	0	--	3	100
3	Elective III	Elective	3	0	--	3	100
	a) Stability of Structures						
	b) Advanced Steel Design						
	c) Analysis of Shells and Folded Plates						
4	Elective IV	Elective	3	0	--	3	100
	a) Earthquake Resistant Design of Buildings						
	b) Precast and Prefabricated Structures						
	c) Management Information Systems						
6	Computer Aided Design Laboratory - 2		--	--	4	2	100
7	Advanced Structural Engineering Laboratory	Lab	--	--	4	2	100
8	Mini Project With Seminar		0	0	4	2	100
9	Audit Course -2	Audit	2	0	0	0	100
Total Credits / Marks						**18**	**800**

III – Semester

S.No.	Course Name	Category	L	T	P	C	Marks
1	Elective 5: Program Elective /MOOCS**	Elective	3	0	--	3	100
	a) Design of Prestressed Concrete structures						
	b) Structural Health Monitoring						
	c) Industrial Structures						
2	Open Elective / MOOCS** a) Artificial Intelligence Technique b) Construction Management c) Green Technology	Elective	3	0	--	3	100
3	Dissertation Phase-I / Industrial Project (To be continued and Evaluated next Semester)*		--	--	20	10	
Total Credits / Marks						**16**	**200**

* Evaluated and displayed in 4th Semester marks list
** Students Going for Industrial Project / Thesis will complete these courses through MOOCS. Students can also choose SWAYAM or NPTEL with a 12 weeks' course duration in PG level with 3 credits, but the chosen subject should not be covered in their M. Tech Course

IV - Semester

Sl No.	Course Name	Category	L	T	P	C	Marks
1	Project / Dissertation Phase II (Continued from III Semester)		0	0	32	16	100
Total Credits / Marks						**16**	**100**

Audit course 1 & 2

1. English for Research PaperWriting
2. DisasterManagement
3. Sanskrit for TechnicalKnowledge
4. ValueEducation
5. Constitution of India
6. PedagogyStudies
7. Stress Management byYoga
8. Personality Development through Life Enlightenment Skills.

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I Year - I Semester		L	T	P	C
		3	0	0	3

THEORY OF ELASTICITY (Program Core1)

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

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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I Year - I Semester		L	T	P	C
		3	0	0	3
C++ and Data Structures					

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 constructiors, 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 Year - I Semester		L	T	P	C
		3	0	0	3

MATRIX ANALYSIS OF STRUCTURES (Elective-I)

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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I Year - I Semester		L	T	P	C
		3	0	0	3

ANALYTICAL & NUMERICAL METHODS FOR STRUCTURAL ENGINEERING (Elective-I)

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

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I Year - I Semester		L	T	P	C
		3	0	0	3
STRUCTURAL DYNAMICS (Program Core 2)					

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 Year - I Semester		L	T	P	C
		3	0	0	3

Modeling, Simulation & Computer Applications

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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I Year - I Semester		L	T	P	C
		3	0	0	3

REPAIR AND REHABILITATION OF STRUCTURES

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

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I Year - I Semester		L	T	P	C
		3	0	0	3
ADVANCED REINFORCED CONCRETE DESIGN (Elective-II)					

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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I Year - I Semester		L	T	P	C
		2	0	0	3

ADVANCED CONCRETE TECHNOLOGY

Objectives:
To impart knowledge on concrete making materials, concrete mix design for proportioning and their testing.

Outcomes:
The learner will be able to design concrete mixes of different grades and also use the special concretes.

UNIT – I
Concrete Making Materials : Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alakali Silica Reaction – Admixtures – Chemical and Mineral Admixtures. Bureau of Indian Standards (BIS) Provisions.

UNIT – II
Fresh And Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding.
Hardened Concrete : Abrams Law, Gel space ratios, Maturity concept – Stress strain Behaviour – Creep and Shrinkage – Durability Tests on Concrete – Non Destructive Testing of Concrete. BIS Provisions.

UNIT – III
High Strength Concrete – Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete.
High Performance Concrete – Requirements and Properties of High Performance Concrete – Design Considerations. BIS Provisions.

UNIT – IV
Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete – Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications.
Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design Method – BIS Method – IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method– Light Weight Concrete, Self Compacting Concrete.

UNIT – V
Form work – materials – structural requests – form work systems – connections – specifications – design of form work – shores – removal for forms - shores – reshoring – failure of form work.

TEXT BOOKS

1. Properties of Concrete by A. M. Neville, ELBS publications Oct 1996.
2. Concrete Technology by A. R. Santhakumar, 2nd Edition, Oxford University Press.
3. Concrete Technology by M.S. Shetty, S.Chand & Co 2009.

REFERENCES

1. Concrete: Micro Structure, Properties and Materials by P. K. Mehta and P. J. Monteiro,. Mc. Graw-Hill Publishing Company Ltd. New Delhi
2. Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.
3. Special Structural concretes by Rafat Siddique, Galgotia Publications 2000.
4. IS 10262-2009
5. Relevant BIS Codes

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

I Year - I Semester		L	T	P	C
		0	0	4	2
ADVANCED CONCRETE TECHNOLOGY LABORATORY					

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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I Year - I Semester		L	T	P	C
		0	0	4	2
Computer Aided Design Laboratory - 1					

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
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AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

Understand that how to improve your writing skills and level of readability

Learn about what to write in each section

Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Syllabus

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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AUDIT 1 and 2: DISASTER MANAGEMENT

Course Objectives: -Students will be able to:

learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Syllabus		
Units	**CONTENTS**	**Hours**
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man- made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

Suggested Readings:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit	Content	Hours
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	4
2	Order Introduction of roots Technical information about Sanskrit Literature	4
3	Technical concepts of Engineering-Electrical,	4
4	Technical concepts of Engineering - Mechanical.	4
5	Technical concepts of Engineering - Architecture.	4
6	Technical concepts of Engineering – Mathematics.	4

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus

Unit	Content	Hours
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements	4
2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature ,Discipline	4
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking.	4
4	Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	4
5	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women.	4
6	All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	4

Suggested reading

1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

Course outcomes

Students will be able to 1.Knowledge of self-development
2.Learn the importance of Human values 3.Developing the overall personality

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AUDIT 1 and 2: CONSTITUTION OF INDIA

Course Objectives:
Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus		
Units	**Content**	**Hours**
1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.	4
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4

5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	4
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

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AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives:
Students will be able to:

4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
5. Identify critical evidence gaps to guide the development.

Syllabus		
Units	**Content**	**Hours**
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.	4
2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	4
3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	4
4	Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	4
5	Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes	4
6	**Research gaps and future directions** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.	4

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

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AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Syllabus

Unit	Content	Hours
1	Definitions of Eight parts of yog. (Ashtanga)	5
2	Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha	5
3	Yam and Niyam. Do`s and Don't's in life. Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	5
4	Asan and Pranayam Various yog poses and their benefits for mind & body	5
5	Regularization of breathing techniques and its effects-Types of pranayam	4

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami YogabhyasiMandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue)	4
2	Neetisatakam-Holistic development of personality Verses- 52,53,59 (dont's) Verses- 71,73,75,78 (do's)	4
3	Approach to day to day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,	4
4	Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	4
5	Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18	4
6	Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	4

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

I Year - II Semester		L	T	P	C
		3	0	0	3

FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING

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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I Year - II Semester		L	T	P	C
		3	0	0	3

CAD & COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING

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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I Year - II Semester		L	T	P	C
		3	0	0	3

STABILITY OF STRUCTURES

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

I Year - II Semester		L	T	P	C

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		3	**0**	**0**	**3**

ADVANCED STEEL DESIGN

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.

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

I Year - II Semester		L	T	P	C
		3	0	0	3

ANALYSIS OF SHELLS AND FOLDED PLATES

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.

I Year - II Semester		L	T	P	C
		3	0	0	3

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

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

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

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.

I Year - II Semester		L	T	P	C
		3	0	0	3

MANAGEMENT INFORMATION SYSTEMS

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.

I Year - II Semester		L	T	P	C
		0	0	4	2
COMPUTER AIDED DESIGN LABORATORY – 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.

I Year - II Semester		L	T	P	C
		0	0	4	2

ADVANCED STRUCTURAL ENGINEERING LABORATORY

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.

SEMINAR

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

CO1	Collect research material on some topic and to summaries it report and give to present the same

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO 7
CO1	--	--	1	1	2	2	2

1. Slightly 2. Moderately 3. Substantially

DESIGN PROJECT

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

CO1	Analyse, design and prepare a report on Special Design topic related to Structural Engineering

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO 7
CO1	1		1	2	3	1	3

1 Slightly 2. Moderately 3. Substantially

DISSERTATION / THESIS

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

CO1	Identifying the topic after thorough review of literature on chosen topic and Can able to do the Project either Experimental Work or analytical Work

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO 7
CO1	1		2	2	3	3	3

1. Slightly 2. Moderately 3. Substantially

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II Year - I Semester		L	T	P	C
		3	0	0	3
Program Elective 5- DESIGN OF PRE-STRESSED CONCRETE STRUCTURES					

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

CO1	Explain the principle, types and systems of prestressing and analyze the deflections.
CO2	Determine the flexural strength and design the flexural members, end blocks.
CO3	Analyze the statically indeterminate structures and design the continuous beam.
C04	Design the tension and compression members and apply it for design of piles.
C05	Analyze the stress, deflections, flexural and shear strength and apply it for the design of bridges.
C06	Analyze the Composite construction of Pre-stressed and in-situ concrete.

Mapping of Course Outcomes with Program Outcomes:

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

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus

UNIT I:

Introduction – Prestressing Systems – Pretensioning Systems – Postensioning Systems – High Strength Steel and Concrete - Analysis of Prestress - Resultant Stresses at a Section – Pressure Line or Thrust Line – Concept of Load Balancing - Losses of Prestress – Loss Due to Elastic Deformation of Concrete – Shrinkage of Concrete – Creep – Relaxation of Stress in Steel – Friction – Anchorage Slip.

UNIT II:

DEFLECTIONS OF PRESTRESSED CONCRETE MEMBERS : Importance of Control of Deflections – Factors Influencing Deflection – Short-term Deflections of Uncracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012.

Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned Steel.

UNIT III:

COMPOSITE CONSTRUCTIONS: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate Flexural and shear strength of composite sections- Deflection of Composite Beams. Design of Composite sections.

UNIT IV:

PRESTRESSED CONCRETE SLABS: Types Of Prestressed Concrete Floor Slabs- Design of Prestressed Concrete One Way and Two Way Slabs.

Prestressed Concrete Pipes and Poles : Circular prestressing- Types of Prestressed Concrete Pipes- Design of Prestressed Concrete Pipes - Prestressed Concrete Poles.

UNIT V:

CONTINUOUS BEAMS: Advantage of Continuous Members – Effect of Prestressing Inderterminate Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments – Concordant Cable Profile – Guyon's Theorem. Redistribution of moments in a continuous beam.

Anchorage Zone Stresses in Beams : Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel's method- Guyon's Method - Anchorage zone Reinforcement.

TEXT BOOKS

1. Prestressed Concrete, 6e by N. Krishna Raju, Mc Graw Hill Publishers
2. Prestressed Concrete by K. U.Muthu, PHI Learning Pvt Limited

REFERENCES:

1. Prestressed Concrete Analysis and Design, Antone E. Naaman 2e, Techno Press 3000
2. Design of Prestressed Concrete- T. Y. Lin, Ned H. Burns 3e, Wiley Publications
3. Design of prestressed Concrete by E.G. Nawy
4. Prestressed Concrete by N. Rajagopalan, Narosa Publishing
5. IS1343 2012 Prestressed concrete Code of Practice

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II Year - I Semester		L	T	P	C
		3	0	0	3
Program Elective 5 - STRUCTURAL HEALTH MONITORING					

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

CO1	Diagnose the distress in the structure by understanding the causes and factors
CO2	Assess the health of structure using static field methods.
CO3	Assess the health of structure using dynamic field tests
C04	Carryout repairs and rehabilitation measures of the structure

Mapping of Course Outcomes with Program Outcomes:

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

1. Slightly 2. Moderately 3. Substantially

UNIT-I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures

UNIT-II

Structural Health Monitoring: Concept, Various Measures, Structural Safety in Alteration

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures

UNIT-III

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT-IV

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), Piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

TEXT BOOKS

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.

REFERENCES

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

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II Year - I Semester		L	T	P	C
		3	0	0	3
Program Elective 5 – **INDUSTRIAL STRUCTURES**					

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

CO1	Plan the functional requirements of structural systems for various industries.
CO2	Get an idea about the materials used and design of industrial structural elements.
CO3	Realize the basic concepts and design of power plant structures.
CO4	Design power transmission structures.
C05	Possess the ability to understand the design concepts of Chimneys, bunkers and silos

Mapping of Course Outcomes with Program Outcomes:

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

1 Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

UNIT: I

Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations

UNIT: II

Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations

UNIT: III

Design of Pre Engineered Buildings

UNIT: IV

Power plant structures- Bunkers and silos- chimney and cooling towers-Nuclear containment structures

UNIT: V

Power transmission structures- transmission line towers- tower foundations- testing towers

TEXT BOOKS

1. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company

REFERENCES:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings
3. Design of steel structures by N. Subramanian

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II Year - I Semester		L	T	P	C
		3	0	0	3

Open Elective: a). ARTIFICIAL INTELLIGENCE TECHNIQUES

(Common to M. Tech - Structural Engineering and Computer Aided Structural Analysis & Design)

OUTCOME:

- Asses the applicability, strengths and weakness of problems and methods for particular engineering problem
- Can develop intelligent system for particular problem.

UNIT-I
Artificial Intelligence (AI): Introduction: Principal Characteristics of AI, Expert system, components, classification, Decision Support Systems (DSS).
Introduction to Neural Networks: Biological Neuron, Neural Processing, History of ANN, Adaline and Madaline, Perceptron and its characteristics.

UNIT-II
Neural Networks Models: ANN components, input, output and hidden layers, threshold function, weights. Feed forward network. Hopfield network.

UNIT-III
Learning and Training: Objective of learning, Supervised and Unsupervised learning, Hebb's rule, Delta Rule. Back propagation algorithm. Factors effecting network training.

UNIT-IV
Fuzzy Logic: Crispness, Uncertainty, Vagueness, Fuzzyness, history of Fuzzy logic, motivation, Fuzzy sets.

UNIT-V
Fuzzy Relations, Fuzzy association memory, Fuzzy events, Means, Variances. Fuzzy if then Rules, Fuzzy Implications.

REFERENCE:
1. Neural Networks and Fuzzy Systems by Bart. Kosko, Prietence hall of India, 1994.
2. Artificial Neural Networks by Robert J. Schalokoff.
3. Fuzzysets Uncertainity an information by George.J.Klir and Tina, Pretence Hall of India, New Delhi

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II Year - I Semester		L	T	P	C
		3	0	0	3

Open Elective: b). CONSTRUCTION MANAGEMENT

(Common to M. Tech - Structural Engineering, Structural Engineering & Structural Design, and Computer Aided Structural Analysis & Design)

COURSE OUTCOME:

- Able to plan, coordination, and control of a project from beginning to completion.
- Adopting the most effect method for meeting the requirement in order to produce a functionally and financially viable project.

UNIT -I
Management process- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.
UNIT-II
Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications. Preliminary Planning- Collection of Data-Contract Planning – Scientific Methods of Management: Network Techniques in construction management - Bar chart, Gant chart, CPM, PERT- Cost & Time optimization.
UNIT-III
Resource planning - planning for manpower, materials, costs, equipment. Labour -Scheduling - Forms of scheduling - Resource allocation. budget and budgetary control methods
UNIT-IV
Contract - types of contract, contract document, and specification, important conditions of contract – tender and tender document - Deposits by the contractor - Arbitration. negotiation - M.Book - Muster roll -stores.
UNIT-V
Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws - Safety in construction: legal and financial aspects of accidents in construction. occupational and safety hazard assessment. Human factors in safety. Legal and financial aspects of accidents in construction. Occupational and safety hazard assessment.

REFERENCE:
1. Ghalot, P.S., Dhir, D.M., Construction Planning and Management, Wiley Eastern Limited,1992.
2. Chitkara,K.K., Construction Project Management¸ Tata McGraw Hill Publishing Co, Ltd., New Delhi,998.
3. Punmia,B,C., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi,1987.
4. Sengupta, B. &Guha, H, Construction Management and Planning by: Tata McGraw-hill publications.

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II Year - I Semester		L	T	P	C
		3	0	0	3

Open Elective: c). GREEN TECHNOLOGY

(Common to M. Tech - Structural Engineering, Structural Engineering & Structural Design, and Computer Aided Structural Analysis & Design)

COURSE OUTCOMES:

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

- Enlist different concepts of green technologies in a project
- Understand the principles of Energy efficient technologies
- Estimate the carbon credits of various activities
- Recognize the benefits of green fuels with respect to sustainable development.

UNIT- I

Introduction: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology.
Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion – Barriers – Role of Industry.

UNIT- II

Cleaner Production Project Development and Implementation:
Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies.
Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- III

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling.

UNIT –IV

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.

UNIT- V

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economical and social impacts- public policies and market-driven initiatives.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

REFERENCES:

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.
2. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and MandarParasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok
3. 'Non-conventional Energy Sources' by Rai G.D.
4. 'Energy, The Solar Hydrogen Alternative' by Bokris J.O.
5. Waste Energy Utilization Technology' by Kiang Y. H.
6. 'Solar Energy' by Sukhatme S.P.
7. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.
8. 'Handbook of Organic Waste Conversion' by Bew

II Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**32**	**16**

DISSERTATION / THESIS

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

CO1	Identifying the topic after thorough review of literature on chosen topic and Can able to do the Project either Experimental Work or analytical Work

Mapping of Course Outcomes with Program Outcomes:

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

1. Slightly 2. Moderately 3. Substantially