R22

M.Tech. (STRUCTURAL ENGINEERING)

M.Tech. R22 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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DEPARTMENT OF

CIVIL ENGINEERING

VISION OF THE DEPARTMENT

To develop Civil Engineering Department as a Centre of excellence for imparting value based education to the students at undergraduate and post-graduate level to meet industry needs and to develop as a major research center meeting national and international standards.

MISSION OF THE DEPARTMENT

- To impart in-depth and up-to-date knowledge of Civil Engineering concepts with focus on character enhancement, leadership qualities, effective communication, social responsibility and pursuit of lifelong learning and professional development.

- To provide a platform to the students to engage in original innovative research.

M.TECH.
(STRUCTURAL ENGINEERING)

M.TECH. (STRE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: To provide proficiency in the basic principles and advanced courses of technology in structural engineering so that students are able to formulate, analyse and solve the societal problems for sustainable development related to structural engineering.

PEO-II: To expose the students to the latest innovations and trends with a view to inculcate strong research orientation in structural engineering as well as in multidisciplinary streams.

PEO-III: To produce structural engineers who integrate and build on the program's core curricular concepts in the pursuit of professional leadership, teamwork, life-long learning, and successful career advancement.

M.TECH. (STRE)

PROGRAM OUTCOMES

PO-1: An ability to independently carryout research / investigation and development work to solve practical problems.

PO-2: An ability to write and present a substantial technical report / document.

PO-3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO-4: To motivate the graduate students to address the societal needs by interdisciplinary approach through advanced courses.

PO-5: To enrich the graduate students to get hands on training on latest equipment / software to be industry ready / pursue advanced research.

PO-6: To inculcate ethical practices and to establish understanding of professionalism, safety, sustainability, their duties, and contribution to the society.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(STRUCTURAL ENGINEERING)

I SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	22PC1ST01	Advanced Structural Analysis	3	0	0	3
Professional Core-II	22PC1ST02	Theory of Elasticity	3	0	0	3
Professional Core-III	22PC1ST03	Structural Dynamics	3	0	0	3
Professional Elective-I	22PE1ST01	Theory of Plates and Shells	3	0	0	3
	22PE1ST02	Fracture Mechanics of Concrete Structures				
	22PE1ST03	Stability of Structures				
	22PE1ST04	Computer Oriented Numerical Methods				
	22PE1ST05	Energy Efficient Buildings				
Professional Elective-II	22PE1ST06	Advanced Concrete Technology	3	0	0	3
	22PE1ST07	Structural Optimization				
	22PE1ST08	Analytical and Numerical Methods for Structural Engineering				
	22PE1ST09	Structural Health Monitoring				
	22PE1ST10	Construction Methods and Equipment				
Professional Core Lab-I	22PC2ST01	Advanced Concrete Laboratory	0	0	2	1
Professional Core Lab-II	22PC2ST02	Numerical Analysis Laboratory	0	0	2	1
Communication Skills	22SD5HS01	Communication Skills for Academic and Research Writing	0	0	2	1
Project	22PW4ST01	Technical Seminar	0	0	4	2
Mandatory	22MN6HS01	Research Methodology and IPR	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(STRUCTURAL ENGINEERING)

II SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	22PC1ST04	FEM in Structural Engineering	3	0	0	3
Professional Core-V	22PC1ST05	Design of Advanced Reinforced Concrete Structures	3	0	0	3
Professional Core-VI	22PC1ST06	Earthquake Resistant Design of Buildings	3	0	0	3
Professional Elective-III	22PE1ST11	Design of Advanced Steel Structures	3	0	0	3
	22PE1ST12	Structural Reliability				
	22PE1ST13	Building Services				
	22PE1ST14	Design of Formwork				
	22PE1ST15	Design of High-Rise Structures				
Professional Elective-IV	22PE1ST16	Design of Prestressed Concrete Structures	3	0	0	3
	22PE1ST17	Theory and Applications of Cement Composites				
	22PE1ST18	Design of Sub-Structures				
	22PE1ST19	Pre-Fabricated Structures				
	22PE1ST20	Design of Bridges				
Professional Core Lab-III	22PC2ST03	Structural Engineering Laboratory	0	0	2	1
Professional Core Lab-IV	22PC2ST04	Advanced Computer Aided Design Laboratory	0	0	2	1
Industry Engagement	22SD5ST01	Industry Engagement	0	0	2	1
Project	22PW4ST02	Mini-Project	0	0	4	2
Mandatory	22MN6H02	Ancient Wisdom	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. II YEAR COURSE STRUCTURE AND SYLLABUS

(STRUCTURAL ENGINEERING)

III SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Elective-V	22PE1ST21	Repair, Rehabilitation and Retrofitting of Structures	3	0	0	3
	22PE1ST22	Pre-Engineered Buildings				
	22PE1ST23	Design of Steel-Concrete Composite Structures				
	22PE1ST24	Underwater Construction				
	22PE1ST25	Construction Technology and Project Management				
Open Elective	22OE1CN01	Business Analytics	3	0	0	3
	22OE1AM01	Industrial Safety				
	22OE1AM02	Operations Research				
	22OE1AM03	Entrepreneurship and Start-ups				
	22OE1PS01	Waste to Energy				
Project	22PW4ST03	Project Part – I	0	0	16	8
Total			**6**	**0**	**16**	**14**

IV SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Project	22PW4ST04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1ST01) ADVANCED STRUCTURAL ANALYSIS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To learn how to calculate static and kinematic indeterminacies of various types of structures
- To formulate the stiffness matrix for continuous beams, portal frames and trusses
- To formulate the flexibility matrix for continuous beams, portal frames and trusses
- To obtain the global stiffness matrix by assembling the element stiffness matrices

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Formulate the stiffness and flexibility matrices for various types of structures

CO-2: Analyze the continuous beams, portal frames and trusses by stiffness method (Structure approach)

CO-3: Analyze the continuous beams, portal frames and trusses by flexibility method (Structure approach)

CO-4: Solve the Trusses, Continuous beams, Portal frames using element approach of stiffness method

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	3	-	1	-
CO-2	1	-	3	-	1	-
CO-3	1	-	3	-	1	-
CO-4	1	-	3	-	1	-

UNIT–I:

Introduction to Matrix Methods of Analysis: Types of framed structures, Forces and Displacements, Conditions of equilibrium, Compatibility of deformations, Degree of freedom, Static indeterminacy and Kinematic indeterminacy for Continuous beams, Portal frames and Trusses, Concept of Stiffness and Flexibility methods, Formulation of Stiffness matrix.

UNIT–II:

Stiffness Method (Structure Approach): Analysis of continuous beams, plane frames, plane trusses. (Degree of kinematic indeterminacy limited to 3).

Flexibility method (Structure approach): Formulation of Flexibility matrix - Analysis of continuous beams.

UNIT–III:

Stiffness Method (Element Approach-Trusses): Local and global coordinates, Formulation of element stiffness matrix, Transformation matrix for plane truss element, Assembly of element stiffness matrices to generate global stiffness matrix, Application to the pin jointed trusses.

UNIT–IV:

Stiffness Method (Element Approach-Beams): Formulation of element stiffness matrix, Assembly of element stiffness matrices to generate global stiffness matrix, Application to the continuous beams.

UNIT–V:

Stiffness Method (Element Approach-Frames): Formulation of element stiffness matrix, Transformation matrix for plane frame element, Assembly of element stiffness matrices to generate global stiffness matrix, Application to the portal frames.

TEXT BOOKS:

1. Structural Analysis: A Matrix Approach, G. S. Pandit, S. P. Gupta, Tata McGraw-Hill Publishers
2. Matrix Analysis of Framed structures, William Weaver, James M. Gere, CBS Publications

REFERENCES:

1. Structural Analysis, Devdas Menon, Narosa Publishers
2. Matrix methods of Structural Analysis, P. N. Godbole, PHI Learning Pvt. Ltd.
3. Structural Analysis, A. Ghali, A. M. Neville and T. G. Brown, Spon Press
4. Matrix methods of Structural Analysis, M. B. Kanchi, New Age International Publishers

ONLINE RESOURCES:

1. NPTEL course on Structural Analysis, http://nptel.ac.in/courses/105.105.166

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1ST02) THEORY OF ELASTICITY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To define stresses, strains, equilibrium and compatibility
- To derive the governing equilibrium equations in Two-dimensional & in three dimensional problems
- To solve the problems in plane stress, plane strain, torsion, bending
- To apply the concepts of elasticity & Plasticity to solve Structural Engineering problems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Solve simple problems of elasticity and understanding the basic concepts
CO-2: Apply numerical methods to solve continuum problems
CO-3: Solve engineering problems such as thick cylinders, rotating discs, shafts and complex loading on structural members
CO-4: Solve problems of theory of plasticity

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	1	3	1
CO-2	1	1	3	1	3	1
CO-3	1	1	3	1	3	1
CO-4	1	1	2	1	3	1

UNIT–I:

Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity, Generalized Hook's law.

Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Compatibility Conditions, Plane Stress and Plane Strain Problems, Airy's stress Function, Hydrostatic and Deviatoric Components.

UNIT–II:

Two-Dimensional Problems in rectangular Coordinates: Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems: Solution by polynomials, Saint Venant's principle, determination of displacements, bending of simple beams

UNIT–III:

Two-Dimensional Problems in Polar Coordinates: Differential Equations of Equilibrium, Compatibility Conditions - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions - simple symmetric and asymmetric problems - general solution of two- dimensional problem in polar coordinates

UNIT–IV:

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.

UNIT–V:

Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening

TEXT BOOKS:

1. Theory of Elasticity, S. Timoshenko & J. N. Goodier, McGraw-Hill Publications
2. Theory of Elasticity, Sadhu Singh, Khanna Publishers

REFERENCES:

1. Mechanics of Solids, Srinath L. S., Tata McGraw Hill Publications
2. Theory of Plasticity, J. Chakarbarthy, McGraw-Hill Ryerson
3. Applied Elasticity, C. T. Wang, McGraw Hill Publications
4. Elasticity - Theory, Applications and Numerics, Martin and H. Sadd, Elsevier
5. Theory of Plasticity, Sadhu Singh, Dhanpat Rai sons Private Limited

ONLINE RESOURCES:

1. https://online courses nptel.ac.in/noc22-ce103

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1ST03) STRUCTURAL DYNAMICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To know the fundamental concepts and theory of dynamic analysis
- To understand the free vibrations concepts and the problem of determining the natural frequency of a system
- To understand the free vibrations concepts of harmonically excited vibrations
- To understand the free Vibrations of Multi -degree of freedom

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Apply the fundamental concepts and definitions used in structural dynamics

CO-2: Calculate the natural frequency of a system using equilibrium or energy methods

CO-3: Determine the solution technique for dynamics of MDOF system

CO-4: Develop analytical skills to calculate natural frequencies and mode shape

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	-	-	-
CO-2	2	2	2	-	-	-
CO-3	1	2	2	-	-	-
CO-4	1	1	2	-	-	-

UNIT–I:

Theory of Vibrations: Introduction - Elements of vibratory system - Degrees of Freedom – Continuous and Lumped mass idealization - Oscillatory motion - Simple Harmonic motion – Vectorial representation of S.H.M.

UNIT–II:

Single Degree of Freedom systems – Free Vibrations: Fundamental objectives of dynamic analysis -Types of prescribed loading – Method of discretization - Formulation of equations of motion by different methods - Direct equilibration using Newton's law of motion, D' Alembert's principle of virtual work and Hamilton Principle, Single Degree of Freedom systems – Free Vibrations : Formulation and solution of the equation of motion – Free vibration response - Formulation of single degree of freedom system - Undamped and Damped motions – Critical damping - Logarithmic decrement.

UNIT–III:

Single Degree of Freedom Systems – Forced Vibrations: Response to Harmonic, Periodic, Impulsive and General dynamic loadings - Duhamel integral - Dynamic magnification factor- Phase angle – Bandwidth

UNIT–IV:

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 super position procedure

UNIT–V:

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

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.

TEXT BOOKS:

1. Dynamics of Structures, Clough and Penzien, McGraw Hill
2. Structural Dynamics, Mario Paz, CBS Publishers

REFERENCES:

1. Dynamics of Structures, Anil K. Chopra, Pearson Education

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST01) THEORY OF PLATES AND SHELLS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Theory of Elasticity, Structural Analysis

COURSE OBJECTIVES:

- To understand the behaviour of thin plates under bending
- To study the different solution techniques of rectangular thin plates
- To obtain knowledge on the behavior of various types of shells subjected to various loading
- To understand the analysis techniques of different types of shells
- To know the structural behaviour of folded plates

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Develop and solve differential equation of thin plates subjected to flexure
CO-2: Analyze rectangular plates using Navier's and Levy's methods
CO-3: Differentiate and Analyze the various types of shells based on structural behavior
CO-4: Identify the structural behaviour of folded plates

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	2	-	-	-
CO-2	2	2	2	-	-	-
CO-3	1	2	2	-	-	-
CO-4	1	2	2	-	-	-

UNIT–I:
Plates: Introduction- Different kind of plates -Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load. Ritz Method to rectangular plates subjected to simple loadings.

UNIT–II:
Small Deflection Theory of Thin Rectangular Plates: Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier solution – Application to different cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

Circular Plates: Symmetrical loading - Relations between slope, deflection, moments and curvature - Governing differential equation - Uniformly loaded plates with clamped and simply supported edges - Central hole - bending by moments and shearing forces uniformly distributed.

UNIT–III:

Shells: Introduction, Space Curves, Surfaces, Shell Co-ordinates, classification of shells – Definitions -Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium, Boundary Conditions. functional behaviour – examples – structural behaviour of shells. Equations of equilibrium: Derivation of stress resultants – cylindrical shells.

UNIT–IV:

Static Analysis of Shells: Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells. Shells of Revolution: with Bending Resistance - Cylindrical and Conical Shells,

UNIT–V:

Folded Plates: Introduction - Types of folded plates - structural behaviour of folded plates - advantages – Assumptions – Whitney's method of analysis - Simpson's method of Analysis of folded plates. (No analytical problem).

TEXT BOOKS:

1. Theory of Plates & Shells, Stephen P. Timoshenko, S. Woinowsky Krieger, Tata McGraw Hill Edition
2. Theory of Plates and Shells, Bhavikatti S. S., New Age International Publisher, First Edition, 2012
3. Stresses in Beams, Plates and Shells, Ansel C. Ugural, CRC Press

REFERENCES:

1. Analysis and Design of Concrete Shell Roofs, G. S. Ramaswami, CBS Publications
2. Design of Concrete Shell Roofs, Billington, Tata McGraw Hill
3. Shell Analysis, N. K. Bairagi, Khanna Publishers
4. Design of Shells and Folded Plates, P. C. Varghese, PHI Learning Pvt. Ltd.
5. Design of Concrete Shell Roofs, Chatterjee, Oxford and IBH

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST02) FRACTURE MECHANICS OF CONCRETE STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the reasons for failure of an existing structure
- To apply the concepts of basic fracture mechanics to evaluate the residual strength in the cracked structural element
- To apply numerical methods and evaluate the service life through fracture characterization
- To evaluate the performance of structural elements constructed using composite materials

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify and classify cracking of concrete structures based on fracture mechanics
CO-2: Implement stress intensity factor for notched members
CO-3: Apply fracture mechanics models to high strength concrete and FRC structures
CO-4: Compute J-integral for various sections understanding the concepts of LEFM

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	3	-	-
CO-2	3	-	3	3	-	-
CO-3	3	-	3	3	1	-
CO-4	3	-	3	3	1	-

UNIT–I:

Introduction to Fracture Mechanics: Kinds of Failure - Historical Aspects - Brittle and Ductile Fracture - Modes of Fracture Failure – Crack - Point of View - Damage Tolerance

Energy Release Rate: Griffith Dilemma - Energy Release Rate - Mathematical Formulation - Change in Compliance Approach - Change in the Strain Energy Approach – Energy Release Rate of DCB Specimen - Anelastic Deformation at Crack-tip - Crack Resistance - Stable and Unstable Crack Growth - R-curve for Brittle Cracks - Thin Plate vs Thick Plate - Critical Energy Release Rate

UNIT–II:

Stress Intensity Factor: Introduction - Crack Tip - Linear Elastic Fracture Mechanics (LEFM) - Stress and Displacement Fields in Isotropic Elastic Materials - Stress Intensity Factor - Background for Mathematical Analysis - Field Equations - Elementary

Properties of Complex Variables - Westergaard's Approach for Models with Opening Mode, Sliding Mode & Tearing Mode.

UNIT–III:

Inelastic Deformation at the Crack Tip: Further Investigation at the Crack Tip - Approximate Shape and Size of the Plastic Zone - Plastic Zone Shape for Plane Stress - Plastic Zone Shape for Plane Strain - Effective Crack Length - Approximate Approach - The Irwin Plastic Zone Correction - Plastic Zone Size through the Dugdale Approach - Effect of Plate Thickness.

UNIT – VI:

J Integral & Crack Tip Opening Displacement: J-Integral: Relevance and Scope - Definition - Path Independence - Stress-Strain Relation - Crack Tip Opening Displacement: Introduction - Relationship between CTOD, Kr and Gr for Small Scale Yielding - Equivalence between CTOD and J.

UNIT–V:

Application to Cementitious Composites: Material models - General concepts – crack models – band models - Models based on continuum damage mechanics– applications to high strength concrete – fibre reinforced concrete – crack concepts and numerical modelling.

TEXT BOOKS:

1. Introduction to Fracture Mechanics, Prasant Kumar, McGraw Hill Publications
2. Fracture Mechanics, Suri C. T. and Jin Z. H., Elsevier Academic Press

REFERENCE BOOKS:

1. Elementary Engineering Fracture Mechanics, Broek David, Springer
2. Fracture Mechanics of Concrete Structures – Theory and Applications, Elfgreen L. RILEM Report, Chapman and Hall

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST03) STABILITY OF STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To derive the differential equations for beam-columns
- To understand the elastic buckling of bars and frames
- To understand the Torsional Buckling
- To analyze lateral buckling of beams and plate

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Apply the approximate methods based on energy to determine the stability of simple systems

CO-2: Differentiate how the tangent modulus and double modulus theories of inelastic buckling led to the column paradox, thereby preventing further difficulties for a general theory of structures

CO-3: Analyze elastic and in-elastic buckling of bars and frames

CO-4: Analyze the beams for lateral torsional buckling

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	1	1	-
CO-2	3	-	3	1	1	-
CO-3	3	-	3	1	1	-
CO-4	3	-	3	1	1	-

UNIT–I:

Buckling of Columns: Introduction; Method of Neutral Equilibrium; The Critical Load of the Euler Column; Linear Column Theory – An Eigen Value problem; Boundary Conditions – Both ends fixed, One end fixed and one end free, One end fixed and one end hinged, Elastically restrained end; Effecting-Length Concept and Design concept, Higher Order Differential Equation for Columns – hinged-hinged, free-free - Large Deformation Theory for Columns; Initially Bent Columns; Eccentrically Loaded Columns.

UNIT–II:

Inelastic Buckling of Columns: Introduction; Double Modulus Theory; Tangent Modulus Theory; Shanley's Theory of Inelastic Column Behaviour; Eccentrically Loaded Inelastic Columns; Buckling of Short Columns.

Beam Columns: Introduction; Beam Column with Concentrated Lateral Load; Beam Column with Distributed Lateral Load; Effect of Axial Load on Bending Stiffness – Slope-Deflection Equation; Failure of Beam Columns.

UNIT–III:

Buckling of Frames: Introduction; Modes of Buckling; Critical Load of a Frame using Neutral Equilibrium; Calculation of Critical Loading using Slope-Deflection Equation; Stability of a Frame by Matrix Analysis; Effect of Primary Bending and Plasticity on Frame Behaviour.

UNIT–IV:

Torsional Buckling: Introduction; Torsional Load-Deformation Characteristics of Structural Members; Strain Energy of Torsion; Torsional and Torsional-Flexural Buckling of Columns; Lateral Buckling of Beams; Lateral Buckling of Rectangular Beams in Pure Bending; Buckling of I Beams by Energy Method; Lateral Buckling of Cantilever Beam by Finite Differences.

UNIT–V:

Buckling of Plates: Introduction; Differential Equation of Plate Buckling – Linear Theory; Critical Load of a Plate Uniformly Compressed in One Direction; Strain Energy of Bending in a plate; Critical Load of Uniaxially Compressed Plate, Fixed along all edges by the Energy method; Critical Load of a Plate in Shear by Galerkin Method; Inelastic Buckling of plates.

TEXT BOOKS:

1. Principles of Structural Stability, Alexander Chajes A., Prentice-Hall Inc.
2. Theory of Elastic Stability, Timoshenko S. P., and Gere J. M., Tata McGraw Hill

REFERENCE:

1. Stability of Metallic Structures, Blunch, McGraw Hill

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST04) COMPUTER ORIENTED NUMERICAL METHODS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Mathematics I and II

COURSE OBJECTIVES:

- To apply the basic knowledge of Mathematics in Engineering
- To provide a formidable base for analysis and programming using computer applications
- To develop the ability in programming and solutions based on the various analysis tools
- To check the consistency of system of linear equations

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Apply numerical methods to find the roots of an equation
CO-2: Identify mathematical model for solution of common engineering problems
CO-3: Formulate simple problems into programming models
CO-4: Solve ordinary and partial differential equations

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	2	2	-
CO-2	3	-	3	2	2	-
CO-3	3	-	3	2	2	-
CO-4	3	-	3	2	2	-

UNIT - I:

Solutions of Linear Equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method -Applications

UNIT - II:

Eigen Values and Eigen Vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method, Fast Fourier Transform (FFT) Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

UNIT - III:

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.

UNIT - IV:

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length- extrapolation method – Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – legrange interpolation method- radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method.

UNIT - V:

Ordinary Differential Equation: Euler's method – Backward Euler method – Midpoint method – single step method, Taylor's series method, Runge-Kutta method Predictor-Corrector Method -Trapezoidal and Midpoint method – Implicit Runge Kutta method – Boundary value problem – Difference method – Shooting method -Structural Engineering Applications

TEXT BOOKS:

1. Numerical Methods for Scientific and Engineering Computations, M. K. Jain, S. R. K. Iyengar, R. K. Jain, Wiley Eastern Limited
2. Numerical Methods for Engineers, Stevan C. Chopra, Raymond P. Canal, McGraw Hill

REFERENCES:

3. Applied Numerical Analysis, Curtis I. Gerala, Addison Wesley
4. C Language and Numerical Methods, C. Xavier, New Age International

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST05) ENERGY EFFICIENT BUILDINGS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To study the design of energy efficient buildings which balances all aspects of energy, lighting, space conditioning and ventilation
- To learn passive solar design strategies
- To understand the use of materials with low embodied energy
- To design the standards for ventilation and different climatic zones

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Design energy efficient buildings which balance all aspects of energy, lighting, space conditioning and ventilation

CO-2: Design energy efficient buildings with passive solar design strategies

CO-3: Use materials with low embodied energy

CO-4: Apply concepts in Energy auditing

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	3	-	3
CO-2	3	-	3	3	-	3
CO-3	3	-	3	3	-	3
CO-4	3	-	3	3	-	3

UNIT–I:

Introduction: Energy required for building construction - Heat Transfer – Measuring Conduction –Thermal Storage – Measurement of Radiation – The Green house Effect – Psychrometry Chart – Measuring latent and sensible heat. Thermal Comfort – Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Protection – Types of Shading Devices – Conservation – Heating and Cooling loads.

UNIT–II:

Passive Solar Heating and Cooling: General Principles of passive Solar Heating – Key Design Elements - Direct gain Trombe Walls, Water Walls, Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Predicting ventilation in buildings – window ventilation calculations - Radiation – Evaporation and dehumidification – Mass Effect – Load Control – Air Filtration and odor removal – Heat Recovery in large buildings

UNIT–III:

Daylighting and Electrical Lighting: Materials, components and details - Insulation – Optical materials – Radiant Barriers Glazing materials - Day lighting – Sources and concepts – Building Design Strategies –Case Studies – Electric Lighting –Light Distribution – Electric Lighting control for day lighted buildings – Illumination requirement – Components of Daylight factor – Recommended Daylight factors – Day lighting analysis – Supplementary Artificial Lighting Design

UNIT–IV:

Heat Control and Ventilation: Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings Influence of Design Parameters – Mechanical controls –Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation.

UNIT–V:

Design for Climatic Zones: Energy efficiency – an overview of design concepts and architectural interventions –Energy efficient buildings for various zones – cold and cloudy – cold and sunny –composite – hot and dry – moderate – warm and humid – case studies of residences, office buildings and other buildings in each zones – Energy Audit – Certification

TEXT BOOKS:

1. Energy – Efficient Buildings in India, Majumdar, M. (Ed), Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2002
2. Handbook on Energy Audits and Management, Tata Energy Research, Tyagi A. K.(Ed)

REFERENCES:

1. Environmental Control System, Moore F., McGraw Hill Inc., 2002
2. Sun, Wind and Light – Architectural Design Strategies, Brown G. Z. and DeKay M., John Wiley, 2001
3. Energy Conservation in Commercial and Residential Buildings, Chilogioji M. H., and Oura E. N., Marcel Dekker Inc., New York and Basel, 1995
4. Energy Conservation Standards – For Building Design, Construction and Operation, Dubin F. S. and Long C. G., McGraw Hill Book Company,1990

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST06) ADVANCED CONCRETE TECHNOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To determine the properties of concrete ingredients i.e., cement, sand, coarse aggregate by conducting different tests and decide the suitability
- To recognize the effects of the rheology and early age properties of concrete on its long-term behavior
- To design economic concrete mix proportions for the given exposure conditions and with the available materials, for the desired strength and performance criteria
- To use advanced techniques for Service Life assessment of Concrete Structures

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Design an appropriate economic cementitious composite based on the performance requirements

CO-2: Determine the characteristics of concrete making materials and decide it's suitability

CO-3: Judge and Resolve any controversy that arises regarding material suitability through required field and laboratory investigations

CO-4: Assess the service life of an existing structure through determining the mechanical, durability and the current state of corrosion of reinforcement in concrete

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	-	3
CO-2	3	1	3	2	-	2
CO-3	3	1	2	2	-	2
CO-4	3	1	2	3	3	2

UNIT–I:

Concrete Making Materials: Cement - Bogue's compounds - Hydration process - Types of cement - Aggregates Mineral and Chemical Characterization of aggregates - Gradation curves - Fullers Curve - Grading Evaluation and Specifications - Alkali silica reaction - Admixtures: mineral and chemical admixtures - Secondary Pozzolanic Reaction due to mineral admixtures – Efficiency Concept.

UNIT–II:

Fresh and Hardened Concrete: Fresh concrete - Workability tests on concrete- Workability tests on Self Compacting Concretes - segregation and bleeding.

Hardened Concrete - Abram's law - Gel- space ratio - Maturity concept - Stress Strain behavior, Creep and Shrinkage.

UNIT–III:

High Performance and High Strength Concretes: High performance concrete - Requirements and properties of high-performance concrete - Design considerations – High strength concrete – Design considerations.

UNIT–IV:

Special Concretes: Light weight concrete - Self Compacting concrete - Polymer concrete - Fiber reinforced concrete – Reactive powder concrete - Bacterial concrete-Geo-polymer concrete – Requirements and guidelines- Advantages and Applications – Porous pavement – White Topping – Roller compacted concrete. Concrete 3D Printing.

UNIT–V:

Concrete Mix Design: Quality control - Quality assurance - Quality audit - Mix design by various methods - BIS method - ACI method Mix Design of self-compacting concrete by IS 10262 -2019

Performance Evaluation of Reinforced Concrete Members: Durability of concrete & Corrosion tests - Resistivity of concrete - Half Cell Potential - Rapid Chloride Penetration Test - Macro cell Corrosion - Effects of concrete exposed to acidic environment - Durability Factor - Accelerated Corrosion Cracking Test - Non-destructive evaluation of concrete structures - Ultrasonic Pulse Velocity - Evaluation of Dynamic Shear & Young's Modulus - Introduction to XRD & SEM Analysis.

TEXT BOOKS:

1. Properties of Concrete, A. M. Neville, Pearson Education
2. Concrete Microstructure, Properties and Materials, P. K. Mehta and Paulo J. M. Monteiro, McGraw Hill
3. Concrete Technology, M. L. Gambhir, Tata McGraw-Hill Pres

REFERENCES:

1. Corrosion of Steel in Concrete, P. Schiess, Chapman & Hall
2. Concrete Making Materials, Sandor Popovics, Hemisphere Publishing Corporation
3. Aggregates in Concrete, Mark Alexander & Sydney Mindess, Taylor & Francis
4. Cement Based Composites, Andrzej M. Brandt

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST07) STRUCTURAL OPTIMIZATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the concepts calculus of variation for optimization
- To perform linear, non-linear and geometric programing methods
- To understand the applications of mathematical optimization methods to steel and RCC
- To perform the designs based on frequency constraint

COURSE OUTCOMES: After completion of the course, students should be able to **CO-1:** Use Variational principle for optimization
CO-2: Perform linear, non-linear, dynamic and geometric programing methods
CO-3: Apply optimization techniques to structural steel and concrete members
CO-4: Design using frequency constraint

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	1	-	-
CO-2	3	-	3	1	-	-
CO-3	3	-	3	1	-	-
CO-4	3	-	3	1	-	-

UNIT–I:
Introduction: Simultaneous Failure Mode and Design, Classical External Problems.

UNIT–II:
Calculus of Variation: Variational Principles with Constraints

UNIT–III:
Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,

UNIT–IV:
Geometric Programming and Stochastic Programming
Applications: Structural Steel and Concrete Members, Trusses and Frames.

UNIT–V:
Design: Frequency Constraint, Design of Layouts.

TEXT BOOKS:

1. Elements of Structural Optimization, Haftka, Raphael T., Gürdal Zafer, Springer
2. Variational Methods for Structural Optimization, Cherkaev Andrej, Springer

REFERENCES:

1. Introduction to Structural Optimization (Solid Mechanics and Its Applications), Peter W. Christensen, A. Klarbring, Springer
2. Engineering Optimization: Theory and Practice, Singiresu S. Rao, New Age International

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST08) ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To apply the basic knowledge of mathematics in engineering
- To provide a formidable base for analysis and programming using computer applications
- To develop the ability in programming and solutions based on the various analysis tools
- To check the consistency of system of linear equations

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Apply numerical methods to find the roots of an equation
CO-2: Identify mathematical model for solution of common engineering problems
CO-3: Formulate simple problems into programming models
CO-4: Solve ordinary and partial differential equations

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	1	1	-
CO-2	2	2	1	1	1	-
CO-3	2	1	1	-	-	-
CO-4	1	2	1	-	-	-

UNIT–I:
Solution of Nonlinear Algebraic and Transcendental Equations: Introduction, errors and approximations, binary and decimal systems, computing roots using direct methods (bisection, Regula- falsi) and Iterative Methods (fixed point iterative and Newton- Raphson Methods) and applications.

UNIT–II:
Elements of Matrix Algebra: Introduction, Methods of solution direct (Matrix inversion and Gauss elimination methods) and iterative methods (Gauss Jacobi and Gauss seidel methods), Eigen values, computing largest Eigen value by power method and applications.

UNIT–III:
Fundamentals of Numerical Methods: Interpolation: Introduction, Interpolation for equally spaced data and unequally space data by Newton's methods, Lagrange's method and cubic spline, Error Analysis, Polynomial Approximations.

Curve Fitting: Fitting a straight line, Second degree curve, Exponential curve, power curve by method of least squares.

UNIT–IV:

Numerical Differentiation and Integration: Numerical differentiation formulae using finite differences and interpolation. Newton-Cotes integration formulae (Trapezoidal and Simpsons rules) and Gauss quadrature formulae.

Numerical Solution of ordinary Differential Equations: Introduction, Solution of ODE of IVP type by Euler's methods, Runge-Kutta methods (single step) and Multistep methods.

UNIT–V:

Finite Difference Scheme: Numerical solution of PDE using finite difference schemes approaches: Bender Schmidt and Crank-Nicolson Methods (Parabolic, Elliptic type) and applications.

Computer Algorithms: Introduction to Matlab, Matlab Algorithms (Gauss Jacobi and Gauss seidel methods, power method, Euler's methods, Runge-Kutta methods).

TEXT BOOKS:

1. Numerical Methods, Dr. B. S. Grewal
2. Numerical Analysis, R. L. Burden and J. D. Faires

REFERENCES:

1. An Introduction to Numerical Analysis, Atkinson K. E., J. Wiley and Sons
2. Theory and Problems of Numerical Analysis, Scheid F., McGraw Hill Book Company, Schaum Series
3. Introductory Methods of Numerical Analysis, Sastry S. S., Prentice Hall of India

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST09) STRUCTURAL HEALTH MONITORING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the concepts of health monitoring
- To assess the structural health of the structures using static and dynamic field methods
- To suggest the possible repair and rehabilitation methods
- To perform the Structural Auditing after the investigation

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Diagnose the distress in the structure understanding the causes and factors
CO-2: Assess the health of structure using static field methods
CO-3: Assess the health of structure using dynamic field tests
CO-4: Suggest repairs and rehabilitation measures of the structure

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	1	2	2	1
CO-2	1	2	1	1	-	-
CO-3	1	2	1	1	-	-
CO-4	1	1	2	2	2	1

UNIT–I:
Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.
Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

UNIT–II:
Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT–III:
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT–IV:

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–V:

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
2. Health Monitoring of Structural Materials and Components - Methods with Applications, Douglas E. Adams, John Wiley and Sons

REFERENCES:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol. 1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1ST10) CONSTRUCTION METHODS AND EQUIPMENT

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the economics of various construction equipment
- To comprehend the planning for earthworks
- To know the different soil stabilization methods
- To select a suitable equipment for construction works

COURSE OUTCOMES: After completion of the course, students should be able to **CO-1:** Take decisions related to construction equipment management
CO-2: Learn techniques for estimating equipment ownership and operating costs
CO-3: Estimate site work and scheduling using equipment productivity and cost data, types of equipment
CO-4: Estimate techniques for equipment productivity and gain knowledge of contemporary issues pertaining construction methods, equipment usage and management

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	1	-	-	1
CO-2	1	-	1	-	-	1
CO-3	2	-	2	-	-	1
CO-4	2	-	2	-	1	-

UNIT–I:
Equipment Economics - Equipment records, Cost of Capital, Elements of ownership Cost, Operating Cost, Replacement Decisions, Rent and Lease Considerations.

UNIT–II:
Planning for Earthwork Construction - Planning, Graphical Presentation of Earthwork, Earthwork Quantities, Mass Diagram, Pricing Earthwork Operations. Compaction and Stabilization Equipment - Compaction of Soil and rock, Types of Compacting

UNIT–III:
Equipment, Dynamic Compaction, Stabilizing soils with Lime, Cement Soil Stabilization. Mobile Equipment Power Requirements - Required Power, Available power, Usable power, Performance Charts.

UNIT–IV:
Dozers, Scrapers, Excavators - Introduction, Performance Characteristics of Dozers, Pushing Material, Land Clearing, Scraper types, operation, Performance Charts, Production cycle, Hydraulic Excavators, Shovels, Hoes.Trucks and Hauling Equipment, Finishing Equipment - Trucks, productivity, Performance Calculations, Graders, Trimmers.

UNIT–V:
Concrete and Concrete Equipment, Cranes, Piles and Pile-Driving Equipment, Planning for Building Construction - Concrete Mixtures, Batching of Concrete, Placing of Concrete.

TEXT BOOKS:

1. Construction Planning Equipment and Methods, Peurifoy R.L, Ledbetter W.B, and Schexnayder C, 5th Edition, McGraw Hill, Singapore, 1995
2. Construction Equipment and Management, Sharma S.C, Khanna Publishers, 1988

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2ST01) ADVANCED CONCRETE LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To know the different concrete making materials and their influence on the properties of conventional and special concretes
- To understand the different tests for fresh and hardened state properties of conventional and special concretes
- To study the different non-destructive tests on concrete
- To comprehend the various durability tests for concrete

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Design the mix proportions for ordinary, normal and high strength grades of conventional and special concretes

CO-2: Evaluate the fresh and hardened state properties of conventional and special concretes

CO-3: Assess the condition of concrete using non-destructive tests

CO-4: Determine the durability and corrosion characteristics of concrete through different tests

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	2	3	2
CO-2	3	1	2	2	3	2
CO-3	3	1	3	2	3	2
CO-4	3	1	3	2	3	2

LIST OF EXPERIMENTS:

1. **Characterization of concrete making materials:**
   a) Specific gravity of cement, fine aggregate and coarse aggregate
   b) Consistency and Setting times of cement
   c) Zone classification and Fineness modulus of fine aggregates

2. **Mix design of Ordinary, Normal and High Strength grades of concrete as per IS: 10262 - 2019 and evaluation of workability using:**
   a) Slump Cone test
   b) Compaction Factor test and
   c) Vee-Bee Consistometer test

3. **Mix design of Self Compacting Concrete as per EFNARC guidelines and IS: 10262 - 2019 and evaluation of fresh state properties using:**
   a) Slump Flow Test
   b) J-Ring Test
   c) V-Funnel test
   d) L-Box test
   e) U-Box test

4. **Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.**
5. Non Destructive Evaluation of concrete strength using Rebound Hammer test
6. Evaluation of concrete quality using Ultra Sonic Pulse Velocity (UPV) test
7. Determination of water permeability characteristics of concrete
8. Evaluation of permeability of chloride ions through Rapid Chloride Penetration Test (RCPT).
9. Evaluation of probability of corrosion of reinforcement embedded in concrete using Half-cell Potential test.
10. Determination of Abrasion resistance of concrete.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2ST02) NUMERICAL ANALYSIS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To solve a system of linear and non-linear equations
- To draw best fit curve for the given data set
- To find the areas and volumes using numerical integration techniques
- To solve ordinary differential equations numerically

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Analyze the beams by solving a system of equations

CO-2: Generate the best fit curves, Sketch the basic 2D, 3D plots

CO-3: Apply the concepts of numerical integration techniques to solve Structural Engineering Problems

CO-4: Solve the ordinary differential equations in Structural Engineering applications

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	1	-	3	-
CO-2	1	2	2	-	3	-
CO-3	1	2	2	-	3	-
CO-4	1	2	2	-	3	-

LIST OF EXPERIMENTS:

1. Overview of MATLAB, Matrix operations (Addition, Subtraction, Multiplication, Transpose)
2. Solution of simultaneous equations using matrix inversion – Resolution of forces and moments and finding the reactions on a beam.
3. To check whether the system has Unique solution / Many solutions / No solution using the Rank of a matrix.
4. Solution of system of linear equations using Gauss Elimination method - Application to the analysis of indeterminate beams
5. Solution of System of linear equations using Gauss Seidal iteration Method – Application to the analysis of portal frames
6. Finding the Roots of non-linear equations using Newton – Raphson Method - Application for finding the slopes and deflections in determinate beams
7. Finding the Solution of an Eigen Value problem – Application to a multistory RC building for determining the Time periods and Mode shapes.
8. Plotting Simple Graphs - Basic 2D Plots, 3D Plots

9. Curve Fitting by Method of Least Squares – Application for finding the Modulus of elasticity of steel from stress - strain curve obtained by conducting Tension test.
10. Numerical Integration using Trapezoidal & Simpson's Rule – Application for finding the Areas and Volumes of a given plot.
11. Numerical solution of ordinary differential equations by Runge-Kutta method.
12. Numerical solution of second and higher order differential equations

ONLINE RESOURCES:

1. MATLAB programming for Numerical computation
2. nptel.ac.in/courses/103.106.118

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22SD5HS01) COMMUNICATION SKILLS FOR ACADEMIC AND RESEARCH WRITING

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To equip the students with an understanding of the mechanics and conventions of academic and research writing including cohesion and coherence to produce texts that demonstrate precision and clarity
- To enable students to present focused, logical arguments that support a thesis
- To empower the students to find, analyze, evaluate, summarize and synthesize appropriate source material for literature review
- To enable students to use appropriate language to analyze and interpret the data, and prepare an outline
- To enable students to become adept in the requirements and specifications of standard writing to produce academic and research papers

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of academic language features, and text structure and ensure cohesion and coherence as connected to various text types

CO-2: Demonstrate the use of writing process strategies through outlining, reviewing, composing, and revising

CO-3: Evaluate sources and use summary, analysis, synthesis, and integration to construct a literature review on a topic chosen by the student

CO-4: Prepare an outline for Research Articles and Thesis

CO-5: Apply standard documentation style to produce academic and research papers that meet the demands of specific genres, purposes, and audiences

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	3	1	-	2
CO-2	2	3	3	1	-	2
CO-3	2	3	3	1	-	2
CO-4	3	3	3	1	-	1
CO-5	3	3	3	1	-	2

UNIT-I:

a) Factors Influencing Effective Writing: Mechanics of Writing, Purpose of Writing, Audience/reader, Organisation- Cohesion, and Coherence

b) Features of Academic Writing: Introduction, Complexity, Formality, Precision, Objectivity, Explicitness, Accuracy and Appropriacy, Relevance, Hedging

UNIT-II:

1. Academic Writing Forms:

a) Analysing arguments; Building an argument
b) Making a Counter Argument- Managing tone, and tenor

2. Types of Research: Primary and Secondary Research;
3. Research Design: Statement of the Problem, Survey of relevant literature, Writing Hypotheses, Developing Objectives; Research Tools

UNIT-III:

a) Criteria of Good Research- Avoiding Plagiarism
b) Data Interpretation
c) Preparing an outline for Research Articles & Research Reports

UNIT-IV:

a) Reference Skills -Paraphrasing (Change of parts of speech, word order, synonyms, using the passive form), -Summarizing (Steps in summarising)
b) Documentation Format: APA style
c) Documentation Format: MLA style

UNIT-V:

a) Writing Article Reviews
b) Report Writing: a) Writing Technical Reports b) Writing Proposals

TEXT BOOKS:

1. A Course in Academic Writing, Gupta R., Orient Black Swan, 2010
2. Academic Writing: Exploring Processes and Strategies, Leki I., CUP, 1998
3. Writing-up Research: Experimental Research Report Writing for Students of English, Weissberg R., & Buker S., Englewood Cliffs, Prentice Hall, 1990

REFERENCES:

1. English Academic Writing for Students and Researchers. Yakhontova T., 2003
2. Inside Track: Successful Academic Writing, Gillett A., Hammond A., Martala M., Pearson Education, 2009
3. English for Academic Research: Writing Exercises, Wallwork, Springer, 2013
4. The MLA Handbook for Writers of Research Papers, 7th Edition, Modern Language Association
5. Academic Writing for Graduate Students: A Course for Non-native Speakers of English, Swales J. M., & Feak C. B., University of Michigan Press, 1994

ONLINE RESOURCES:

1. https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/centre-for-academic-writing/support-for-students/academic-writing-resources/
2. https://www.biz-e-training.com/resources-for-learners/academic-writing-online-resources/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22MN6HS01) REASEARCH METHODOLOGY AND IPR

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand research problem formulation

CO-2: Analyze research related information & Follow research ethics

CO-3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO-4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

CO-5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	2	2	3	3
CO-2	3	-	2	2	3	3
CO-3	3	2	-	2	-	3
CO-4	3	2	-	2	-	3
CO-5	3	2	-	2	-	-

UNIT – I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT – II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT – III:
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT – IV:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – V:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System.
New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS:

1. Research Methodology: An Introduction for Science & Engineering Students, Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
3. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar, 2nd Edition

REFERENCES:

1. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd., 2007
2. Industrial Design, Mayall, McGraw Hill, 1992
3. Product Design, Niebel, McGraw Hill, 1974
4. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016
5. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1ST04) FEM IN STRUCTURAL ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To have a detailed knowledge and understanding of the fundamental concepts of finite element methods
- To introduce basic aspects of finite element methods, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems
- To develop proficiency in the application of the finite element methods (modeling, analysis, and interpretation of results) to realistic engineering 1-D,2-D and 3-D problems
- To gain knowledge and analysis skills in formulating the solution for complex problems using a commercial FEA software

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the fundamental theory of finite element methods

CO-2: Analyze finite element method efficiently in order to solve structural problems using truss, beam, frame, and plane elements

CO-3: Identify appropriate planar (plane stress or strain), axi-symmetric, special idealization (type of element), and modeling techniques

CO-4: Apply the professional level finite element software to solve the engineering problems

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	3	1	1
CO-2	3	2	3	2	1	1
CO-3	3	2	2	2	1	1
CO-4	3	2	2	3	1	1

UNIT–I:

Introduction to FEM: general steps-Advantages-Disadvantages-Applications-Historical back ground-Types of forces encountered by deformable bodies –Equations of equilibrium for elastic 2-D / 3-D continua - Boundary conditions – Strain-displacement relation for 2-D / 3-D – Stress-strain relation for 2-D / 3-D – Plane stress / Plane strain problems.

Variational Formulation: Approximate methods of Analysis- Weighted residual method - Rayleigh-Ritz Method and Galerkins method -Strong form weak form -Variational principle - Stationary Functional. Application to problems of mathematics / structural Engineering, number of trial functions not exceeding two.

UNIT–II:

Finite Element Formulation for1-D Problems: Minimum Potential Energy approach, week form approach, introduction to natural coordinates -Finite element approximations in one dimensions- FE formulation for Axial bar, Euler Bernoulli beam - Numerical Examples. Application to problems of plane trusses with static indeterminacy not exceeding three.

Finite Element Formulation for 2-D Problems: FE Approximation in 2-Dimension, Pascals triangle, Convergence criterion, Compatible and incompatible elements, FE Formulation for plane stress, plane strain problems, Shape functions for 2-Dimensional CST Element-4 noded quadrilateral element -Higher order triangular and rectangular elements- Consistent Nodal load vector -Numerical Examples

UNIT – III

Iso-Parametric Elements: Isoparametric concept-FE Formulation for linear and quadratic isoparametric quadrilateral elements- Construction of shape functions using natural coordinates/Strain-displacement matrices/Load matrices for body force and surface traction/ Expressions for stiffness matrix, load matrices for 4-noded quadrilateral elements.

Numerical Integration: Gauss Quadrature of numerical integration-one point , two point and three point formula.

UNIT–IV:

Finite Element Formulation for 3 -D Elements:

FE Formulation for Tetrahedral and Hexahedral Elements: Volume coordinates, Strain-displacement matrix, stiffness matrix, load matrices due to body force and surface traction/ introduction to Hexahedron (brick) elements.

UNIT-V

Axisymmetric Analysis: Bodies of revolution axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements. Strain-displacement relationship-determination of stiffness matrix for 3-noded triangle element and load matrices for body force and surface traction/ Problems with kinematic indeterminacy not exceeding three for 3-noded triangle elements only.

Computer Implementation of FEA: Pre-Processing, Solution, Post- Processing, Use of Commercial FEA Software-

Numerical Examples: Simple 1-D model, 2-D model and a 3-D model/ analysis.

TEXT BOOKS:

1. A First Course in the Finite Element Method, Daryl L. Logan, 6th Edition, Cengage Learning, 2016
2. Fundamentals of Finite Element Analysis, David V. Hutton, Tata McGraw-Hill Publishing Company Limited, 2005
3. Finite element Analysis, S. S. Bhavikatti, New Age International, 2006

REFERENCES:

1. The Finite Element Method, Zienkiewicz O. C. And Taylor R. L, Vol. 1, McGraw Hill, 1989
2. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegundu A. D., Prentice Hall of India, 2001
3. Finite Element Analysis, Seshu P., Prentice Hall of India, 2003
4. Finite Element Procedures, Bathe K. J., Prentice Hall of India, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1ST05) DESIGN OF ADVANCED REINFORCED CONCRETE STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze and design of slabs by using yield line theory
- To understand the various types of loads in current codes of practice for the design of tall buildings
- To understand the design concepts of flat slabs
- To analyze and design of concrete deep beams and retaining walls

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Determine moment of resistance for square and circular slabs
CO-2: Analyze and design of flat slabs and deep beams
CO-3: Design concrete retaining walls
CO-4: Understand the various types of loads to consider in the design of tall buildings and Pre-Engineered Buildings

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	-	-	-	1
CO-2	3	1	-	-	1	1
CO-3	3	1	-	-	-	-
CO-4	2	1	1	-	-	-

UNIT–I:
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- Reinforcement details.

UNIT–II:
Design of 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 shear - Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip.

UNIT–III:
Design of Reinforced Concrete Deep Beams: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams.

UNIT–IV:

Retaining Walls: Analysis and Design of Cantilever Retaining wall, Counterfort Retaining wall.

UNIT–V:

Introduction to Tall Buildings: Tall Building in the Urban Context - Tall Building and its Support Structure - Development of High Rise-Building Structures - General Planning Considerations. Dead Loads - Live Loads - Construction Loads - Snow, and Wind Loads -Seismic Loading.

TEXT BOOKS:

1. Reinforced Concrete Design, S. Unnikrishnan Pillai and Devdas Menon, TMH
2. Advanced Reinforced Concrete Design, P. C. Varghese, Practice Hall
3. Design of Reinforced Concrete Structures, N. Subramanian, Oxford University Press, 2010

REFERENCES:

1. Limit State Theory and Design of Reinforced Concrete, Dr. S. R. Karve and Dr. V. L. Shah, Standard Publishers
2. Reinforced Concrete design, Kennath Leet, 2nd Edition, Tata McGraw-Hill International, 1991
3. IS 456- 2000 Plain and Reinforced Concrete Book of Practice
4. SP 34 - Hand Book as Concrete Reinforcement and Retaining

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1ST06) EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To explain the possible causes for earthquakes understanding seismology
- To understand the principles of earthquake resistant deign of RC and masonry buildings
- To learn to evaluate base shears using IS methods
- To detail the structural members for ductile requirements

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Predict the sources of earthquakes understanding seismology and conceptually design the buildings

CO-2: Apply the Response Spectrum Analysis Method and static equivalent method for the determination of lateral loads on the buildings

CO-3: Apply ductility requirements for the design of structural components

CO-4: Assess seismic performance of non-structural components and structural components and identify effective measures to mitigate potential damage

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	1	1	-	1
CO-2	2	1	1	2	2	1
CO-3	2	-	1	2	-	3
CO-4	3	1	2	2	-	3

UNIT–I:

Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults-plate seismic tectonics- waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake- scales – Energy released – Earthquake measuring instruments - seismoscope, accelerograph, Characteristics of strong ground motions - Seismic zones of India.

Conceptual Design: Introduction-Functional planning-continuous load path-overall form- simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility- definition-ductility relationships, flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete, masonry-reinforcing steel.

Introduction to Earthquake Resistant Design: Seismic design requirements-regular and irregular configurations - basic assumptions - design earthquake loads - basic load combinations- permissible stresses-seismic methods of analysis-factors in seismic

analysis-equivalent lateral force method – response spectrum method -Time history method.

UNIT–II:

Reinforced Concrete Buildings and Design Methods: Principles of earthquake resistant deign of RC members-structural models for frame buildings- seismic methods of analysis- seismic design methods- IS code based methods for seismic design-Seismic Coefficient and Response Spectrum Method- Determination of design lateral forces-Equivalent lateral force procedure- Lateral distribution of base shear.

UNIT–III:

Masonry Buildings: Introduction-Elastic properties of masonry assemblage- Categories of masonry buildings- Behaviour of unreinforced and reinforced masonry walls-Behaviour of walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings- Load combinations and permissible stresses- seismic design requirements- Lateral load analysis of masonry buildings.

UNIT–IV:

Structural Walls and Non-Structural Elements: Strategies in the location of structural walls- sectional shape & variations in elevation- cantilever walls without openings- Failure mechanism of non-structures- Effects of non-structural elements on structural system- Analysis of non-structural elements- prevention of non-structural damage- Isolation of non- structures.

UNIT–V:

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction-Impact of Ductility, Requirements for Ductility- Assessment of ductility- Factors-affecting Ductility- Ductile detailing considerations as per IS 13920. Behaviour of beam, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquakes.

Capacity Based Design: Introduction to capacity Design, Capacity Design for Beams and columns- Case studies.

TEXT BOOKS:

1. Earthquake Resistant Design of Structures, S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of Structures, Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India

REFERENCES:

1. Seismic Design of Reinforced Concrete and Masonry Building, T. Paulay and M. J. N. Priestly, John Wiley
2. Earthquake Resistant Design and Risk Reduction, D. J. Dowrick, Wiley India
3. Earthquake Resistant Design of Masonry Building, Miha Tomazevic, Imperial College Press
4. Earthquake Tips - Learning Earthquake Design and Construction, C. V. R. Murthy

CODE BOOKS:

1. IS: 1893 (Part 1)- 2016, Criteria for Earthquake Resistant Design of Structures, B.I.S. New Delhi
2. IS: 13920-2016, Ductile Detailing of Concrete Structures Subjected to Seismic Force-Guidelines, B.I.S., New Delhi

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST11) DESIGN OF ADVANCED STEEL STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze bolted and welded eccentric connections
- To sketch the Influence line diagrams for truss members
- To estimate the various types of loads such as Dead, Live and Wind loads on roof trusses
- To determine the shape factor and Define the theorems of plastic analysis

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Design the eccentric and moment connections
CO-2: Design the truss members subjected to tension, compression
CO-3: Determine the collapse loads for continuous beams and portal frames
CO-4: List the advantages of PEBs over CSBs and Estimate the capacity of sections

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	3	-	1	-
CO-2	2	-	3	-	1	-
CO-3	2	-	3	-	1	-
CO-4	2	-	3	-	1	-

UNIT-I:
Eccentric and Moment Connections: Beam-Column connections, Bolted framed connections, Bolted seat connections, Bolted bracket connections, Welded framed connections, Welded seat connections, Welded bracket connections.

UNIT-II:
Truss Girder Bridges: Types of truss girders for bridges, components of truss girder bridge, economic Proportions of truss bridge, self-weight of truss girder, Influence line diagrams for top chord member, bottom chord member, vertical member, diagonal member, Influence line diagrams for forces in the members of a truss girder - Pratt truss with parallel chords, Warren truss with parallel chords.

UNIT-III:
Roof Trusses: Introduction, Types of roof trusses, Components of a roof truss, Economical spacing of roof trusses, Loads on the roof trusses – Dead load, Live load, Wind load, Analysis of Angular Roof Truss, Tubular Roof Truss, Design of truss members subjected to tension, compression, Design of Purlins.

UNIT-IV:

Plastic Theory: Stress-Strain curve for Mild steel, Plastic bending of beams, Stages of bending of rectangular sections, Fully Plastic Moment of a Section, Shape Factor – Rectangular, Triangular, Circular, Hollow circular sections, Moment-Curvature relationships, Plastic Hinge, Load Factor, Theorems of plastic analysis – Static/Lower bound theorem, Kinematic/Upper bound theorem, Uniqueness/Combined theorem - Beam mechanism, Collapse load for cantilevers, simply supported beams, propped cantilever beams, fixed beams, continuous beams

UNIT-V:

Plastic Analysis: Sway mechanism, Combined mechanism, Collapse load for portal frames (Single bay-Single storey).

Introduction to Pre-Engineered Buildings: Concept of Pre-Engineered Buildings, Components of PEB – Primary framing system, Secondary framing system, Advantages of PEBs over Conventional Steel buildings.

TEXT BOOKS:

1. Limit State Design of Steel Structures, S. K. Duggal, TMH
2. Design of Steel Structures, N. Subramanian, Oxford University Press

REFERENCES:

1. Design of Steel Structures, S. S. Bhavikatti, I. K. International Publishing House
2. Limit State Design of Steel Structures, V. L. Shaw, Structures Publications
3. Comprehensive Design of Steel Structures, B. C. Punmia, Laxmi Publications
4. Design of Steel Structures – Vol. II, Ram Chandra, Scientific Publishers

CODE BOOKS:

1. IS 800 : 2007 – General Construction in Steel – Code of Practice
2. IS 875 (Part 3) : 2015 – Design Loads (Other than Earthquake) for Buildings and Structures – Code of Practice
3. Steel Tables, R. Agor, Birla Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST12) STRUCTURAL RELIABILITY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To acquire basic knowledge of statistics and probability theory
- To understand resistance distribution and parameters
- To develop the ability to do computation of structural reliability
- To understand reliability design criteria

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand basics of statistics and explain probability theory
CO-2: Characterize the dimensional variations of materials
CO-3: Explain and apply Monte Carlo method
CO-4: Develop reliability-based designs

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	2	-	2	-
CO-2	-	-	2	-	2	-
CO-3	-	-	2	-	2	-
CO-4	-	-	3	-	3	-

UNIT–I:
Concepts of Structural Safety: General - Design methods- Basic Statistics: Introduction -Data reduction – Histograms - Sample correlation - Probability Theory: Introduction, Random events - Random variables - Functions of random variables - Moments and expectation - common probability distribution - Extremal distribution.

UNIT–II:
Resistance Distributions and Parameters: Introduction - Statistics of properties of concrete, steel, strength of bricks and mortar - dimensional variations - characterization of variables - Allowable stresses based on specified reliability.

UNIT–III:
Basic Structural Reliability: Introduction - Computation of Structural reliability- Monte Carlo Study of Structural Safety: General- Monte Carlo method - Applications.

UNIT–IV:
Reliability Methods: Introduction - Basic variables and failure surface - First-order second-moment methods (FOSM)

UNIT–V:

Reliability Based Design: Introduction - Determination of partial safety factors - Safety checking formats - Development of reliability-based design criteria - Optimal safety factors -Summary of results of study for Indian standard – RCC Design.

TEXT BOOKS:

1. Structural Reliability Analysis and Design, R. Ranganathan, Jaico Publishing House, 2006
2. Structural Reliability – Analysis & Prediction, R. E. Melchers, 2nd Edition, Wiley – Blackwell, 1999

REFERENCES:

1. Structural Reliability, Maurice Lemaire, Wiley, 2009
2. Reliability and Optimization of Structural Systems, Dan M. Frangopol, Mitsuo Kawatani & Chul-Woo Kim, Taylor & Francis, 2006

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST13) BUILDING SERVICES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Building Planning and Construction

COURSE OBJECTIVES:
- To understand the importance of building planning and its requirements
- To know the important considerations in fire protection of buildings
- To apply the different vertical transportation systems during building construction
- To comprehend the different building services

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Design buildings for grouping and circulation, lighting, ventilation and fire protection
CO-2: Design vertical transportation in buildings-stair cases and lifts
CO-3: Analyse and Design prefabrication systems in buildings
CO-4: Plan and Design various building services as electrical installation, air conditioning, plumbing services and acoustics

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	-	1
CO-2	2	1	3	2	-	1
CO-3	2	1	3	2	-	1
CO-4	2	1	3	2	-	1

UNIT–I:
Orientation and Planning - Selection of site - Orientation of building - Design of residential buildings with particular reference to grouping and circulation.General building requirements - Open spaces in and around buildings for lighting and ventilation - Minimum sizes and height of roofs - Rat and Termite proofing of buildings - Lightning protection of buildings.

UNIT–II:
Fire protection of buildings - Important considerations in fire protection - Fire resisting – Properties of common building materials - Fire safety and exit requirements.

UNIT–III:
Vertical transportation in buildings - Essential requirements and details of construction of stairs, lifts escalators and ramps. Prefabrication systems in residential buildings -

Planning and modules and sizes of components in prefabrication - Testing of components - Manufacturing and erection guide lines.

UNIT–IV:
Miscellaneous structures - Shell structures – Domes - Folded plate structures - Skeletal and space frame structures - Grain storage structures - Earthquake resistant structures.

UNIT–V:
Building services - Lighting and Ventilation - Electrical installation - Air-conditioning and heating - Acoustics and Sound insulation - Plumbing services.

TEXT BOOKS:

1. National Building Code of India, Bureau of Indian Standards, 2005
2. Arora and Bindra, Building Construction, 3rd Edition, Dhanpat Rai and Sons, 1984
3. Hand Book for Building Engineers, N. B. O

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST14) DESIGN OF FORMWORK

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the requirements of formwork
- To know the different materials used for formwork
- To apply the concepts for designing the formwork for different structures
- To understand the reasons for failures of formwork

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Comprehend the knowledge on requirements of formwork and select the suitable material for formwork
CO-2: Design a suitable formwork for various structural elements
CO-3: Select a suitable type of formwork for different structures
CO-4: Apply the knowledge in analyzing the failure of formwork

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	1	-	-	1
CO-2	2	1	2	-	-	2
CO-3	2	-	2	-	-	2
CO-4	2	1	2	-	-	3

UNIT–I:
Introduction: Requirements and Selection of Formwork.
Formwork Materials: Timber – Plywood – Steel – Aluminium - Plastic, and Accessories - Horizontal and Vertical Formwork Supports.

UNIT–II:
Formwork Design: Concepts - Formwork Systems and Design for Foundations –Walls – Columns - Slab and Beams.

UNIT – III
Formwork Design for Special Structures: Shells – Domes - Folded Plates - Overhead Water Tanks - Natural Draft Cooling Tower - Bridges.

UNIT–IV:
Flying Formwork: Table Form - Tunnel Form - Slip Form - Formwork for Precast Concrete - Formwork Management Issues - Pre and Post-Award.

UNIT–V:

Formwork Failures: Causes and Case studies in Formwork Failure - Formwork Issues in Multi-Storied Building Construction.

TEXT BOOKS:

1. Formwork for Concrete Structures, Kumar Neeraj Jha, Tata McGraw Hill, 2012
2. Formwork for Concrete Structures, Peurify, McGraw Hill India, 2015

REFERENCES:

1. Formwork for Concrete, M. K. Hurd, ACI

IS Codes:

1. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST15) DESIGN OF HIGH-RISE STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the design aspects of transmission towers and masts
- To understand the analysis and design of steel and rc chimneys
- To develop through understanding of the loading and structural forms of tall buildings
- To understand the modelling for analysis of tall buildings

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Analyze and design transmission line towers and masts

CO-2: Analyze and design steel chimney

CO-3: Analyze and design rc chimney

CO-4: Understand various loadings and structural forms of Tall Buildings and perform modal analysis

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	-	-	1	2
CO-2	2	-	1	-	-	1
CO-3	2	1	1	-	-	1
CO-4	2	2	1	-	-	1

UNIT–I:

Design of Towers and Masts: Introduction, Lattice Tower Configuration and Bracings, Load acting on Lattice Towers, Analysis and Design of Lattice Towers.

UNIT–II:

Masts, Transmission Line Towers, Loads on Transmission Line Towers, Effect of Temperature Variation on Conductors and Earth Wires, Analysis and Design of Transmission Line Towers, Foundations for Towers.

UNIT–III:

Design of Steel Chimney: Introduction, Dimensions of Steel Stacks, Chimney Lining, Breech Openings and Access Ladder, Loading and Load Combinations, Design Considerations, Stability Considerations, Design of Base Plate, Design of Foundation Bolts, Design of Foundation.

Design of RC Chimney: Introduction, Wind Pressure, Stresses in Chimney Shaft due to Self-Weight and Wind, Stresses in Horizontal Reinforcement due to Wind Shear, Stresses due to Temperature Difference, Combined Effect of Self-Load, Wind and

Temperature, Temperature Stresses in Horizontal Reinforcement, Design of RC Chimney.

UNIT–IV:

Loading:

Gravity Loading: Methods of Live Load Reduction, Impact Gravity Loading, Construction Loads; Wind Loading: Simple Static Approach, Dynamic Method; Earthquake Loading: Equivalent Lateral Force Procedure, Modal Analysis Procedure.

Structural Form: Braced-Frame, Rigid-Frame, Infilled-Frame, Flat-Plate and Flat- slab, Shear Wall, Wall-Frame, Framed Tube, Outrigger-Braced, Suspended, Core, Space and Hybrid Structures; Floor Systems (Reinforced Concrete): One-Way Slabs on Beams or Walls, One-Way Pan Joists and Beams, One-Way Slab on Beams and Girders, Two-Way Flat Plate, Two-Way Flat Slab, Waffle Flat Slab, Two- Way Slab and Beam; Floor Systems (Steel Framing): One- Way, Two-Way and Three-Way Beam Systems, Composite Steel-Concrete Floor Systems.

UNIT–V:

Modelling for Analysis: Approaches to Analysis: Preliminary Analyses, Intermediate and Final Analysis, Hybrid Approach to Preliminary and Final Analyses; Assumptions; High-Rise Behaviour; Modelling for Approximate Analyses: Approximate Representation of Bents, Approximate Modelling of Slabs, Modelling for Continuum Analyses; Modelling for Accurate Analysis: Plane Frames, Plane Shear Walls, Three-Dimensional Frame and Wall Structures, P- Delta Effects, The Assembled Model; Reduction Techniques: Symmetry and Antisymmetry, Two-Dimensional Models of Nontwisting Structures, Two-Dimensional Models of Structures that Translate and Twist, Lumping, Wide-Column Deep-Beam Analogies.

TEXT BOOKS:

1. Comprehensive Design of Steel Structures, Punmia B. C., Jain A. K., and Jain A. K., Laxmi Publications
2. Comprehensive Design of Reinforced Concrete Structures, Punmia B. C., Jain A. K., and Jain A. K., Laxmi Publications

REFERENCES:

1. Tall Building Structures: Analysis and Design, Stafford Smith B. and Coull A., Wiley Interscience Publication

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST16) DESIGN OF PRESTRESSED CONCRETE STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To critically review the techniques of pre-stressing both Pre-tensioning and Post-tensioning
- To design the pre-stressed concrete members for ultimate limit state and limit state of serviceability
- To realize the importance of the Statically Indeterminate structures and Load Balancing
- To analyze and design continuous pre-stressed concrete beams with bent cables having straight and parabolic profiles

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Realize the importance of pre-stressing the long span structures and heavily loaded members

CO-2: Acquire the knowledge of various pre-stressing techniques; their merits and demerits

CO-3: Develop skills in planning, analysis and design of pre-stressed concrete beams, and slabs

CO-4: Develop skills to satisfy the serviceability and strength provisions of the Indian Standards (IS:1343-2012)

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	-	-	2
CO-2	1	1	1	2	-	2
CO-3	1	1	1	3	-	2
CO-4	2	1	2	3	-	2

UNIT–I:

General Principles and Systems of Pre-Stressing: Basic concepts of prestresing, Need for High strength steel and concrete, Advantages and Applications of PSC, Different methods and systems of pre-stressing like Hoyer system, Freyssinet system.

Analysis of Pre-Stressed Beams: Basic concepts, Analysis of sections for flexure, stresses at transfer and service loads, Pre-stressing by straight, concentric, eccentric, bent and parabolic tendons, Pressure line, concept of load balancing, cracking moment.

UNIT–II:

Losses of Pre-Stress: Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional loss.

Deflections of Pre-stressed Concrete Beams: Short term deflections of un-cracked members, Prediction of long-time deflections, IS code requirements for maximum deflections.

UNIT–III:

Design of Sections for Flexure: Allowable stresses, Elastic design of simple beams having rectangular and I-sections, kern lines, cable profile and cable layout.

Design of Sections for Shear: Shear and Principal Stresses, Improving shear resistance by different pre-stressing techniques - horizontal, inclined and vertical pre-stressing, Design of beams having rectangular and I-sections, Design of shear reinforcement, IS code provisions.

UNIT–IV:

Transfer of Pre-stress in Pre-tensioned Members: Transmission of pre-stressing force by bond, Transmission length, Bond stresses, IS code provisions.

Anchorage Zone Stresses in Post-Tensioned Members: Stress distribution in End block - Analysis by Guyon and Magnel methods, Anchorage zone reinforcement.

UNIT–V:

Statically Indeterminate Structures: Advantages & Disadvantages of continuous beams - Primary and Secondary moments - P and C lines - Linear transformation, concordant and Non-concordant cable profiles - Analysis of continuous beams.

Composite Construction: Advantages, Types, Analysis of stresses in Propped and Unpropped construction with precast PSC beams and cast in-situ RC slab, Differential shrinkage.

TEXT BOOKS:

1. Pre-Stressed Concrete, Krishna Raju, Tata McGraw-Hill
2. Pre-Stressed Concrete, Muthu K. U., Ibrahim Azmi, Janardhana Maganti, Vijayanand M., PHI Learning

REFERENCES:

1. Pre-Stressed Concrete, Ramamrutham, Dhanpat Rai & Sons
2. Pre-Stressed Concrete, N. Rajagopalan, Narosa
3. Pre-Stressed Concrete Structures, P. Dayaratnam, Oxford & IBH
4. Design of Pre-stressed Concrete Structures, T. Y. Lin and N. H. Burns, John Wiley

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST17) THEORY AND APPLICATIONS OF CEMENT COMPOSITES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To distinguish conventional and composite materials
- To understand the behaviour of composite materials
- To study the different cement / polymer based composite materials
- To apply the different types of composite materials for construction

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Understand stress-strain behaviour and formulate constitutive behaviour of composite materials

CO-2: Understand the classification of materials based on orthotropic and anisotropic behaviour

CO-3: Estimate elastic constants using theories applicable to composite materials.

CO-4: Analyse and Design structural elements made of cement composites as ferrocement, SIFCON and fibre reinforced concrete

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	2	2	-	-
CO-2	1	-	2	2	-	-
CO-3	1	-	2	2	-	-
CO-4	3	2	3	3	-	1

UNIT–I:

Introduction - Classification and characteristics of composite materials - Basic terminology –advantages. Stress-strain relations - Orthotropic and anisotropic materials - Engineering constants for orthotropic materials – restrictions on elastic constants – plane stress problem - Biaxial strength– theories for an orthotropic lamina.

UNIT–II:

Mechanical behaviour - Mechanics of materials approach to stiffness – determination of relations between elastic constants - Elasticity approach to stiffness – bounding techniques of elasticity – exact solutions - Elasticity solutions with contiguity – Halpin – Tsai equations – comparison of approaches to stiffness.

UNIT–III:

Cement composites - Types of cement composites – terminology - Constituent materials and their properties - Construction techniques for fibre reinforced concrete, Ferrocement, SIFCON,

UNIT–IV:
Polymer concretes - Preparation of reinforcement – casting and curing. Mechanical properties of cement composites - Behaviour of ferrocement, fiber reinforced concrete in tension, compression, flexure, shear, fatigue and impact, durability and corrosion.

UNIT–V:
Application of cement composites - FRC and Ferrocement - housing – Water storage – Boats and miscellaneous structures.

TEXT BOOKS:
1. Mechanics of Composite Materials, Robert M. Jones, 2nd Edition, Taylor and Francis/BSP Books, 1998

REFERENCES:
1. Ferrocement – Theory and Applications, R. P. Pama, IFIC, 1980
2. New Concrete Materials, R. N. Swamy, 1st Edition, Blackie, Academic and Professional, Chapman & Hall, 1983

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST18) DESIGN OF SUB-STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the importance of sub-soil investigations
- To analyse the different stress in the sub-soil
- To study the various shallow and deep foundations
- To understand and analyze the different forces in well foundations

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Plan soil investigation and calculate the stresses on soil due to applied loads
CO-2: Calculate bearing capacity of soil to design shallow foundations & calculate the settlements in soils
CO-3: Design pile foundations for structures
CO-4: Design well foundation

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	1	-	-	1
CO-2	2	-	1	-	-	1
CO-3	3	2	3	-	-	1
CO-4	3	2	3	-	-	1

UNIT-I:
Sub Soil Investigation and Sampling: Introduction; Planning of sub-surface exploration Program; Stages in sub-surface exploration; Methods of exploration; Soil sampling and samplers; Water table location; Depth and number of borings; Bore hole logging; In-situ tests – Standard penetration test, Static cone penetration test, Dynamic cone penetration test and Vane shear tests.

UNIT–II:
Stresses due to Applied Loads: Stress-strain parameters; Vertical and horizontal stresses due to concentrated loads; Boussinesq and Westergarrd solutions; Isobars; Influence diagram; Newmark's influence charts; Contact pressure distribution

UNIT-III:
Shallow Foundations: Different bearing capacity equations; Types of shear failures; Effect of inclined load, eccentric load and water table on bearing capacity; Bearing capacity from in-situ tests; Methods of improving bearing capacity; Plate load test Settlement Analysis Settlement of foundations; Immediate and consolidation

settlements; Allowable settlement; Proportioning of a foundation for a given settlement.

UNIT-IV:

Pile Foundations: Necessity of pile foundation; Classification of piles; Construction of piles; Load carrying capacity of single pile from static, dynamic and in-situ test methods; Pile load tests; Pile group and its efficiency; Settlement of pile foundation; Negative skin friction; Under-reamed pile foundation in swelling soils.

UNIT-V:

Well Foundations: Forces acting on well foundation; Types, different shapes of wells; Analysis of well foundation; Individual components of well; Sinking of wells; Measures for rectification of tilts and shifts.

REFERENCES:

1. Basic and Applied Soil Mechanics, Gopal Ranjan and A. S. R. Rao, 2nd Edition, New Age International, 2006
2. Soil Mechanics and Foundation Engineering, K. R. Arora, Standard Publishers and Distributors, 2009
3. Advanced Foundation Engineering, V. N. S. Murthy, CBS Publishers and Distributors, 2007
4. Foundation Analysis and Design, Joseph E. Bowles, 4th Edition, McGraw Hill International, 1988

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST19) PRE-FABRICATED STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the requirements for prefabricated structures
- To study the various design principles of prefabricated structures
- To comprehend the analysis and design of various components of prefabricated structures
- To know the analysis and design of industrial buildings

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Identify design principles and IS code specifications
CO-2: Analyze and design shear walls
CO-3: Analyze and design different types of floors and roof slabs
CO-4: Design industrial buildings

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	1	-	-	-
CO-2	2	2	3	-	-	2
CO-3	2	2	3	-	-	2
CO-4	3	2	3	-	-	3

UNIT–I:

Introduction: General Civil Engineering requirements, specific requirements for planning and layout of prefabricates plant. IS Code specifications

UNIT–II:

Design Principles: Modular coordination, standardization, Disuniting, of Prefabricates, production, transportation, erection, stages of loading and codal provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

UNIT–III:

Walls: Prefabricated structures, Long wall and cross wall large panel buildings, framed buildings with partial and curtain walls, single storey. Types of wall panels, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

UNIT–IV:

Floors, Stairs and Roofs: Types of floor slabs, analysis and design example of cored and panel types and two way systems, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, deflection control for short term and long term loads, ultimate strength calculations in shear and flexure.

UNIT–V:

Design of Industrial Buildings: Components of single storey industrial sheds with crane gantry systems, design of R.C. Roof Trusses, roof panels,design of R.C. crane gantry girders, corbels and columns, wind bracing design, Design of shell roofs for Industrial sheds.

REFERENCES:

1. Basics of Dynamics and Aseismic Design, S. R. Damodaraswamy & S. Kavitha, PHI Learning, 2009
2. Earthquake Resistant Design of Structures, Pankaj Agarwal & Shrikhande, PHI Learning, 2009
3. Dynamics of Structures - Theory and Applications to Earthquake Engineering, Chopra A. K., 2nd Edition, Pearson Education, 2007
4. Pre-fabricated Structures, V. Soundararajan, R. Jagadeesh Kumar, S. Kalpana, Devi ars publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1ST20) DESIGN OF BRIDGES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Structural Analysis I &II, Reinforced Concrete Design

COURSE OBJECTIVES:
- To understand the bridge hydrology
- To list the components of bridge substructure, superstructure and types of bearings
- To understand the codal provisions for loading and design standards of bridges
- To design RC and PSC bridges

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Determine flood discharge, waterway, economic span
CO-2: Select type of super structure, sub structure and the bearings
CO-3: Calculate the various types of loads acting on the bridges
CO-4: Design the Slab bridges, Girder bridges and Prestressed Concrete bridges

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	1	-	-	-
CO-2	1	2	1	-	-	-
CO-3	2	1	1	-	-	1
CO-4	3	2	1	-	-	1

UNIT–I:
Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load- live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.
Solid Slab Bridges: Introduction-Method of Analysis and Design.

UNIT–II:
RCC Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy

UNIT–III:
Box Culverts: Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

UNIT–IV:

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in prestressed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams- Composite Section-Propped-Design of Propped Composite Section-Unpropped composite section- Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT–V:

Sub-Structure of Bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments.

TEXT BOOKS:

1. Design of Concrete Bridges, M. G. Aswani, V. N. Vazirani and M. M. Ratwani
2. Essentials of Bridge Engineering, Johson Victor, Oxford & IBH

REFERENCES:

3. Bridge Deck Behaviour, E. C. Hambly
4. Concrete Bridge Design and Practice, V. K. Raina
5. Design of Bridges, V. V. Sastry, Dhanpat Rai & Co.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2ST03) STRUCTURAL ENGINEERING LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To understand the under reinforced and over reinforced failure of RC beam
- To study the shear and bond characteristics in RC members
- To comprehend the strengthening techniques for structural members
- To understand the load carrying capacity of columns

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Distinguish the failure behaviour of under reinforced and over reinforced beams

CO-2: Evaluate the shear capacity and pull-out strength in RC members

CO-3: Apply the retrofitting techniques for RC members and Evaluate its characteristics

CO-4: Determine the behaviour of columns under compression

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	2	-	3	2
CO-2	2	2	2	-	3	2
CO-3	2	2	2	2	3	3
CO-4	2	2	2	-	3	2

LIST OF EXPERIMENTS:

1. Evaluation of tensile characteristics of HYSD bar and GFRP laminates
2. Determination of pull-out strength of reinforcement embedded in concrete
3. Evaluation of the flexural capacity of an under reinforced RC beam
4. Evaluation of the flexural capacity of an over reinforced RC beam
5. Determination of shear capacity of RC beams with and without shear reinforcement
6. Determination of flexural characteristics of RC beam retrofitted with fibre wrapping technique
7. Evaluate the confinement effect of fibre wraps on the compressive strength of concrete
8. Estimation of load carrying capacity of an axially loaded RC column
9. Measurement of force using strain gauge
10. Determination of vibration characteristics of steel flat using PZT sensor

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2ST04) ADVANCED COMPUTER AIDED DESIGN LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To understand the importance of writing templates in Excel
- To model the beams, frames and trusses
- To analyze the beams, frames and trusses
- To interpret the results from post processing

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Write the programs in Excel
CO-2: Analyze the Beams, Portal Frames and Trusses using Staad Pro
CO-3: Analyze and Design the Multistory RC Buildings for various loads using Staad Pro
CO-4: Determine the stresses in plane stress and plane strain problems using ANSYS

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	1	-	2	-
CO-2	2	2	2	-	3	-
CO-3	2	2	2	-	3	-
CO-4	3	2	3	-	3	-

LIST OF EXPERIMENTS:

1. Excel Template for the design of a Two-way Slab
2. Excel Template for the design of an Isolated Square Footing
3. Analysis of Continuous Beams
4. Analysis of Portal Frames
5. Analysis and Design of Steel Truss
6. Analysis of Multistory RC Building for gravity loads
7. Design of Beams and Columns of a Multistory RC Building for dead and live loads
8. Analysis of Multistory RC Building for Wind loads
9. Analysis of Multistory RC Building for Seismic loads
10. Stress Analysis of Plane stress problems
11. Stress Analysis of Plane strain problems
12. Stress Analysis of Axi-symmetric problems

Note: Staad Pro / Any other equivalent analysis software may be used.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PW4ST02) MINI-PROJECT

TEACHING SCHEME

L	T/P	C
0	4	2

CIE	SEE	TOTAL
40	60	100

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the formulated industry / technical / societal problems
CO-2: Analyze and / or develop models for providing solution to industry / technical / societal problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo a mini-project during II semester of the M.Tech. programme.
- A student, under the supervision of a faculty member, shall collect literature on an allotted project topic of his / her choice, critically review the literature, carry out the project work, submit it to the department in a prescribed report form and shall make an oral presentation before the departmental Project Review Committee.
- Evaluation of the mini-project shall consist of CIE and SEE and shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- CIE shall be carried out for 40 marks on the basis of review presentation as per the calendar dates and evaluation format.
- SEE shall be carried out at the end of semester fpr 60 marks on the basis of oral presentation and submission of mini-project report.
- Prior to the submission of mini-project report to the PRC, its soft copy shall be submitted to the PG Coordinator for PLAGIARISM check.
- The mini-project report shall be accepted for submission to the PRC only upon meeting the prescribed similarity index of less than 25%.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22MN6HS02) ANCIENT WISDOM

TEACHING SCHEME

L	T/P	C
2	0	0

EVALUATION SCHEME

SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology
- To trace, identify and develop the ancient knowledge systems
- To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Familiarize learners with major sequential development in Indian science, engineering and technology

CO-2: Understand eco-friendly, robust and scientific planning and architecture system of ancient India

CO-3: Trace, identify, practice and develop the significant Indian mathematic and astronomical knowledge

CO-4: Understand the importance of Indian aesthetics in individual realization of the truth arises by realizing the harmony within

UNIT-I:

Indian Science & Technology: Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas)

Ancient Architecture:

Scientific Achievements though Ancient Architect: Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79oE 41'54, Veerbhadra temple with 70 hanging pillars

UNIT-II:

Foundation Concept for Science and Technology: The Introduction to Ancient Mathematics & Astronomy Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, 22 bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system,

Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System

UNIT-III:

Humanities & Social Sciences: Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-IntellectConsciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State

UNIT-IV:

Aspiration and Purpose of Individual and Human Society: Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha.

Individual Level:

Program for Ensuring Human Purpose:

Fundamental Concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul).

The True Constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana

Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health

Introduction to Yoga: Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. the six cleansing procedures of Yoga, understanding of Indian psychological concept, consciousness, tridosha & triguna.

UNIT-V:

Five Important Slokas for Enlightenment

Gayatri Mantram, Santi Mantram: Asatoma Sadgamaya, Geeta (Yada Yadahi Dharmasya, Glanirbhavati Bharata), Amanitwam Adambitwam.., Karmanyevadikarastu… Maa phaleshukadachana

TEXT BOOKS:

1. Textbook on Indian Knowledge Systems, Prof. B Mahadevan, IIM Bengaluru
2. Indian Knowledge Systems, Kapur K. and Singh A. K., 2005

REFERENCES:

1. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995
2. Value and Distribution System in India, B. L. Gupta, Gyan Publication House
3. Ancient Indian Culture and Civilization, Reshmi Ramdhoni, Star Publication, 2018
4. Ancient Indian Society, Maharaj Swami Chidatmanjee, Anmol Publication
5. Ancient Indian Classical Music, Lalita Ramkrishna, Shubhi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1ST21) REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the causes of deterioration of structures
- To understand various Non-Destructive Evaluation tests for assessment of health of a structure
- To know various repair materials and their properties
- To understand various repair strategies for rehabilitation and retrofitting of structures.

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Identify the causes of deterioration of structures

CO-2: Perform various Non-Destructive Evaluation tests and asses the health of a structure

CO-3: Suggest suitable repair material for concrete

CO-4: Suggest suitable repair technique for the rehabilitation of a structure

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	1	-	1
CO-2	3	-	3	-	1	1
CO-3	3	-	3	1	-	1
CO-4	3	-	3	-	1	1

UNIT–I:

Causes of Deterioration and Durability Aspects: Holistic Model for Deterioration of RCC; Permeability of Concrete: Capillary Porosity, Air Void, Micro and Macro Cracks; Aggressive Deteriorating Chemical Agents: Corrosion of reinforcing bars, Sulphate Attack, Alkali Silica Reaction, Intrinsic and Extrinsic Causes and Stages of Distress.

UNIT–II:

Condition Survey and Non-Destructive Evaluation: Definition, Objective, Stages, Consideration for Repair Strategy.

Non-Destructive Evaluation Tests: Concrete Strength Assessment: Rebound Hammer Test, Ultrasonic Pulse Velocity (UPV) Test, Penetration Resistance (Windsor Probe and; PNR Test), Pull-out (LOK) Test, Core Sampling and Testing; Chemical Tests: Carbonation Test, Chloride Content; Corrosion Potential Assessment: Cover meter survey, Half-cell potential survey, Resistivity Measurement.

UNIT–III:

Selection of Repair Materials for Concrete: Essential Parameters for Repair Materials; Materials for Repair: Premixed Cement Concrete/Mortars: Cements, Mineral and Chemical Admixtures, Water Cement Ratio; Epoxies and Epoxy Systems including Epoxy Mortars/Concretes: Epoxies, Modifies Epoxy Systems, Precautions to be taken, Field of Applications; Polyester Resins; Surface Coatings: Essential Parameters for coatings, Types of surface coatings.

Polymer Modified Mortars and Concrete (PMM/PMC): Materials, Process of Polymer Modification in Cement Concrete/Mortar, Composition of Polymers, General Requirements, Classification and Properties of Polymer Latexes, Physical and Mechanical Properties of Polymer Modified Mortars/Concretes, Mix Proportioning, General Guidelines and; Precautions for use of Polymer Modified Cement Mortar/Concrete, Field of Applications.

UNIT–IV:

Rehabilitation and Retrofitting Methods: Repair options; Performance Requirements of Repair Systems; Important factors to be considered for Selection of Repair Methods; Repair Stages; Repair Methods: Repairs using Mortars, Dry Pack and Epoxy Bonded Dry Pack, Pre- placed Aggregate Concrete (PAC), Shotcrete, Concrete Replacement, Epoxy Bonded Concrete, Silica Fume Concrete, Polymer Concrete System, Strengthening Concrete by Surface Impregnation using Vacuum Methods, Thin Polymer Overlays, Thin Epoxy Overlays, Resin/Polymer Modified Cement Slurry Injection, Protective Seal Coats on the Entire Surface.

UNIT–V:

Repair Methods: Ferro-cement, Plate Bonding, RCC Jacketing, Propping and Supporting, Fibre Wrap Technique, Foundation Rehabilitation Methods, Chemical and Electro-chemical Methods of Repair; Repair/Rehabilitation Strategies – Stress Reduction, Repair/Strengthening of Columns, Beams and Slabs, Compressive Strength of Concrete, Cracks/Joints, Masonry, Protection, Foundation, Base Isolation.

TEXT BOOKS:

1. Handbook on Repair and Rehabilitation of RCC Buildings, Director General (Works), Central Public Works Department (CPWD), Government of India Press, New Delhi
2. Concrete – Microstructure, Properties and Materials, Mehta P. K. and Monteiro P. J., McGraw-Hill

REFERENCES:

1. Concrete Structures – Protection, Repair and Rehabilitation, Woodson R. D., Butterworth-Heinemann, Elsevier

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1ST22) PRE-ENGINEERED BUILDINGS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To distinguish between conventional steel buildings and Pre-Engineered Buildings (PEB)
- To identify the Pre-Engineered Building components
- To estimate the loads on Pre-Engineered Buildings
- To identify the various design parameters of PEB frames

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Understand the functions of primary system, secondary system and bracing system of PEB components

CO-2: Calculate the dead, live, wind and seismic loads acting on PEB's

CO-3: Check the structural stability of PEB's

CO-4: Analyze and design the PEB's

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	3	-	2	2
CO-2	2	-	3	-	2	2
CO-3	3	-	3	-	2	3
CO-4	3	-	3	-	2	3

UNIT–I:

Introduction to Pre-Engineered Buildings: Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB - Differences between Conventional Steel Buildings and Pre- Engineered Buildings.

UNIT–II:

Pre-Engineered Building Components: Primary system: Main frames, Gable End frame - Secondary system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases.

UNIT–III:

Design Loads on Pre-Engineered Buildings: Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and other applicable Loads - Serviceability limits as per code, Design parameters for PEB frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to Thickness of Web ratios of sections - Section sizes as per manufacturing limitations.

UNIT–IV:

Structural Stability of Pre-Engineered Buildings: Shear buckling effect (d/t ratio exceeding 67ε) - Effective cross-sectional area concept for compression members (d/t ratio exceeding 42ε) - Effect of d/t ratio for flexural members according to section classifications - Bracing system: Flange Bracing, Rod Bracing, Angle Bracing, Portal Bracing, Design bending and shear capacity – column, rafter.

UNIT–V:

Analysis and Design of Pre-Engineered Buildings: Analysis and Design of Rigid Frames - Rigid Frame Moment Connection, Shear Connection - Anchor bolt and base plate design - Pinned and Fixed

TEXT BOOKS:

1. Pre-Engineered Steel Building, K. S. Vivek und P. Vyshnavi, Lambert Academic Publishing
2. Metal Building Systems: Design and Specifications, Alexander Newman, McGraw Hill

REFERENCES:

1. Pre-Engineered Metal Building Iron Worker, Red-Hot Careers, Create Space Independent Publishing Platform
2. Pre-Engineered Metal Building Systems, Labsori

CODE BOOKS:

1. IS 800 : 2007 – General Construction in Steel – Code of Practice
2. IS 875 (Part 3) : 2015 – Design Loads (Other than Earthquake) for Buildings and Structures – Code of Practice

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1ST23) DESIGN OF STEEL-CONCRETE COMPOSITE STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To distinguish between conventional and composite construction
- To understand the design concepts of beam and column composite construction
- To know the design of composite truss construction
- To understand the design concepts of composite girder bridges

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify the behaviour of composite beams and columns
CO-2: Design composite beams, columns and trusses
CO-3: Design connections in composite structures
CO-4: Identify the behaviour of composite girder bridges

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	3	-	1	1
CO-2	3	-	3	-	1	2
CO-3	3	-	3	-	1	2
CO-4	2	-	3	-	1	1

UNIT–I:
Introduction: Introduction to Steel - Concrete Composite Construction - Theory of Composite Structures - Introduction to Steel - Concrete - Steel - Sandwich Construction - Behaviour of composite beams and columns.

UNIT-II:
Design of Composite Beam and Columns: Introduction to Steel - Concrete Composite beams and columns - types of loads acting - Design of Composite beams – Design of Composite Columns.

UNIT-III:
Design of Composite Trusses: Introduction to Steel - Concrete Composite trusses - types of loads acting - Design of Composite Trusses.

UNIT-IV:
Design of Connections: Types of Connections - Design of Connections in Composite structures - Shear Connections - Design of Connections in composite trusses.

UNIT-V:

Composite Girder Bridges & Case Studies: Behaviour of girder bridges - Design concepts. Case Studies on steel - concrete composite construction structures in buildings - Seismic behaviour of composite structures and design methods

TEXT BOOKS:

1. Teaching Resource Material for Structural Steel Design, Volume 2/3 jointly prepared, 1. I.I.T., MS 2. Anna University 2. SERC, MS 4. Institute for Steel Development and growth, Calcutta
2. Steel Designs Manual, Owens G. W., & Knowels P., 6th Edition, Steel Concrete

REFERENCES:

1. Composite Structures of Steel and Concrete, Johnson R. P., 2nd Edition, Blackwell Scientific Publications, 2001
2. Steel Designers Manual, Owens G. W. and Knowels P, 5th Edition, Oxford Blackwell Scientific Publications, 2000

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1ST24) UNDERWATER CONSTRUCTION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basics and importance of under-water construction
- To know the different excavation techniques
- To explain the different requirements for shoring and underpinning
- To understand the different tunneling methods for various conditions

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify correct site and other requirements for tunneling
CO-2: Check stability of slopes for coastal structures and Design offshore platforms
CO-3: Apply correct tunnelling technique for various types of rocks
CO-4: Design deep water foundation for structures

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	3	-	-	-
CO-2	3	-	3	-	1	1
CO-3	2	-	3	-	1	1
CO-4	3	-	3	-	2	2

UNIT–I:

Introduction: Introduction - site preparation - temporary roads - site drainage - deep trench and deep basement excavations - bulk excavation.

UNIT-II:

Coastal Structures: Coastal structures - stability of slopes to open excavations - support of excavation by timbering and sheet piling.

UNIT-III:

Offshore Platforms: Offshore Platforms - retaining walls and sheet pile design - requirements for shorting and underpinning - methods of shoring of Underpinning.

UNIT-IV:

Tunneling: Dewatering and Groundwater Control for Soft Ground Tunneling - Tunneling in touch, medium-tough and soft rocks - tunneling by bors shield tunneling.

UNIT-V:

Deep Water Foundations: Deep water foundations - Design of piles - pile load tests - Foundation design for dynamic conditions.

TEXT BOOKS:

1. Construction of Marine and Offshore Structures, Ben C. Gerwick Jr., 3rd Edition, CRC Press, 2007
2. Construction Dewatering: New Methods and Applications, Patrick Powers J., John Wiley and Sons, 1992

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1ST25) CONSTRUCTION TECHNOLOGY AND PROJECT MANAGEMENT

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand role of project management
- To learn preparation of project schedules and life cycle cost
- To learn about critical construction management
- To understand about on BOT, BOOT & PP projects

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Develop organization structure of construction company
CO-2: Estimate project cost and develop cost models
CO-3: Prepare contract documents
CO-4: Explain the importance of construction safety

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	2	1	-	-
CO-2	-	1	3	1	1	-
CO-3	-	3	3	2	-	-
CO-4	-	-	2	1	-	3

UNIT-I:
Introduction to Project Management: Construction as industry and its challenges, Role of Project management, systems approach, systems theory and Concepts, Organisation, Management Functions, Overview of Management Objectives, Tools and Techniques, Life cycle of construction projects, time estimates and construction schedules, CPM and PERT, Linear programming, queuing concept, simulation, bidding models, game theory

UNIT-II:
Project Cost Estimation: Approximate cost, detailed cost estimates, administrative approval and expenditure sanctions, rate analysis by client and contractor, bidding processes and strategies, Pre-qualification of bidders

UNIT-III:
Construction Equipment: Equipment economics, Excavators, Rollers, Dozers, Scrapers, Handling equipment, Concrete equipment, Cranes, Draglines and Clamshells. various itemsof construction : Earthwork, Excavation, Earth- moving, Drilling, Blasting, dewatering, foundation, Finishing items

UNIT-IV:

Contract Management: Why law is critical to construction management, contract, its definition, Indian contract Act, documents forming a contract, Tendering and contractual procedures, stages of awarding contract, general conditions of Indian (domestic) contracts, General conditions of International contracts (FIDIC), contract administration; Duties and responsibilities of parties; important site documents, importance of standards and codes incontract documents.

UNIT-V:

Quality Management and Safety in Construction Industry: Quality control by statistical methods, sampling plan, control charts, ISO standards, Safety Measures, Personnel, Fire and Electrical safety, Safety Programmes, Safety Awareness and Implementation of Safety Plan - Compensation

TEXT BOOKS:

1. A Guide to Quantity Surveyors, Engineers Architects and Builders (Vol. I: Taking Off Quantities, Abstracting & Billing; Vol II: Analysis of Prices), Kharb K. S.
2. Construction Project Management, K. K. Chitkara, Tata McGraw Hill Education

REFERENCES:

1. Construction Technology, Subir K. Sarkar, Subhajit Saraswati, Oxford University Press
2. Construction Project Management – Theory and Practice, Kumar Neeraj Jha, Pearson Education
3. Project Planning and Control with PERT and CPM, B. C. Punmia, K. K. Khandelwala, Laxmi Publications
4. Construction Planning & Management, U. K. Srivastava, Galgotia Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1CN01) BUSINESS ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the role of business analytics within an organization and to analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making and to become familiar with processes needed to develop, report, and analyze business data
- To use decision-making tools/Operations research techniques and to manage business process using analytical and management tools
- To analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of data analytics

CO-2: Think critically in making decisions based on data and deep analytics

CO-3: Use technical skills in predicative and prescriptive modeling to support business decision-making

CO-4: Translate data into clear, actionable insights

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	1	-	1	1
CO-2	3	-	2	-	1	2
CO-3	2	1	1	-	1	1
CO-4	1	2	1	-	1	1

UNIT-I:

Business Analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data Business Analytics Technology.

UNIT-III:

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV:

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V:

Decision Analysis: Formulating Decision Problems, Decision Strategies without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business Analytics-Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press
2. Business Analytics, James Evans, Pearson Education
3. Business Analytics, Purba Halady Rao, PHI, 2013

REFERENCES:

1. Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Gert H. N. Laursen, Jesper Thorlund, 2nd Edition, Wiley Publications
2. Business Analytics: Data Analysis & Decision Making, S. Christian Albright, Wayne L. Winston, 5th Edition, 2015
3. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman Elsevier, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM01) INDUSTRIAL SAFETY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Elements of Mechanical, Civil, Electrical and Industrial Engineering

COURSE OBJECTIVES:

- To achieve an understanding of principles, various functions and activities of safety management
- To communicate effectively information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities
- To anticipate, recognize, and evaluate hazardous conditions and practices affecting people, property and the environment, develop and evaluate appropriate strategies designed to mitigate risk
- To develop professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards

CO-2: Communicate effectively on health and safety matters among the employees and with society at large

CO-3: Demonstrate the use of state of the art occupational health and safety practices in controlling risks of complex engineering activities and understand their limitations

CO-4: Interpret and apply legislative / legal requirements, industry standards, and best practices in accident prevention programmes in a variety of workplaces

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	3	1
CO-2	-	-	-	-	2	3
CO-3	3	1	2	1	-	-
CO-4	-	2	-	1	-	2

UNIT-I:

Safety Management: Evaluation of modern safety concepts – Safety management functions – safety organization, safety department – safety committee, safety audit -

performance measurements and motivation – employee participation in safety and productivity.

UNIT-II:

Operational Safety: Hot metal Operation – Boiler, pressure vessels – heat treatment shop - gas furnace operation-electroplating-hot bending pipes – Safety in welding and cutting. Cold-metal Operation- Safety in Machine shop- metal cutting – shot blasting, grinding, painting – power press and other machines.

Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers

UNIT-III:

Safety Measures: Layout design and material handling - Use of electricity – Management of toxic gases and chemicals – Industrial fires and prevention – Road safety– Safety of sewage disposal and cleaning – Control of environmental pollution – Managing emergencies in industrial hazards.

UNIT-IV:

Accident Prevention: Human side of safety – personal protective equipment – Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP – Training and development of employees – First Aid – Fire fighting devices – Accident reporting investigation.

UNIT-V:

Safety, Health, Welfare & Laws: Safety and health standards – Industrial hygiene – occupational diseases prevention - Welfare facilities – History of legislations related to safety–pressure vessel act- Indian boiler act- The environmental protection act – Electricity act - Explosive act.

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, New Delhi, 1989
2. Safety Management in Industry, Krishnan N. V., Jaico Publishing House, 1996

REFERENCES:

1. Occupational Safety Manual, BHEL
2. Industrial Safety and The Law, P. M. C. Nair Publisher's, Trivandrum
3. Managing Emergencies in Industries, Loss Prevention of India Ltd., Proceedings, 1999
4. Safety Security and Risk Management, U. K. Singh & J. M. Dewan, A. P. H. Publishing Company, New Delhi, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw-Hill, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM02) OPERATIONS RESEARCH

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze linear programming models in practical and their practical use
- To apply the transportation, assignment and sequencing models and their solution methodology for solving problems
- To apply inventory and queuing, inventory models and their solution methodology for solving problems
- To evaluate the simulation models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Evaluate the problems using linear programming
CO-2: Analyze assignment, transportation problems
CO-3: Apply inventory and queuing problems for real time problems
CO-4: Model the real-world problem and simulate it

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	3	2	-	-
CO-2	1	3	3	3	-	-
CO-3	1	3	3	3	-	-
CO-4	1	3	3	3	-	-

UNIT-I:

Introduction to Operations Research: Definitions of OR, Characteristics of OR, Scope of OR, Classification of Optimization Techniques, models in OR, General L.P Formulation, Graphical solution, Simplex Techniques.

Allocation: Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT-II:

Transportation Problem: Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem-Travelling Salesman Problem.

Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT-III:

Waiting Lines: Introduction-Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

UNIT-IV:

Inventory Models: Deterministic inventory, models - Probabilistic inventory control models

UNIT-V:

Simulation: Definition-Types of simulation models-phases of simulation-applications of simulation Inventory and Queuing problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research, S. D. Sharma, Kedarnath Ramnath, Meerut, New Delhi
2. Engineering Optimization, S. S. Rao, New Age International Publications, 2014
3. Introduction to Genetic Algorithms, S. N. Sivanandam, Springer

REFERENCES:

1. Operations Research-An Introduction, H. A. Taha, PHI, 2008
2. Principles of Operations Research, H. M. Wagner, PHI, Delhi, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, Delhi, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM03) ENTREPRENEURSHIP AND START-UPS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To understand different Theories of Entrepreneurship and their Classification
- To create Feasibility Reports, Business, Project Plans and resolve Operational problems
- To understand the roles of Family, non-family entrepreneurs and learning about Startups' Opportunities, Corporate Legal and Intellectual Property related issues

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the role of an entrepreneur in the economic development and discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Learn different Theories of entrepreneurship, the role of Family and Non-Family entrepreneurs and problem-solving skills

CO-3: Create Marketing, Financial Plans and evaluate Structural, Financial and Managerial Problems

CO-4: Apply lean methodology to startup ideas using Business Model Canvas and be able to create Business Plans through establishing business incubators. Understand Corporate Legal and Intellectual Property related matters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	-	3
CO-2	1	-	-	-	-	2
CO-3	1	-	-	-	-	2
CO-4	-	-	-	1	-	-

UNIT-I:

Entrepreneurship: Definition of Entrepreneur, Entrepreneurial motivation and barriers; Internal and external factors; Types of entrepreneurs, Personality and Skill Set of an Entrepreneur, Entrepreneurship as a career for engineers, scientists, and technologists.

UNIT-II:

Theories of Entrepreneurship: Classification of entrepreneurship. Creativity and Innovation: Creative Problems Solving, Creative Thinking, Lateral Thinking, Views of De Bono, Khandwala and others, Creative Performance in terms of motivation and skills.

Family and Non-Family Entrepreneurs: Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Sick industries, Reasons for Sickness, Remedies for Sickness, Role of BIFR in revival, Bank Syndications.

UNIT-III:

Creativity and Entrepreneurial Plan: Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning, Evaluation, Monitoring and Control, segmentation, Targeting and positioning of Product, Role of SIDBI in Project Management.

UNIT-IV:

Operation Problems: Incubation and Take-off, Problems encountered Structural, Financial and Managerial Problems, Types of Uncertainty. Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

UNIT-V:

Startups' Opportunity Assessment, Business Models, Entrepreneur talk, Clinical/ Regulatory, Sector Specific Group Briefing by Advisory Committee, Corporate Legal and Intellectual Property, Pitching, Payers and Reimbursement, Pitch practice, Investors, Mistakes I Won't Repeat, Business Development and Exits, Finance, Budgeting, Team Building, Opportunities in Telangana State and India – incubators, schemes, accelerators.

TEXT BOOKS:

1. Understanding Enterprise: Entrepreneurship and Small Business, Bridge S. et al., Palgrave, 2003
2. Holt- Entrepreneurship: New Venture Creation, Prentice-Hall, 1998
3. Entrepreneurship Development, Robert D. Hisrich, Michael P. Peters, Tata McGraw Hill Edition

REFERENCES:

1. New Venture Creation: An Innovator's Guide to Entrepreneurship, Marc H. Meyer and Frederick G. Crane, 2nd Edition, Sage Publications
2. Technology Ventures: From Idea to Enterprise, Byers, Dorf, Nelson
3. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist - Feld, Mendelson, Costolo
4. Breakthrough Entrepreneurship, Burgstone and Murphy
5. Business Model Generation, Alexander Osterwalder

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1PL01) WASTE TO ENERGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To create awareness in students of energy conservation
- To identify the use of different types of Bio waste energy resources
- To understand different types of bio waste energy conservations
- To detect different waste conversion into different forms of energy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find different types of energy from waste to produce electrical power
CO-2: Estimate the use of bio waste to produce electrical energy
CO-3: Understanding different types of bio waste and its energy conversions
CO-4: Analyze the bio waste utilization and to avoid the environmental pollution

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	1	2	1
CO-2	3	3	3	3	2	3
CO-3	3	2	3	2	2	3
CO-4	3	3	3	3	2	3

UNIT-I:
Introduction to Energy From Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW (Municipal solid waste) – Conversion devices – Incinerators, Gasifiers, Digestors. Urban waste to energy conversion, Biomass energy Programme in India.

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III:
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power.

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion.

Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXT BOOKS:

1. Biogas Technology-Transfer and Diffusion, M. M. EL-Halwagi, Elsevier Applied Science Publisher, 1984
2. Introduction to Biomass Energy Conversions, Sergio Capareda

REFERENCES:

1. Non-Conventional Energy, Desai Ashok V., Wiley Eastern Ltd., 1990
2. Biogas Technology - A Practical Hand Book, Khandelwal K. C. and Mahdi S. S., Vol. I & II, Tata McGraw Hill, 1983
3. Food, Feed and Fuel from Biomass, Challal D. S., IBH Publishing Co. Pvt. Ltd., 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996