SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR
(AUTONOMOUS)
Department of Civil Engineering
Master of Technology
Specialization: Structural Engineering

I M.Tech - I Semester

S No.	Course Code	Course Name	L	T	P/ Drg	C
1	20HS0823	Research Methodology and IPR	2	-	-	2
2	20CE1001	Advanced Structural Analysis	3	-	-	3
3	20CE1002	Advanced Solid Mechanics	3	-	-	3
4	**Programme Elective (PE) – I**					
	20CE1008	Theory of Thin Plates and Shells	3	-	-	3
	20CE1009	Theory and Applications of Cement Composites				
	20CE1010	Theory of Structural Stability				
5	**Programme Elective (PE) – II**					
	20HS0837	Analytical and Numerical Methods for Structural Engineering	3	-	-	3
	20CE1011	Structural Health Monitoring				
	20CE1012	Structural Optimization				
6	20CE1003	Structural Design Lab	-	-	4	2
7	20CE1004	Advanced Concrete Lab	-	-	4	2
Audit Course – I						
8	20HS0818	English for Research Paper Writing	2	-	-	-
Contact periods / week			16	-	8	**18**
			Total/Week		**24**	

L – Lecture hour; T – Tutorial; Drg – Drawing; P - Practical; C – Credits.

I M.Tech - II Semester

No.	Course Code	Course Name	L	T	P/ Drg	C
1	20CE1005	FEM in Structural Engineering	3	-	-	3
2	20CE1006	Structural Dynamics	3	-	-	3
3	**Programme Elective (PE) – III**					
	20CE1013	Advanced Steel Design	3	-	-	3
	20CE1014	Design of Formwork				
	20CE1015	Design of High-Rise Structures				
	20CE1016	Design of Masonry Structures				
4	**Programme Elective (PE) – IV**					
	20CE1017	Design of Advanced Concrete Structures	3	-	-	3
	20CE1018	Advanced Design of Foundations				
	20CE1019	Soil Structure Interaction				
	20CE1020	Design of Industrial Structure				
5	20CE1007	Structural Dynamics lab (Virtual Lab)	-	-	4	2
6	20HS0838	Numerical Analysis Lab	-	-	4	2
7	20CE1025	Mini Project	-	-	4	2
Audit Course - II						
8	20HS0829	Constitution of India	2	-	-	-
Contact periods / week			14	-	12	**18**
			Total/WeeK**26**			

L – Lecture hour; T – Tutorial; Drg – Drawing; P - Practical; C – Credits.

II M.Tech – I SEMESTER

S No.	COURCE CODE	SUBJECT	L	T	P/ Drg	C
1	**Professional Elective Course (PEC) – V**		3	-	-	3
	20CE1021	Design of Prestressed Concrete Structures				
	20CE1022	Analysis of Laminated Composite Plates				
	20CE1023	Fracture Mechanics of Concrete Structures				
	20CE1024	Design of Plates and Shells				
2	**Open Elective Course**		3	-	-	3
	20HS0824	Business Analytics				
	20ME3026	Industrial Safety				
	20ME3027	Advances in Operations Research				
	20ME3028	Composite Materials				
	20EE2128	Waste to Energy				
3	20CE1026	Dissertation Phase – I	-	-	20	10
Contact Periods / Week			6	-	20	**16**
			Total/Week **26**			

L – Lecture hour; T – Tutorial; Drg – Drawing; P - Practical; C – Credits.

II M.Tech – II SEMESTER

S No.	COURCE CODE	SUBJECT	L	T	P/ Drg	C
1	20CE1027	Dissertation Phase – II	-	-	32	16
Contact Periods / Week			-	-	32	**16**
			Total/Week **32**			

L – Lecture hour; T – Tutorial; Drg – Drawing; P - Practical; C – Credits.

AUDIT COURSE I & II

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Addition
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

Note:

- L – Lecture hour; T – Tutorial; Drg – Drawing; P Practical; C –Credits.
- **Total credits:**18+18+16+16**=68**

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I M. TECH - I SEM. (SE)

L	T	P	C
2	-	-	2

(20HS0823) RESEARCH METHODOLOGY AND IPR

Course Objectives:

1. *Understand some basic concepts of research and its methodologies.*
2. *Identify and discuss appropriate research topics, select appropriate research design, and implement a research project.*
3. *Understand the method of research writing and presenting research report and proposal*
4. *Provide an understanding on the importance of intellectual property rights*
5. *Understand the intricacies of grant of patent, patentability, licensing and revocation at national and international level.*

Course outcomes:

On successful completion of this course, the student shall be able to

1. *Explain the key concepts and issues in research and basic framework of research process.*
2. *Formulate appropriate research problem and implement suitable research design for the research problem.*
3. *Identify various sources of information for literature review and data collection.*
4. *Develop an understanding of ethics in conducting applied research and make use of components of scholarly writing in report preparation.*
5. *Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.*
6. *Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.*

UNIT I:

Research Methodology: Meaning, Objective and importance of research - Types of research - steps involved in research - Motivation in Research, Types of Research - Significance of Research - Research Methods versus Methodology - Importance of Knowing How Research is done - Research Process - Criteria of Good Research defining research problem - Errors in selecting a research problem

UNIT II:

Research Design and Data Collection: Research design - Different Research Designs - Effective literature studies - Classification of Data - Methods of Data Collection – Sampling - Sampling techniques, procedure and methods - Ethical considerations in research - Responsibility of ethics in research

UNIT III:

Research Report Writing: 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. Stuart Melville and Wayne Goddard, ‒Research methodology: an introduction for science & engineering students‟‖
2. Wayne Goddard and Stuart Melville, ‒Research Methodology: An Introduction‖

REFERENCES:

1. Ranjit Kumar, 2nd Edition, ‒Research Methodology: A Step by Step Guide for beginners‖ Halbert, ‒Resisting Intellectual Property‖, Taylor & Francis Ltd , 2007.
2. Mayall, ‒Industrial Design‖, McGraw Hill, 1992. Niebel , ―Product Design‖, McGraw Hill, 1974.
3. Asimov, ‒Introduction to Design‖, Prentice Hall, 1962.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, ‒Intellectual Property in New Technological Age‖, 2016.
5. T. Ramappa, ‒Intellectual Property Rights Under WTO‖, S. Chand, 2008

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I M. TECH - I SEM. (SE)

L	T	P	C
3	-	-	3

(20CE1001) ADVANCED STRUCTURAL ANALYSIS

COURSE OBJECTIVES

1. *To analyse continuous beam, portal frames, pin jointed structures, trusses*
2. *To emanate frames by Flexibility and Stiffness matrix methods.*
3. *Formation of global Stiffness matrix from local Stiffness matrix and equation solving Techniques.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Ascertain the indeterminacy of frames, trusses by idealization*
2. *Analyse continuous beam by Stiffness & flexibility matrix methods*
3. *Analyse Rigid Jointed frames by Stiffness & flexibility matrix methods*
4. *Analyse Pin Jointed trusses by Stiffness & Flexibility matrix methods*
5. *Formulate global & element stiffness matrix, by direct stiffness method*
6. *Realize Equation solution Techniques*

UNIT-I

Introduction to Matrix Methods of Analysis: Flexibility and stiffness matrices, Force displacement relationships for axial force, couple, torsional moments, Stiffness method of analysis and flexibility method of analysis

UNIT-II

Analysis of Continuous Beams: Stiffness method and flexibility method of analysis, Continuous beams of two and three spans with different end conditions Analysis of Two-Dimensional Pin Jointed Trusses: Stiffness and flexibility methods, Computation of joint displacement and member forces

UNIT-III

Analysis of Two - Dimensional Portal Frames: Stiffness and flexibility method of analysis of 2-D portal frames with different end conditions - Plotting of bending moment diagrams

UNIT-IV

Solution Techniques: Solution of system of linear algebraic equations, direct inversion method, Gauss elimination method, Cholesky method, Banded equation solvers, Frontal solution technique

UNIT-V

Nonlinear analysis of structures: Introduction, Material & Geometric nonlinearities, Analysis of statically determinate and indeterminate bars of uniform and non-uniform thickness subjected to small deformations; inelastic analysis of bars with and without axial restraints

TEXT BOOKS

1. C. S. Reddy, *Basic Structural Analysis,* 3rd edition, McGraw-Hill Education Private Limited, New Delhi
2. G.S. Pandit, S.P. Gupta *Structural Analysis* (A Matrix Approach), 2nd edition, , Tata McGraw-Hill Education Private Limited, New Delhi

REFERENCES

1. R.C. Coates, M.G. Coutie, F.K. Kong, *Structural Analysis*, 3rd edition, Van Nostrand Reinhold publishers
2. Richard H. Gallagher, Ronald D. Ziemian, *Matrix Structural Analysis,* 2nd edition, William McGuire Create Space Independent Publishing Platform
3. J. S. Prezemieniecki, *Theory of Matrix Structural Analysis,* Dover Publications
4. R.C. Hibbeler, *Structural Analysis*, 8th edition, Pearson Prentice Hall
5. John L Meek, *Matrix Structural Analysis*, Tata McGraw-Hill Education Private Limited, New Delhi

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I M. TECH - I SEM. (SE)

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(20CE1002) ADVANCED SOLID MECHANICS

COURSE OBJECTIVES

1. *To learn about plane stress and plane strain analysis*
2. *To analyse Stress and strain in three dimensions and torsion of Prismatic bars*
3. *To perceive the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student able to

1. *Understand Two dimensional analysis of stress and strain*
2. *Understand Three dimensional analysis of stress and strain*
3. *Comprehend the concept of pure bending, gravity loading etc*
4. *Inculcate the habit of researching and practicing in the field of elasticity*
5. *Enhance the competency level*
6. *Develop compatibility conditions, equilibrium through homogeneity*

UNIT-I

Introduction: Elasticity, Notation for forces and stresses, Components of stress, Components of strain, Hooke‘s law.

Plane Stress and Plane Strain Analysis: Plane stress, plane strain, Differential equations of equilibrium, Boundary conditions, Compatibility equations, Stress function.

UNIT-II

Two Dimensional Problems in Rectangular Coordinates: Solution by polynomials, Saint Venant‘s principle, Determination of displacements, Bending of simple beams, Application of Fourier series for two dimensional problems, Gravity loading.

UNIT-III

Two Dimensional Problems in Polar Coordinates: General Equation in polar co-ordinates, Stress distribution symmetrical about an axis, Pure bending of curved bars, Strain components in polar coordinates, Displacements for symmetrical stress distributions, Simple problems.

UNIT-IV

Analysis Of Stress and Strain in Three Dimensions: Introduction, Principal stresses, Stress ellipsoid and stress-director surface, Determination of the principal stresses, Determination of the maximum shearing stress, Homogeneous deformation, Principal axes of strain, Rotation, Differential equations of equilibrium, Conditions of compatibility, Determination of displacements, Equations of equilibrium in terms of displacements.

UNIT-V

Torsion of Prismatic Bars: Torsion of prismatic bars – Elliptical cross section – Other elementary solutions – Membrane analogy – Torsion of rectangular bars.

TEXT BOOKS

1. S.P. Timoshenko, G.N. Goodier, *Theory of Elasticity*, Tata McGraw-Hill Education Private Limited, New Delhi.
2. Dr. Sadhu Singh, *Theory of Elasticity and Plasticity*, 4th edition, Khanna Publications.

REFERENCES

1. E. P. Popov, *Mechanics of materials*, 2nd edition, Prentice Hallpublications.
2. Elasticity Theory, Applications and Numerics, 3rd edition, Martin H. Sadd, Elsevier publications, Academic Press, India.
3. R.J. Atkin, N. Fox, *Introduction to Theory of Elasticity*, Reprint of the Longman Group Ltd., London, 1980edition.

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I M. TECH - I SEM. (SE)

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PROGRAMME ELECTIVE (PE) – I
(20CE1008) THEORY OF THIN PLATES AND SHELLS

COURSE OBJECTIVES

1. *To understand the basic equations, bending effects of plates*
2. *To understand the symmetrical loading and various loading conditions of circular and annular plates*
3. *To understand the simultaneous bending and stretching of plates and to develop governing equation*
4. *To understand the analytical methods for the solution of shells*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Explain the behavior of plates for UDL, hydrostatic, concentrated load cases*
2. *Perform the pure bending of rectangular , circular plates and Derive Its deflection theories*
3. *Analyze the behavior of simply supported rectangular plates under different load conditions*
4. *Analyze the plates using Navier's method for concentrated load*
5. *Define the solution of shells by Using various analytical methods*
6. *Apply the numerical techniques to Perform the behavior of Cylindrical shells*

UNIT- I

Bending of Long Rectangular Plates to a Cylindrical Surface : Differential equation for cylindrical bending of plates - Uniformly loaded rectangular plates with simple supported edges and with built- in edges-Cylindrical bending of a plate on an elastic foundation

UNIT- II

Pure Bending of Plates: Slopes and Curvatures of bent plates - Relations between bending moments and curvature - Particular cases - Strain energy in pure bending - Limitations -Thermal stresses in plates with clamped edges; Symmetrical bending of circular plates: Differential equation

UNIT -III

Simply Supported Rectangular Plates : Simply supported rectangular plates under sinusoidal loading- Navier's solution and its application to concentrated load - Simply supported rectangular plates under hydrostatic pressure- Thermal stresses in Simply supported rectangular plates

UNIT- IV

Introduction to Shells: Definition and Notation -Classification of shell surfaces - The first quadratic form; Equation to the normal of a surface -The second quadratic form; Principal curvatures, Gauss curvature, and lines of curvature

UNIT -V

Cylindrical Shells: Membrane theory of cylindrical shells - Thermal stresses in cylindrical shells- The use of Stress function; Deflection of a portion of cylindrical shell-Equation of equilibrium cylindrical shells loaded symmetrically with respect to their axis

TEXTBOOKS

1. P.Timoshenko and S.Woinowsky Krieger , *Theory of plates and shells* , 2nd Edition , S McGraw-Hill,2010
2. A.C.Ugural , *Stresses in plates and shells* , McGraw-Hill,1999

REFERENCES

1. T.K.Varadan and K.Bhaskar , *Analysis of plates*, Narosa Publishing House,1999
2. Flugge ,*Stresses in Shells*, Blaisdell Publishing Co,1966
3. G.S.Ramaswamy, *Design and construction of concrete shell roofs*, CBS Publishers & Distributors, 1986.

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I M. TECH - I SEM. (SE)

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PROGRAMME ELECTIVE (PE) – I
(20CE1009) THEORY AND APPLICATIONS OF CEMENT COMPOSITES

COURSE OBJECTIVES

1. *To understand the basic parameters involved in Cement composites*
2. *To understand the mechanisms and types of Composites*
3. *To study the theories underlying analysis of Cement composites*
4. *To study the models pertaining to analysis of cement composites*
5. *To understand the application of Cement composites.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Formulate constitutive behaviour of composite materials - Ferro cement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour*
2. *Classify the materials as per orthotropic and anisotropic behaviour.*
3. *Understand the mechanical properties of materials and able to suggest according to need in the field.*
4. *Estimate strain constants using theories applicable to composite materials.*
5. *Analyse and design structural elements made of cement composites.*
6. *the use of various sources to design cement-based materials with tailor-made properties*

UNIT I

Introduction

Classification and characteristics of composite Materials - Basic terminologies - 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 Continuity - 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 - Polymer Concretes - preparation of reinforcement -casting and curing.

UNIT IV

MECHANICAL PROPERTIES OF CEMENT COMPOSITES

Behaviour of Ferrocement - Fibre Reinforced Concrete in Tension - Compression, Flexure, Shear, Fatigue and Impact - Durability - Corrosion.

UNIT V

APPLICATION OF CEMENT COMPOSITES

FRC and Ferro cement - Housing, Water Storage, Boats and Miscellaneous Structures - Composite Materials - Orthotropic and Anisotropic behaviour - Constitutive relationship - Elastic Constants.

ANALYSIS AND DESIGN OF CEMENT COMPOSITE STRUCTURAL ELEMENTS

Ferro-cement - SIFCON - Fibre Reinforced Concrete.

TEXT BOOKS

1. Neville, A. M. *Properties of Concrete*, Longman Publishers, Fourth Edition, 1995
2. Jones, R. M. "*Mechanics of Composite Materials"* 2 nd Edition, Taylor and Francis, BSP Books, 1998.

REFERENCES

1. Pama, R. P. "Ferrocement - Theory and Applications" IFIC, 1980.
2. Swamy, R. N. "New Concrete Materials", 1st Edition, Blackie, Academic and Professional, Chapman & Hall, 1983.
3. Brandt, A. M. "Cement-based Composites: Materials, Mechanical Properties and Performance", Second Edition, CRC Press LLC, 2017.
4. Balaguru, P. N and Shah S. P., "Fiber-reinforced cement composites", McGraw-Hill, 1992

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PROGRAMME ELECTIVE (PE) – I
(20CE1010)THEORY OF STRUCTURAL STABILITY

COURSE OBJECTIVES

1. *Beam columns with different loads, elastic and inelastic buckling of bars, mathematical treatment of stability problems, torsional buckling of thin walled bars*
2. *Lateral buckling of rectangular cross-sectional beams and buckling of rectangular plates*
3. *To train students in dealing with buckling, and torsion developed for different structures under different support and loading conditions.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Analyze elastic and inelastic buckling of bars*
2. *Understand the various numerical methods for treatment of stability problems and buckling of rectangular cross-sectional beams and plates*
3. *Mathematical treatment of stability problems.*
4. *To acquaint with basic principles relating to stability of structures.*
5. *To acquaint students with the Elastic and in-elastic Buckling behavior of structures.*
6. *An appreciation of the fundamental basis of design rules concerned with structural instability.*

UNIT-I

Beam Columns: Differential equation for beam columns, Beam column with concentrated loads, Continuous lateral load, Couples, Beam column with built in ends, Continuous beams with axial load.

UNIT-II

Elastic Buckling of Bars: Elastic buckling of straight columns, Effect of shear stress on buckling, Eccentrically and laterally loaded columns, Energy methods, buckling of a bar on elastic foundation, buckling of bar with intermediate compressive forces and distributed axial loads, buckling of bars with change in cross section, Effect of shear force on critical Load-Built up columns.

UNIT-III

Inelastic Buckling: Buckling of straight bars, double modulus theory and Tangent modulus theory.

Mathematical Treatment of Stability Problems: Buckling problem, Orthogonality Relation-Ritz method, Timoshenko method and Galerkin‘s method.

UNIT-IV

Torsional Buckling: Pure torsion of thin walled bar of open cross section, Non-uniform torsion of thin walled bars of open cross section, Torsional buckling, Buckling by Torsion and Flexure.

UNIT-V

Lateral Buckling of Simply Supported Beams: Beams of rectangular cross section subjected to pure bending.

Buckling of Simply Supported Rectangular Plates: Derivation of equation of plate subjected to constant compression in two directions and one direction.

TEXT BOOKS

1. Stephen P. Timoshenko & James M. Gere, Dover , *Theory of Elastic Stability,* 2nd edition Publications.
2. Alexander Chajes, *Principles of Structural Stability Theory (Prentice-Hall Civil Engineering and Engineering Mechanic Series),* Prentice Hall Publications,1974.

REFERENCES

1. Structural Stability Theory and Implementation, Reprint Edition of 1987, Wai-Fan Chen, E.M. Lui, PTI Prentice Hall Private Limited.
2. Theory of Beam Columns, Vol I&II, 2nd edition, Atsuta, Chen W.F., Tata McGraw Hill Education Private Limited, New Delhi.
3. Introduction to the Elastic Stability of Structures (Prentice-Hall Civil Engineering and Engineering Mechanic Series), 1st edition, Smites, George, Prentice Hall Publishers.
4. Guide to Stability Design Criteria for Metallic Structures, 6th edition, Ronald D. Ziemian, Wiley Publications

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PROGRAMME ELECTIVE (PE) – II

(20HS0837)ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

COURSE OBJECTIVES

1. *To train the students thoroughly in Mathematical concepts of Interpolation, Curve fitting, Numerical Differentiation and Integration and their applications*
2. *To prepare students for lifelong learning and successful careers using mathematical concepts of Interpolation, Curve fitting, Numerical solution of ordinary differential equations and their applications*
3. *to develop the skill pertinent to the practice of the mathematical concepts including the student's abilities to formulate and modeling the problems, to think creatively and to synthesize information*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Have acquired ability to participate effectively in group discussions*
2. *Have developed ability in writing in various contexts*
3. *Have acquired a proper level of competence for employability*
4. *Have acquired computational skills to solve real world problems in engineering*
5. *Create programming code and present numerical results in an informative way*
6. *Apply numerical methods to obtain approximate solutions to mathematical problems*

UNIT-I

Fundamentals of Numerical Methods:

Error Analysis- Polynomial Approximations.

Interpolation:

Newton's forward and backward interpolation formulae, Gauss forward and backward interpolation formulae and Lagrange's interpolation formulae.

UNIT-II

Curve Fitting:

Fitting of a straight line, Second degree curve, Exponentional curve, Power curve by method of least squares.

UNIT-III

Solution of Nonlinear Algebraic and Transcendental Equations:

The Bisection Method, The Method of False Position, Newton-Raphson Method.

UNIT-IV

Elements of Matrix Algebra:

Solution of Systems of Linear Equations, Eigen value problems.

UNIT-V

Numerical Solution of Ordinary Differential Equations:

Solution by Taylor's series, Picard's Method of successive Approximations, Euler's Method, Runge-Kutta second and fourth order methods, Milne's predictor- corrector method.

TEXT BOOK

1. B.S. Grewal, *Higher Engineering Mathematics*, Khanna publishers 42nd ed.2015.d
2. Peter V.O'Neil, *Advanced Engineering Mathematics*, CENGAGE publisher 7th ed.2011.

REFERENCES

1. Atkinson K.E.,J.*An Introduction to Numerical Analysis*, Wiley and Sons, 1989.
2. Scheid F, *Theory and Problems of Numerical Analysis*, McGraw Hill Book Company, (Shaum Series), 1988.
3. Sastry S.S, *Introductory Methods of Numerical Analysis*, Prentice Hall of India, 1998.

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I M. TECH - I SEM. (SE)

L	T	P	C
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PROGRAMME ELECTIVE (PE) – II
(20CE1011) STRUCTURAL HEALTH MONITORING

COURSE OBJECTIVES

1. *Learn the fundamentals of structural health monitoring.*
2. *Study the various vibration-based techniques for structural health monitoring.*
3. *Learn the structural health monitoring using fiber-optic and Piezoelectric sensors.*
4. *Study the structural health monitoring using electrical resistance and electromagnetic techniques.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Identify the probable reasons for the deterioration of various structural members.*
2. *Diagnosisthedistressinthestructureunderstandingthecausesandfactors.*
3. *Assess the health of structure using static field methods.*
4. *Assess the health of structure using dynamic field tests.*
5. *Use an appropriate health monitoring technique and demolition technique.*
6. *Assess the structural health monitoring using electrical resistance and electromagnetic techniques.*

UNIT – I

Structural Health–Factors affecting Health of Structures–Repair and Rehabilitation – Facets of Maintenance – importance of Maintenance – Various aspects of Inspection – Assessment procedure for evaluating a damaged structure – causes of deterioration

UNIT-II

Structural Health Monitoring–Concepts, Various Measures, Structural Safety in Alteration
Structural Audit–Assessment of Health of Structure- Assessment by NDT equipment‘s- Collapse and Investigation Management, SHM Procedures

UNIT – III

Static Field Testing– Types of Static Tests, Static Testing- Static field testing- types of static tests- loading methods- Behavioral/ Diagnostic tests - Proof tests -Static response measurement – strain gauges, LVDTs, dial gauges - case study

UNIT – IV

Dynamic Field Testing–Types of dynamic tests - Stress history data -Dynamic load allowance tests - Ambient vibration tests – Forced Vibration Method - Dynamic response methods - Impact hammer testing- Shaker testing - Periodic and continuous monitoring

UNIT – V

Introduction to Repairs and Rehabilitations of Structures– Case Studies(Site Visits), piezo–electric materials and others materials, electro mechanical impedance (EMI) technique, adaptations of EMI technique

TEXTBOOKS

1. Hua-Peng Chen, *Structural Health Monitoring of Large Civil Engineering Structures* ,John Wiley & Sons Ltd, Year: 2018
2. Douglas E Adams, *Health Monitoring of Structural Materials and Component -Methods with Applications*, John Wiley and Sons, 2007.

REFERENCES

1. Bhattacharjee, *Concrete Structures Repair Rehabilitation and Retrofitting,* CBS; first edition (2019).
2. J. P. Ou, H. Li and Z. D. Duan, Taylor, *Structural Health Monitoring and Intelligent Infrastructure, Vol1, and* Francis Group, London, UK, 2006
3. Victor Giurglutiu, *Structural Health Monitoring with Wafer Active Sensors*, Academic Press Inc, 2007
4. Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, *Structural Health Monitoring,* John Wiley and Sons, 2006
5. Fu-Kuo, *Chang Structural Health Monitoring: Current Status and Perspectives* CRC Press; 1 edition (24 April 1998)

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I M. TECH - I SEM. (SE)

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PROGRAMME ELECTIVE (PE) – II
(20CE1012) STRUCTURAL OPTIMIZATION

COURSE OBJECTIVES

1. *Introduce concepts of design optimization and review major conventional and modern optimization methods used in structural optimization applications*
2. *Understand the formulation of structural optimization problems*
3. *To get familiarized with the application of linear and non-linear programming to structural optimization*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Use the optimization tools for the design of structures effectively*
2. *Solve problems of linear and non-linear optimization methods*
3. *Solve problems of geometric and dynamic optimization methods*
4. *Use approximate concepts and stochastic optimization methods*
5. *Understand the concept of optimality criteria methods*
6. *To be familiar with genetic algorithm and simulated annealing*

UNIT-I

Introduction Basic Concepts of minimum weight, minimum cost design, objective, function, constraints, classical methods.

UNIT-II

Concept of Structural Optimization Variable, Objective Function- Constraints- Design Space- Feasible & amp; Infeasible- Formulation of optimization Problems.

UNIT-III

Optimization techniques and Algorithms: Linear, Integer, Quadratic, Dynamic and Geometry Programming methods for optimized design of structural elements.

UNIT-IV

Optimization Problems: Optimization by structural theorems- Maxwell, Mitchell and Heyman‘s theorems for trusses and frames, fully stressed design with deflection constraints, optimally criterion methods.

UNIT-V

Structural Engineering Applications: Continuous beams and single storied frames using plastic theory, minimum weight design for truss members, optimization principles to design of R.C structures such as multi-storeyed building, water tanks and bridges.

TEXTBOOKS

1. Singiresu S. Rao, *Engineering Optimization Theory and Practice*, New Age International Publishers, 4th Edition, 2016
2. Haftka, Raphael T, Gürdal, Zafer, *Elements of Structural Optimization*, Springer, 3rd Edition,1992

REFERENCES

1. Gupta P.K and Hira D.S, *Operations Research*, S. Chand and Company Ltd.,2016
2. Andrej Cherkaev, *Variational Methods for Structural Optimization*, Springer
3. J K Sharma, *Operations Research*, Macmillan Publishers India Ltd, 4th Edition ,2009

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(20CE1003) STRUCTURAL DESIGN LAB

COURSE OBJECTIVES

1. *To learn the software applications in structural engineering.*
2. *To learn the analysis of plane, space truss and frames subjected to different types of loadings.*
3. *To draw the detailing of RCC members and to learn the estimations.*
4. *To study the design concepts of steel members like truss, beams and columns*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Design and Detail all the Structural Components of Frame Buildings.*
2. *Design and Detail complete Multi-Storey Frame Buildings*

LIST OF EXPERIMENTS:

1. Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

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(20CE1004) ADVANCED CONCRETE LAB

COURSE OBJECTIVES

The objective of concrete laboratory is to determine the strength characteristics of reinforced cement concrete and conducting NDT.

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Design high grade concrete and study the parameters affecting its performance.*
2. *Conduct Non Destructive Tests on existing concrete structures.*
3. *Apply engineering principles to understand behavior of structural/elements.*
4. *Understand and apply the proper testing requirements for cement.*
5. *Be able to test the behavior of special concretes*
6. *Can understand the effect of various admixtures on the properties of fresh and hardened concrete*

LIST OF EXPERIMENTS/ASSINMENTS

1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
2. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with
3. relevance to a) workability, b) strength
4. NDT on hardened concrete – a) Rebound hammer, b) UPV
5. Total Permeability tests on hardened concrete
6. Behavior of Beams under flexure strength
7. Study on strain characteristics of concrete.

REFERENCES

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.

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(20HS0818) ENGLISH FOR RESEARCH PAPER WRITING

COURSE OBJECTIVES

1. Understand that how to improve your writing skills and level of readability.
2. Learn about what to write in each section.
3. Understand the skills needed when writing a Title.
4. Ensure the good quality of paper at very first-time submission.
5. Understand critical thinking in research writing

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Familiarize students with the key concepts of linguistics and develop awareness of the latest trends in language study.*
2. *Lead to a greater understanding of the human communicative action through an objective study of language.*
3. *Know and appreciate the location of literature within humanities.*
4. *Gain knowledge of research methods in literary studies and advanced knowledge of literature in the English language and literary theory.*
5. *Carry out an independent, limited research project under supervision, in accordance with applicable norms, ideals and conditions for literary research.*
6. *Improve common and basic scholarly requirements of logical and empirical rigor.*

UNIT-I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT-II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts and Introduction.

UNIT-III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV

Key skills needed when writing a Title, key skills needed when writing abstract, key skills needed when writing an Introduction, skills when writing a Review of the Literature.

UNIT-V

Skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills needed when writing the Conclusions.

TEXT BOOKS

1. Goldbort R *Writing for Science,* Yale University Press.2006
2. Day R *How to Write and Publish a Scientific Paper,* Cambridge University Press. 2006

REFERENCES

1. Highman N *Handbook of Writing for the Mathematical Sciences,* SIAM. Highman‘s Books, 1998
2. Adrian Wallwork, *English for Writing Research Papers,* Springer New York Dordrecht. Heidelberg London, 2011.

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(20CE1005) FEM IN STRUCTURAL ENGINEERING

COURSE OBJECTIVES

1. *Implement the basics of FEM related to stresses and strains.*
2. *Solve 1-D & 2-D problems using Finite Element Analysis approach.*
3. *To study the application of the matrix method of analysis to the FEM analysis concept*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Obtain an understanding of the fundamental theory of the FEA method*
2. *Develop the ability to generate the governing FE equations for systems governed by partial differential equations*
3. *Develop shape functions for bar and beam elements*
4. *Understand global, local and natural coordinates*
5. *Understand the formulation of 1-dimensional & 2-dimensional elements*
6. *Compute the stiffness matrix for Iso-parametric elements.*
7. *Analyze plane stress and plane stain problems*

UNIT – I

INTRODUCTION: Concepts of FEM, Steps involved Merits and demerits, Energy principles, Discretization, Rayleigh Ritz method of functional approximation.

PRINCIPLES OF ELASTICITY: Stress equations, Strain displacement relationships in matrix form, Plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT – II

ONE-DIMENSIONAL FEM: Stiffness matrix for beam and bar Elements-Shape functions for 1-D elements, Static condensation of global stiffness matrix, Solution, Initial strain and temperature effects.

UNIT – III

TWO-DIMENSIONAL FEM: Different types of elements for plane stress and plane strain analysis, Displacement models, generalized coordinates, Shape functions, Convergent and compatibility requirements, Geometric invariance, Natural coordinate system, Area and volume coordinates, Generation of element stiffness and nodal load matrices, Static condensation.

UNIT – IV

ISOPERIMETRICFORMULATION: Concept, Different isoperimetric elements for 2-D analysis, Formulation of 4-noded and 8-noded isoperimetric quadrilateral elements, Lagrangian elements - Serendipity elements.

AXI-SYMMETRIC ANALYSIS: Bodies of revolution, Axi-symmetric modeling, Strain displacement relationship, Formulation of axi-symmetric elements.

UNIT – V

THREE-DIMENSIONAL FEM: Different 3-D elements, 3-D strain, displacement relationship, Formation of hexahedral and isoperimetric solid element.

TEXTBOOKS

1. C.S. Krishna Murthy ,*Finite Element Analysis –Theory & Programming*, Tata McGraw-Hill Education Private Limited, New Delhi, 2nd edition
2. Tirupati Chandrupatla, Ashok D. Belegundu, *Introduction to Finite Element Method*, Prentice Hall Publications, 4th edition

REFERENCES

1. S. Md. Jalaludeen ,*Finite element Analysis in Engineering*, Anuradha Publications
2. S.S. Bhavakatti, *Finite Element Analysis* -New age international publishers
3. Robert D. Cook, *Concepts and Applications of Finite Element Analysis*, 4th edition, John Wiley and sons Inc., NewYork.
4. J.N. Reddy ,*An Introduction to Finite Element Method*, Tata McGraw-Hill Publishing Company Limited, NewDelhi, 3rd edition
5. Klaus-Jurgen Bathe ,*Finite Element Procedures*, Prentice Hall, 2nd edition

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(20CE1006) STRUCTURAL DYNAMICS

COURSE OBJECTIVES

1. *Introduce fundamentals of vibrations of SDOF system*
2. *Introduce damped and undamped system*
3. *Introduce free and forced vibration*
4. *Introduce free and forced vibration of MDOF system*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Identify different types of vibrations under SDOF system.*
2. *Evaluate impact of degree of freedom on vibration of structures*
3. *Find response of free and forced vibration (harmonic and periodic) of SDOF system*
4. *Find natural frequency and mode shapes of MDOF system*
5. *Find natural frequency and mode shapes of simple beams with different end conditions*
6. *Determine natural frequency and mode shapes by using stodola method & holzer method*

UNIT – I

INTRODUCTION TO STRUCTURAL DYNAMICS: Introduction - Fundamental Objective of Structural Dynamic Analysis, Types of Prescribed Loadings, Essential Characteristics of a Dynamic Problem, Methods of Discretization, Lumped-Mass Procedure, Continuous Systems, Generalized Displacements, D'Alembert's Principle, Degree of Freedom, Types of Vibrations, Formulation of the Equations of Motion for Single Degree of Freedom (SDOF) Systems

UNIT – II

SINGLE DEGREE OF FREEDOM SYSTEM: Solutions of the Equations of Motion for Free Vibration Response, Undamped and Damped, Critical Damping, Logarithmic Decrement, Forced Vibrations of SDOF systems, Harmonic Excitation, Dynamic Magnification Factor, Bandwidth. Response to harmonic, periodic, impulsive and general dynamic loading, Duhamel integral.

UNIT – III

MULTI DEGREE OF FREEDOM SYSTEM: Selection of the Degree of Freedom, Evaluation of Structural Property Matrices, Formulation of MDOF Equations of Motion, Undamped free vibrations, Solution of Eigen Value Problem for Natural Frequencies and Mode Shapes, Orthogonality Conditions, Analysis of Dynamic Response using Superposition, Normal Coordinates, Uncoupled Equations of Motion, Mode Superposition Procedure.

UNIT – IV

CONTINUOUS SYSTEM: Introduction –Flexural Vibrations of Beams- Elementary Case- Equation of Motion –Analysis of Undamped Free Shapes of Simple Beams with different End Conditions-Principles of application to Continuous Beams.

UNIT – V

PRACTICAL VIBRATION ANALYSIS: Stodola Method, Fundamental Mode Analysis, Analysis of Second and Higher Modes, Holzer Method - Basic Procedure, Transfer Matrix Procedure.

TEXTBOOKS

1. Clough and Penzium, *Dynamics of Structures*, Tata McGraw-Hill Publications, 2nd Edition, 1993
2. Mario Paz, *Structural Dynamics*, CBS Publishers,2nd Edition,2004

REFERENCES

1. AnilK Chopra, *Dynamics of structures*, Prentice-Hall of India Limited, 3rd Edition,2006.
2. S.R.Damodarasamy&S.Kavitha, *Basics of Structural Dynamics and a Seismic Design*, PHI Pvt.Ltd,2009
3. Jagmohan L. Humar, *Dynamics of structures*, CRC Press,3rd Edition, 2012
4. Frenklin& Cheng, *Matrix analysis of structural dynamics*

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PROGRAMME ELECTIVE (PE) – III

(20CE1013) ADVANCED STEEL DESIGN

COURSE EDUCATIONAL OBJECTIVES:

1. *Describe the basic principles bolted and welded connection*
2. *Analyse beam-column connections and design the roof systems subjected to wind action*
3. *Analysis and design of industrial buildings*
4. *Understand and apply the design procedure of steel bridges as per Indian standard codal provisions.*

COURSEOUTCOMES: (COs)

On successful completion of this course, the student shall be able to

1. *Analyze and design simple bolted and welded connections.*
2. *Analyze the strength and design beam-column connections*
3. *Design steel framing system and connections of an industrial building.*
4. *Design roof systems, purlins and bracings subjected to lateral wind loads.*
5. *Design and analyse steel girder and truss bridges as per IS 800:2007.*
6. *They also know the plastic analysis.*

UNIT-I

Connections – Eccentric and Moment Connections: Review of bolted & welded connections and their types – Beam–Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections – Bolted Seat Connections – Bolted Bracket Connections – Welded Framed & bracket
Connections –Moment Resistant Connections.

UNIT-II

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

UNIT-III

Design of Steel Truss Girder Bridges: Types of truss bridges– component parts of truss bridge– economic proportions of trusses – self weight of truss girders, design of bridge compression members – tension members. Wind load on truss girder bridges.

UNIT-IV

Plastic Analysis and Design: Introduction, Shape factor, combined mechanisms – Analysis of portal frames, plastic design of tension & compression members - Theory of plastic bending - Plastichinge -redistribution of moments - failure mechanisms - plastic analysis and design of fixed beams,continuous beams and portal frames by mechanism method – design of straight corner connections &Haunched Connections

UNIT V

Design of Light Gauge Steel Structures: Introduction to Direct Strength Method - Behaviour of Compression Elements - Effective width for load and deflection determination – Behaviour of Unstiffened and Stiffened Elements – Design of webs of beams – Flexural members – Lateral buckling of beams – Shear Lag – Flange Curling – Design of Compression Members – Wall Studs.

TEXTBOOKS:

1. S.K. Duggal, *Design of Steel Structures,* 3rd edition, Tata McGraw-Hill Education Private Limited, NewDelhi.
2. N Subramanian, *Design of Steel Structures,* 2ndedition, Oxford Higher Education, New Delhi.

REFERENCES:

1. K.S. SaiRam,*Design of Steel Structures,* Dorling Kindersley(India),Pvt. Ltd, Pearson Education in SouthAsia.
2. L.S. Negi, *Design of Steel Structures,* 2ndedition, Tata McGraw-Hill Education Private Limited, NewDelhi.
3. (ISI)-No.6,*Structural Engineers Handbook,* Bureauof Indian Standard.
4. Arya and Ajmani, *Design of Steel Structures*,6^{th} edition, New Chand Publishers.

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I M. TECH - II SEM. (SE)

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PROGRAMME ELECTIVE (PE) – III
(20CE1014) DESIGN OF FORMWORK

COURSE OBJECTIVES

1. *To make the student to understand the necessity and types of form work for various structures of Civil Engineering.*
2. *To prepare the student to select proper type of form work, accessories and materials required.*
3. *To train the student to carry out the design the form work for various structural elements like beam, slab, column, wall & foundation and for special structures like shells, retaining walls, bridges, bunkers & water tanks.*
4. *To make the student to understand the working of flying form work like tunnel forms, slip forms and table forms.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Understand the necessity and types of form work for various structures of civil Engineering and select proper type of form work, accessories and materials required.*
2. *Design the form work for various structural elements like beam, slab, column, wall and foundation.*
3. *Design the form work for special structures like shells, retaining walls, bridges, Silos, bunkers & water tank.*
4. *Understand the working of flying form work like tunnel forms, slip forms and table forms.*
5. *The students will able to Judge the form work failures and assess the form work issues in multi – storey building construction through case studies.*
6. *Judge the form work failures from case studies.*

UNIT I
INTRODUCTION TO FORMWORK

Requirements and Selection of Formwork, Formwork Materials-Timber, Plywood, Steel, Aluminum, 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 and Bridges.

UNIT IV
FLYING FORMWORK

Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award. Precast Concrete, Form work Management Issues –Pre- and Post-Award

UNIT V
FORM WORK FAILURES

Causes and Case studies in Formwork Failure, Formwork issues in Multi Story Building Construction.

TEXT BOOKS & CODES:

1. Peurify, *Formwork for Concrete Structures,* McGraw Hill India, 2015.
2. Kumar Neeraj Jha, *Formwork for Concrete Structures,* Tata McGraw Hill Education, 2012.
3. IS 14687: 1999, False work for Concrete Structures – Guidelines; BIS, NewDelhi.

REFERENCES

1. Jha, K.N., Formwork for Concrete Structures, First Edition, McGraw Hill. 2012
2. Austin, C.K., Formwork for concrete, Cleaver - Hume Press Ltd., London, 1996
3. Michael P. Hurst, Construction Press, London and New York., 2003
4. Robert L. Peurifoy and Garold D. Oberiender, Formwork for Concrete Structures, McGraw Hill, 1996.
5. Tudor Dinescu and Constantin Radulescu, Slip Form Techniques, Abacus Press, Turn Bridge Wells, Kent, 2004

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PROGRAMME ELECTIVE (PE) – III
(20CE1015) DESIGN OF HIGH RISESTRUCTURES

COURSE OBJECTIVES

1. *To understand the Design philosophy and essential amenities.*
2. *To understand the Types of loads and Materials for the tall buildings.*
3. *To understand the load distribution in steel and concrete and different resisting systems*
4. *To study the concepts of analysis for displacements and member forces for load transfer system and dynamic analysis*
5. *To understand the research needs in tall building materials, systems and designs..*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Analyze design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.*
2. *Analyses design and detail the RC and Steel Chimney.*
3. *Analyses design and detail the tall buildings subjected to different loading conditions using relevant codes.*
4. *Analysis and design of dynamic approach OF STRUCTURAL DESIGN USING is Code provisions*
5. *Analysis and design of the various horizontal load transfer systems.*
6. *Know the structural systems for future generation buildings.*

UNIT-I

Design of Transmission/ TV Tower, **Mast and Trestles**: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

UNIT-II

Analysis and Design of RC and Steel Chimney: Foundation design for varied soil strata.

UNIT-III

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads,

UNIT-IV

Dynamic approach, structural design considerations and IS code provisions. Fire fighting design provisions.

UNIT-V

Application of software in analysis and design

TEXT BOOKS

1. Bungale S.Taranath, *Design of High Rise Structures: Steel, Concrete,* and Composite Systems - 2016.
2. Feng Fu, *Design Of High Rise Structures* - 2018

REFERENCES

1. Structural Design of Multi-storied Buildings, Varyani U. H., 2nd Ed., South Asian Publishers, New Delhi, 2002.
2. Structural Analysis and Design of Tall Buildings, Taranath B. S., McGraw Hill,1988
3. Design of High Rise Structures -Harry G. Poulos-2017
4. Design Of High Rise Structures -- Analysis And Design Of RC And Steel Chimney Dr. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain - 1992

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PROGRAMME ELECTIVE (PE) – III
(20CE1016) DESIGN OF MASONRY STRUCTURES

COURSE OBJECTIVES
1. *The Masonry Materials, Masonry Design Approaches,*
2. *Flexural Strength of Reinforced Masonry Members, and Prestressed Masonry…etc.*
3. *To understand the push over analyse and their techniques.*

COURSE OUTCOMES *(*COs)
On successful completion of this course, the student shall be able to
1. *Understand the masonry design approaches.*
2. *Analyses Reinforced Masonry Members.*
3. *Determine interactions between members.*
4. *Determine shear strength and ductility of Reinforced Masonry members*
5. *Check the stability of wall*
6. *Perform elastic and in elastic analysis of masonry walls.*

UNIT-I
Introduction

What is masonry?, Plain & Reinforced masonry, A Brief history of masonry construction, Evolution of reinforced masonry, Unreinforced, Reinforced and pre-stressed masonry, Historical development of building codes and standard for masonry combination, advantages and development of load-bearing masonry.

UNIT-II
Masonry materials and Properties

Materials: Bricks and blocks, Mortar, Lime: Non-hydraulic or semi hydraulic, sand, water, plasticized Portland cement mortar, use of pigments, proportioning and strength, choice of unit and mortar, wall tiles, concrete infill and grout, reinforcing and pre-stressing steel. Properties: Compressive strength, Modulus of masonry materials, Thermal effect on masonry, Influence of moisture on masonry: Shrinkage, creep in masonry, effect of workmanship on masonry strength.

UNIT-III
Strength, behaviour and Design of Masonry beams and columns:

Strength & Behaviour: strength of masonry in combined compression and shear, the tensile strength of masonry, stress-strain properties of masonry, Strength Design philosophy, Assumptions in strength design. Design of Beams: Analysis of rectangular sections in flexure modulus of rupture and nominal cracking moment of masonry beams, Design of masonry beams, procedure for flexural design of beams, over reinforced beams, design for shear in reinforced masonry beams, serviceability criteria for beams, service load analysis of reinforced masonry beams, deflections.

UNIT-IV

Design of Masonry columns and Walls: Design of columns:

Behaviour of axially loaded columns, axial strength of reinforced masonry columns, MSJC code provisions for reinforced masonry columns, analysis of masonry columns, design procedure for reinforced masonry columns, columns under combined axial load and bending, shear strength of masonry columns, masonry piers. Design of Walls: Types of masonry walls, Bond patterns in masonry walls, Analysis of walls under gravity and transverse loads, analysis of masonry walls for out- of-plane loads, axial loads on walls subjected to out- of- plane loads, non-load bearing walls.

UNIT-V

Design of Shear walls and Movement in walls

Shear walls: Types of shear walls, rigidity and relative rigidity of shear walls and shear wall with opening, Determination of seismic lateral forces in shear walls, Horizontal diaphragms, analysis of shear walls and diaphragms under direct shear and torsional moment, design of multi-storeyed shear walls, Failure modes of shear walls. Movements in masonry buildings: Causes of movement in building, Horizontal movement in masonry walls, and Vertical movement in masonry walls.

TEXT BOOKS

1. A.W. Hendry, B.P. Sinha, S.R. Davies *Design of Masonry Structures* –2003
2. Narendra Taly, *Design of Masonry Structures.*

REFERENCES

1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2ndEdn,
2. Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., 1994.
3. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.
4. Earthquake-resistant Design of Masonry Buildings, Toma evi Miha, Imperial College Press, 1999.

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PROGRAMME ELECTIVE (PE) – IV
(20CE1017) DESIGN OF ADVANCED CONCRETE STRUCTURES

COURSE OBJECTIVES

1. *Student shall learn about the estimation of crack width, Redistribution of moments in Reinforced concrete beams, design of deep beams, ribbed (voided) slabs, grid floors, flat slabs, plain concrete wall and shear wall using IS 456-2000.*
2. *To understand the short term and long term deflections of beams and slabs.*
3. *To understand the mechanism of flexural cracking and its estimation.*
4. *To understand the design of deep beams, plain concrete walls and shear walls.*
5. *To understand the design of beam column joints.*

COURSE OUTCOMES *(*COs)

On successful completion of this course, the student shall be able to

1. *Estimation of crack width and Redistribution of moments in Reinforced concrete beam.*
2. *Design of deep beams, ribbed (voided) slabs.*
3. *Design of Grid floors, flat slabs.*
4. *Design of plain concrete walls.*
5. *Design of shear walls.*
6. *Design of R.C. beams and slabs to satisfy the limit state of serviceability by determining the short term and long term deflection.*

UNIT-I

Estimation of Crack Width and Redistribution of Moments in Reinforced Concrete Beams: Limit State of cracking, Cracking in R.C. members, Causes, mechanism and effects of cracking, Classification and effect of cracks, Factors affecting crack width in beams, Calculation of crack width, Empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking, Redistribution of moments in a fixed beam and a two-span continuous beam, Advantages and disadvantages of moment redistribution, Moment-Curvature relation of reinforced concrete sections.

UNIT-II

Design of Deep Beams and Corbels: Steps of designing deep beams by IS 456, Detailing of deep beams, Design of corbels.

UNIT-III

Design of Ribbed (Voided) Slabs: Analysis of the ribbed slabs for moment and shears, Design for shear, Deflections, Arrangement of reinforcements.

UNIT-IV

Design of Grid Floors: Introduction, Design of grid floors by IS Code method.

Design of Flat Slabs: Introduction, Advantages and disadvantages of flat slabs, Design of flat slabs using direct design method and equivalent frame method, Design for interior panel.

UNIT-V

Design of Plain Concrete Walls: Braced and unbraced walls, Eccentricities of vertical loads, Empirical design method (walls carrying axial load), Design of wall for In-plane horizontal forces.
Design of Shear Walls: Classification of shear walls, Loads in shear walls, Design of rectangular and flanged shear walls, Moment of resistance of rectangular shear walls.

TEXT BOOKS

1. Advanced Reinforced Concrete Design, 2nd edition, P.C. Varghese, Prentice-Hall of India, Private Ltd., New Delhi.
2. Advanced Reinforced Concrete Design-SI Units, N. Krishna Raju, 3rd edition, CBS Publications, New Delhi.

REFERENCES

1. Illustrated Design of Reinforced Concrete Buildings, 4th edition, Dr. V.L. Shah and Dr. S.R. Karve, Structures Publications, Pune.
2. Reinforced Concrete Design, S. Unnikrishna Pillai and Devdas Menon, 3nd edition, Tata McGraw-Hill Education Private Limited, NewDelhi.
3. Reinforced Concrete. Vol.II, (Advanced Reinforced Concrete), 7th edition, H.J.Shah, Charotar Publishing House Pvt. Ltd., Anand.

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PROGRAMME ELECTIVE (PE) – IV
(20CE1018) ADVANCED DESIGN OF FOUNDATIONS

COURSE OBJECTIVES

1. *Student shall learn about the planning of soil exploration, shallow foundations, pile foundations & coffer dams*
2. *To learn the type of foundations to be recommended for construction of different engineering structures.*
3. *To design different types of foundations and retaining walls*
4. *Design appropriate/suitable foundation system (shallow/Deep) for different structures, that satisfy the allowable bearing capacity and settlement requirements based on soil properties.*

COURSE OUTCOMES *(*COs)

On successful completion of this course, the student shall be able to

1. *Decide the suitability of soil strata for different projects.*
2. *Design shallow foundations deciding the bearing capacity of soil.*
3. *Analyze and design the pile foundation.*
4. *Understand analysis methods for well foundation*
5. *Design deep foundation satisfying bearing capacity and settlement requirements.*
6. *Design and analysis of retaining walls and sheet piles under static loads.*

UNIT-I

Planning of Soil Exploration: for Different Projects, Methods of Subsurface Exploration, and methods of Borings along with Various Penetration Tests.

UNIT-II

Shallow Foundations: Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

Pile Foundations: Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behaviour of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.

UNIT-III

Well Foundation: IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods.

UNIT-IV

Tunnels and Arching in Soils, Pressure Computations around Tunnels.
Open Cuts, Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types.

UNIT-V

Coffer Dams: Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction.

TEXT BOOKS

1. N.P. Kurian, Narosa ,*Design of foundation system*, Publishing House
2. J. E. Bowles, *Foundation Analysis and Design*, McGraw Hill New York

REFERENCES

1. Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th edition, 1997.
2. Das B.M., Shallow Foundations: Bearing capacity and settlement, CRC Press, 1999.
3. Tomlinson M.J., Pile design and construction Practice, Chapman and Hall Publication, 1994.
4. Poulos, H. G. and Davis, F. H., ―Pile Foundation Analysis and Design‖, Wiley and Sons. 1980
5. Analysis and Design of Substructures, Sawmi Saran, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

R20 **M.Tech - SE**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR
(AUTONOMOUS)

I M. TECH - II SEM. (SE)

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PROGRAMME ELECTIVE (PE) – IV
(20CE1019) SOIL STRUCTURE INTERACTION

COURSE OBJECTIVES

1. *The planning of foundation design, subsoil characteristics, linear and non-linear stress-strain characteristics*
2. *Focus is on idealization of soil response to closely represent continuum behavior*
3. *Interaction analysis between the soil-structure with reference to relative stiffness of beams, slabs and piles under different loading conditions*

COURSE OUTCOMES *(*COs)

On successful completion of this course, the student shall be able to

1. *Understand soil structure interaction concept and complexities involved.*
2. *Evaluate soil structure interaction for different types of structure under various conditions of loading and sub soil characteristics.*
3. *Prepare comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.*
4. *Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics*
5. *Evaluate action of group of piles considering stress-strain characteristics of real soils.*
6. *Idealize soil response in order to analyze and design foundation elements subjected to different loadings.*

UNIT-I

Introduction to Soil – Foundation Interaction Problems – Contact Pressure Distribution –Idealized Soil Behaviour, Foundation Behaviour, Interface Behaviour, Analytical techniques.

UNIT-II

Idealized Soil Response Models for the Analysis of Soil – Foundation Interaction – Elastic Models for Soil Behaviour, Winkler model, Elastic Continuum Model, Two –Parametric Elastic Models – Elastic – Plastic and Time Dependent Behaviour of Soil Masses.

UNIT-III

Plane Strain Analysis of an Infinite plate and an Infinitely Long Beam- Bernoulli – Euler Beam Theory and its Modifications – Effect of Shear Deformations- Analysis of beams of finite length- Finite Beams on a Winkler Medium – Method of Initial Parameters – Method of Super Position – Strain Energy Method.

UNIT-IV

Analysis of finite plate – Axi Symmetric Leading of a Circular Plate – Circular Plate Resting on Winkler
Medium – Circular Plate Resting on a Two – parameter elastic.

UNIT-V

The Determination of Soil Parameters, Experimental Investigations and Field Studies Determination- The Measurement and Interpretation of Parameters Encountered in Idealized Soil Models in Relation to Soil—Foundation Behaviour- Contact Stress Measurements Beneath Rigid Footings- Flexible Beams- Mat and Raft Foundations.

TEXT BOOKS

1. Bowels J.E., *Analytical and Computer Methods in Foundation,* McGraw Hill Book Co.,New York,1974.
2. Desai C.S. and Christian J.T., *Numerical Methods in Geotechnical Engineering,* ,McGraw Hill Book Co., NewYork.

REFERENCES

1. Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg.Vol-17
2. Analysis & Design of substructures, Swami Saran, Oxford &IBH Publishing Co. Pvt. Ltd.
3. Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing.

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I M. TECH - II SEM. (SE)

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PROGRAMME ELECTIVE (PE) – IV (20CE1020)
DESIGN OF INDUSTRIAL STRUCTURES

COURSE OBJECTIVES

Student shall learn about the Industrial structures i.e., Chimneys, Water tanks, Silos,

1. *Bunkers, Grid floors…etc.*
2. *To learn the design concepts of steel gantry girder.*
3. *To learn the design of steel bunkers and silos.*
4. *To study the design of water tanks.*
5. *To learn the design of composite slabs.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Explain various types of industrial structures and its design methodologies*
2. *Design bunkers, silo.*
3. *Design chimney and towers.*
4. *Design various industrial floors.*
5. *Design rectangular water tank.*
6. *Design of staging.*

UNIT-I

Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

UNIT-II

Water Tanks – Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchor bolts.

UNIT-III

Design of Pressed Steel Water Tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder –Design of staging and foundation.

UNIT-IV

Design for Material Storage - Stand pipes – Jessen & Rankine's theories – design of silos – design of bunkers

UNIT-V

Design of Industrial Floors - Ground floor – Pavement design – Mezzanine floors – Gratings – chequered plates – composite deck slab

TEXT BOOKS

1. A.R. Santhakumar and S.S. Murthy, _*Transmision Line Structures'*, Tata McGraw-Hill, 1992.
2. Dr. K. Rajagopalan, *'Storage Structures'*, Routledge, 2004.

REFERENCES

1. S.N. Manohar, Tall Chimneys, _Design and Construction', Tata McGraw-Hill, 1985.
2. Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., 2nd Ed., Lakshmi Publishers.

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I M. TECH - II SEM. (SE)

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(20CE1007) STRUCTURAL DYNAMICS LAB (VIRTUAL LAB)

COURSE OBJECTIVES

To strengthen the concepts of structural design through virtual lab

COURSE OUTCOMES (COs)

On successful completion of this course, the student should be able to

1. *To recall the fundamentals of Virtual Smart Structures and Dynamics*
2. *To understand the theory behind an experimental procedure*
3. *To apply the concepts learned to perform experiments*
4. *To study the modes of vibration of simply supported beam and plates*
5. *To understand the Non- destructive evaluation of corrosion rate using sensors.*
6. *To analyse and present the output from the experiments*

LIST OF EXPERIMENTS

Following experiments are conducted in virtual environment:

1. Modes of vibrations of simply supported beam
2. Modes of vibrations of simply supported plate
3. Damage detection and qualitative quantification using electro-mechanical impedance (EMI) Technique.
4. Non- destructive evaluation of corrosion rate
5. Vibration characteristic of aluminium cantilever beam using piezoelectric sensors.
6. Force excitation of steel beam using portable shaker
7. Photogrammetry for displacement measurement.
8. Piezoelectric energy harvesting and structural health monitoring using thin surface bonded PZT patches.

Any six experiments may be conducted through virtual labs

REFERENCE

Virtual Labs - Civil Engineering (vlab.co.in)

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(20HS0838) NUMERICAL ANALYSIS LAB

COURSE OBJECTIVES

1. *To train the students thoroughly in Mathematical concepts of Interpolation, Curve fitting, Numerical Differentiation and Integration and their applications.*
2. *To prepare students for lifelong learning and successful careers using mathematical concepts of Interpolation, Curve fitting, Numerical solution of ordinary differential equations and their applications*
3. *To develop the skill pertinent to the practice of the mathematical concepts including the students abilities to formulate and modeling the problems, to think creatively and to synthesize information*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Find roots of non-linear equations by Bisection method and Newton's method.*
2. *Do curve fitting by least square approximations*
3. *Solve the system of linear equations using gauss - elimination/ gauss-seidal iteration/*
4. *Gauss - Jordan method*
5. *Integrate numerically using trapezoidal and Simpson's rules*
6. *Find numerical solution of ordinary differential equations by Euler's method, Runge-Kutta method.*
7. *Use numerical methods to solve engineering problems.*

SYLLABUS CONTENTS:

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jorden Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations By Euler's Method.
10. Numerical Solution of Ordinary Differential Equations ByRunge- Kutta Method.

TEXTBOOKS

1. Grewal *B.S, Higher Engineering Mathematics*, Khanna publishers, 2017
2. Peter V.O'Neil, *Advanced Engineering Mathematics*, CENGAGE publisher, 2011

REFERENCES

1. Atkinson K.E., J. *An Introduction to Numerical Analysis*, Wiley and Sons, 1989.
2. Scheid F, *Theory and Problems of Numerical Analysis*, McGraw Hill Book Company, (Shaum Series), 1988.
3. Sastry S. S, *Introductory Methods of Numerical Analysis*, Prentice Hall of India, 1998

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I M. TECH - II SEM. (SE)

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(20HS0829) CONSTITUTION OF INDIA

COURSE OBJECTIVES

The objectives of this course:

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

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Explain the key concepts of political economy.*
2. *Analyse the significant developments in the political ideologies.*
3. *Describe the salient features of the constitution of India.*
4. *Interpret, integrate and critically.*
5. *Analyse the political economy of Indian international relations and gain knowledge in Judiciary system.*
6. *Apply their knowledge and skills acquired to write civil service examinations*

UNIT-I

Introduction to Indian Constitution.

UNIT-II

Historical Perspective of the Constitution of India, Salient features and characteristics of the Constitution of India

UNIT-III

Scheme of the fundament rights, The scheme of the Fundamental Duties and its legislative status, The Directive Principles of State Policy – Its importance and implementation, Federal structure and distribution of legislative and financial powers between the Union and States.

UNIT-IV

Parliamentary Form of Government in India – The constitution powers and status of the President of India, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions : National Emergency, President Rule, Financial Emergency

UNIT-V

Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality, Scheme of the Fundamental Right to certain Freedom under Article19, Scope of the

Right to Life and Personal Liberty under Article21.

TEXT BOOK

1. Government of India Ministry of Law and Justice (Legislative Department) *The Constitution of India, 1950 (Bare Act)* Government Publication, 2015
2. Dr. Busi S.N , *Dr. B.R. Ambedkar framing of Indian Constitution*, 1st Edition, Government Publication 2015.

REFERENCES

1. Jain M. P *Indian Constitution Law* Lexis Nexis Publishers 7th Edition.2014
2. Basu D.D *Introduction to the Constitution of India* Lexis Nexis, 8th Edition 2015

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II M. TECH - I SEM. (SE)

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PROFESSIONAL ELECTIVE COURSE (PEC) – V
(20CE1021) DESIGN OF PRESTRESSED CONCRETE STRUCTURES

COURSE OBJECTIVES

Student shall learn about Losses of prestress, Analysis and design of sections for flexure and shear, Bond and anchorage

1. *To understand deflections of prestressed concrete beams, Circular prestressing*
2. *Analysis and design of statically indeterminate structures*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Discuss about the historical development and its principles of prestressed concrete*
2. *Analyze the methods of prestressing and its losses*
3. *Predict the deflection and its importance in Prestressed concrete*
4. *Define flexural, shear & torsional resistance in prestressed concrete*
5. *Discuss and analyze composite members in prestressed concrete*
6. *Analysis and design of statically indeterminate beams*

UNIT- I

Introduction: Historic development – Terminology- General principles of prestressing, pretensioning and post tensioning –Advantages and Applications of prestressed concrete

Methods of Prestressing: Tensioning devices -Methods and Systems of Prestressing– Analysis of post tensioning - Different systems of prestressing like Hoyer System, Magnel System Freyssinet system and Gifford – Udall System

UNIT- II

Losses of Prestress: Estimation of the loss of prestress due to various causes like elastic shortening of concrete, Creep of concrete - Shrinkage of concrete, Relaxation of stress in steel, Slip in anchorage, friction etc.

UNIT -III

Deflections of Prestressed Concrete Members: Importance of control of deflections- factors influencing deflections- Short term deflections of un cracked member – Prediction of long term deflections -Cracked members

UNIT- IV

Flexural, Shear & Torsional Resistance of Concrete Members: Types of flexural failure Strain compatibility method– Code procedures - Shear and principal stresses – Prestressed concrete members in torsion – Design of sections for flexure, Axial Tension, Compression and bending, shear, Bond – Introduction to Limit state Design of Prestressed concrete for flexure.

UNIT -V

Composite sections: Analysis for stresses- Differential shrinkage- Flexural and Shear strength of composite sections

Statically Indeterminate Structures: Advantages and disadvantages of continuity - Layouts for continuous beams -Primary and secondary moments - Elastic analysis of continuous prestressed members - Concordant cable profile - Design of continuous beams

TEXTBOOKS

1. N Krishna Raju, *Prestressed Concrete* 4th edition , Mc Graw-Hill Education Private Limited, New Delhi,2008
2. S. Ramamrutham, *Design of Reinforced Concrete Structures*, Dhanpat Rai Publishing ,2010

REFERENCES

1. T.Y. Lin, Ned H. Burns, *Design of Prestressed Concrete Structures*, 3rdedition,John Willey and Sons ,2019
2. N. Rajagopalan, *Prestressed Concrete*, 2nd edition, Narosa Book Distributors, 2018.
3. Arthur H. Nilson, *Design of Prestressed Concrete*, 2ndedition, Wiley Publications, 1997.

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II M. TECH - I SEM. (SE)

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PROFESSIONAL ELECTIVE COURSE (PEC) – V
(20CE1022) ANALYSIS OF LAMINATED COMPOSITE PLATES

COURSE OBJECTIVES

Students should able to Learn the Composite plates in engineering structure continues to increase dramatically, and there have been equally significant advances in modeling for general and composite materials and structures in particular

1. *To impart knowledge on the behavior of plates and to analyze the problems pertaining to beams on elastic foundation*
2. *To introduce the finite element method and their applications*
3. *To study the various numerical methods for the stress analysis*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Analyze the rectangular composite plates using the analytical solutions*
2. *Analyze the composite plates using advanced finite element method*
3. *Precise the various numerical methods for the stress analysis*
4. *Analyze the discretion of classical plates theory by using spatial approximations*
5. *Develop the finite element method by stiffness matrix & Numerical integration*
6. *Analyze the computation of stresses by using rectangular laminated plates*

UNIT-I

Introduction: Displacement Field Approximations for Classical Laminated Plate Theory (CLPT) and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT

UNIT-II

Governing Equations: Navier Solutions of Cross – Ply and Angle – Ply Laminated Simply-Supported Plates, Determination of Stresses - Levy Solutions for Plates with Other Boundary Conditions

UNIT-III

Finite Element Models of the Classical Plate Theory (CLPT) – Weak Forms – Spatial Approximations – Semi discrete Finite Element Model – Quadrilateral Elements and Numerical Integration – Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT

UNIT-IV

Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses

UNIT-V

Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT. Finite Element Model, Co-Element Formulation, Post Computation of Stresses

TEXT BOOKS

1. Reddy J. N., *Mechanics of Laminated Composites Plates and Shells*, CRC Press
2. *Laminated Composite Plates and Shell,* Ye, Jianqiao

REFERENCES

1**.** Reddy J. N., *Mechanics of Laminated Composites Plates and Shells*, CRC Press

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II M. TECH - I SEM. (SE)

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PROFESSIONAL ELECTIVE COURSE (PEC) – V

(20CE1023) FRACTURE MECHANICS OF CONCRETE STRUCTURES

COURSE OBJECTIVES

1. To understand the basic parameters involved in Fracture Mechanics
2. To understand the mechanisms and types of Fracture
3. To study the theories underlying Fracture analysis of structures
4. To study the models pertaining to Fracture analysis of structures

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Describe the Basics Concepts of Fracture Mechanics &its Mechanism*
2. *Identify and classify cracking of concrete structures based on fracture mechanics.*
3. *Perform Stresses at Crack Tip and different Criteria involved*
4. *Explain the fatigue and fatigue crack grow rate*
5. *Describe the basic concepts of CTOD and COD*
6. *Explain the fracture resistance of materials*

UNIT-I

Fracture Mechanics Principles: Introduction, Mechanisms of Fracture, a crack in structure, the Griffith's criterion, modern design – strengths, stiffness and toughness. Stress intensity approach

UNIT-II

Stress Analysis for Members with Cracks: Linear elastic fracture mechanics, Crack tip stress and deformations, Relation between stress intensity factor and fracture toughness, Stress intensity-based solutions. Crack tip plastic zone estimation, Plane stress and plane strain concepts. The Dugdale approach, the thickness effect

UNIT-III

Elastic – Plastic Fracture Mechanics: Introduction, Elasto–plastic factor criteria, crack resistance curve, J-integral, Crack opening displacement, crack tip opening displacement. Importance of R-curve in fracture mechanics, experimental determination of J-integral, COD and CTOD

UNIT-IV

Fatigue and Fatigue Crack Growth Rate: Fatigue loading, various stages of crack propagation, the load spectrum, approximation of the stress spectrum, the crack growth integration, fatigue crack growth laws

UNIT-V

Fracture Resistance of Materials: Fracture criteria, fatigue cracking criteria, effect of alloying and second phase particles, effect of processing and anisotropy, effect of temperature, closure

TEXT BOOKS

1. David Broek – Sijthoff & Noordhoff – Alphen aan den Rijn – *Elementary engineering fracture mechanics* – Netherlands
2. Suri C. T. and Jin Z.H., *Fracture Mechanics*, 1st Edition, Elsevier Academic Press,2012

REFERENCES

1. Fracture mechanics – applications to concrete – Edited by Victor, C.Li, & Z.P.Bazant– ACI SP118.
2. Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi
3. Venkataraman and Patel ‒Structural Mechanics with introduction to Elasticity and Plasticity‖ – McGraw Hill,1990
4. Shanes – ‒Introduction to Solid Mechanics – II Edition, PH,1989
5. Fracture mechanics of concrete structures – Theory and applications – Rilem Report – Edited by L. Elfgreen – Chapman and Hall – 1989

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II M. TECH - I SEM. (SE)

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PROFESSIONAL ELECTIVE COURSE (PEC) – V
(20CE1024) DESIGN OF PLATES AND SHELLS

COURSE OBJECTIVES

1. Understand various types of spatial structures
2. Analyze spatial structures by various methods
3. Apply knowledge of analytical solution in problem solving
4. Design and detailing of spatial structures

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to
1. Analyze and design thin plates with defection
2. Analyze and design of laterally loaded, uniformly loaded circular plates
3. Analyze and design thin shells using approximate solutions
4. Analyze different types of plates (rectangular and circular) under different boundary connections by various classical methods and approximate methods
5. Analyze and design of prismatic folded plate system
6. Analyze and design of doubly curved shells

UNIT I

Thin Plates with Small Deflection: Laterally loaded thin plates – governing differential equations - Simply supported and fixed boundary conditions

UNIT II

Design of Circular Plates: Symmetrical bending of Circular plates - Differential equation for symmetricalbendingoflaterallyloadedcircularplates-uniformlyloadedcircularplates-Circular plates with circular hole at center - circular plate concentrically loaded

UNIT III

Thin Shells: Geometry of shells - Detailing of Reinforcement in shells - edge beams and transfer beam Structural actions - Membrane theory

UNIT IV

Design of Shells: Cylindrical shells - Design of spherical dome –Folded plate structures - Design of folded plates

UNIT V

Design of Doubly Curved Shells: Analysis and design of doubly curved shells – Elliptic paraboloid - Conoid and hyperbolic paraboloid roofs

TEXT BOOKS

1. Timoshenko and Woinowsky-Krieger S.,*Theory of Plates and Shells*,, Tata Mc GrawHill Edition, 2010
2. G.S. Ramaswamy, *Design and Construction of Shell Structures*, CBS Publishers, New Delhi,1996

REFERENCES

1. Jawad Maan H., *Design of Plate and Shell Structures,* Springer Science
2. Szllard, R. *Theory of Analysis of Plates*, Prentice HallInc
3. K Chandrashekhara, ‒*Analysis of thin concrete shells*‖, New Age International,1995
4. Billington D. P., *Thin Shell Concrete Structures,* McGraw-Hill, 1995

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II M. TECH - I SEM. (SE)

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OPEN ELECTIVE COURSE – I
(20HS0824) BUSINESS ANALYTICS

COURSE OBJECTIVES

1. *Understand the concepts and methods of business analytics*
2. *To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making*
3. *To become familiar with processes needed to develop, report, and analyze business data*

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization*
2. *Design alternatives to solve business problems utilizing quantitative analysis, critical thinking and sound ethical decision making*
3. *Summarize, process and transform data for obtaining meaningful conclusions*
4. *Interpret data using latest data analytics tools to address organizational problems*
5. *Organize and critically apply the concepts and methods of business analytics*
6. *Assess decision problems and build models for creating solutions using business analytical tools*

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 with the 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. S. Christian Albright & Wayne Winston, *Business Analytics: Data analysis & Decision making*, 6th Edition, Cengage Learning, 2019
2. James Evans, *Business Analytics*, 2nd Edition, Pearson Education, 2013

REFERENCES

1. Marc J. Schniederjans, Dara, G. Schniederjans, Christopher M. Starkey, *Business analytics Principles, Concepts, and Applications*,1st Edition, Pearson FT Press, 2014
2. Seema Acharya & RN Prasad, *Fundamentals of Business Analytics*, 2ndEdition,WILEY
3. GalitShmueli, Peter C. Bruce, Nitin R. Patel, *Data mining for business analytics: Concepts, Techniques and Applications in Microsoft Office Excel with XLMiner*, WILEY, 2008

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II M. TECH - I SEM. (SE)

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OPEN ELECTIVE COURSE – I
(20ME3026) INDUSTRIAL SAFETY

COURSE OBJECTIVES

1. *Learn about Mechanical and electrical hazards.*
2. *Understand the Fundamentals of Maintenance Engineering.*
3. *Identify the importance of Wear, Corrosion and their prevention.*
4. *Explain the Fault Tracing concept of various instruments used.*
5. *Know the terms Periodic and preventive maintenance.*

COURSE OUTCOMES

On successful successful completion of this course the student will be able to

1. *Explain the Points of factories act 1948 for health and safety.*
2. *Define the term Cost & its relation with replacement economy.*
3. *Recognize the Concept of Wear, Corrosion and its Prevention methods.*
4. *Understand the Concept of sequence of fault finding activities and the importance of decision tree.*
5. *Elaborate the importance of scheduled preventive maintenance of mechanical and electrical equipment.*
6. *Distinguish between Periodic and Preventive maintenance of equipments.*

UNIT-I

Industrial Safety: Accident, causes, types, results and control, mechanical and electricalhazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II

Fundamentals Of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III

Wear And Corrosion And Their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment‘s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V

Periodic And Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

TEXT BOOKS

1. Higgins & Morrow, *Maintenance Engineering Handbook,* Da Information Services.
2. H. P. Garg, *Maintenance Engineering,* S. Chand and Company.

REFERENCES

1. Audels, *Pump-hydraulic Compressors*, Mcgrew Hill Publication.
2. Winterkorn, *Foundation Engineering Handbook,* Chapman & Hall London.

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M.Tech - SE

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR

(AUTONOMOUS)

II M. TECH - I SEM. (SE)

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OPEN ELECTIVE COURSE – I

(20ME3027) ADVANCES IN OPERATIONS RESEARCH

COURSE OBJECTIVES:

1. Enumerate the fundamentals of Linear Programming
2. Learn classical optimization techniques
3. Develop the best strategy of Game and identifying the Queuing theory.
4. Understand about sequence and optimum Duration of the Project
5. Develop the importance of Replacement models and Inventory control

COURSE OUTCOMES (COs)

On successful completion of this course, the student shall be able to

1. *On completion of this course, the student shall be able to*
2. *Create mathematical models of the real time situations.*
3. *Implement Transportation and Assignment problems to solve in real time industry*
4. *Choose the best strategy of Game and capable of identifying the suitable queuing theory*
5. *Enumerate fundamental techniques and apply it to solve various optimization areas*
6. *Investigate, study, Apply knowledge in Replacement models and*
7. *Understand the Inventory control Models*

UNIT-I

Introduction to OR and Linear Programming-OR definition–Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Degeneracy - Problems

UNIT-II

Transportation Problem – Formulation; Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel_s Approximation Method, Modified Distribution (MODI) Method, Unbalanced Transportation - Problems

Assignment Problem – Formulation, Optimal Solution -Traveling Salesman problem.

UNIT-III

Game Theory - Introduction – Minimax (Maxi mini) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy and Mixed Strategies – 2 X 2 Games – Dominance Principle.

Queuing Theory- Introduction to queuing system–Service Channel, Arrival Pattern, Size of Population, Service Pattern, Queue Discipline, Customer Behavior, Probability Distribution-Birth & Death Process, Simple Problems on Single Service channel only.

UNIT-IV

Sequencing –Terminology - Johnson‘s Algorithm for n-jobs x 2 Machines and n-jobs x 3 machines models - Problems

PERT & CPM: Introduction, Difference between PERT and CPM, Terminology- Activities, Events, Predecessor, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float; CPM-Deterministic Model; PERT- Probabilistic Model, Critical Path, Optimal Project Duration, Least Possible Project Duration- Problems.

UNIT-V

Replacement– Failure Mechanism of Items**,** Types of Replacements- Individual Replacement policy, Group Replacement policy, Replacement of items fail suddenly – problems

Inventory - Necessity for maintaining inventory, inventory costs, classification of fixed order quantity inventory models, selective inventory management techniques.

TEXT BOOKS:

1. D. SHARMA*Operations Research* KNRN Publications. 17th edition 2015
2. Hamdy A Taha , *Operations Research* Pearson Publications, 9 th edition 2015

REFERENCES BOOKS

1. Manohar Mahajan *Operations Research,* DhanpatRai & Co 2016
2. Er. Premkumar Guptha & Dr. D. S. Hira *Operations Research,* Schand publications 2012.
3. R Panneerselvam *Operations Research* PHI, 2nd edition, 2012.

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M.Tech - SE

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II M. TECH - I SEM. (SE)

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OPEN ELECTIVE COURSE – I
(20ME3028) COMPOSITE MATERIALS

COURSE OBJECTIVES

1. *Understand the mechanical behavior of composite materials.*
2. *Get an overview of the methods of manufacturing composite materials.*
3. *Know the fundamentals of composite materials.*
4. *Understand the fabrication and process of composites.*
5. *Recognize the applications of composite materials.*
6. *Understand the mechanics of composites in the manufacturing process.*

COURSE OUTCOMES

On successful Completion of this course the student will be able to

1. *Explain the Fundamental concept of composite materials.*
2. *Classify different types of composite materials.*
3. *Describe the Fabrication and processing of composite materials.*
4. *Illustrate the Methods of preparation of Metal matrix Composites and polymer matrix composites.*
5. *Discuss about the Mechanical behavior of composite materials.*
6. *Explain the application of composite materials.*

UNIT-I

Introduction To Composites: Fundamentals of composites – need– enhancement of properties – classifications –Introduction to Reinforcement composites–types, Applications- Fiber production techniques for glass, carbon and ceramic fibers –Resin materials-Types.

UNIT-II

Polymer Matrix Composites: Fabrication of PMC‘s ,Fabrication of Fibers, Plastic Fiber Forms, Pre-pregs, Molding Compounds-Processes, Lay-Ups, Filament Winding, Pultrusion, and Recycling-Matrix – Reinforcement Interface, Wettability.

UNIT-III

MMC&CMC: Fabrication of MMC‘S, Liquid Infiltration- Casting, Solid State Processes-Diffusion Bonding &In Situ Technique- Fabrication of CMC‘s, Hot-Pressing, Infiltration, In Situ Chemical reaction Techniques. CVD & CVI, Sol-gel, Carbon Carbon composites.

UNIT-IV

Mechanics of Composites: Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, Von -Mises Yield criterion for isotropic materials, generalized Hill‘s criterion for anisotropic materials, Tsai-Hill‘s criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

UNIT-V

Applications Of Composites: Applications of advanced composite materials- Environmental effects in Composites, Green composites, Synthesis and Properties of Nano composites. Surface Composites & Surface metal matrix composites: Need, Synthesis, Properties and applications.

TEXT BOOKS

1. Mathews F. L. and Rawlings R. D., *Composite Materials: Engineering and Science*, Chapman and Hall, London, England, 1st Edition, 1994.
2. Chawla K. K., *Composite materials*, Springer – Verlag, 2nd Edition, 1998.

REFERENCES

1. Clyne, T. W. and Withers, P. J., *Introduction to Metal Matrix Composites*, Cambridge University Press, 1993.
2. Strong, A.B., *Fundamentals of Composite Manufacturing*, SME, 2nd Edition, 1989.
3. Sharma, S.C., *Composite materials*, Narosa Publications, 4th Edition, 2000.

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M.Tech - SE

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II M. TECH - I SEM. (SE)

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OPEN ELECTIVE COURSE – I
(20EE2128) WASTE TO ENERGY

COURSE OBJECTIVES

1. To learn different types of waste materials available for energy conversion
2. To understand Pyrolytic oil and gases
3. To introduce gasification methods for biomass
4. To learn concepts of biomass resources, combustion types and biogas plant technology

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to
1. Analyse agro based, forest residue and industrial waste conversion processes.
2. Manufacture of Pyrolytic oils and gases
3. Manufacture of charcoal, yields and applications
4. Understand various types of gasifiers operation
5. Understand inclined and fluidized bed combustors operation
6. Understand types of biogas plants and biomass energy programme in India

UNIT- I

Introduction to Energy from waste: Classification of waste as fuel –Agro based- Forest residue- Industrial waste- MSW- conversion devices- Incinerators- Gasifiers- Digestors.

UNIT- II

Bio-mass 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- construction and operation- Gasifier burner arrangement for thermal heating.

UNIT- IV

Biomass Combustion: Biomass stoves- Types- Inclined combustors- Fluidized bed combustors- construction and operation of above biomass combustors.

UNIT- V

Properties of Biogas: Biogas plant Technology and status – Biomass resources and their classification- Biomass conversion processes- thermo chemical conversion –Direct Combustion- Biomass gasification- Pyrolysis and liquefaction – bio-chemical conversion-anaerobic digestion- Types of biogas plants- applications-Biomass Energy Programme in India.

TEXT BOOKS

1. Desai Ashok V. *Non-Conventional Energy,* Wiley Eastern Ltd 1990.
2. Khandelwal K.C. and Mahdi SS, *Biogas Technology* – A Practical Hand Book –Vol I &II. McGraw Hill Publishing Co Ltd., 1983.

REFERENCES

1. Food, Feed and Fuel from Biomass – Challal D.S., IBH Publishing Co Pvt Ltd., 1991.
2. Non-conventional Energy Sourcrs- GD Roy, Khanna Publishers, 6th Edition
3.Biomass & Bioenergy – Khahid Rehman Hekeem, Mohammad Jawald., Umar Rashid- Springer International Publishing Ltd.