MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
Madanapalle

(UGC-AUTONOMOUS)

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MASTER OF TECHNOLOGY

STRUCTURAL ENGINEERING

ACADEMIC REGULATIONS (R18)
COURSE STRUCTURE
&
DETAILED SYLLABI
For the students admitted to

Master of Technology in Structural Engineering from the academic year 2018-19 Batches onwards

M. Tech. Regular Two Year P. G. Degree Course

CURRICULUM STRUCTURE

I Year I Semester

Sl.No.	Course Code	Name of the Course	Credits
1	18SEP101	Advanced Structural Analysis	3
2	18SEP102	Theory of Elasticity and Plasticity	3
	Discipline Elective - I		
3	18SEP401	Advanced Steel Design	3
	18SEP402	Theory of Thin Plates and Shells	
	18SEP403	Theory and Application of Cement Composites	
	Discipline Elective - II		
4	18SEP404	Design of Masonry Structures	3
	18SEP405	Structural Health Monitoring	
	18SEP406	Structural Optimization	
5	18SEP201	Structural Design Laboratory	2
6	18SEP202	Advanced Concrete Laboratory	2
7	18RMP101	Research Methodology and IPR	2
		Audit Course - I	
8	18AUP901	Disaster Management	0
	18AUP902	Sanskrit for Technical Knowledge	
	18AUP903	Constitution of India	
	18AUP904	Pedagogy Studies	
		Total Credits	18

I Year II Semester

Sl.No.	Course Code	Name of the Course	Credits
1	18SEP103	Finite Element Method	3
2	18SEP104	Structural Dynamics	3
	Discipline Elective - III		
3	18SEP407	Design of Advanced Concrete Structures	3
	18SEP408	Analytical and Numerical Methods for Structural Engineering	
	18SEP409	Earthquake Resistant Design of Structures	
	18SEP410	Advanced Design of Foundations	
	Discipline Elective - IV		
4	18SEP411	Theory of Structural Stability	3
	18SEP412	Design of Industrial Structures	
	18SEP413	Design of High Rise Structures	
	18SEP414	Soil Structure Interaction	
5	18SEP203	Model Testing Laboratory	2
6	18SEP204	Numerical Analysis Laboratory	2
7	18SEP701	Mini Project	2
		Audit Course - II	
8	18AUP905	English for Research Paper Writing	0
	18AUP906	Value Education	
	18AUP907	Stress Management by Yoga	
	18AUP908	Personality Development through Life Enlightenment Skills	
		Total Credits	18

II Year I Semester

Sl.No.	Course Code	Name of the Course	Credits
	Discipline Elective - V		
1	18SEP415	Design of Pre-stressed Concrete	3
	18SEP416	Fracture Mechanics of Concrete Structures	
	18SEP417	Design of Plates and Shells	
	18SEP418	Analysis of Laminated Composite Plates	
	Open Elective		
2	18OEP301	Business Analytics	3
	18OEP302	Industrial Safety	
	18OEP303	Operations Research	
	18OEP304	Cost Management of Engineering Projects	
	18OEP305	Composite Materials	
	18OEP306	Waste to Energy	
3	18SEP702	Dissertation Phase I	10
		Total Credits	16

II Year II Semester

Sl.No.	Course Code	Name of the Course	Credits
1	18SEP703	Dissertation Phase II	16
		Total Credits	16

18SEP101 ADVANCED STRUCTURAL ANALYSIS

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

Determination of static and kinematic indeterminacies of different beams, frames and trusses, matrix methods of analysis for analysis of continuous beams, two dimensional single bay portal frames and pin jointed trusses- formulation of global stiffness and flexibility matrix from element matrix.

Course Objectives

1. To understand the static and kinematic indeterminacy of the structures.
2. To understand the concepts of matrix methods of analysis of structures.
3. To understand the analysis of continuous beams.
4. To understand the analysis of rigid and pin jointed frames.

UNIT I

INTRODUCTION TO MATRIX METHODS OF ANALYSIS

Determination of static and kinematic indeterminacies of two-dimensional and three-dimensional portal frames, pin jointed trusses and hybrid frames-coordinate systems - structural idealization - 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

Analysis of continuous beams with maximum of three spans under different support conditions subjected to concentrated loads, UDL and moments - internal hinges - using Stiffness and Flexibility methods.

UNIT III

ANALYSIS OF TWO DIMENSIONAL PORTAL FRAMES

Analysis of two dimensional single bay portal frames under different support conditions subjected to concentrated loads, UDL - using Stiffness and Flexibility methods.

UNIT IV

ANALYSIS OF TWO-DIMENSIONAL PIN-JOINTED TRUSSES

Computation of member forces and joint displacements of pin jointed trusses- using Stiffness and flexibility methods.

UNIT V

TRANSFORMATION OF COORDINATES

Local and Global co-ordinate systems -transformation of matrices from local to global coordinates of element stiffness matrix-direct stiffness method of analysis-assembly of global stiffness matrix from element stiffness matrices.

Course Outcomes

After completion of the course the students will be able to

1. Distinguish between determinate and indeterminate structures.
2. Identify the suitable method of analysis for analysis of indeterminate structures.
3. Apply suitable matrix method for analysis for continuous beams.
4. Apply suitable matrix method for analysis for rigid jointed frames.
5. Apply suitable matrix method for analysis for pin jointed frames.

Text Books

1. Pundit & Gupta, Structural Analysis, Tata McGraw Hill Publications
2. C.S.Reddy, Structural Analysis, Tata McGraw Hill Publications

Reference Books

1. Cotes, R.C., Couties, M.G., and Kong, F.K., Structural Analysis, Chapman & Hall India, Madras
2. John L.Meek., Matrix Structural Analysis, MC Graw Hill Book Company.
3. R.C.Hibbeler, Structural Analysis, Pearson Education
4. C.K.Wang, Indeterminate Structural Analysis, McGraw Hill Publishers

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP102 THEORY OF ELASTICITY AND PLASTICITY

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Objectives

1. To make the students to understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.
2. To enhance the competency level and develop the self-confidence through quality assignments in theory of Elasticity.
3. To inculcate the habit of researching and practicing in the field of elasticity.
4. To understand the concepts of plasticity, yield criteria, plastic flow etc.,

UNIT I

INTRODUCTION TO ELASTICITY:
Elasticity -Notation for forces and stresses-Components of stresses -components of strain -Hooke's law.

PLANE STRESS AND PLANE STRAIN:
Plane stress-plane strain- Equations of equilibrium- Boundary conditions- Compatibility equations- Two dimensional Problems in-Cartesian-Coordinates. Plane Stress and Plane Strain Problems.

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.

TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES:
General solution, Equations of equilibrium and compatibility conditions in Polar coordinates-Axi-symmetrical problems -bending of curved bar. General solution of two dimensional problem in polar coordinates- Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

UNIT III

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS:
Principal stresses and strains for three dimensional element -Equations of equilibrium and compatibility conditions for 3D problems in Cartesian co-ordinates -Transformation of stresses and strains.

UNIT IV

TORSION OF PRISMATIC BARS:
General solution of problems by St. Venant's method-Prandtl's Membrane analogy - Torsion of circular and non-circular (elliptic and rectangular) sections - Torsion of thin rectangular section and hollow thin walled section - Single and multi-celled sections.

UNIT V

THEORY OF PLASTICITY:
Introduction to plasticity- Stress-strain curve -Plastic analysis- Theories of strength and failure - Yield Criteria - Yield Surface - Plastic Flow - Plastic Work - Plastic Potential - Strain hardening.

Course Outcomes

After the completion of the course the students will be able to

1. Apply numerical methods to solve continuum problems.
2. Solve the problems of 3-D elasticity with confidence.
3. Can independently work with the problems of 2-D elasticity in Cartesian/Polar Coordinates.
4. Familiarized with the use of Airy's stress function in 2-D problems of elasticity in Cartesian/Polar Coordinates.
5. Equipped with the knowledge of various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion.

Text Books

1. Timoshenko.S and Goodier, (2000), Theory of Elasticity, MC Graw Hill company.
2. Sadhu Singh., (2004), Theory of Plasticity, DhanpatRai sons Private Limited, New Delhi

Reference Books

1. Advanced Mechanics of Solids, SrinathL.S., Tata McGraw Hill,2000.
2. Solid Mechanics, Kazimis. M. A., Tata McGraw Hill,1994.
3. Lubliner, J., Plasticity Theory, Mac Millan Publishing Co., New York.
4. Y.C.Fung., Foundations of Solid Mechanics, Prentice Hall India

Mode of Evaluation: Assignments, Mid Examinations, End Examination

DISCIPLINE ELECTIVE I

18SEP401 ADVANCED STEEL DESIGN

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Objectives

1. To learn the preliminary design criterion of different structures.
2. To analyze and design various components in steel structures under different loads.
3. To understand about types gantry girders and its design methodologies.
4. To understand theorems of plastic analysis and principles of optimization in structural design.

UNIT I

DESIGN OF SELF SUPPORTING STACKS/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

PLASTIC ANALYSIS AND DESIGN OF STRUCTURES
Introduction - Shape factors - Mechanisms - Plastic hinge - Analysis of beams and portal frames - Design of fixed and continuous beams.

ANALYSIS OF MULTI-STOREY FRAMES USING APPROXIMATE METHODS
Cantilever method - Portal method - Analysis of multi-storey frames using substitute frame method.

UNIT III

INDUSTRIAL BUILDINGS
Classification of structures-wind load analysis, Industrial buildings-braced and unbraced - Gable frames with gantry-Rigid industrial frames.

UNIT IV

TOWERS
Basic structural configurations - free standing and guyed towers -Loads on towers - wind loads - foundation design - design criteria for different configurations and transmission line towers.

UNIT V

PRINCIPLES OF OPTIMIZATION IN STRUCTURAL DESIGN
Application to simple - rectangular portal frame - minimum weight design. Fire resistant design-Fatigue resistant design.

Course Outcomes

Upon completion of the course the student will be able to

1. Solve the problems on wind load analysis and plastic analysis.
2. Design self-supporting stacks and chimneys for industrial buildings.
3. Analyse multi-storey frames using approximate methods and able to design gantry girder to resist all types of loads.
4. Analyse portal frames by using plastic design methodologies.
5. Apply principles of optimization in structural design.

Text Books

1. Vazarani and Ratwani, Design of Steel Structures, Khanna Publishers.
2. Punmia, B.C., Analysis of Steel Structure.
3. Galyord and Galyord (2012), Design of Steel Structures. Tata McGraw Hill, Education.

Reference Books

1. B.G.Neal, Plastic analysis of structures, John Wiley & Sons, Inc.
2. Baker, Steel Skeleton V.I and II, the Cambridge University Press.
3. Timoshenko, Strength of materials (Vol-II), CBS Publications.
4. Pinfold, Analysis of Steel Structure.
5. Analysis of Steel Structure by Relevant IS codes.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP402 THEORY OF THIN PLATES AND SHELLS

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

This course covers design and analysis of plates and shells using different methods under different conditions using various theories.

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 study the concepts of orthotropic plates, numerical, approximate methods, large deflection theory of plates.
5. To understand the analytical methods for the solution of shells.
6. To apply the numerical techniques and tools for the complex problems in 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.

UNIT II:

Pure bending of plates - Slopes - Curvatures of bent plates - Relations between bending moments and curvature - Particular cases - Strain energy in pure bending - Limitations. Symmetrical bending of circular plates: Differential equation - Boundary conditions.

UNIT III

Simply supported rectangular plates under sinusoidal loading Naviers solution and its application to concentrated load - Levy's solution for uniformly distributed load or hydrostatic pressure.

UNIT IV

Introduction to Shells Parametric representation of a surface; The first quadratic form; Equation to the normal of a surface; The second quadratic form; Principal curvatures, Gauss curvature, and lines of curvature; Some definitions; Classification of shell surfaces.

UNIT V

Cylindrical shells Membrane theory of cylindrical shells; bending theory of cylindrical shells loaded symmetrically -Approximate solution by Schorer's method, Beam method of analysis.

Course Outcomes

After the completion of the course the students will be able to

1. Understand behaviour of plates for UDL, hydrostatic, concentrated load cases.
2. Perform cylindrical bending of long rectangular plates, pure bending of rectangular and circular plates, and deflection theories.
3. Understand bending theory for structural behaviour of plates.
4. Implement numerical and approximate methods for plate problems.
5. Use analytical methods for the solution of shells.
6. Apply the numerical techniques and tools for the complex problems in shells.

Text Books

1. Theory of plates and shells by S.P.Timoshenko and S.Woinowsky-Krieger, McGraw-Hill, 1959.
2. Stresses in plates and shells by A.C.Ugural, McGraw-Hill, 1999.

Reference Books

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

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP403 THEORY AND APPLICATION OF CEMENT COMPOSITES

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

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.

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 Ferrocement - 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

Ferrocement - SIFCON - Fibre Reinforced Concrete.

Course Outcomes

At the end of the course, students will be able to

1. Formulate constitutive behaviour of composite materials - Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour.
2. Classify the materials as per orthotropic and anisotropic behaviour.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyse and design structural elements made of cement composites.

Text Books

1. Jones, R. M. "Mechanics of Composite Materials" 2nd Edition, Taylor and Francis, BSP Books, 1998.

Reference Books

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.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

DISCIPLINE ELECTIVE II

18SEP404 DESIGN OF MASONRY STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

This course includes the basic of Masonry Structures including its types and classifications. Further, in this course, strength and stability of Masonry structures have been discussed along with design considerations, loads and the complete procedure for design. Reinforced masonry and the composite action of Masonry walls have also been discussed.

UNIT I

MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION
Brick, stone and block masonry units - strength, modulus of elasticity and water absorption of masonry materials -classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks.

UNIT II

STRENGTH AND STABILITY
Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

PERMISSIBLE STRESSES:
Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

UNIT III

DESIGN CONSIDERATIONS
Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels.

LOAD CONSIDERATIONS FOR MASONRY:
Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, freestanding wall.

UNIT IV

DESIGN OF MASONRY WALLS
Design of load bearing masonry for building up to 3 storeys using IS : 1905 and SP : 20 procedure.

UNIT V

REINFORCED MASONRY
Application, flexural and compression elements, shear walls.

MASONRY WALLS IN COMPOSITE ACTION
Composite wall-beam elements, infilled frames.

Course Outcomes

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

1. Identify the types of Masonry structures.
2. Identify the materials used in Masonry structures.
3. Apply analytical skills to assess strength and stability of Masonry structures.
4. Analyze and Design Masonry structures.
5. Understand codal provisions pertaining to Masonry structures.

Text Books

1. A.W. Hendry, B.P. Sinha, S.R. Davies, Design of Masonry Structures, Third Edition, Tata McGraw Hill Publications
2. Narendra Taly, Design of Reinforced Masonry Structures, 2nd Edition.

Reference Books

1. Richard E. Klingner, Masonry Structural Design, 2nd Edition, Jennifer Eisenhauer Tanner.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP405 STRUCTURAL HEALTH MONITORING

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

This course examines the various distress and damages to concrete and masonry structures. This course covers the importance of maintenance of structures, types and properties of repair materials, etc. Also, this course covers how to assess damage to structures using various repair techniques. This course has been designed with an aim to give the students an insight into the subject of structural health monitoring, concrete repair, its protection and strengthening.

Course Objectives

1. To learn various distress and damages to concrete and masonry structures
2. To understand the importance of maintenance of structures
3. To study the various types and properties of repair materials
4. To assess the damage to structures using various tests
5. To learn the importance and methods of substrate preparation
6. To learn various repair techniques of damaged structures, corroded structures
7. To learn the fundamentals of structural health monitoring.

UNIT I

DETERIORATION OF CONCRETE STRUCTURES

Overview of distress- Deterioration in concrete structures-Types of deterioration - Signs, causes & symptoms- Mechanism of deterioration- contributing factors like permeability- inadequate durability & micro-structure of concrete- Physical deterioration due to moisture- temperature-shrinkage- freeze-thaw- abrasion- erosion- cavitation- crystallization of salts- Efflorescence-exposure to severe environment like marine exposure- Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced)- Alkali-silica reaction- sulphate attack-Acid attack.

Deterioration due to water leakage, fire - detection & mitigation of the same- Deterioration due to ageing- inadequate maintenance- Design & construction deficiencies- overloading etc.

UNIT II

CONDITIONAL/DAMAGE ASSESSMENT & EVALUATION OF STRUCTURES
STRUCTURAL ASSESSMENT

Conditional evaluation / Structural Appraisal of the structure - Importance- objective & stages- Conditional/damage assessment procedure- Preliminary & Detailed investigation - Scope-Objectives- Methodology & Rapid visual inspection of structures.

DAMAGE ASSESSMENT ALLIED TESTS (DESTRUCTIVE, SEMI-DESTRUCTIVE, NON-DESTRUCTIVE)

Field & laboratory testing procedures for evaluating the structure for strength- corrosion activity- performance & integrity- durability. Interpretation of the findings of the tests.

UNIT III

REPAIR OF STRUCTURE AND MATERIALS FOR REPAIR

Criteria for durable concrete repair- Methodology- performance requirements- repair options- selection of repair materials- Preparatory stage of repairs- Different types of repair materials & their application- types of repair techniques.

Special mortars and concretes: Polymer Concrete and Mortar- Quick setting compounds.

Grouting materials: Gas forming grouts- Salfoalumate grouts- Polymer grouts- Acrylate and Urethane grouts.

Bonding agents: Latex emulsions- Epoxy bonding agents.

Protective coatings: Protective coatings for Concrete and Steel.

FRP sheets.

UNIT IV

RETROFITTING/STRENGTHENING

Need for retrofitting- Design philosophy of strengthening structures- Techniques available for strengthening including conventional and advanced techniques.

RETROFITTING OF SLABS

Necessity of Strengthening Reinforced Concrete Slabs -Cement grout-Ferro-cement cover- Section enlargement- External plate bonding- External post-tensioning-Steel plate strengthening-CFRP.

UNIT V

PROTECTION & MAINTENANCE OF STRUCTURES

Importance of protection & maintenance- Categories of maintenance- Building maintenance. Corrosion mitigation techniques to protect the structure from corrosion.

LONG TERM HEALTH MONITORING / STRUCTURAL HEALTH MONITORING (SHM)

Definition and motivation for SHM- Basic components of SHM and its working mechanism- SHM as a tool for proactive maintenance of structures.

Course Outcomes

After learning the course, the students should be able to:

1. Identify and define all the terms and concepts associated with deterioration of concrete structures.
2. Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.
3. Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.
4. Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

Text Books

1. Repair and protection of concrete structures by Noel P. Mailvaganam, CRC Press, 1991.
2. Rehabilitation of Concrete Structures, B. Vidivelli, Standard Publishers Distributors New Delhi, 1st edition (2009).
3. Concrete repair and maintenance Illustrated by Peter. H. Emmons, Galgotia publications Pvt. Ltd., 2001.

Reference Books

1. Concrete microstructure, Properties and materials - P Kumar Mehta and Paulo J. M. Monterio.
2. Handbook on Repairs and Rehabilitation of RCC buildings - CPWD, Government of India.
3. Concrete technology - A. R. Shanthakumar, Oxford University Press, India.
4. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill Education, Third Edition.
5. Appraisal and Repair of Reinforced concrete by R. Holland, Thomas Telford Ltd. London. 6. J.H. Bungey, S.G. Millard & M.G. Grantham, Testing of Concrete in Structures, 4th Edition, Taylor & Francis, London & New York, 2006.
6. V. M. Malhotra, Nicholas J. Carino 2004 "Handbook on Nondestructive Testing of Concrete"
7. Repair and Strengthening of Concrete structures", FIP guide, Thomas Telford, London. 9. Concrete Structures, Protection, Repair and Rehabilitation by R. Dodge Woodson.
8. Structural Condition assessment by Robert T. Ratay.
9. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP406 STRUCTURAL OPTIMIZATION

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

Optimization methods; linear programming, non-linear programming - geometric programming, dynamic programming - integer programming, quadratic programming, engineering applications.

Course Objectives

1. To acquaint with basic principles relating to structural optimization.
2. To help the students to learn about various methods for structural optimization.
3. To train students in linear programming, non-linear programming, geometric programming and dynamic programming for achieving the goal of optimization.
4. To acquaint students with advanced approaches for optimization including decision theory and game theory.

UNIT I

INTRODUCTION AND OPTIMIZATION TECHNIQUES
Introduction - Statement of optimization problem - Classification of optimization problems - Optimization techniques - Single variable optimization - Multivariable optimization with no constraints - Multivariable optimization with equality constraints - Multivariable optimization with inequality constraints.

UNIT II

LINEAR PROGRAMMING - SIMPLEX METHOD
Introduction - standard form of a linear programming problems - geometry of linear programming problems - Definitions and theorem - Motivation to the simplex method - simplex algorithm.

UNIT III

NON-LINEAR PROGRAMMING: ONE DIMENSIONAL MINIMIZATION
Introduction - unimodel function - Elimination method - Unrestricted search - Exhaustive search - Dichotomous search - Fibonacci method - Golden section method - Interpolation method.

UNIT IV

GEOMETRIC PROGRAMMING
Introduction - Posynomial- Unconstrained minimization problem.

DYNAMIC PROGRAMMING
Introduction - Multi stage decision processes - Concept of sub optimization and the principle of optimality - Computational in procedure in dynamic programming.

UNIT V

FURTHER TOPICS

Integer programming - Stochastic programming - Quadratic programming - Game theory - Decision Theory.

Course Outcomes

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

1. To understand basic theoretical principles and algorithms developed for solving various types of optimization problems.
2. To get a broad picture of the various applications of optimization viz linear and non-linear programming methods used in engineering.
3. To develop formulation and solution methods in optimization.
4. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.
5. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.

Text Books

1. Rao S.S., Engineering optimization Theory and Practice, New Age International Publishers, New Delhi, Third Edition ,2016.
2. Gupta P. K and Hira D.S., Operations Research, S. Chand and Company Ltd.,2016.

Reference Books

1. Ravindran A, Ragsdell K.M, Reklaitis G.V, Enginnering Optimization Methods and Application, Wiley India Edition, New Delhi, Second Edition 2012.
2. Sharma S.D, Operations Research, Kedar Nath Ram Nath, Mecrut, Revised Edition, 2015.
3. Srinivasan G, Operations Research: Principles and Applications, PHI Learning Private Limited, New Delhi, Third Edition,2017
4. Kalavathy S, Operations Research, Vikas Publishing House Pvt. Ltd., New Delhi, Fourth Edition, 2014.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP201 STRUCTURAL DESIGN LABORATORY

L	T	P	C
0	0	4	2

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.

List of Experiments

1. Analysis and Design of plane frame using STAAD Pro
2. Analysis and Design of truss using STAAD Pro
3. Design of continuous beam using MS Excel/STAAD Pro
4. Design of columns using MS Excel/STAAD Pro
5. Design of one way Slab using MS Excel
6. Design of two way Slab using MS Excel
7. Analysis of Bridge Deck slab
8. Design of Combined Footing using MS Excel/STAAD Pro
9. Analysis of Multistoreyed space frame using STAAD Pro
10. Analysis of Retaining wall using MS Excel/STAAD Pro

After the completion of the course the students will be able to

Course Outcomes

1. Understand the software usages and produce structural drawing for structural members.
2. Design and analyze plane frame and truss subjected to different type of loading.
3. Design, detailing and estimations of RC structural members like beam, column, slab, and Footing
4. Design and analysis of bridge deck slab for different loading conditions
5. Design and analysis of retaining wall for different loading conditions.

Mode of Evaluation: Continuous cumulative evaluation of the lab experiments, reords, viva-voce and external lab examination

18SEP202 ADVANCED CONCRETE LABORATORY

L	T	P	C
0	0	4	2

Course Objectives

1. To learn the principles and procedures of testing Concrete materials.
2. To get hands on experience by conducting the tests and evolving inferences.

List of Experiments:

1. Test on cement
   a.Consistency
   b.Setting time
   c.Soundness
   d.Compressive strength
2. Mix Design of concrete with different industrial wastes
3. Flexural behavior of concrete beam using UTM
4. Durability tests on concrete
5. Non destructive testing of concrete
6. Accelerated curing of concrete
7. Test on self compacted concrete - L box test, J box test, U box test and Slump test
8. Influence of different chemical admixtures on concrete
9. Mix design of fly ash concrete including casting and testing of specimens

Course Outcomes

After completion of the course the student will be able to

1. Understand and apply the proper testing requirements for cement.
2. Be able to design and test concrete mix designs for a specific purpose as per various code requirements
3. Understand and apply the proper testing requirements and techniques of plastic and hardened concrete.
4. Be able to test the behaviour of special concretes
5. Can understand the effect of various admixtures on the properties of fresh and hardened concrete.

Mode of Evaluation: Continuous cumulative evaluation of the lab experiments, reords, viva-voce and external lab examination

18RMP101 RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

Course Prerequisites: None

Course Description:

This course provides the fundamental aspects of data collection, analysis, and interpretation of research problem. it also provides the effective way of paper writing, intellectual property rights and process of patenting.

Course Objectives:

Upon the completion of subject student will be able to-

1. To obtain solution for research problem, data collection and analysis.
2. To know effective paper writing
3. To know the patenting process
4. To know the new developments in IPR

UNIT I: INTRODUCTION

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations, Effective literature studies approaches, analysis Plagiarism, Research ethics.

UNIT II: EFFECTIVE PAPER 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 III: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 IV: PATENT RIGHTS:

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V: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.

Course Outcomes

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

1. Analyze research related information
2. Follow research ethics
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
3. Mayall , "Industrial Design", McGraw Hill, 1992.
4. Niebel , "Product Design", McGraw Hill, 1974.
5. Asimov , "Introduction to Design", Prentice Hall, 1962.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

AUDIT COURSE I

18AUP901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Course Prerequisites: None

Course Objectives:

Upon the completion of subject student will be able to-

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches,
5. planning and programming in different countries, particularly their home country or the countries they work in

UNIT I:

Disaster classification
Disaster: definition, factors and significance; difference between hazard and Disaster; natural disaster: earthquakes, volcanisms, cyclones, tsunamis, floods, droughts and famines, landslides and avalanches; man-made disasters: nuclear reactor meltdown, industrial accidents, oil slicks and spills, outbreaks of disease and epidemics, war and conflicts

UNIT II:

Repercussions of Disasters:
Economic damage, loss of human and animal life, destruction of ecosystem.
Disaster Prone Areas in India:
Study of seismic zones; areas prone to floods and droughts, landslides and Avalanches; areas prone to cyclonic and coastal hazards with special reference to tsunami.

UNIT III:

Disaster Preparedness and Management
Preparedness: monitoring of phenomena triggering a disaster or hazard;
Evaluation of risk:
application of remote sensing, data from meteorological and Other agencies, media reports: governmental and community preparedness.

UNIT IV:

Risk Assessment
Disaster risk: concept and elements, disaster risk reduction, global and national disaster risk situation. Techniques of risk assessment, global co-operation in risk assessment and warning.

UNIT V

Disaster Mitigation

Meaning, concept and strategies of disaster mitigation, emerging trends in Mitigation. Structural mitigation and non-structural mitigation, programs of Disaster mitigation in India.

Course Outcomes

After the completion of the subject following outcomes can be achieved-

1. Students will be able to understand disaster and its types in general.
2. They will understand the post disaster damage in terms of both like and commodity.
3. They will have clear picture of disaster prone zones,.
4. They will be able to understand the pre and post disaster preparedness needed to mitigate the disaster impact in large scale.
5. Student will also understand to quantify the risk in terms of monetary for both commodity and life.
6. Student will also learn the structural and non-structural measures for risk mitigation

Text Books

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

References

1. Ghosh G.K., 2006, "Disaster Management", APH Publishing Corporation

18AUP902 SANSKRIT FOR TECHNICAL KNOWLEDGE

L	T	P	C
2	0	0	0

Course Prerequisites: None

Course Objectives

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

UNIT I

Alphabets- Vowels- Consonants - Māheśvara sutras - Combined alphabets- Verbs- Basic words.**(6)**

UNIT II

Singular/Dual/Plural - Nominative case - Accusative case - Instrumental case - Dative case - Ablative case- Genitive case - Locative case. **(6)**

UNIT III

Nouns and adjectives - Indeclinables - Present tense - Past tense - Future tense- Order and request- Prefixes - Number word - Combinations and cases. **(6)**

UNIT IV

Sanskrit literature-Harsacaritasangrah-Kumarasambhava-sabdamanjari. **(6)**

UNIT V

Technical concept of Architecture-Manasar text -logic- nyaya sutras -pramana-mathematics-sulva sutras-baudhyana theorem. **(6)**

Course Outcomes

Students will be able to

1. Understanding basic alphabets and vowels
2. Understanding the cases in Sanskrit language
3. Understanding of Nouns and tense
4. Understanding of some literature
5. Analyzing the observation through pramana,application of architecture and mathematics

Suggested reading

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

18AUP903 CONSTITUTION OF INDIA

L	T	P	C
2	0	0	0

Course Prerequisites: NIL

Course Objectives

The course is intended to:

1. To know about Indian constitution.
2. To know about central and state government functionalities in India; and
3. To know about Indian society.

UNIT I

INTRODUCTION
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II

STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III

STRUCTURE AND FUNCTION OF STATE GOVERNMENT
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV

CONSTITUTION FUNCTIONS
Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V

INDIAN SOCIETY
Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Course Outcomes

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

1. Understand the functions of the Indian government; and
2. Understand and abide the rules of the Indian constitution.

Text Books

1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India, New Delhi.
2. R.C.Agarwal, Indian Political System, S.Chand and Company, New Delhi.
3. Maciver and Page, Society: An Introduction Analysis, Mac Milan India Ltd., New Delhi.
4. K.L.Sharma, Social Stratification in India: Issues and Themes, Jawaharlal Nehru University, New Delhi.

Reference Books

1. Sharma, Brij Kishore, Introduction to the Constitution of India, Prentice Hall of India, New Delhi.
2. U.R.Gahai, Indian Political System, New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, Indian Social Problems, Media Promoters and Publishers Pvt. Ltd.

18AUP904 PEDAGOGY STUDIES

L	T	P	C
2	0	0	0

Course Prerequisites: None

Course Objectives

Students will be able to:

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

UNIT I

INTRODUCTION AND METHODOLOGY

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions.
- Overview of methodology and Searching.

UNIT II

- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

UNIT III

- Evidence on the effectiveness of pedagogical practices.
- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV

- Professional development: alignment with classroom practices and follow-up support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

UNIT V

- Research gaps and future directions
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact

Course Outcomes

Students will be able to understand:

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

Text Books

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

18SEP103 FINITE ELEMENT METHOD

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

Principles of Analysis of Stress and Strain - Finite Element Method for the analysis of one and two dimensional problems - stress and strain parameters and their inter relations of the continuum.

Course Objectives

1. To provide an overview and basic fundamentals of Finite Element Analysis.
2. To introduce basic aspects of finite element theory, including domain discretization, interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
3. To explain the underlying concepts behind variational methods and weighted residual methods in FEM.
4. Formulate simple structural problems in to finite elements.

UNIT I

BASICS OF THEORY OF ELASTICITY

Basic principles of structural mechanics - equations of equilibrium -strain displacement relations -stress strain relations - plane stress and plane strain problems - virtual work - principles of minimum potential energy -basic steps of finite element analysis - discretization - basic element shapes - displacement function - element properties - node numbering procedure - stiffness matrix - Nodal load vector - assemblage - boundary conditions -primary unknowns - secondary unknowns - convergence requirements.

UNIT II

ONE DIMENSIONAL ELEMENTS

Shape functions for one dimensional structures - formulation of element stiffness matrix - formulation of element nodal load vector.

TWO DIMENSIONAL ELEMENTS

Plane stress - plane strain - 3,6 noded triangular elements - rectangular elements -Lagrange and Serendipity elements - Isoparametric elements - shape functions, element stiffness matrix - load vector formulations - gauss quadrature rule.

UNIT III

INTRODUCTION TO ISOPARAMETRIC ELEMENTS

Concept of sub - iso - super parametric elements - gauss quadrature - examples in one dimension.

SOLUTION TECHNIQUES

Different solvers - variational approach - weighted mean residual methods like collocation method, subdomain method, Galerkin method and least square methods (only theory)

UNIT IV

DIRECT STIFFNESS METHOD

Steps in direct stiffness method of FEA - elements stiffness matrix - global stiffness matrix - boundary conditions - problems on simple beams, trusses.

UNIT V

THREE DIMENSIONAL FEM

Different 3-D elements ,3D strain - displacement relationship - Formulation of hexahedral and Isoparametric solid elements.

Course Outcomes

After the completion of the course the students will be able to

1. Analyse and build FEA models for various Engineering problems.
2. Able to identify information requirements and sources for analysis, design and evaluation
3. Use professional-level finite element software to solve engineering problems.
4. Interpret results obtained from FEA software solutions, not only in terms of conclusions but also awareness of limitations.

Text Books

1. Krishnamoorthy C.S, Finite Element Analysis, Tata MC Grew -Hill, New Delhi, Second Edition ,2011
2. Tirupati.R, Chandrupatla and Ashok D Belgundu.,"Introduction to finite elements in engineering", Third edition, 2005.
3. Bhavikatti S.S, "Finite Element Analysis", New Age International Publishers New Delhi, Third Edition ,2018.

Reference Books

1. Cook Robert D., Concept and Application of Finite Element Analysis, John Wiley and Sons INC ,1995.
2. Rajasekaran S., Finite Element Analysis in Engineering Design, S. Chand and Co. Ltd.,2008.
3. Desai C.S and Abel J.F. Introduction to the Finite Element Method Affiliated East West Press, 1972.
4. T.N. Seshu,"Finite element analysis - Theory and programming", Second edition, Tata McGraw Hill publishing co.,1994.
5. Rao S.S., The Finite Element Methods in Engineering, Pergaman press Edition, 2003.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP104 STRUCTURAL DYNAMICS

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Objectives

1. To acquaint with basic principles relating to Dynamics of structures under both damped and undamped condition.
2. To understand Impact of degree of freedom on vibration of structures
3. To make students learn about mathematical treatment of dynamics of structural Problems both single degree and multi degree of freedom.
4. To train students in dealing with vibration and earthquake analysis.

UNIT I

INTRODUCTION
Basic concepts of structural dynamics: single degree of freedom system - force displacement relationship damping force - equation of motion - mass-spring-damper system - methods of Solution of differential equation.

FREE VIBRATION (SDOF)
Undamped free vibration - viscously damped free vibration - energy in free vibration.

UNIT II

MULTI DEGREE OF FREEDOM SYSTEM
Selection of the degree of freedom -Evaluation of structural property matrices-Formulation of the MDOF equations of motion -Undamped free vibrations Solution of Eigen value problem for natural frequencies and mode shapes- Orthogonality conditions

UNIT III

DYNAMIC RESPONSE OF MDOF SYSTEMS
Normal co-ordinates - Mode superposition technique - Numerical integration procedures

UNIT IV

INTRODUCTION TO EARTHQUAKE ANALYSIS
Introduction -Excitation by rigid base translation - Lumped mass approach -SDOF and MDOF system- I.S code methods of analysis.

UNIT V

APPROXIMATE METHODS
Rayleigh's method - Dunkarley'S method - Stodola's method.

DYANMICS OF 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.

Course Outcomes

After the completion of the course the students will be able to

1. Identify different types of vibrations under SDOF and MDOF system conditions.
2. Evaluate impact of degree of freedom on vibration of structures.
3. Demonstrate skills in treating structures for earthquake analysis.
4. Develop skills relating to continuous system of structures relating to different loading conditions.

Text Books

1. A.K.Chopra, "Structural Dynamics for Earthquake Engineering",Prentice Hall,1994
2. S.R Damodarasamy & S.Kavitha,“Basics of Structural Dynamics and a Seismic Design”, PHI Pvt. Ltd., 2009

Reference Books

1. Clough & Penziem, Dynamics of structures, Mc Graw Hill Publications
2. Mario Paz, Structural dynamics, CBS Publications.
3. I.S:1893(latest) “code of practice for earthquakes resistant design of structures”

Mode of Evaluation: Assignments, Mid Examinations, End Examination

DISCIPLINE ELECTIVE III

18SEP407 DESIGN OF ADVANCED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

This course covers calculation of short and long term deflections of various types of beams, mechanism of flexural cracking and estimation of crack width, design of reinforced concrete deep beams, design of elevated water tanks and shear walls, design of beam column joints and design of bunkers and silos.

Course Objectives

1. To understand the short term and long term deflections of beams and slabs.
2. To understand the mechanism of flexural cracking and its estimation.
3. To understand the design of deep beams, plain concrete walls and shear walls.
4. To understand the design of beam column joints.

UNIT I

DEFLECTION OF REINFORCED CONCRETE BEAMS AND SLABS
Introduction -Short-term Deflection of beams and Slabs -Deflection due to -Imposed loads - Short-term deflection of beams due to applied loads- Calculation of deflection by IS 456 - Deflection of continues beams by IS 456 - Deflection of Cantilevers - Deflection of Slabs .

ESTIMATION OF CRACK WIDTH IN REINFORCED CONCRETE MEMBERS
Introduction - Factors affecting Crack width in beams - Mechanism of Flexural cracking Calculation of crack widths - Simple Empirical method - Estimation of Crack width in -beams by IS 456 of BS 8110 - Shrinkage and Thermal Cracking

UNIT II

DESIGN OF REINFORCED CONCRETE DEEP BEAMS Introduction - Minimum Thickness - Steps of Designing deep beams - Design of beam by IS 456 - Design according to British Practice - ACI Procedure for design of deep beams - Checking for local failures - Detailing of deep beams.

UNIT III

DESIGN OF ELEVATED WATER TANKS
Introduction - Types of overhead water tanks- Design of Intze type water tank- design of conical or funnel shaped water tank.

DESIGN OF SHEAR WALLS Introduction - Classification of shear walls - Classification according to behaviour - Loads in shear walls - Design of Rectangular and flanged shear walls - Derivation of formula for moment of Resistance of Rectangular shear walls

UNIT IV

DESIGN OF CAST IN-SITU BEAM-COLUMN JOINTS

Introduction - Types of cast in-situ joints - Joints in multi-storeyed Buildings - Forces acting on Joints - Strength Requirement of Columns - Forces directly acting on joints - Design of joints for strength - Anchorage - Confinement of core of joint - Shear strength of joint - Corner (Knee) joint - Detailing for Anchorage in exterior beam-column joint - Procedure for design of joint.

UNIT V

BUNKERS AND SILOS

Introduction - Differences between bunkers and Silos- Design of Square, Rectangular and Circular bunkers- Design of Silos - Silos for storage of cement.

Course Outcomes

After the completion of the course the students will be able to:

1. Design of R.C. beams and slabs to satisfy the limit state of serviceability by determining the short term and long term deflection.
2. Estimate the crack width in beams for the given load.
3. Design deep beams as per the codal provisions
4. Design of elevated water tanks
5. Design of shear walls
6. Design beam-column joint for the given loading system
7. Design of bunkers and Silos

Text Books

1. P.C. Verghese, Advanced Reinforced Concrete Design, PHI Learning, New Delhi
2. N. Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers & Distributors.

Reference Books

1. C.E. Reynolds and J.C. Steedman, Reinforced Concrete- Desigers Hand book, a view point publication.
2. P.Dayaratnam , Limit State Design of Reinforced Concrete Structures, Oxford & IBH Publishers, 2004 edition.
3. Devadas Menon, Reinforced cement concrete Structures, Tata McGraw Hill Education
4. P.Purushothaman, Reinforced concrete Structural Elements: Behaviour, analysis and Design, TATA Mc Graw Hill.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP408 ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Objectives

1. To apply the analytical and numerical techniques for different structural elements.
2. To study the different numerical procedures for calculating the response of structures.

UNIT I:

FUNDAMENTALS OF NUMERICAL METHODS
Error Analysis- Polynomial Approximations and Interpolations- Curve Fitting: Interpolation and extrapolation

UNIT II:

SOLUTION OF NONLINEAR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: ELEMENTS OF MATRIX ALGEBRA
Solution of Systems of Linear Equations- Eigen Value Problems. Evaluation of Eigen values for stability problems- Evaluation of Eigen vectors for stability problems.

UNIT III:

NUMERICAL DIFFERENTIATION & INTEGRATION
Solution of Ordinary and Partial differential equations related to structural mechanics problems, boundary conditions, and initial conditions. Numerical integration (Trapezoidal and Simpson's rule) for determining shear, moment and deflection in beams- Gauss Quadrature formula. Newmark's method - Determination of shear force - Bending moment - Slope and deflection in beams.

UNIT IV

FINITE DIFFERENCE SCHEME
Implicit & Explicit scheme- Membrane analogy using finite difference method for slabs-slope and deflection of slabs- Finite Strip method for analysis of plates.

UNIT V

COMPUTER ALGORITHMS
Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

Course Outcomes

At the end of the course, students will be able to:

1. Solve ordinary and partial differential equations in structural mechanics using numerical methods.
2. Write a program to solve a mathematical problem.

Text Books

1. Steven O'Hara, Carisa H Ramming, Numerical Structural Analysis (Sustainable Structural Systems Collection), Momentum Press 2014.
2. MK. Jain, SRK. Iyengar and RK Jain, Numerical Methods for Scientific and Engineering Computations, Wiley Eastern.

Reference Books

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

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP409 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Objectives

1. To make the students understand the fundamental concepts in the analysis of the structures subjected to seismic forces.
2. To understand the vibration of structures during earthquakes.
3. To understand the students to do a competent design & detailing of seismic resistant structures.
4. To understand the student fundamentals of Seismic Planning.

UNIT I

ENGINEERING SEISMOLOGY

Earthquake - causes of earthquake - earthquakes and seismic waves - scale and intensity of earthquakes - seismic activity - Measurements of earth quakes - seismometer- strong motion accelerograph / field observation of ground motion - analysis of earthquakes waves - earth quake motion - amplification of characteristics of surface layers - earthquake motion on the ground surface.

UNIT II

VIBRATION OF STRUCTURES UNDER GROUND MOTION

Elastic vibration of simple structures - modelling of structures and equations of motion - free vibrations of simple structures - steady state forced vibrations - Non steady state forced vibrations - response spectrum representations; Relation between the nature of the ground motion and structural damage.

UNIT III

DESIGN APPROACHES

Methods of analysis - selection of analysis - equivalent lateral force procedure seismic base shear - seismic design co-efficient - vertical distribution of seismic forces and horizontal shear - twisting moment - Over turning moment - vertical seismic load and orthogonal effects lateral deflection - P- characteristics effect - soil structure Interaction Seismic - zoning map.

UNIT IV

Dynamic - analysis procedure: Model analysis - Inelastic - time history analysis Evaluation of the results. Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings - codal provisions.

UNIT V

Seismic response control concepts - Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures. Selection of materials and types of construction form of superstructure - framing systems and seismic units - devices for reducing. Earthquake loads.

Course Outcomes

After the completion of the course the students will be able to:

1. Analyse the forces acting on structures due to earthquake.
2. Computation of design moments and shears for framed structure as per IS:1893 and its detailing.
3. Apply the concepts in the design of structures.
4. Implementing the Selection process of materials and construction form of super structure.

Text Books

1. J.A. Blume, N.M. Newmark, L.H. Corning., "Design of Multi-storeyed Buildings for Earthquake ground motions", Portland Cement Association, Chicago,1961.
2. Pankaj Agarwal, Earthquake Resistant Design.

Reference Books

1. Minoru Wakabayashi, Design of earthquake resistant structures.
2. A.K.Chopra, Structural Dynamics for Earthquake Engineering, PrenticeHall 1995.
3. R.W.Clough, Dynamics of structures. Mc GrawHill, 2nd edition, 1992.
4. N.M Newmark and E.Rosenblueth, Fundamentals of Earthquake Engineering, PrenticeHall, 1971.
5. David Key, Earthquake design practice for buildings. Thomas Telford, London, 1988.
6. R.L. Wegel, Earthquake Engg; Prentice Hall 12nd edition 1989.
7. I.S.Codes No. 1893,4326,13920.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP410 ADVANCED DESIGN OF FOUNDATIONS

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

The course "Advanced Design of Foundations" will cover various aspects of foundation engineering including soil exploration, details of shallow and deep foundations, well foundations, and retaining walls. The course on "Advanced design of foundations" provides the students basic knowledge on foundation selection, foundation forces, foundation design and its stability under seismic forces. Various types of foundation and their analytical solution helps the student to design suitable foundation with respect to soil and site condition.

Course Objectives

1. To learn the type of foundations to be recommended for construction of different engineering structures
2. To design different types of foundations and retaining walls

UNIT I:

SELECTION OF FOUNDATION AND SUB-SOIL EXPLORATION/INVESTIGATION
Types of foundation- Factors affecting the selection of type of foundations- steps in choosing types of foundation based on soil condition- Objectives and planning of exploration program- methods of exploration-wash boring and rotary drilling-depth of boring, soil samples and soil samplers-representative and undisturbed sampling- field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods- Bore log and report writing- data interpretation.

UNIT II:

SHALLOW FOUNDATION
Introduction- significant depth- design criteria- modes of shear failures. Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton) - bearing capacity determination using IS Code- Presumptive bearing capacity. Settlement- components of settlement & its estimation-permissible settlement- Proportioning of footing for equal settlement- allowable bearing pressure. Bearing capacity from in-situ tests (SPT, SCPT, PLATE LOAD)- Factors affecting bearing capacity including Water Table- Bearing capacity of raft/mat foundation as per codal provisions- Contact pressure under rigid and flexible footings- Floating foundation.

UNIT III:

PILE FOUNDATION
Introduction, load transfer mechanism- types of piles and their function- factors influencing selection of pile- their method of installation and their load carrying characteristics for cohesive and granular soils- piles subjected to vertical loads- pile load carrying capacity from static formula-dynamic formulae (ENR and Hiley)- penetration test data & Pile load test (IS 2911). Pile group: carrying capacity- efficiency and settlement. Negative skin friction.

UNIT IV

WELL FOUNDATION

Types- components- construction methods- design methods (Terzaghi, IS and IRC approaches) - check for stability- base pressure- side pressure and deflection.

UNIT V

RETAINING WALLS

Types (types of flexible and rigid earth retention systems: counter fort, gravity, diaphragm walls, sheet pile walls, soldier piles and lagging). Support systems for flexible retaining walls (struts, anchoring) - construction methods- stability calculations- design of flexible and rigid retaining walls- design of cantilever and anchored sheet pile walls.

Course Outcomes

After learning the course, the students should be able to

1. Select appropriate soil investigation/testing technique/method and get true sub soil parameters used for selection of type of foundation as per codal guidelines.
2. Select and design appropriate/suitable foundation system (shallow/Deep) for different structures, that satisfy the allowable bearing capacity and settlement requirements based on soil properties.
3. Design deep foundation satisfying bearing capacity and settlement requirements.
4. Design and analysis of retaining walls and sheet piles under static loads.

Text Books

1. Joseph Bowles, "Foundation Analysis and Design", McGrawâĂŘHill Book Company.
2. V.N.S. Murthy, "Advanced Foundation Engineering", CBS Publishers and Distributors.

Reference Books

1. P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.
2. B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.
3. Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi.
4. Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai.
5. V. N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants, Banglore.
6. Braja M. Das, "Principles of Foundation Engineering", PWS Publishing Company.
7. Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi.

IS Codes

1. Code of practice for determination of bearing capacity of shallow foundation IS: 6403.
2. Code of practice for design and construction of pile foundation- IS: 2911 (Part I to IV).
3. Method for standard penetration test for soil- IS: 2131.
4. Code of practice for subsurface investigation for foundation- IS: 1892.

5. Code of practice for structural safety of buildings: Shallow Foundations- IS: 1904.
6. Code of practice for calculation of settlement of foundations- IS: 8009.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

DISCIPLINE ELECTIVE IV

18SEP411 THEORY OF STRUCTURAL STABILITY

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Objectives

1. To acquaint with basic principles relating to stability of structures
2. To help the students to learn about mathematical treatment of stability Problems.
3. To train students in dealing with buckling, and torsion developed for different structures under different support and loading conditions.
4. To acquaint students with the Elastic and in-elastic Buckling behaviour of structures.

UNIT I

FORMULATIONS RELATED TO BEAM COLUMNS Concept of Stability, 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 -application of Trigonometric series - Determination of allowable stresses.

UNIT II

ELASTIC BUCKLING OF BARS
Static equilibrium - Governing equation for columns - Analysis for various boundary conditions. Elastic buckling of straight columns - Eccentrically and laterally loaded columns -Energy methods -Buckling of a bar on elastic foundation, Buckling of a 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 -Tangent modulus theory.

ANALYSIS AND STABILITY OF FRAMES
Various Boundary Conditions - Differential equations - Slope Deflection method.

MATHEMATICAL TREATMENT OF STABILITY PROBLEMS:
Linear and non Linear Eigen Value problems-Buckling problem orthogonality relation -Ritz method-Timoshenko method, Galerkin method.

UNIT IV

TORSIONAL BUCKLING
Torsional load-Deformation characteristics of structural members- strain energy of torsion - Torsional and flexural torsional buckling of columns.

LATERAL BUCKLING OF SIMPLY SUPPORTED BEAMS
Beams of rectangular cross section subjected for pure bending.

UNIT V

BUCKLING OF SIMPLY SUPPORTED RECTANGULAR PLATES

Differential Equation of plate buckling -linear theory - critical load of a plate uniformly compressed in one direction.

Course Outcomes

After the completion of the course the students will be able to

1. Distinguish different types of beam columns and developing differential equations under different loading conditions.
2. Demonstrate skills in treating both elastic and in-elastic buckling of structures.
3. Develop skills relating to torsion and lateral buckling of structures.
4. Identify the difference of elastic and in-elastic buckling behaviour of structures

Text Books

1. Iyengar. N.G.R., (2007), Elastic Stability of Structural Elements, McMillan, New Delhi
2. Timoshenko, S., and Gere., Theory of Elastic Stability, Mc Graw Hill Book company, 1973.

Reference Books

1. Galambos. T.V., Surovek A. E(2008), Structural Stability of Steel: Concepts and Applications for Structural Engineers, Wiley, London.
2. Chajes, A., Principles of Structural Stability Theory, Prentice Hall,1974.
3. Ashwini Kumar, Stability Theory of Structures, TATA Mc Graw Hill publishing company Ltd, New Delhi, 1985.
4. Gambhir, M.L, Stability Analysis and Design of Structures, Springer-verlag Berlin Heidal Berg Publishers, 2004.
5. Bleach, Stability Of Metallic Structure , Mc-Graw Hill.
6. Chen & Atsuta, Theory of Beam Columns Vol I, Mc-Graw Hill.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP412 DESIGN OF INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisites: 18SEP401

Course Objectives

1. To learn the design concepts of steel gantry girder.
2. To learn the design of steel bunkers and silos.
3. To study the design of water tanks.
4. To learn the design of composite slabs.

UNIT I

STEEL GANTRY GIRDERS
Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.

UNIT II

STEEL BUNKERS AND SILOS
Design of square bunker - Jansen's and Airy's theories - IS Code provisions - Design of side plates - Stiffeners - Hooper - Longitudinal beams Design of cylindrical silo - Side plates - Ring girder - stiffeners.

UNIT III

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 IV

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 V

DESIGN OF LIGHT GAUGE STEEL STRUCTURES
Types of cross sections - Local buckling and lateral buckling - Design of compression and tension members - Beams - Deflection of beams- Cold formed steel structures-Pre-engineered metal buildings- long span structures.

COMPOSITE STRUCTURES
Design of composite slabs.

Course Outcomes

After the completion of the course the students will be able to

1. Design Steel Gantry Girders.
2. Design Steel Bunkers and Silos.
3. Design Chimneys and Water Tanks.
4. Design pressed steel water tank.
5. Design of composite slabs.

Text Books

1. Galyordand Galyord (2012), Design of Steel Structures, Tata McGraw Hill Education.

Reference Books

1. Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., 2nd Ed., Lakshmi Publishers, 1998.
2. Design of Steel Structures, Ram Chandra, 12th Ed., Standard Publishers, 2009.
3. Design of Steel Structures, N Subramaniyam.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP413 DESIGN OF HIGH RISE STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

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 systems and dynamic analysis
5. To understand the research needs in tall building materials, systems and designs.

UNIT I

INTRODUCTION

Design Philosophy - History - advantages and disadvantages - Vertical city-concepts - essential amenities - fire safety - water supply - drainage and garbage disposal - service systems - structural and foundation systems.Factors affecting height, growth and form - Human comfort criteria.

UNIT II

LOADS AND MATERIALS

Gravity loading - Dead and Live load - calculation - Impact and construction loads. Wind loading - static and dynamic approach - Analytical and wind tunnel experimental method. Earthquake loading - Equivalent lateral force,Modal analysis - combination of loading in various design philosophies. Materials for tall buildings - High strength concrete - Lightweight concrete - Fiber reinforced concrete Composite Materials

UNIT III

STRUCTURAL SYSTEMS

Behavior of High Rise structures - Different system for load distribution in steel and concrete - Vertical and horizontal load resistant systems - Rigid frames - braced frames - infilled frames - shear walls - wall frames - tubular systems - outrigger braced systems - Mega systems.

UNIT IV

ANALYSIS AND DESIGN

Analysis and Design principles of various horizontal load transfer systems - approximate methods - Modelling for accurate analysis - 3D analysis - Member forces - displacements. Analysis for various secondary effects -Creep, shrinkage and temperature. Stability Analysis - Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, P - delta effect and various methods of analysis - influence of foundation instability, out of plumb effects - Elastic Deformations. Dynamic Analysis - Principles of design of tall braced frames for earthquake and blast resistant design.

UNIT V

ADVANCED TOPICS

Design of transmission/ TV tower - Mast and trestles: Configuration, bracing system - Analysis and Design of RC and Steel Chimney - Foundation design for varied soil strata - Firefighting design for tall buildings - application of software in analysis and design of high rise structures

Course Outcomes

After the completion of the course the students will be able to:

1. Calculate the loads on the tall buildings like live loads, dead loads, impact loads etc.
2. Know the load distribution in different resisting systems.
3. Analysis and design of the various horizontal load transfer systems.
4. Know the structural systems for future generation buildings.

Text Books

1. Schuller. W.G., "High Rise Building Structures", John Wiley & sons, 1977.
2. Lynn.S. Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, New Delhi, 1996.

Reference Books

1. LinT.Y. and Burry D.Stotes, "Structural Concepts and Systems for Architects and Engineers" , John Wiley, 1994.
2. Gupta.Y.P.,(Editor), "Proceedings of National Seminar on High RiseStructures - Design and Construction Practices for Middle Level Cities", New Age International Limited, New Delhi,1995.
3. Lecture Notes on "Tall Buildings"- Short Term Course organized by Civil Engineering Department, SRM Engg college, Kattankulathur. June 2002.
4. Smith B.S. and Coull .A., "Tall Building Structure", 'Analysis and Design', John Wiley & Sons, Inc., 1991.
5. Taranath B.S., "Structural Analysis and Design of Tall Buildings", Mc Graw Hill Co. 1988.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP414 SOIL STRUCTURE INTERACTION

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Objectives

1. Focus is on idealization of soil response to closely represent continuum behavior
2. Interaction analysis between the soil-structure with reference to relative stiffness of beams, slabs and piles under different loading conditions

UNIT I

SOIL-FOUNDATION INTERACTION
Introduction to soil - Foundation interaction problem - Soil behavior -Foundation behavior- Interface- behavior- Scope of soil-foundation interaction analysis -soil response models- Winkler- Elastic continuum- Two parameter elastic models- Elastic plastic behavior- Time dependent behaviour.

UNIT II

BEAM ON ELASTIC FOUNDATION - SOIL MODELS
Infinite beam- Isotropic elastic half space - Analysis of beams of finite length- Classification of finite beams in relation to their stiffness.

UNIT III

PLATE ON ELASTIC MEDIUM
Infinite plate - Winkler- Two parameters - Isotropic elastic medium- Thin and thick plates- Analysis of finite plates- rectangular and circular plates-Numerical analysis of finite plates-simple solutions.

UNIT IV

ELASTIC ANALYSIS OF PILE
Elastic analysis of single pile-Theoretical solutions for settlement and load distribution- Analysis of pile group- Interaction analysis- Load distribution in groups with rigid cap.

UNIT V

LATERALLY LOADED PILE
Load deflection prediction for laterally loaded piles - subgrade reaction and elastic analysis- Interaction analysis- pile raft system- solutions through influence charts.

Course Outcomes

After the completion of the course the students will be able to:

1. Idealize soil response in order to analyze and design foundation elements subjected to different loadings.

Text Books

1. Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998.
2. McCarthy, D.F. Essentials of Soil Mechanics and Foundations, basic geotechnics (6th Edition), Prentice Hall, 2002.
3. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
4. Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.

Reference Books

1. Scott, R.F. Foundation Analysis, Prentice Hall, 1981.
2. Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley, 1980.
3. ACI 336, Suggested Analysis and Design Procedures for Combined Footings and Mats,American Concrete Institute, Dehit, 1988.
4. Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers
5. Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New Yor
6. Analytical and Computer Methods in Foundation, Bowels J.E.,McGraw Hill Book Co., New York, 1974

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP203 MODEL TESTING LABORATORY

L	T	P	C
0	0	4	2

Course Objectives

1. To learn the experimental set-up for theories learnt during Structural dynamics course
2. To learn the application of dynamic load on a structural system to obtain its response
3. To understand how changes in material changes response of the structure
4. To get familiarized with the technology involved in Structural dynamics experiment and how real structures can be tested in a lab set-up.

List of Experiments

1. Dynamic models of Single degree of freedom systems and multi-degree of freedom systems using poly carbonate bars.
2. Demonstration of Single degree of freedom systems with base excitation low frequency, Resonant and high frequency excitation.
3. Cantilever beam (Poly carbonate or Meter Scale), Vibration by hand tapping, Demonstration of second mode with nodal point, Frequency measurement using Accelerometer.
4. 3-storeyed frame with and without soft first story (Polycarbonate).
5. Vibration of multi-storeyed modal (Aluminium) with sinusoidal base excitation, Frequency and mode shapes.

Course Outcomes

After the completion of the course the students will be able to

1. Understand the dynamic response of single and multi-degree of freedom systems.
2. Get the knowledge of single degree of freedom systems with base excitation low frequency, Resonant and high frequency excitation.
3. Be able to test the behaviour of beam subjected to free and forced vibrations
4. Study the seismic response of multi-storeyed frame with and without soft story.
5. Evaluate the frequency and mode shapes for multi-storied model subjected to base excitation.

Mode of Evaluation: Continuous cumulative evaluation of the lab experiments, reords, viva-voce and external lab examination

18SEP204 NUMERICAL ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

Course Objectives

1. To develop understanding about approximation problem.
2. Use approximation algorithm in real word problem.

Course Outcomes

After completion of the course the student will 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/ Gauss - Jorden Method
4. To Integrate Numerically Using Trapezoidal and Simpson's Rules
5. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge - Kutta Method.

List of Experiments:

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 - Seidel Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jordan 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 by Runge - Kutta Method.

Mode of Evaluation: Continuous cumulative evaluation of the lab experiments, reords, viva-voce and external lab examination

AUDIT COURSE II

18AUP905 ENGLISH FOR RESEARCH PAPER WRITING

L	T	P	C
2	0	0	0

Course Prerequisites: None

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

Ensure the good quality of paper at very first-time submission

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. Introduction

UNIT-III

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

UNIT-IV

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT-VI

useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Course Outcomes:

Students will be able to:

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

Text/Reference Books:

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

18AUP906 VALUE EDUCATION

L	T	P	C
2	0	0	0

Course Prerequisites: None

Course Objectives

1. Understand value of education
2. Understand value of self- development
3. Imbibe personality development
4. Imbibe spiritual development and to about the importance of character
5. Incorporate good emotional intelligence with self control

UNIT I

Values and self-development -Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements. **(6)**

UNIT II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness,Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline. **(6)**

UNIT III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline Values and self-development -Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles.

Value judgements. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour.Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature. **(6)**

UNIT IV

Character - Holy books vs Blind faith.Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. **(6)**

UNIT V

Competence- Emotional Intelligence- Mind your Mind, Self-control-Honesty, Studying effectively **(6)**

Course Outcomes:

Students will be able to:

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the moral personality
4. Development of spiritual personality
5. Development of emotional personality for efficiency in work

Text/Reference Books:

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

18AUP907 STRESS MANAGEMENT BY YOGA

L	T	P	C
2	0	0	0

Course Prerequisites: None

Course Objectives

1. To know the human psyche: Yogic and modern concepts
2. To have the importance for mental health
3. To know the relationship between mind and body
4. To understand the concept of stress according to modern science and yoga
5. To achieve overall health of mind through yoga

UNIT-I: Scientific Foundations of Stress

Concept of stress - Sources of stress - Types of Stress - Personality factors and Stress - Stress and the college student. **(6)**

UNIT-II: Consequences of Stress on Human Mind

Human Psyche: Yogic and Modern concepts, behavior and consciousness - Frustation - Conflicts - Psychosomatic Disorders. **(6)**

UNIT-III: Mental Hygiene and Yoga

Mental health: A Yogic Perspective - Mental hygiene and role of Yoga in mental hygiene - Yogic principles for the management of stress (Prayer and meditation for mental health). **(6)**

UNIT-IV: Ashtanga Yoga Introduction

Introduction to Ashtanga Yoga - Concepts and techniques of stress management in Ashtanga yoga of Patanjali Yoga sutra (i.e. Benefits of Meditation for stress management). **(6)**

UNIT-V: Yogic Management of Stress

Specific practices for stress management: Yogasana, breath awareness, shvasana, yoganidra, pranayama and meditation. **(6)**

Course Outcomes:

Students will be able to:

1. Understand the role of yoga in stress management
2. Understand the role of yoga in life management
3. Understanding the role of yoga in mental hygiene
4. Develop strong mental health
5. Develop healthy mind and there by improve efficiency

Text/Reference Books:

1. "Certification of yoga professionals, Official guide book for Level 1 and Level 2" Excel books private limited, Noida

2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

18AUP908 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L	T	P	C
2	0	0	0

Course Prerequisites: None

Course Objectives

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

UNIT - I

Neetisatakam - Holistic development of personality

- Verses - 19, 20, 21, 22 (wisdom)
- Verses - 29, 31, 32 (pride & heroism)
- Verses - 26, 28, 63, 65 (virtue)
- Verses - 52, 53, 59 (dont's)
- Verses - 71, 73, 75, 78 (do's)

UNIT - II

- Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : Chapter 2 - Verses 41, 47, 48,
- Chapter 3 - Verses 13, 21, 27, 35, Chapter 6 - Verses 5, 13, 17, 23, 35,
- Chapter 18 - Verses 45, 46, 48.

UNIT - III

- Statements of basic knowledge.
- Shrimad BhagwadGeeta: Chapter 2 - Verses 56, 62, 68
- Chapter 12 - Verses 13, 14, 15, 16, 17, 18
- Personality of Role model. Shrimad BhagwadGeeta:
- Chapter 2 - Verses 17, Chapter 3 - Verses 36, 37, 42,
- Chapter 4 - Verses 18, 38, 39
- Chapter 18 - Verses 37, 38, 63

Course Outcomes

Students will be able to

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

Suggested reading

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

DISCIPLINE ELECTIVE V

18SEP415 DESIGN OF PRE-STRESSED CONCRETE

L	T	P	C
3	0	0	3

Course Prerequisites: NIL

Course Description

This course includes Historic development of prestressing, methods of prestressing, losses of prestress. Further, in this course, analysis of sections for flexure, design of sections for flexure, design of section for shear will be explained. Composite section and deflections of prestressed concrete beams will also be explained.

Course Objectives

Student will be able to

1. To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students.
2. Students will be introduced to the design of prestressed concrete structures subjected to flexure and shear.
3. To explain analysis of composite sections, deflection of pre stressed concrete beams.

UNIT I

INTRODUCTION

Principles - Pretensioning - Post - tensioning - Types of prestressing - systems of pre stressing- Comparison of prestressed concrete with reinforced concrete material characteristics of concrete - Characteristics of high tensile steel. Analysis and Behaviour.

Theory and behaviour of Prestressed concrete beams in bending - calculating Fibre stresses for various sections (Rectangle, I, T) of simply supported beam due to prestressing force, dead load and external live load - Stress method - Moment of resistance method -Load balancing method.

UNIT II

DESIGN OF PRESTRESSED CONCRETE BEAMS

Pre tensioned and post tensioned simply supported rectangle, I,T sections - Stress method - Design for flexure, bond and shear- IS Code provisions

END BLOCK

Introduction - Stress distribution in end block - Anchorage zone stresses - Guyon and Magnel method

UNIT III

DESIGN OF TENSION AND COMPRESSION MEMBERS

Design of Prestressed tension members subjected to axial load - Design of axially prestressed compression members subjected to axial compression load.

UNIT IV

LOSSES AND DEFLECTIONS

Various losses in prestressed concrete members - Causes for losses in prestress - calculation of losses - losses due to elastic shortening of pre tensioned and post tensioned members - losses due to creep, shrinkage of concrete - Relaxation losses - friction and anchorage losses.

Deflection of prestressed concrete flexural members due to prestressing force, dead load, live load - BIS Code provisions - Effect of tendon Profile on deflection - Calculation of Elastic short term deflection for simply supported beams - Deflections due to creep effect - calculation of long term deflection.

UNIT V

COMPOSITE PRESTRESSED CONCRETE BEAMS

Types of composite construction - Transformation of composite sections - flexural analysis of composite simply supported beams - calculation of stresses.

Limit state design criteria - partial prestressing - Non-prestressed reinforcements.

Course Outcomes

Student shall have knowledge on methods of prestressing and able to design various prestressed concrete structural elements.

Text Books

1. Krishnaraju N., Prestressed Concrete, Tata McGraw Hill Publishing company Ltd, New Delhi, Fifth Edition 2017.
2. Sinha N.C and Roy S.K.,Fundamentals of Prestressed Concrete, S.Chand and Co Ltd 1985.

Reference Books

1. Lin T.Y., and Ned H. Burns., Design of prestressed concrete structures., John Wiley & Sons, International Edition, New York, Third Edition 2015.
2. Dayaratnam P., Prestressed Concrete Structures, Oxford and IBH Publishing Company pvt. Ltd, New Delhi, 1982.
3. Ramamrutham S.,Prestressed Concrete,Dhanpat Rai Publishing Company (P) Ltd .,New Delhi, Fifth Edition ,2016.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP416 FRACTURE MECHANICS OF CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisites: 18SEP102

Course Objectives

Student will be able to

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.
5. To understand the application of Fracture mechanics principle to concrete structures.

UNIT I

INTRODUCTION TO FRACTURE MECHANICS

Introduction - significance - Crack in a Structure - Mechanisms of Fracture and Crack Growth - Cleavage Fracture - Ductile Fracture - Fatigue Cracking - Environment assisted Cracking - Service Failure Analysis.

UNIT II

STRESS AT CRACK TIP

Stress at Crack Tip - Linear Elastic Fracture Mechanics - Griffith's Criteria - Stress Intensity Factors - Crack Tip Plastic Zone - Erwin's Plastic Zone Correction - R curves - Compliance - J Integral - Concept of CTOD and CMD.

UNIT III

SUSTAINED LOAD FRACTURE

Time-to-failure (TTF) tests - Crack growth rate testing - Experimental problems - Method of predicting failure of a structural component - Practical significance of sustained load fracture testing.

UNIT IV

PRACTICAL PROBLEMS

Through cracks emanating from holes - Corner cracks at holes - Cracks approaching holes - fracture toughness of weldments - Service failure analysis - applications in pressure vessels - pipelines and stiffened sheet structures.

UNIT V

MATERIAL MODELS

General Concepts - Crack Models, - Band Models - Models based on Continuum Damage Mechanics - Applications to High Strength Concrete - Fibre Reinforced Concrete - Crack Concepts and Numerical Modeling.

Course Outcomes

After the completion of the course the students will be able to:

1. Identify and classify cracking of concrete structures based on fracture mechanics.
2. Implement stress intensity factor for notched members.
3. apply fracture mechanics models to high strength concrete and FRC structures.
4. Compute J-integral for various sections understanding the concepts of LEFM.

Text Books

1. Kumar, P. "Elements of Fracture Mechanics", Wheeler Publishing, 2009.

Reference Books

1. Suri, C. T and Jin, Z. H. "Fracture Mechanics" 1st Edition, Elsevier Academic Press, 2012.
2. Broek, David. "Elementary Engineering Fracture Mechanics", 3rd Rev. Ed. Springer, 1982.
3. Elfgreen, L. "Fracture Mechanics of Concrete Structures", Theory and Applications, RILEM Report, Chapman and Hall, 1989.
4. Bazant Z. P, "Fracture Mechanics - Applications to Concrete", Victor, Li C., ACI SP 118, ACI Detroit, 1989.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP417 DESIGN OF PLATES AND SHELLS

L	T	P	C
3	0	0	3

Course Prerequisites: 18SEP402

Course Objectives

Student will be able to

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.

UNIT I

INTRODUCTION TO PLATE THEORY
Small deflection of laterally loaded thin rectangular plates of pure bending. Navier's solution for various lateral loading (No derivations)-Numerical examples.

UNIT II

Levy's solution for various lateral loading and boundary conditions (No derivations)- Numerical examples. Energy methods for rectangular plates with clamped edges.

UNIT III

CIRCULAR PLATES
Bending of circular plates with various edge conditions for both solid and annular plates.

UNIT IV

CURVED SURFACES
Introduction to curved surfaces and classification of shells-membrane theory of spherical shells-Cylindrical shell-Hyperbolic paraboloid,-Elliptic paraboloid.

UNIT V

CYLINDRICAL SHELLS
Design and detailing of cylindrical shells. Introduction to folded plates-analysis of folded plates by whitney's and simpson's method.

Course Outcomes

After the completion of the course the students will be able to

1. Explain principles of analysis for special structures.
2. Apply analytical skills to evaluate performance of spatial structures
3. Analyze spatial structures using various methods.
4. Prepare Design and detailing for spatial structures.

Reference Books

1. Timosheko, S. and Woinowsky-Krieger, W., "Theory of Plates and Shells" 2nd Edition, McGraw-Hill Co., New York,1959, ISBN-10: 0070647798; ISBN-13: 978-0070647794.
2. J E Gibson BG Neal, Linear Elastic theory of thin shells Volume I ,Elsevier, ISBN: 978-0-08-010944-2.
3. Ugural, A. C. "Stresses in Plates and Shells", 2nd edition, McGraw-Hill, 1999, ISBN 10: 0070657300 ISBN 13: 9780070657304.
4. R. Szilard, "Theory and analysis of plates - classical and numerical methods", Prentice Hall,1994, ISBN-13: 9780139134265 ISBN: 0139134263.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18SEP418 ANALYSIS OF LAMINATED COMPOSITE PLATES

L	T	P	C
3	0	0	3

Course Prerequisites: 18SEP103

Course Description

This course is designed to introduce various theories of laminated composite plate and Further, the course includes numerical & approximate methods for the stress analysis.

Course Objectives

1. To impart knowledge on the behavior of plates and to analyse 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.

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

RECTANGULAR PLATES
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, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

UNIT III

NUMERICAL & APPROXIMATE METHODS
Introduction, Applications to rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses.

UNIT IV

THEORY AND APPLICATIONS
Finite Element Solutions for bending of rectangular laminated plates using FSDT. Finite Element Model, C^0 element formulation, Post computation of stresses.

UNIT V

ANALYSIS
Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT. Analysis of Rectangular Composite Plates using Analytical Methods.

Course Outcomes

After the completion of the course the students will be able to:

1. Analyse the rectangular composite plates using the analytical methods.
2. Analyse the composite plates using advanced finite element method.
3. Develop the computer programs for the analysis of composite plates.

Text Books

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

Reference Books

1. J N Reddy. mechanics of laminated composite plates and shells: theory and analysis, second edition November 2003.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

OPEN ELECTIVE

18OEP301 BUSINESS ANALYTICS

L	T	P	C
3	0	0	3

Course Prerequisites: None

Course Description:

Course delves into commonly encountered business situations requiring optimization of business resources and provides basic solutions methods using traditional and advanced methods.

Course objective:

1. Refresh basic statistics
2. Explain the importance of statistics in business analytics
3. Introduce predictive modeling for business decisions
4. Explain the tools for predictive modeling
5. Explain the use of simulation to make business decision
6. Explain the use of data mining techniques for making business decision

UNIT I: INTRODUCTION TO BUSINESS ANALYTICS

Introduction to Business Analytics (BA). Evolution and Scope of Business Analytics. Data for Business Analytics.Analyzing uncertainty and model assumptions - What if analysis, Data tables, Scenario manager and Goal Seek. Regression modelling.

UNIT II: STATISTICS FOR BUSINESS ANALYTICS

Brief overview of descriptive statistics, graphical representation of data, and overview of hypothesis testing, Introduction to R statistical software

UNIT III: PREDICTIVE ANALYTICS METHODS

Forecasting techniques - Statistical forecasting techniques. Decomposition model - Estimation of trend, seasonality and cyclical components. Smoothing models for forecasting - moving average, exponential smoothing methods, time series analysis.

UNIT IV: SIMULATION, RISK ANALYSIS AND DATA MINING

Simulation and Risk Analysis - Monte Carlo simulation Examples of simulation models, Introduction to Data Mining - Scope of Data Mining. Data exploration and reduction. Classification - Measuring classification performance. Classification techniques - K nearest neighbor, Discriminant Analysis, factor analysis, and Logistic regression.

UNIT V: DECISION ANALYSIS

Decision making with uncertain information. Decision strategies for a minimize objective. Decision strategies for a maximize objective. Decision Tress. Building a decision tree. Decision trees and risk. Sensitivity analysis, Baye's Rule.

Case Study:

Compulsory and Relevant Cases have to be discussed in each unit.

Assignment:

Two relevant assignments have to be given to the students

Course Outcomes

At the end of this course students will be able to

1. Understand the need and significance of business analytics for decision making
2. Use statistical tools to extract information from raw data
3. Use regression technique to build predictive models
4. Apply simulation technique to predict business scenarios
5. Use data mining techniques to make business decsisions

Text Books:

Essentials of Business Analytics, Jeffrey Camm, James Cochran, Michael Fry, Jeffrey Ohlmann, David Anderson

References:

1. Albright C. S., Winston Wayne L. and Zappe C. J (2009). Decision Making Using Microsoft Excel (India Edition). Cengage Learning.
2. Evans J. R (2013). Business Analytics Methods, Models and Decisions. Pearson, Upper Saddle River, New Jersey.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18OEP302 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

Course Prerequisites: None

UNIT-I:

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, 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 treeconcept, 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

References

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18OEP303 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

Course Prerequisites: None

UNIT-I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT-II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT-III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT-IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT-V

Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Course Outcomes

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

References

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18OEP304 COST MANAGEMENT OF ENGINEERING PROJECTS

L	T	P	C
3	0	0	3

Course Prerequisites: None

UNIT I:

Introduction and Overview of the Strategic Cost Management Process

UNIT II:

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT III:

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT IV:

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V:

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18OEP305 COMPOSITE MATERIALS

L	T	P	C
3	0	0	3

Course Prerequisites: None

UNIT I

INTRODUCTION: Definition - Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III

Manufacturing of Metal Matrix Composites: Casting - Solid State diffusion technique, Cladding - Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration - Liquid phase sintering. Manufacturing of Carbon - Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs - hand layup method - Autoclave method - Filament winding method - Compression moulding - Reaction injection moulding. Properties and applications.

UNIT V

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books

1. Material Science and Technology - Vol 13 - Composites by R.W.Cahn - VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials - K.K.Chawla.
3. Composite Materials Science and Applications - Deborah D.L. Chung.
4. Composite Materials Design and Applications - Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Mode of Evaluation: Assignments, Mid Examinations, End Examination

18OEP306 WASTE TO ENERGY

L	T	P	C
3	0	0	3

Course Prerequisites: None

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

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

UNIT III

Biomass Gasification: Gasifiers - Fixed bed system - Downdraft and updraft gasifiers - Fluidized bed gasifiers - Design, construction and operation - Gasifier burner arrangement for thermal heating - Gasifier engine arrangement and electrical power - Equilibrium and kinetic consideration in gasifier operation.

UNIT IV

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

UNIT V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology andstatus - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants - Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References

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

Mode of Evaluation: Assignments, Mid Examinations, End Examination