SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti – 626 115.

(*An Autonomous Institution*)

DEPARTMENT OF CIVIL ENGINEERING

M.E. STRUCTURAL ENGINEERING

REGULATIONS 2015 – CHOICE BASED CREDIT SYSTEM

REVISED CURRICULUM & SYLLABUS

Approved in the

Academic Council Meeting on 21.07.2017

Chairperson/BOS

Chairperson
Board of Studies
Civil Engineering
Sethu Institute of Technology
Kariapatti - 626 115

Chairman

Academic Council

CHAIRMAN
ACADEMIC COUNCIL
Sethu Institute of Technology
Pulloor, Kariapatti - 625 115

SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti – 626 115

(***An Autonomous Institution***)

M.E. Degree Programme

CURRICULUM

Regulations 2015

Master of Engineering in Structural Engineering

OVERALL COURSE STRUCTURE

Category	Total No. of Courses	Credits	Percentage
Basic Science	**1**	**4**	**6**
Programme CORE	**11**	**30**	**43**
Programme ELECTIVE	**5**	**15**	**21**
Open Elective	**1**	**3**	**4**
Project Work	**2**	**18**	**26**
TOTAL	**22**	**70**	**100**

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	TOTAL
Structural Engineering	**18**	**17**	**20**	**15**	**70**

LIST OF WINTER COURSES

SI.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	C	WINTER/SUMMER	CATEGORY
1.	15PMA125	Applied Mathematics for Structural Engineering	3	2	0	4	Winter	BS
2.	15PSE102	Concrete Structures	3	0	0	3	Winter	PC
3.	15PSE103	Theory of Elasticity and Plasticity	3	0	0	3	Winter	PC
4.	15PSE104	Stability of Structures	3	0	0	3	Winter	PC
5.	15PSE106	Structural Engineering Laboratory	0	0	4	2	Winter	PC
6.	15PSE301	Structural Dynamics	4	0	0	4	Winter	PC
7.	15PSE302	Experimental Techniques and Instrumentation	3	0	0	3	Winter	PC
8.	15PSE306	Industrial Training	0	0	0	1	Winter	PC
9.	15PSE307	Project Work (Phase I)	0	0	6	3	Winter	PW

LIST OF SUMMER COURSES

SI.NO	SUBJECT CODE	SUBJECT NAME	L	T	P	C	WINTER/SUMMER	CATEGORY
1.	15PSE201	Finite Element Analysis for Structural Engineering	4	0	0	4	Summer	PC
2.	15PSE202	Steel Structures	3	0	0	3	Summer	PC
3.	15PSE203	Design of Prestressed Concrete Structures	3	0	0	3	Summer	PC
4.	15PSE206	Internship	0	0	2	1	Summer	PC
5.	15PSE401	Project Work (Phase II)	0	0	30	15	Summer	PW

LIST OF PROGRAMME ELECTIVES

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	15PSE501	Analysis and Design of Tall Buildings	3	0	0	3
2.	15PSE502	Forensic Engineering and Rehabilitation of Structures	3	0	0	3
3.	15PSE503	Offshore Structures	3	0	0	3
4.	15PSE504	Optimization of Structures	3	0	0	3
5.	15PSE505	Design of Bridges	3	0	0	3
6.	15PSE506	Mechanics of Composite Materials	3	0	0	3
7.	15PSE507	Advanced Concrete Technology	3	0	0	3
8.	15PSE508	Wind and Cyclone Effects on Structures	3	0	0	3
9.	15PSE509	Design of Sub Structures	3	0	0	3
10.	15PSE510	Computer Aided Analysis and Design	3	0	0	3
11.	15PSE511	Design of Shell and Spatial Structures	3	0	0	3
12.	15PSE512	Design of Steel Concrete Composite Structures	3	0	0	3
13.	15PSE513	Design of Industrial Structures	3	0	0	3
14.	15PSE514	Nonlinear Analysis of Structures	3	0	0	3
15.	15PSE515	Precast and Prefabricated Structures	3	0	0	3
16.	15PSE516	Theory of Plates and Shells	3	0	0	3
17.	15PSE517	Earthquake Analysis and Design of structures	3	0	0	3
18.	15PSE518	Advanced Construction Technology	3	0	0	3
19.	15PSE519	Matrix Methods for Structural Analysis	3	0	0	3
20.	15PSE520	Design of Storage Structures	3	0	0	3
21.	15PSE521	Remote Sensing Techniques and GIS	3	0	0	3
22.	15PSE522	Engineering Fracture Mechanics	3	0	0	3
23.	15PSE523	Durability of Concrete Structures	3	0	0	3
24.	15PSE524	Constitutive Models and modes of failure	3	0	0	3
25.	15PSE525	Smart Materials and Smart Structures	3	0	0	3

LIST OF OPEN ELECTIVES

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	15PSE601	Research Methodology	3	0	0	3
2.	15PEN602	Pedagogy for Engineering Education	3	0	0	3
3.	15PEN603	Professional Communication Skills	2	0	2	3
4.	15PPE604	Soft Computing	3	0	0	3
5.	15PCD605	Industrial Safety	3	0	0	3
6.	15PCD606	Business Management and Leadership	3	0	0	3
7.	15PCS607	Management Information System	3	0	0	3

SEMESTER I

Course Code	Course Title	L	T	P	C
THEORY					
15PMA125	Applied Mathematics for Structural Engineering	3	2	0	4
15PSE102	Concrete Structures	3	0	0	3
15PSE103	Theory of Elasticity and Plasticity	3	0	0	3
15PSE104	Stability of Structures	3	0	0	3
	Professional Elective I	3	0	0	3
PRACTICAL					
15PSE106	Structural Engineering Laboratory	0	0	4	2
	TOTAL	**15**	**2**	**4**	**18**
Total No. of Credits – 18					

SEMESTER II

Course Code	Course Title	L	T	P	C
THEORY					
15PSE201	Finite Element Analysis for Structural Engineering	4	0	0	4
15PSE202	Steel Structures	3	0	0	3
15PSE203	Design of Prestressed Concrete Structures	3	0	0	3
	Professional Elective II	3	0	0	3
	Professional Elective III	3	0	0	3
PRACTICAL					
15PSE206	Internship	0	0	2	1
	TOTAL	**16**	**0**	**2**	**17**
Total No. of Credits – 17					

SEMESTER III

Course Code	Course Title	L	T	P	C
THEORY					
15PSE301	Structural Dynamics	4	0	0	4
15PSE302	Experimental Techniques and Instrumentation	3	0	0	3
	Professional Elective IV	3	0	0	3
	Professional Elective V	3	0	0	3
	Open Elective I	3	0	0	3
PRACTICAL					
15PSE306	Industrial Training	0	0	0	1
15PSE307	Project Work (Phase I)	0	0	6	3
	TOTAL	**16**	**0**	**6**	**20**
Total No. of Credits – 20					

SEMESTER IV

Course Code	Course Title	L	T	P	C
PRACTICAL					
15PSE401	Project Work (Phase II)	0	0	30	15
	TOTAL	**0**	**0**	**30**	**15**
Total No. of Credits – 15					

M.E. Degree Programme (Part- Time)

CURRICULUM

Regulations 2015

Master of Engineering in Structural Engineering

OVERALL COURSE STRUCTURE

Category	Total No. of Courses	Credits	Percentage
Basic Science	**1**	**4**	**6**
Programme CORE	**11**	**30**	**43**
Programme ELECTIVE	**5**	**15**	**21**
Open Elective	**1**	**3**	**4**
Project Work	**2**	**18**	**26**
TOTAL	**22**	**70**	**100**

COURSE CREDITS – SEMESTER WISE

Branch	I	II	III	IV	V	VI	TOTAL
Structural Engineering	**12**	**11**	**10**	**9**	**13**	**15**	**70**

SEMESTER I

Course Code	Course Title	L	T	P	C
THEORY					
15PMA125	Applied Mathematics for Structural Engineering	3	2	0	4
15PSE102	Concrete Structures	3	0	0	3
	Professional Elective I	3	0	0	3
PRACTICAL					
15PSE106	Structural Engineering Laboratory	0	0	4	2
	TOTAL	**9**	**2**	**4**	**12**
Total No. of Credits – 12					

SEMESTER II

Course Code	Course Title	L	T	P	C
THEORY					
15PSE201	Finite Element Analysis for Structural Engineering	4	0	0	4
15PSE202	Steel Structures	3	0	0	3
	Professional Elective II	3	0	0	3
PRACTICAL					
15PSE206	Internship	0	0	2	1
	TOTAL	**10**	**0**	**2**	**11**
Total No. of Credits – 11					

SEMESTER III

Course Code	Course Title	L	T	P	C
THEORY					
15PSE103	Theory of Elasticity and Plasticity	3	0	0	3
15PSE104	Stability of Structures	3	0	0	3
	Professional Elective III	3	0	0	3
PRACTICAL					
15PSE306	Industrial Training	0	0	0	1
	TOTAL	**9**	**0**	**0**	**10**
Total No. of Credits – 10					

SEMESTER IV

Course Code	Course Title	L	T	P	C
THEORY					
15PSE203	Design of Prestressed Concrete Structures	3	0	0	3
	Professional Elective IV	3	0	0	3
	Professional Elective V	3	0	0	3
	TOTAL	**9**	**0**	**0**	**9**
Total No. of Credits – 9					

SEMESTER V

Course Code	Course Title	L	T	P	C
THEORY					
15PSE301	Structural Dynamics	4	0	0	4
15PSE302	Experimental Techniques and Instrumentation	3	0	0	3
	Open Choice Elective I	3	0	0	3
PRACTICAL					
15PSE307	Project Work (Phase I)	0	0	6	3
	TOTAL	**10**	**0**	**6**	**13**
Total No. of Credits – 13					

SEMESTER IV

Course Code	Course Title	L	T	P	C
PRACTICAL					
15PSE401	Project Work (Phase II)	0	0	30	15
	TOTAL	**0**	**0**	**30**	**15**
Total No. of Credits – 15					

SEMESTER-I

15PMA125	APPLIED MATHEMATICS FOR STRUCTURAL ENGINEERING	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To familiarize the student with the basic concepts of calculus of variations.
- To make the student knowledgeable with the concepts of Eigen value problems and Numerical Integrations.

UNIT I ONE DIMENSIONAL WAVE AND HEAT EQUATIONS 9 + 6

Laplace transform methods for one dimensional wave equation – Displacements in a long string – Longitudinal vibration of an elastic bar – Fourier transform methods for one dimensional heat conduction problems in infinite and semi-infinite rods.

UNIT II SIMULTANEOUS EQUATIONS AND NUMERICAL INTEGRATION 9 + 6

Solving of set of equations : Choleski method, Iterative methods, Relaxation method. System of non-linear equations - Gaussian Quadrature – One and Two Dimensions – Gauss Hermite Quadrature – Monte Carlo Method – Multiple Integration by using mapping function.

UNIT III CALCULUS OF VARIATIONS 9 + 6

Calculus of variations and its properties – Euler's equation – Functional dependant on first and higher order derivatives - Functional dependant on functions of several independent variables – Rayleigh Ritz method - Galerkin method.

UNIT IV EIGEN VALUE PROBLEMS 9 + 6

Methods of solutions: Faddeev – Leverrier method, Power method with deflation – Approximate methods: Rayleigh – Ritz method.

UNIT V ESTIMATION THEORY 9 + 6

Principles of least squares – Regression - Multiple and Partial Correlations - Estimation of Parameters - Maximum likelihood estimates – Method of Moments.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

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

- Solve the one dimensional heat conduction problems using Laplace and Fourier Transforms methods which is widely used in Engineering to obtain the temperature distributions.
- Form Euler's equation and functional dependent functions which are widely used to find the maxima, minima and critical points of a function in string theory.
- Interpret Eigen value problems in different methods which is widely used to test for cracks or deformities in a solid.
- Evaluate and implement the basic principles of interpolation and numerical techniques in Structural analysis.
- Apply the concepts of Calculus of variations which is useful in engineering problems.

REFERENCE BOOKS:

1. SANKARA RAO, K., “Introduction to Partial Differential Equations”, Prentice Hall of India, New Delhi, 3rd Edition, (2007).
2. RAJASEKARAN.S, “Numerical Methods in Science and Engineering, A Practical approach”, A.H.Wheeler and Company, New Delhi, 2nd Edition, (1986).
3. GUPTA, A.S, “Calculus of Variations with Applications”, Prentice Hall of India, New Delhi, 3rd Reprint, (2003).
4. RICHARD JOHNSON, MILLER & FREUN’S “Probability and Statistics for Engineers”, Prentice Hall of India, New Delhi, 7th Edition, (2007).
5. ANDREWS, L.C. and SHIVAMOGGI, B.K., “Integral Transforms for Engineers”, Prentice Hall of India, New Delhi, 4th Edition, (2005).

15PSE102	CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an exposure on the behaviour, analysis and design of R.C. structures.
- To teach the design aspects of shear walls, flat slabs, deep beams etc.
- To impart knowledge on detailing for earthquake resistant design.

UNIT I DESIGN PHILOSOPHY 9

Limit state design - beams, slabs and columns according to IS Codes. - Calculation of deflection and crack width according to IS Code.

UNIT II DESIGN OF SPECIAL RC ELEMENTS 9

Behaviour and Design of slender columns - Design of RC walls - ordinary and shear walls. Strut and tie method of analysis for corbels and deep beams, Design of corbels, Deep-beams and grid floors.

UNIT III FLAT SLABS AND YIELD LINE BASED DESIGN 9

Design of flat slabs and flat plates according to IS Method - Check for shear - Design of spandrel beams - Yield line theory and Hillerborgs strip method of design of slabs.

UNIT IV INELASTIC BEHAVIOUR OF CONCRETE STRUCTURES 9

Inelastic behaviour of concrete beams and frames, moment - rotation curves

UNIT V DUCTILE DETAILING 9

Concept of Ductility – Detailing for ductility – Design of beams, columns for ductility - Design of cast-in-situ joints in frames – Fire resistance of Reinforced concrete members.

TOTAL: 45 PERIODS

(Note: Use of IS 13920:1993, IS 456:2000 and SP16 are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Design beams, slabs and columns by limit state method.
- Estimate deflection and crack width according to IS and ACI Codes.
- Design special R.C. elements such as shear walls, Corbels and deep beams.
- Apply Yield line theory for design of slabs.
- Detail R.C. members for ductility as per IS codes.

REFERENCES:

1. Unnikrishna Pillai and Devdas Menon “Reinforced concrete Design’, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2009.
2. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, 2007.
3. Varghese, P.C, “Advanced Reinforced Concrete Design”, Prentice Hall of India, 2009.
4. Purushothaman, P, “Reinforced Concrete Structural Elements : Behaviour Analysis and Design”, Tata McGraw Hill, 1986

5. Gambhir.M.L., “Design of Reinforced Concrete Structures”, Prentice Hall of India, 2012.

STANDARDS:

1. IS:13920-1993 - Ductile detailing of reinforced concrete structures subjected to seismic forces – Code of Practice
2. IS:456-2000 - Indian Standard Code of Practice for Plain and Reinforced Concrete.
3. SP16-Design Aid for RC to IS 456-1978.

15PSE103	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the elastic and plastic properties of various elements.
- To train the students to solve problems of thin walled open and closed sections subjected to torsion.
- To introduce energy principles and their application to elasticity problems.

UNIT I ELASTICITY **9**

Analysis of stress and strain, Equilibrium equations - Compatibility equations – stress strain relationship - Generalized Hooke's law.

UNIT II ELASTICITY SOLUTION **9**

Methods of formulation of elasticity problems - methods of solution of elasticity problems - Plane stress and plane strain - Simple two dimensional problems in Cartesian and polar co-ordinates.

UNIT III ENERGY METHODS **9**

Numerical and Energy methods - Castiglianos theorem - Principle of Virtual work - Principle of stationary potential energy - Principle of least work - Rayleigh's method - Rayleigh-Ritz method- Finite difference method - Simple applications.

UNIT IV TORSION **9**

Introduction - general solution of torsion problems - boundary conditions- stress function method- Torsion of non-circular sections - Prandtl's membrane analogy - torsions of thin walled open and closed sections and thin walled multiple cell closed sections.

UNIT V PLASTICITY **9**

Physical Assumptions – criterion of yielding, plastic stress strain relationship - Elastic plastic problems in bending – torsion and thick cylinder.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Distinguish plane stress and plane strain problems.
- Obtain elasticity solutions for Simple two dimensional problems in Cartesian and polar co-ordinates.
- Solve thin walled open and closed sections for torsion.
- Apply energy methods to solve elasticity problems.
- Solve Plasticity problems.

REFERENCES:

1. Ansel.C.Ugural and Saul.K.Fenster, "Advanced Strength and Applied Elasticity," Fourth Edition, Prentice Hall Professional technical Reference, New Jersy, 2003.
2. Chakrabarty.J, "Theory of Plasticity", Third Edition, Elsevier Butterworth - Heinmann – UK, 2006.
3. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, New Delhi 1995.
4. Slater R.A.C, "Engineering Plasticity", John Wiley and Son, New York,1977.
5. Timoshenko, S. and Goodier J.N."Theory of Elasticity", McGraw Hill Book Co., New York, 1988.

15PSE104	STABILITY OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To teach the buckling concepts of slender members.
- To impart knowledge on buckling of beam column, frame and plates.
- To make the students to estimate critical loads of structural elements using finite difference method.

UNIT I BUCKLING OF COLUMNS 9

Concepts of stability – Classification of buckling problems - Governing equation for columns - Analysis for various boundary conditions– Equilibrium approach, energy approach, imperfection approach - Eccentrically loaded column - Higher order governing equations

UNIT II APPROXIMATE METHODS 9

Approximate methods - Rayleigh Ritz method, Galerkins Method - Numerical Techniques - Finite difference method - Derivation of Column design formula - Effective length of Columns.

UNIT III BUCKLING OF BEAM-COLUMNS 9

Theory of beam column - Stability analysis of beam column with central concentrated load, uniformly distributed load and end couples - Columns on Elastic Foundation.

UNIT IV BUCKLING OF FRAMES 9

Analysis of single storey portal frames with and without sway using Equilibrium approach – Analysis of frames using Slope deflection and stiffness method– Use of Wood's charts

UNIT V BUCKLING OF THIN PLATES 9

Governing differential equation - Buckling of thin plates, various edge conditions - Analysis by equilibrium and energy approach – Finite Difference Method.

TOTAL: 45 PERIODS

(Note: Use of Woods Charts is permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Derive the governing differential equation for buckling of columns
- Calculate the load carrying capacity of columns by approximate methods
- Solve problems on buckling of beam columns.
- Determine the buckling load of frames by stiffness method
- Analyse buckling of thin plates using numerical methods

REFERENCES:

1. Timoshenko, S., and Gere., "Theory of Elastic Stability", McGraw Hill Book Company, 1963.
2. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall, 1974.
3. Ashwini Kumar, "Stability Theory of Structures", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2003.
4. Iyenger.N.G.R.,, "Structural stability of columns and plates", Affiliated East West Press,1988.
5. Gambhir, "Stability Analysis and Design of Structures", Springer, New York, 2004.

15PSE106	STRUCTURAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To train the students to carry out experimental testing of RC and steel beams
- to make them understand the strength and deflection behavior of flexural members
- To prepare them to conduct non destructive tests on concrete

LIST OF EXPERIMENTS

1. Concrete Mix Design- I.S. code Method
2. Concrete Mix Design- ACI code Method
3. Properties of Self Compacting Concrete using slump flow, L Box and V Funnel Tests
4. Determination of Modulus of Elasticity of Concrete using Compressometer
5. Fabrication, casting and testing of simply supported R.C beam for Strength and deflection behaviour.
6. Testing of simply supported Steel beam for strength and deflection behaviour.
7. Fabrication, casting and testing of RC column subjected to Concentric and eccentric loading.
8. Determination of in-situ strength and quality of concrete using
   i) Rebound hammer
   ii) Ultrasonic Pulse Velocity Tester
9. Determination of Impact Resistance of concrete
10. Determination of Permeability of concrete
11. Measurement of Cracks
12. Durability Tests on Concrete
    - Water absorption
    - Sorptivity
    - Acid resistance
    - Sulphate resistance
13. Study of Strain Measuring devices
    - Mechanical Strain Gauge
    - Electrical Strain Gauges

TOTAL: 60 PERIODS

LABORATORTY EQUIPMENTS REQUIREMENTS

1. Strong Floor
2. Loading Frame
3. Hydraulic Jack
4. Load cell
5. Proving Ring

1. Demec Gauge
2. Electrical Strain Gauges
3. Rebound hammer
4. Ultrasonic Pulse Velocity Tester
5. Dial gauges

COURSE OUTCOMES:

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

- Design concrete mixes using IS and ACI Codes
- Determine fresh properties of self compacting concrete
- Evaluate the structural behavior of RCC and Steel flexural members
- Assess the quality of concrete using Non Destructive Testing Methods
- Determine the Durability properties of Concrete

REFERENCES:

Dally J W, and Riley W F, “Experimental Stress Analysis”, McGraw-Hill Inc. New York, 1991.

SEMESTER-II

15PSE201	FINITE ELEMENT ANALYSIS FOR STRUCTURAL ENGINEERING	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To impart the finite element concepts
- To train the students to solve for displacements and stresses using finite element analysis
- To provide an overview of nonlinear analysis of structures.

UNIT I INTRODUCTION TO FINITE ELEMENT METHOD 12

Historical Background - Basic Concept of FEM - Engineering problems and governing differential equations - Finite element modeling - Discretisation - Node, Element - different types of element - Approximate Solutions - Principal of minimum potential energy- Rayleigh-Ritz method and Galerkins methods.

UNIT II FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS 12

One dimensional problems - Coordinate systems – global, local and natural coordinate systems- shape functions – Bar, beam and truss element - Generation of Stiffness Matrix and Load Vector- Applications

UNIT III FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS 12

Two Dimensional problems – Plane Stress, Plane Strain Problems - Triangular and Quadrilateral Elements - Isoparametric Formulation - Natural Coordinates - Shape function - stiffness matrix- Axisymmetric Problems - Higher Order Elements - Numerical Integration.

UNIT IV MESHING AND SOLUTION PROBLEMS 12

Higher Order Elements - p and h Methods of Mesh Refinement - ill conditioned Elements – Discretisation Errors – Auto and Adaptive Mesh Generation Techniques - Error Evaluation.

UNIT V NONLINEAR, VIBRATION AND THERMAL PROBLEMS 12

Material and Geometric Nonlinearity – Methods of Treatment – Consistent System Matrices - Dynamic Condensation - Eigen Value Extraction - thermal analysis.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Explain basic concepts of finite element analysis.
- Solve one dimensional problems like bars, beams and truss
- Find out the solutions for two dimensional and axisymmetric problems using finite element method.
- Describe the concepts of different mesh generation techniques.
- Apply finite element method to solve nonlinear, vibration and thermal problems.

REFERENCES:

1. Bhavikatti.S.S, “Finite Element Analysis”, New Age International Publishers, 2009.
2. Chandrupatla, R.T. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”, Prentice Hall of India, 2007.
3. David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
4. Moaveni, S., “Finite Element Analysis Theory and Application with ANSYS”, Prentice Hall Inc., 2007.
5. Rao.S.S, “Finite Element Method in Engineering”, Butterworth – Heinemann, UK, 2008.

15PSE202	STEEL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To teach the behaviour of steel members and connections.
- To prepare the students to design industrial buildings.
- To give an exposure on the design of cold formed steel and plastic analysis of structures.

UNIT I GENERAL **9**

Design of members subjected to combined forces – Design of Purlins, Louver rails, Gable column and Gable wind girder – Design of simple bases, Gusseted bases and Moment Resisting Base Plates.

UNIT II DESIGN OF CONNECTIONS **9**

Types of connections – Welded and Bolted – Throat and Root Stresses in Fillet Welds – Seated Connections – Unstiffened and Stiffened seated Connections – Moment Resistant Connections – Clip angle Connections – Split beam Connections – Framed Connections.

UNIT III ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS **9**

Analysis and design of different types of Live pan, Pratt and north light trusses roofs – Analysis and design of industrial buildings – Sway and non sway frames – Aseismic design of steel buildings

UNIT IV PLASTIC ANALYSIS OF STRUCTURES **9**

Introduction - Shape factor - Moment redistribution- Combined mechanisms - Analysis of portal frames - Effect of axial force - Effect of shear force on plastic moment - Connections – Requirement – Moment resisting connections. Design of Straight Corner Connections – Haunched Connections – Design of continuous beams.

UNIT V DESIGN OF LIGHT GAUGE STEEL STRUCTURES **9**

Behaviour of Compression Elements - Effective width for load and deflection determination – Behaviour of Unstiffened and Stiffened Elements – Design of webs of beams – Flexural members – Lateral buckling of beams – Shear Lag – Flange Curling – Design of Compression Members – Wall Studs.

TOTAL: 45 PERIODS

(Note: Use of IS 800:2007, IS: 875 (Part I to V), IS: 801-1975, IS: 811-1987, IS: 6533-1989 (Part I & II), IS: 802-1977 and SP: 6 are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Design members subjected to combined forces.
- Design various types of steel connections and joints.
- Analyse and design different types of roof trusses.
- Perform plastic analysis of structures
- Design light gauge steel flexural and compression members.

REFERENCES:

1. Lynn S. Beedle, Plastic Design of Steel Frames, John Wiley and Sons, 1990.

2. Narayanan.R.et.al., Teaching Resource on Structural steel Design, INSDAG, Ministry of Steel Publishing, 2000.

3. Subramanian.N, Design of Steel Structures, Oxford University Press, 2008.

4. Wie Wen Yu, Design of Cold Formed Steel Structures, Mc Graw Hill Book Company, 2008.

STANDARDS:

1. IS: 800-2007 - Indian Standard Code of Practice for general construction in steel (Limit State).
2. IS: 875 (Part I to V) - Code of Practice for Design loads.
3. IS: 801-1975 - Code of practice for use of cold formed light gauge steel structural members in general building construction.
4. IS: 811-1987 - Cold formed light gauge structural steel sections.
5. IS: 6533-1989 (Part I & II) - Code of Practice for Design and Construction of Steel Chimney.
6. IS: 802-1977 - Code of Practice for use of structural steel in Overhead Transmission Line Towers.
7. SP: 6 - Handbook on Structural Steel Section.

15PSE203	DESIGN OF PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the Principles of prestressing.
- To train the students to design prestressed concrete elements.
- To impart the concepts of circular and partial prestressing.

UNIT I PRINCIPLES OF PRESTRESSING 9

Principles of Prestressing - types and systems of prestressing, need for High Strength materials - Analysis methods losses, deflection (short-long term) - camber - cable layouts.

UNIT II DESIGN OF FLEXURAL MEMBERS 9

Behaviour of flexural members - determination of ultimate flexural strength – Codal provisions - Design of flexural members, Design for shear, bond and torsion. Design of end blocks.

UNIT III DESIGN OF CONTINUOUS BEAMS 9

Analysis and design of continuous beams - Methods of achieving continuity - concept of linear transformations, concordant cable profile and gap cables

UNIT IV DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks - Design of compression members with and without flexure - its application in the design piles, flagmasts and similar structures.

UNIT V DESIGN OF COMPOSITE MEMBERS 9

Composite beams - analysis and design, ultimate strength - their applications. Partial prestressing - its advantages and applications.

TOTAL: 45 PERIODS

(Note: Use of IS1343:2012 and IS 3370 Part III & IV are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Determine the losses and deflection in Prestressed elements
- Design prestressed concrete beams for shear, bond and torsion
- Design tension and compression members
- Perform analysis and design of continuous and composite beams
- Discuss the principles of partial prestressing.

REFERENCES:

1. Krishna Raju, “Prestressed Concrete”, Tata McGraw Hill Publishing Co,2008.
2. Sinha.N.C.and.Roy.S.K, “Fundamentals of Prestressed Concrete”, S.Chand and Co., 1998.
3. Lin.T.Y., “Design of Prestressed Concrete Structures”, John Wiley and Sons Inc,1981.

4. Evans, R.H. and Bennett, E.W., “Prestressed Concrete”, Champman and Hall, London, 1958.
5. Rajagopalan.N, Prestressed Concrete, Narosa Publications, New Delhi, 2010.

STANDARDS:

1. IS1343:2012, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, Second revision.
2. IS 3370 Code of practice for concrete structures for the storage of liquids Part III Prestressed concrete structures.
3. IS 3370 Code of practice for concrete structures for the storage of liquids Part IV Design Tables

15PSE206	INTERNSHIP	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide hands on training in an industry or a research institution or an academic institution
- To provide knowledge on practical applications for the theoretical concepts studied

A candidate has to undergo practical training for two weeks in an approved organization related to their branch of study during the vacation period of first semester or should be accommodated in the UG programme laboratory during the second semester. After successful completion of the training the student shall submit the report.

EVALUATION PROCESS

The evaluation is based on the successful completion of the Industrial Training/ Internship, report submitted by the candidate and a viva-voce examination done by a three member panel. The evaluation is done for 100 marks.

COURSE OUTCOMES:

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

- Develop analytical/hardware/software/experimental skills
- Prepare and present technical reports
- Apply practical knowledge to their project work

SEMESTER-III

15PSE301	STRUCTURAL DYNAMICS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To expose the students the principles and methods of dynamic analysis of structures.
- To make the students to solve single, two and MDOF systems
- To outline the practical applications of dynamic analysis.

UNIT I INTRODUCTION 12

Formulation of equations of motion by different methods - Single degree of freedom systems - Free vibration - Forced response to harmonic - Periodic and impulsive loads - Response to general dynamic loading - Effect of damping- Methods of evaluation of damping.

UNIT II TWO DEGREE OF FREEDOM SYSTEMS 12

Equations of Motion of Two degree of freedom systems - damped and undamped free vibrations – Undamped forced vibration- normal modes of vibration-applications

UNIT III MULTI - DEGREE OF FREEDOM SYSTEMS 12

Mathematical models of Multi-degree of freedom systems - orthogonality of normal modes- free and forced vibrations of multi degree of freedom systems - Mode superposition technique - Applications.

UNIT IV CONTINUOUS SYSTEMS 12

Free and forced vibration of continuous systems, Rayleigh – Ritz method – Formulation using Conservation of Energy – Formulation using Virtual Work, Applications.

UNIT V DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE 12

Damping in MDOF systems - Nonlinear MDOF systems, Wilson Theta method - Newmark beta method - step-by-step numerical integration techniques.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Derive the equations of motion by equilibrium and energy methods.
- Determine the dynamic response of single and Multi degrees of freedom systems .
- Apply mode superposition technique to extract modes and modeshapes.
- Solve free and forced vibration of continuous systems.
- Evaluate the response of systems due to dynamic loads using direct integration methods

REFERENCES:

1. Anil K.Chopra, Dynamics of Structures, Pearson Education, 2012.
2. Leonard Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1986, IOS Press, 2006.
3. Mario Paz, Structural Dynamics -Theory and Computation, Kluwer Academic Publishers, 2004.
4. Roy R.Craig, Jr, Andrew J. Kurdila, Fundamentals of Structural Dynamics, John Wiley & Sons, 2011.

15PSE302	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impart knowledge on the principles of measurements of static and dynamic response of structures.
- To discuss the principles of pressure and flow measurements.
- To give an exposure on the principles of non destructive testing methods.

UNIT I FORCES AND STRAIN MEASUREMENT 9

Choice of Experimental stress analysis methods, Errors in measurements – Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long-term monitoring – vibrating wire sensors – Fibre optic sensors.

UNIT II MEASUREMENT OF VIBRATION AND WIND FLOW 9

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – wind tunnels – Flow meters – Venturimeter – Digital data Acquisition systems.

UNIT III ACOUSTICS AND WIND FLOW MEASURES 9

Principles of Pressure and flow measurements – pressure transducers – sound level meter – venturimeter and flow meters – wind tunnel and its use in structural analysis structural modeling – Direct Model Study and Indirect Model study.

UNIT IV DISTRESS MEASUREMENTS AND CONTROL 9

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete – Half cell- construction and use – damage assessment – controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring.

UNIT V NON DESTRUCTIVE TESTING METHODS 9

Load testing on structures- buildings, bridges and towers – Rebound Hammer – acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating- Advanced NDT methods – Ultrasonic pulse echo- Impact echo- impulse radar techniques- GECOR - Ground penetrating radar (GPR).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Describe the working principle of force and strain measuring devices
- Explain the working principles of various vibration measuring instruments
- Discuss the principles of sound and wind measurements
- Diagnose distress in structures.
- Assess the strength of structures by NDT methods

REFERENCES:

1. Sadhu Singh, “Experimental Stress Analysis”, Khanna Publishers, New Delhi, 2006
2. Dalley .J.W and Riley.W.F, “Experimental Stress Analysis”, Mc Graw Hill Book Company, N.Y. 1991
3. Srinath.L.S, Raghavan.M.R, ingaiah.K, Gargesha.G, Pant.B and Ramachandra.K, “Experimental Stress Analysis”, Tata McGraw Hill Company, New Delhi, 1996.
4. Sirohi.R.S., Radhakrishna.H.C, “Mechanical Measurements”, New Age International (P) Ltd. 1997
5. Ravisankar.K. and Chellappan.A., “Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures”, SERC, Chennai, 2007.

15PSE306	INDUSTRIAL TRAINING	L	T	P	C
		0	0	0	1

OBJECTIVES:

- To train the students in the field work so as to have a firsthand knowledge of practical problems related to Structural Engineering in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.

DESCRIPTION

The students individually undertake training in reputed Structural Engineering Companies during the summer vacation for a specified period of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

COURSE OUTCOMES:

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

- Tackle a practical field/industry orientated problem related to Structural Engineering.

15PSE307	PROJECT WORK (PHASE I)	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

PROJECT DESCRIPTION

Every candidate shall be permitted to undertake a research based project work of his choice related to his / her discipline in consultation with the Head of the Department. The project shall be supervised by a faculty member of the Department in which the candidate registered a course.

In case of a project work at Industrial / Research organization, the project work shall be jointly supervised by the faculty supervisor and an expert from the organization.

He / She shall be required to undergo three reviews in a semester to assess the progress of the project work. The project work shall be evaluated based on the project report submitted by the candidate and Viva-voce examination conducted by a committee consisting of an external examiner, internal examiner, and the supervisor of the candidate.

COURSE OUTCOMES:

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

- Have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

SEMESTER-IV

15PSE401	PROJECT WORK (PHASE II)	L	T	P	C
		0	0	30	15

OBJECTIVES:

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

PROJECT DESCRIPTION

Every candidate shall be permitted to undertake a research based project work of his choice related to his / her discipline in consultation with the Head of the Department. The project shall be supervised by a faculty member of the Department in which the candidate registered a course.

In case of a project work at Industrial / Research organization, the project work shall be jointly supervised by the faculty supervisor and an expert from the organization.

He / She shall be required to undergo three reviews in a semester to assess the progress of the project work. The project work shall be evaluated based on the project report submitted by the candidate and Viva-voce examination conducted by a committee consisting of an external examiner, internal examiner, and the supervisor of the candidate.

COURSE OUTCOMES:

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

- Take up any challenging practical problem and find better solutions.

PROGRAME ELECTIVES

15PSE501	ANALYSIS AND DESIGN OF TALL BUILDINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the design philosophy of tall structures.
- To make the students to understand the behavior of various structural systems.
- To give an exposure on the stability analysis of different structural systems.

UNIT I LOADING AND DESIGN PRINCIPLES 9

Loading - sequential loading- Gravity loading - Wind loading - Earthquake loading - Equivalent lateral force - modal analysis - combination of loading – Static and Dynamic approach - Analytical and wind tunnel experimental methods - Design philosophy - working stress method, limit state method and plastic design.

UNIT II BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS 9

Factors affecting growth - height and structural form. High rise behavior - Rigid frames - braced frames - In filled frames- shear walls - coupled shear walls - wall-frames - tubulars - cores- outrigger - braced and hybrid mega systems.

UNIT III ANALYSIS AND DESIGN 9

Modeling for approximate analysis- Accurate analysis and reduction techniques- Analysis of buildings as total structural system considering overall integrity and major subsystem interaction- Analysis for member forces, drift and twist - Computerized three dimensional analysis – Assumptions in 3D analysis – Simplified 2D analysis.

UNIT IV STRUCTURAL ELEMENTS 9

Sectional shapes - properties and resisting capacity - design- deflection - cracking - prestressing - shear flow - Design for differential movement - creep and shrinkage effects - temperature effects and fire resistance.

UNIT V STABILITY OF TALL BUILDINGS 9

Overall buckling analysis of frames - wall-frames - Approximate methods - second order effects of gravity of loading- P-Delta analysis- simultaneous first-order and P-Delta analysis - Translational - Torsional instability - out of plumb effects - stiffness of member in stability - effect of foundation rotation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Illustrate the design principles involved in the design of tall buildings.
- Describe the materials used for construction of Tall Buildings.
- Discuss the structural behavior of various structural systems in tall buildings.
- Apply reduction techniques to simplify the analysis of multistory frames.
- Explain the second order effects of gravity loads.

REFERENCES:

1. Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 2005.
2. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 1988.
3. Gupta.Y.P.,(Editor), Proceedings of National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities, New Age International Limited, New Delhi,1995.
4. Lin T.Y and Stotes Burry D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.
5. Beedle.L.S., “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986

15PSE502	FORENSIC ENGINEERING AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an overview of repair materials and techniques.
- To impart various retrofitting techniques.
- To brief about the various engineered demolition techniques.

UNIT I SERVICEABILITY AND DURABILITY OF STRUCTURES 9

Quality Assurance for concrete construction, as built concrete properties strength permeability, thermal properties and cracking - Effects due to climate – Temperature – chemicals - Wear and erosion - Design and construction errors - Corrosion mechanism - Effects of cover thickness and cracking - Methods of corrosion protection – Inhibitors - Resistant steels – Coatings - Cathodic protection

UNIT II MAINTENANCE AND REPAIR STRATEGIES 9

Definition – Maintenance, repair and rehabilitation, facets of maintenance and importance of maintenance, preventive measures on various aspects, inspection, assessment procedures for evaluating damaged structures, causes of deterioration – Testing techniques, types of problems in foundation, floors, roofs, walls etc - Safety evaluation of existing buildings.

UNIT III MATERIALS FOR REPAIR 9

Special concrete and mortars, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferro - cement, fibre reinforced concrete, water-proofing materials, admixtures.

UNIT IV TECHNIQUES FOR REPAIR 9

Rust eliminators and polymers coating for rebar during repair-formed concrete, mortar and dry pack, vacuum concrete - Gunite and shotcrete, Epoxy injection - Mortar repair of cracks, shoring and underpinning.

UNIT V STRENGTHENING AND DEMOLITION ASPECT 9

Strengthening of existing structures - repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure, use of non destructive testing techniques for evaluation, load testing of structure - Demolition of structures using engineered and non engineered techniques - case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Assess the building conditions and formulate a suitable repair strategy using appropriate structural and construction technologies.
- Apply appropriate standards and statutory controls for maintenance and rehabilitation works.
- Identify the reasons for distress in structures and suggest remedial measures
- Explain the concepts of repair using special concretes and composites
- Describe various strengthening techniques for damaged structures

REFERENCES:

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical, UK, 1991.
2. Allen R.T and Edwards S.C, “Repair of Concrete Structures”, Blakie and Sons, UK,1987
3. Raikar, R.N., “Learning from failures - Deficiencies in Design, Construction and Service” - RandD Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Santhakumar A.R., “Concrete Technology” Oxford University Press, 2007
5. Peter H.Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications pvt. Ltd., 2009.
6. Dayaratnam.P and Rao.R, “Maintenance and Durability of Concrete Structures”, University Press, India, 1997.

15PSE503	OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of wave theories.
- To make the students aware of the various forces acting on offshore structures.
- To make the students to analyse and design offshore structures.

UNIT I WAVE THEORIES **8**

Wave generation process - small and finite amplitude wave theories.

UNIT II FORCES OF OFFSHORE STRUCTURES **8**

Wind forces, wave forces on small and large bodies - current forces and use of Morison equation.

UNIT III OFFSHORE SOIL AND STRUCTURE MODELLING **9**

Different types of offshore structures - foundation modeling and structural modeling- fixed jacket platform structural modeling

UNIT IV ANALYSIS OF OFFSHORE STRUCTURES **10**

Static method of analysis, foundation analysis and dynamics of offshore structures.

UNIT V DESIGN OF OFFSHORE STRUCTURES **10**

Design of platforms - helipads - Jacket tower - analysis and design of mooring cables and pipe lines.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Describe the basic concepts in coastal engineering such as the linear wave theory, energy propagation in waves, shoaling, refraction, diffraction, and breaking.
- Determine the forces acting on offshore structures
- Simulate offshore foundation and structural elements
- Analyse offshore structures for static and dynamic conditions
- Design platforms, helipads and pipelines

REFERENCES:

1. Chakrabarti, S.K. “Hydrodynamics of Offshore Structures”, Computational Mechanics Publications, 2001.
2. Dawson.T.H., “Offshore Structural Engineering”, Prentice Hall Inc Englewood Cliffs, N.J. 1983
3. Brebia, C.A and Walker, S., “Dynamic Analysis of Offshore Structures”, New Butterworths, U.K. 1979.
4. API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex, 2005.
5. Reddy, D.V. and Arockiasamy, M., “Offshore Structures”, Vol.1 and Vol.2, Krieger Publishing Company, Florida, 1991.

15PSE504	OPTIMIZATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the optimization methodologies applied to structural engineering.
- To train the students to use LP and NLP methods for structural optimization.
- To introduce the concepts of geometric and dynamic programming.

UNIT I BASIC PRINCIPLES AND CLASSICAL OPTIMIZATION TECHNIQUES 9

Definition - Objective Function; Constraints - Equality and inequality - Linear and non-linear, Side, Non-negativity, Behaviour and other constraints - Design space - Feasible and infeasible - Convex and Concave - Active constraint - Local and global optima. Differential calculus - Optimality criteria - Single variable optimization - Multivariable optimization with no constraints - (Lagrange Multiplier method) – with inequality constraints (Kuhn - Tucker Criteria).

UNIT II LINEAR AND NON-LINEAR PROGRAMMING 10

LINEAR PROGRAMMING: Formulation of problems - Graphical solution - Analytical methods - Standard form - Slack, surplus and artificial variables - Canonical form - Basic feasible solution - simplex method - Two phase method - Penalty method - Duality theory - Primal - Dual algorithm. NON LINEAR PROGRAMMING: One Dimensional minimization methods: Unidimensional - Unimodal function - Exhaustive and unrestricted search -Dichotomous search - Fibonacci Method - Golden section method - Interpolation methods. Unconstrained optimization Techniques.

UNIT III GEOMETRIC PROGRAMMING 8

Posynomial - degree of difficulty - reducing G.P.P to a set of simultaneous equations - Unconstrained and constrained problems with zero difficulty - Concept of solving problems with one degree of difficulty.

UNIT IV DYNAMIC PROGRAMMING 9

Bellman’s principle of optimality - Representation of a multistage decision problem - concept of sub-optimization problems using classical and tabular methods.

UNIT V STRUCTURAL APPLICATIONS 9

Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory - Minimum weight design for truss members - Fully stressed design - Optimization principles to design of R.C. structures such as multistorey buildings, water tanks and bridges.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the basic concepts of optimization.
- Solve optimisation problems using linear and non-linear programming techniques.
- Solve constrained and unconstrained problems with zero difficulty.
- Explain the concepts of sub-optimization problems using classical and tabular methods.
- Optimise structural elements such as continuous beams, sine story frames and truss.

REFERENCES:

1. Rao,S.S. “Optimization theory and applications”, Wiley Eastern (P) Ltd., 1984.
2. Uri Krish, “Optimum Structural Design”, McGraw Hill Book Co. 1981.
3. Spunt, “Optimization in Structural Design”, Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey 1971.
4. Iyengar.N.G.R and Gupta.S.K, “Structural Design Optimization”, Affiliated East West Press Ltd, New Delhi, 1997

15PSE505	DESIGN OF BRIDGES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To outline the loads and forces on bridges as per IRC guidelines
- To make the students to design several types of bridges.
- To give an overview of bridge foundations.

UNIT I SHORT SPAN RC BRIDGES 8

Types of bridges and loading standards - Choice of type - I.R.C. specifications for road bridges – Design of RCC solid slab bridges -analysis and design of slab culverts - Tee beam and slab bridges.

UNIT II LONG SPAN RC BRIDGES 9

Design principles of continuous girder bridges - box girder bridges - balanced cantilever bridges – Arch bridges – Box culverts

UNIT III PRESTRESSED CONCRETE BRIDGES 10

Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections..

UNIT IV STEEL BRIDGES 9

General – Railway loadings – dynamic effect – Railway culvert with steel beams – Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.

UNIT V BEARINGS AND SUBSTRUCTURES 9

Different types of bearings – Design of bearings – Design of piers and abutments of different types – Types of bridge foundations – Design of foundations.

TOTAL: 45 PERIODS

(Note: Use of IRC: 6-2010, IRC: 18-2000, IRC:21-2000, IRC: 22-2008, IRC: 24-2010, IRC: 83-1999 (Part-I to III), IS 800:2007,IS 456:2000, SP 6-1:1964 and Pigeaud's curves are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Identify the possibility of construction of bridge in a particular location
- Discuss the live loads acting on bridges as per IRC specifications.
- Design Culvert, T beam and prestressed concrete bridges.
- Design plate girder and box girder bridges.
- Describe types and design of bearings.

REFERENCES:

1. Ponnuswamy, S., “Bridge Engineering”, Tata McGraw Hill, 2008.
2. Johnson Victor, D. “Essentials of Bridge Engineering”, Oxford and IBH Publishing Co. New Delhi, 2001
3. Jagadeesh.T.R. and Jayaram.M.A, “Design of Bridge Structures”, Prentice Hall of India Pvt. Ltd. 2004.
4. Raina V.K.” Concrete Bridge Practice” Tata McGraw Hill Publishing Company, New Delhi, 1991.

STANDARDS:

1. IS 800:2007 Indian Standard General Construction in Steel – code of practice, Third Revision.
2. SP 6-1:1964(Reaffirmed 2003) Handbook for Structural Engineers
3. IS:456-2000, Plain and Reinforced Concrete – code of practice (4^{th} Edition).
4. IRC: 6-2010 Standard Specifications and Code of Practice for RoadBridges, Section II – Loads and Stresses (Fifth Revision).
5. IRC: 18-2000 Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete) (Third Revision).
6. IRC:21-2000 Standard Specifications and Code of Practice for Road Bridges, Section III – Cement Concrete (Plain and Reinforced) (Third Revision).
7. IRC: 22-2008 Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction (Limit States Design) (Second Revision).
8. IRC: 24-2010 Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit State Method)Third Revision).
9. IRC: 83-1999 (Part-I) Standard Specifications and Code of Practice for Road Bridges, Section IX – Bearings, Part I : Metallic Bearings (First Revision).
10. IRC: 83-1987 (Part II) Standard Specifications and Code of Practice for Road Bridges, Section IX – Bearings, Part II: Elastomeric Bearings.
11. IRC: 83-2002 (Part III) Standard Specifications and Code of Practice for Road Bridges, Section IX – Bearings, Part III: POT, POT-CUMPTFE,PIN and Metallic Guide Bearings.
12. Pigeaud’s curves

15PSE506	MECHANICS OF COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the behaviour of composite materials
- To impart the failure and fracture characteristics.
- To discuss the applications of various types of composite materials.

UNIT I INTRODUCTION 9

Introduction to Composites, Classifying composite materials, Commonly used fiber and matrix constituents, Composite Construction, Properties of Unidirectional Long Fiber Composites, Short Fiber Composites- Surface Preparation and Bonding Techniques.

UNIT II STRESS STRAIN RELATIONS 9

Concepts in solid mechanics, Hooke's law for orthotropic and anisotropic materials, Linear Elasticity for Anisotropic Materials, Rotations of Stresses, Strains, Residual Stresses.

UNIT III ANALYSIS OF LAMINATED COMPOSITES 9

Governing equations for anisotropic and orthotropic plates. Angle - ply and cross ply laminates. Static, dynamic and stability analysis for simpler cases of composite plates - Interlaminar stresses.

UNIT IV FAILURE AND FRACTURE OF COMPOSITES 9

Netting Analysis - Failure Criterion - Maximum Stress - Maximum Strain - Fracture Mechanics of Composites - Sandwich Construction.

UNIT V APPLICATIONS AND DESIGN 9

Metal and Ceramic Matrix Composites, Applications of Composites, Composite Joints, Design with Composites, Review, Environmental Issues.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Classify composite materials
- Discuss the stress –strain relationships for orthotrophic and anisotrophic materials
- Derive the Governing equations for anisotropic and orthotropic plates
- Understand the failure and fracture mechanism of composites
- Describe the various applications of composite materials

REFERENCES:

1. Agarwal.B.D., Broutman.L.J., and Chandrashekara.K. "Analysis and Performance of Fiber Composites", John-Wiley and Sons, 2006.
2. Daniel.I.M., and Ishai.O, "Engineering Mechanics of Composite Materials", Oxford University Press, 2005.
3. Hyer M.W., and White S.R., "Stress Analysis of Fiber-Reinforced Composite Materials", D.Estech Publications Inc., 2009
4. Jones R.M., "Mechanics of Composite Materials", Taylor and Francis Group 1999.
5. Mukhopadhyay.M, "Mechanics of Composite Materials and Structures", Universities Press, India, 2005.

15PSE507	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To outline the properties of concrete making materials, tests and mix design for concrete.
- To introduce the use of special concretes
- To give an idea about various concreting methods.

UNIT I CONCRETE MAKING MATERIALS 9

Aggregates classification - IS Specifications - Properties - Grading, Methods of combining aggregates - specified gradings - Testing of aggregates. Cement - Grade of cement - Chemical composition - Testing of concrete - Hydration of cement - Structure of hydrated cement - special cements - Water Chemical admixtures - Mineral admixtures

UNIT II TESTS ON CONCRETE 9

Properties of fresh concrete- Hardened concrete- Strength- Elastic properties- Creep and shrinkage – Durability of concrete.

UNIT III MIX DESIGN 9

Principles of concrete mix design - Methods of concrete mix design - IS Method, ACI Method, DOE Method - Testing of Concrete. Statistical quality control - sampling and acceptance criteria.

UNIT IV SPECIAL CONCRETES. 9

Light weight concrete- Fly ash concrete- Fibre reinforced concrete- Sulphur impregnated concrete- Polymer Concrete – High performance concrete. High performance fiber reinforced concrete- Self-Compacting-Concrete- Geo Polymer Concrete- Waste material based concrete – Ready mixed concrete.

UNIT V CONCRETING METHODS 9

Process of manufacturing of concrete - methods of transportation - placing and curing. Extreme weather concreting, special concreting methods. Vacuum dewatering - underwater concrete

TOTAL: 45 PERIODS

(Note: Use of IS 10262:2009, IS:456-2000, Charts from ACI 211.1-91 – 1991 and DOE 1988 are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Describe the properties cement, aggregates and admixtures
- Determine the properties of fresh and hardened concrete.
- Design concrete mixes using IS, ACI and DOE Codes.
- Explain the principles and procedures of Destructive and NDT methods.
- Select the suitable concreting method for different weather conditions.

REFERENCES:

1. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2009.
2. Gupta.B.L., Amit Gupta, “Concrete Technology, Jain Book Agency, 2010.
3. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
4. Santhakumar.A.R. ;”Concrete Technology”,Oxford University Press,2007.
5. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2005.

15PSE508	WIND AND CYCLONE EFFECTS ON STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of wind effects on the analysis and design of structures.
- To give an exposure on wind tunnel studies and their uses.
- To impart knowledge on the design of chimneys, roofs and shelters as per IS 875 provisions.

UNIT I INTRODUCTION **9**

Introduction - Types of wind – Characteristics of wind – Wind velocity - Method of measurement-variation of speed with height - shape factor, aspect ratio, drag effects - Dynamic nature of wind – Pressure and suctions - Spectral studies, Gust factor.

.

UNIT II WIND TUNNEL STUDIES **9**

Wind Tunnel Studies - Types of tunnels - Prediction of acceleration – Load combination factors – Wind tunnel data analysis – Calculation of Period and damping value for wind design - Modeling requirements- Aero dynamic and Aero-elastic models..

UNIT III EFFECT OF WIND ON STRUCTURES **9**

Classification of structures – Rigid and Flexible – Effect of wind on structures - Static and dynamic effects on Tall buildings – Chimneys.

UNIT IV DESIGN OF SPECIAL STRUCTURES **9**

Design of Structures for wind loading – as per IS, ASCE and NBC code provisions – design of Tall Buildings – Chimneys – Transmission towers – Industrial sheds.

UNIT V CYCLONE EFFECTS **9**

Cyclone effect on – low rise structures – sloped roof structures - Tall buildings. Effect of cyclone on claddings – design of cladding – use of code provisions in cladding design – Analytical procedure and modeling of cladding.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Discuss the types of tunnels and principles of wind tunnel studies
- Explain the effects of wind on tall buildings and chimneys
- Distinguish rigid and flexible structures.
- Design chimneys and roofs considering wind forces.
- Describe the effects of cyclone on structures

REFERENCES:

1. Cook.N.J., “The Designer's Guide to Wind Loading of Building Structures”, Butterworths, 1989.
2. Kolousek.V, Pirner.M, Fischer.O and Naprstek.J, “Wind Effects on Civil Engineering Structures”, Elsevier Publications, 1984
3. Peter Sachs, “Wind Forces in Engineering”, Pergamon Press, New York, 1972.
4. Lawson T.V., “Wind Effects on Building Vol. I and II”, Applied Science Publishers, London, 1980.

15PSE509	DESIGN OF SUB STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To teach the design aspects of piles pile cap and sheet pile structures.
- To enhance knowledge on the design of foundations for reciprocating machines, impact machines and design of anchors.
- To give an exposure on the methods of foundation in expansive soils.

UNIT I SHALLOW FOUNDATIONS **9**

Soil investigation – Basic requirements of foundation – Types and selection of foundations. Bearing capacity of soil - plate load test – Design of reinforced concrete isolated, strip, combined and strap footings – mat foundation.

UNIT II PILE FOUNDATIONS **9**

Introduction – Types of pile foundations – load carrying capacity - pile load test – structural design of straight piles – different shapes of piles cap – structural design of pile cap.

UNIT III WELL FOUNDATIONS **9**

. Types of well foundation – Grip length – load carrying capacity – construction of wells – Failures and Remedies – Design of well foundation – Lateral stability.

UNIT IV MACHINE FOUNDATIONS **9**

Introduction - Types of machine foundation – Basic principles of design of machine foundation- Dynamic properties of soil - Vibration analysis of machine foundation - Natural frequency - Design of foundation for Reciprocating machines and Impact machines - Reinforcement and construction details – Vibration isolation.

UNIT V SPECIAL FOUNDATION **9**

Foundation on expansive soils – choice of foundation – under-reamed pile foundation. Foundation for concrete Towers, chimneys – Design of anchors- Reinforced earth retailing walls.

TOTAL: 45 PERIODS

(Note: Use of IS Codes 2911 (Part 1 to 4) and IS: 2974 (Part I to V) are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Select appropriate foundation for various soil conditions
- Estimate bearing capacity of soil using plate load test
- Design piles and pile cap
- Design foundations for Reciprocating machines and Impact machines
- Discuss different methods of foundation for expansive soils

REFERENCES:

1. Swamy Saran, Analysis and Design of Substructures, Oxford and IBH Publishing Co. Pvt. Ltd., 2010
2. P. C. Varghese, Design of Reinforced Concrete Foundations, Prentice-Hall of India Private Ltd, New Delhi, 2009
3. M. J. Thomlinson and R. Boorman, Foundation Design and Construction, ELBS Longman, 1995
4. V. N. S. Murthy, Advanced Foundation Engineering, CBS publisher, 2007

STANDARDS:

1. IS Code 2911 (Part 1):2010 “Concrete Piles” Bureau of Indian Standards, New Delhi, Second revision.
2. IS Code 2911 (Part 2):1980 (Reaffirmed 2010) “Timber Piles”, Bureau of Indian Standards, New Delhi, First Revision.
3. IS Code 2911 (Part 3):1980 (Reaffirmed 2006) “Under Reamed Piles”, Bureau of Indian Standards, New Delhi, First Revision.
4. IS Code 2911 (Part 4):1985 (Reaffirmed 2010) “Load Test on Piles”, Bureau of Indian Standards, New Delhi, First Revision.
5. IS: 2974 (Part I to V) - Code of practice for design and construction of machine foundations.

15PSE510	COMPUTER AIDED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an exposure on the application packages available for structural analysis.
- To train the students on scheduling projects using CPM and PERT.
- To introduce the concepts of computer aided design of steel and R.C structural elements.

UNIT I COMPUTER GRAPHICS 9

Graphic primitives - Transformations - Basics of 2-D drafting - Modeling of curves and surfaces – Wire frame modeling - Solid modeling - Graphic standards - Drafting software packages and usage.

UNIT II STRUCTURAL ANALYSIS 9

Computer method of structural analysis – Simulation and Analysis of steel sections I, channel and Angle – RCC and Composite members - Nonlinear Analysis through software packages

UNIT III STRUCTURAL DESIGN 9

Computer aided design of steel and RC Structural elements – Detailing of reinforcement– Detailed drawing

UNIT IV OPTIMIZATION 9

Introduction to Optimization – Applications of Linear programming – Simplex Algorithm – Post Optimality Analysis – Project scheduling – CPM and PERT Applications.

UNIT V ARTIFICIAL INTELLIGENCE 9

Introduction – Heuristic Research – Knowledge based Expert Systems – Architecture and Applications – Rules and Decision tables – Inference Mechanisms – Simple Applications – Genetic Algorithm and Applications – Principles of Neural Network – Expert system shells.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Perform drafting and modeling operations using drafting software.
- Design R.C and steel structural elements using software
- Apply Linear Programming method to optimize simple structural problems
- Use CPM and PERT for project Scheduling
- Use Knowledge Based Expert Systems for simple applications

REFERENCES:

1. Krishnamoorthy C.S and Rajeev S., “Computer Aided Design”, Narosa Publishing House, New Delhi, 1991.
2. Groover M.P.and Zimmers E.W. Jr.," CAD/CAM, Computer Aided Design and Manufacturing ", Prentice Hall of India Ltd, New Delhi, 1993.
3. Harrison H.B., “Structural Analysis and Design Vol.I and II”, Pergamon Press, 1991
4. Hinton E.and Owen D.R.J., “Finite Element Programming”, Academic Press 1977.
5. Rao. S.S., " Optimization Theory and Applications ", Wiley Eastern Limited, New Delhi, 1987.
6. Richard Forsyth (Ed.), “Expert System Principles and Case Studies”, Chapman and Hall, 1996.

15PSE511	DESIGN OF SHELL AND SPATIAL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the concepts of behavior and design of shells and folded plates.
- To introduce the principles of computer Aided Design.
- To train the students to apply Formex Algebra

UNIT I CLASSIFICATION OF SHELLS 9

Classification of shells, types of shells, structural action - Design of circular domes - conical roofs, and circular cylindrical shells by ASCE Manual No.31.

UNIT II FOLDED PLATES 9

Folded Plate structures, structural behaviour, types, design by ACI - ASCE Task Committee method – pyramidal roof.

UNIT III INTRODUCTION TO SPACE FRAME 9

Space frames - configuration - types of nodes - general principles of design Philosophy -Behaviour.

UNIT IV ANALYSIS AND DESIGN 9

Analysis of space frames – detailed design of Space frames – Introduction to Computer Aided Design and Software Packages.

UNIT V SPECIAL METHODS 9

Application of Formex Algebra- FORMIAN for generation of configuration.

TOTAL: 45 PERIODS

(Note: Use of IS 2210:1988 is permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Design cylindrical shells by ASCE manual
- Explain the structural behaviour of folded plates
- Design folded plates by ACI- ASCE task committee method
- Design space frames
- Understand the concepts of Formex Algebra used in FORMIAN

.

REFERENCES:

1. Billington.D.P, “Thin Shell Concrete Structures”, McGraw Hill Book Co., New York,1982.
2. Santhakumar.A.R and Senthil.R, “Proceedings of International Conference on Space Structures”, Anna University, Chennai, 1997.
3. Subramanian.N ,”Principles of Space Structures”, Wheeler Publishing Co. 1999.
4. Ramasamy, G.S., “Design and Construction of Concrete Shells Roofs”, CBS Publishers, 1986.
5. ASCE Manual No.31, “Design of Cylindrical Shells”1952.

STANDARDS:

1. IS 2210:1988(Reaffirmed 2003) Criteria for design of reinforced concrete shell structures and folded plates, First revision.

15PSE512	DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop an understanding of the behaviour and design study of steel concrete composite elements and structures.
- To prepare the students to design composite beams and columns
- To give an overview of design concepts of box girder bridges.

UNIT I INTRODUCTION **9**

Introduction to steel - concrete composite construction - theory of composite structures - construction.

UNIT II DESIGN OF COMPOSITE MEMBERS **9**

Design of composite beams, slabs, columns - design of principal composite trusses.

UNIT III DESIGN OF CONNECTIONS **9**

Types of connections, Design of connections in the composite structures – shear connections. Degree of shear connection – Partial shear interaction

UNIT IV COMPOSITE BOX GIRDER BRIDGES **9**

Introduction - behavior of box girder bridges - design concepts

UNIT V GENERAL **9**

Case studies on steel - concrete composite construction in buildings - seismic behavior of composite structures.

TOTAL: 45 PERIODS

(Note: Use of BS 5950-1 : 2000, EN 1994 Euro code 4 and IS 11384 – 1985 are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Explain the theory and principles of Steel – Concrete Composite construction
- Design composite beams and columns
- Design shear connectors for composite beams
- Describe the behavior and design concepts of box girder bridges
- Elaborate case studies on steel - concrete composite construction in buildings.

REFERENCES:

1. Johnson R.P., “Composite Structures of Steel and Concrete”, Blackwell Scientific Publications, UK, 2008.
2. Oehlers D.J. and Bradford M.A., “Composite Steel and Concrete Structural Members, Fundamental behaviour”, Pergamon press, Oxford, 1995.
3. Proceedings of Workshop on “Steel Concrete Composite Structures”, Anna University, 2007.
4. Owens.G.W and Knowles.P, ”Steel Designers Manual”, Steel Concrete Institute(UK), Oxford Blackwell Scientific Publications, 1994.

STANDARDS:

1. BS 5950-1 : 2000 Structural use of steel work in building. Code of practice for design – Rolled and welded sections.
2. EN 1994 Euro code 4 : Design of composite steel and concrete structures, composite slabs.
3. IS11384 – 1985 code of practice for composite construction in structural steel and concrete.

15PSE513	DESIGN OF INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an overview of the requirements, planning and design of Industrial structures.
- To train the students to design components of industrial buildings.
- To impart the design concepts of power plant and power transmission structures.

UNIT I PLANNING AND FUNCTIONAL REQUIREMENTS 9

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines of Factories Act.

UNIT II INDUSTRIAL BUILDINGS 9

Roofs for Industrial Buildings - Steel and RCC - Gantry Girders - Design of Corbels and Nibs – Analysis and Design of Steel Space Frames.

UNIT III POWER PLANT STRUCTURES 9

Types of power plants – Design of Turbo generator foundation – containment structures.

UNIT IV TRANSMISSION LINE STRUCTURES AND CHIMNEYS 9

Analysis and design of transmission line towers - Sag and Tension calculations- Testing of towers – Design of self supporting chimney- Design of Chimney bases.

UNIT V FOUNDATION 9

Design of foundation for Towers- Chimneys and Cooling Towers - Machine Foundation – Design of Wind Turbine Foundation.

TOTAL: 45 PERIODS

(Note: Use of IS 6060:1971,IS 3103:1975, IS 800:2007,IS 6533:1989, Part-I, IS 6533:1989,Part-II, IS 4995:1974,Part-II, IS: 3483 -1965, IS: 875 (Part 1 to 5), IS: 3370-1967, IS: 802-1977(Part 2), IS:4091-1979, IS: 9178-1980, IS: 2974 (Part I to V) and IS 456:2000 are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Prepare the layout of Industrial buildings as per requirements
- Design Industrial roofs, steel bunkers, Silos and Chimneys
- Design R.C corbels, bunkers and Silos
- Describe the types of power plants and tower foundations
- Design Turbo Generator Foundation.

REFERENCES:

1. Manohar S.N, “Tall Chimneys - Design and Construction”, Tata McGraw Hill, 1985.
2. Santhakumar A.R.an d Murthy S.S., “Transmission Line Structures”, Tata McGraw Hill, 1992.
3. Srinivasulu P and Vaidyanathan.C, “Handbook of Machine Foundations”, Tata McGraw Hill, 1977.
4. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, “Industrial Buildings: A Design Manual”, Birkhauser Publishers, 2004.
5. Procs. of Advanced course on “Industrial Structures”, Structural Engineering Research Centre, Chennai, 1982.

STANDARDS:

1. IS 4995 (Part I) -1974 - Criteria for design of reinforced concrete bins for the storage of granular and powder materials.
2. IS 4995 (Part II) -1974 - General Requirements and assessment of bin Loads.
3. IS 6060 -1971 - Code of practice for Day lighting of factory buildings.
4. IS 3103 -1975- Code of practice for industrial ventilation.
5. IS: 3483 -1965 - Code of practice for Noise reduction in industrial buildings.
6. IS: 456-2000 - Code of Practice for Plain and Reinforced Concrete.
7. IS: 6533 (Part 2) -1989 - Code of practice for design and construction of steel chimneys.
8. IS: 875 (Part 1 to 5) - Code of Practice for Design loads.
9. IS: 802-1977(Part 2) - Code of practice for use of structural steel in Over Head transmission line towers.
10. IS: 3370-1967 – Part 2 to 4 - Code of Practice for Concrete Structures for the storage of liquids – Reinforced Concrete Structures.
11. IS:4091-1979 - Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles.94
12. IS: 9178-1980 - Criteria for Design of Steel Bins for Storage of Bulk Materials.
13. IS: 2974 (Part I to V) - Code of practice for design and construction of machine foundations.
14. IS 800:2007 Indian Standard General Construction in Steel – code of practice, Third Revision.

15PSE514	NONLINEAR ANALYSIS OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To emphasize the knowledge on the concepts of nonlinear behaviour and analysis of simple structures.
- To introduce the concepts of elastic and inelastic analysis of plates.
- To give an overview of nonlinear vibration of elastically supported beams.

UNIT I INTRODUCTION TO NONLINEAR ANALYSIS 9

Material nonlinearity- geometric nonlinearity - statically determinate and statically indeterminate flexible bars of uniform and variable thickness.

UNIT II INELASTIC ANALYSIS OF FLEXURAL MEMBERS 9

Inelastic analysis of uniform and variable thickness members subjected to small deformations; inelastic analysis of flexible bars of uniform and variable stiffness members with and without axial restraints.

UNIT III VIBRATION THEORY AND ANALYSIS OF FLEXURAL MEMBERS 9

Vibration theory and analysis of flexible members- hysteretic models and analysis of uniform and variable stiffness members under cyclic loading

UNIT IV ELASTIC AND INELASTIC ANALYSIS OF PLATES 9

Elastic and inelastic analysis of uniform and variable thickness plates

UNIT V NONLINEAR VIBRATION AND INSTABILITY 9

Nonlinear vibration and Instabilities of elastically supported beams.

TOTAL: 45. PERIODS

COURSE OUTCOMES:

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

- Perform elastic and inelastic analysis of flexural members
- Discuss the theory of vibration
- Analyse uniform and variable stiffness members for cyclic loads
- Perform elastic and inelastic analysis of plates of uniform and variable thickness
- Describe the concepts of nonlinear vibration and instability of elastically supported beams

REFERENCES:

1. Sathyamoorthy, M.,"Nonlinear Analysis of Structures", CRC Press, Boca Raton, Florida, 2010.
2. Fertis, D. G.,"Nonlinear Mechanics", CRC Press, Boca Raton, Florida, 1999.
3. Reddy.J.N, "Non linear Finite Element Analysis", Oxford University Press, 2008.
4. Varghese.P.C., Design of Reinforced Concrete Shells and Folded Plates, PHI Learning Pvt. Ltd., 2010.

15PSE515	PRECAST AND PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enhance knowledge on the design principles, analysis and design of prefabricated elements.
- To provide an overview of connections involved in prefabricated structures
- To outline the design concepts of precast walls, floors, stairs and roofs.

UNIT I DESIGN PRINCIPLES 9

General Civil Engineering requirements - specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination- standardization - Disuniting of Prefabricates - production- transportation- erection - stages of loading and code provisions - safety factors - material properties - Deflection control- Lateral load resistance - Location and types of shear walls.

UNIT II REINFORCED CONCRETE 9

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, - Connections – Beam to column and column to column.

UNIT III FLOORS,STAIRS AND ROOFS 9

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.

UNIT IV WALLS 9

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls - load transfer from floor to wall panels, vertical loads - Eccentricity and stability of wall panels - Design Curves, types of wall joints - their behaviour and design, Leak prevention - joint sealants - sandwich wall panels, approximate design of shear walls.

UNIT V INDUSTRIAL BUILDINGS AND SHELL ROOFS 9

Components of single-storey industrial sheds with crane gantry systems - R.C. Roof Trusses - Roof Panel - corbels and columns - wind bracing design. Cylindrical, Folded plate and hypar-prefabricated shells - Erection and jointing, joint design, hand book based design

TOTAL: 45 PERIODS

(Note: Use of IS 15916:2011, IS 11447: 1985, IS 1893: 2002 (Part - I) and IS 13920: 1993 are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Explain the requirements for planning and preparing layout of prefabricate plant
- Discuss the types and systems of prefabrication
- Illustrate the design procedure of roof panels, corbels, and columns.

- Describe the joint details of prefabricated units
- Discuss the various precast components of Industrial buildings

REFERENCES:

1. B.Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam/ London/New York, 1966
2. Koncz.T, Manual of Precast Concrete Construction, Vol.I II and III, Bauverlag, GMBH, 1971.
3. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 2009.
4. Laszlo Mokk, Prefabricated Concrete for Industrial and Public Sectors, Akademiai Kiado, Budapest, 2007.
5. Murashev.V, Sigalov.E, and Bailov.V, Design of Reinforced Concrete Structures, Mir Publishers, 1968.
6. Gerostiza. C.Z., Hendrikson, C. and Rehat D.R., Knowledge Based Process Planning for Construction and Manufacturing, Academic Press, Inc., 1989.
7. Warszawski, A., Industrialization and Robotics in Building - A managerial approach, Harper and Row, 1990.

STANDARDS:

1. IS 15916:2011 – Building Design And Erection Using prefabricated Concrete
2. IS 11447: 1985 – Code of practice for construction with large panel prefabricates.
3. IS 1893: 2002 (Part - I)- Criteria for Earthquake Resistant Design of Structures – General.
4. IS 13920: 1993 - Ductile detailing of Reinforced Concrete Structures

15PSE516	THEORY OF PLATES AND SHELLS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the behaviour of thin plates
- To train the students to apply special and approximate methods for analyzing plates.
- To provide an overview of the analysis of anisotropic and thick plates

UNIT I INTRODUCTION TO PLATES THEORY 10

Thin Plates with small deflection. Laterally loaded thin plates, governing differential equation, various boundary conditions.

UNIT II RECTANGULAR PLATES 10

Rectangular plates. Simply supported rectangular plates, Navier solution and Levy's method, Rectangular plates with various edge conditions, plates on elastic foundation.

UNIT III CIRCULAR PLATES 9

Symmetrical bending of circular plates.

UNIT IV CLASSIFICATION OF SHELLS 9

Classification of shells, types of shells, structural action - Design of circular domes, conical roofs, and circular cylindrical shells by ASCE Manual No.31.

UNIT V FOLDED PLATES 7

Folded Plate structures, structural behaviour, types, design by ACI - ASCE Task Committee method – pyramidal roof.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Formulate governing differential equation for bending of thin plates
- Determine the deflection and bending moments of rectangular plates using Naviers solution and Levy's method
- Estimate deflection and bending moments of circular plates
- Solve plate problems using approximate methods
- Design Folded Plate structures

REFERENCES:

1. Timoshenko, S. and Krieger S.W. "Theory of Plates and Shells", McGraw Hill Book Company, New York, 2003.
2. Bairagi, "Plate Analysis", Khanna Publishers, 1996.
3. Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company, 2006.
4. Szilard, R., "Theory and Analysis of Plates", Prentice Hall Inc., 2004.
5. Chandrashekahara, K. Theory of Plates, University Press (India) Ltd., Hyderabad, 2001.

15PSE517	EARTHQUAKE ANALYSIS AND DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To brief the effects and characteristics of earthquakes.
- To impart the design principles of earthquake resistant masonry structures.
- To make the students to design earthquake resistant R.C. buildings.

UNIT I EARTHQUAKES AND GROUND MOTION 9

Engineering Seismology (Definitions- Introduction to Seismic hazard - Earthquake Phenomenon) - Seismotectonics and Seismic Zoning of India - Earthquake Monitoring and Seismic Instrumentation - Characteristics of Strong Earthquake Motion- Estimation of Earthquake Parameters- Microzonation.

UNIT II EFFECTS OF EARTHQUAKE ON STRUCTURES 9

Dynamics of Structures (SDOFS/ MDOFS)- Response Spectra - Evaluation of Earthquake Forces as per codal provisions - Effect of Earthquake on Different Types of Structures - Lessons Learnt From Past Earthquakes

UNIT III EARTHQUAKE RESISTANT DESIGN OF MASONRY STRUCTURES 9

Structural Systems - Types of Buildings, Causes of damage, Planning Considerations, Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design - Earthquake Resistant Masonry Buildings - Design consideration – Guidelines.

UNIT IV EARTHQUAKE RESISTANT DESIGN OF RC STRUCTURES 9

Earthquake Resistant Design of R.C.C. Buildings - Material properties - Lateral load analysis – Capacity based Design and detailing – Rigid Frames – Shear wall

UNIT V VIBRATION CONTROL TECHNIQUES 9

Vibration Control - Tuned Mass Dampers – Principles and application - Basic Concept of Seismic Base Isolation – various Systems- Case Studies - Important structures.

TOTAL: 45 PERIODS

(Note: Use of IS: 13920-1993, IS: 1893 (Part I) – 2002, IS: 4326 – 1993, IS: 13827-1993 and IS: 13828 – 1993 are permitted in the End Semester Examinations)

COURSE OUTCOMES:

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

- Describe the causes and effects of earthquakes.
- Understand the working principle of various earthquake monitoring Instruments
- Calculate earthquake induced lateral force on the structure.
- Discuss the principles and philosophy of .earthquake resistant design of masonry and R.C. Structures
- Explain the basic concepts of seismic base isolation techniques.

REFERENCES:

1. Bruce A Bolt, “Earthquakes” W H Freeman and Company, New York, 2004.
2. C. A. Brebbia,”Earthquake Resistant Engineering Structures VIII”,WIT Press, 2011
3. Mohiuddin Ali Khan “Earthquake-Resistant Structures: Design, Build and Retrofit”, Elsevier Science & Technology, 2012
4. Pankaj Agarwal and Manish Shrikhande, “Earthquake Resistant Design of Structures”, Prentice Hall of India, 2009.
5. Paulay,T and Priestley, M.J.N., “Seismic Design of Reinforced Concrete and Masonry buildings”, John Wiley and Sons, 1992.
6. S K Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press, 2007.

STANDARDS:

1. IS: 13920-1993 - Ductile detailing of reinforced concrete structures subjected to seismic forces – Code of Practice.
2. IS: 1893 (Part I) – 2002 - Indian Standard Criteria for Earthquake Design of Structures – General Provisions and Buildings.
3. IS: 4326 – 1993 - Earthquake Resistant Design and Construction of Buildings - Code of Practice.
4. IS: 13827-1993 - Improving Earthquake Resistance of Earthen Buildings – Guidelines.
5. IS: 13828 – 1993 - Improving Earthquake Resistance of Low Strength Masonry Buildings – - Guidelines.

15PSE518	ADVANCED CONSTRUCTION TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an overview on modern construction methods
- To explain the construction equipments used for substructures and offshore structures.
- To impart knowledge on Operation and maintenance of construction equipments

UNIT I MODERN CONSTRUCTION METHODS 9

Open Excavation, Shafts and Tunnels - Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

UNIT II OTHER CONSTRUCTION METHODS 9

Construction Methods for Bridges, Roads, Railways, Dams, Harbour, River Works Pipelines

UNIT III CONSTRUCTION EQUIPMENTS FOR SUBSTRUCTURES 9

Equipments used for Earth Moving, Excavating, Drilling, Blasting, Tunneling and hoisting

UNIT IV CONSTRUCTION EQUIPMENTS FOR OFFSHORE STRUCTURES 9

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant

UNIT V PRINCIPLES AND PRACTICES OF TEMPORARY STRUCTURES 9

Shoring, and Strutting, Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Describe the modern methods for sub structure construction.
- Discuss the prestressed and precast concrete construction
- Illustrate the construction methods for bridges and roads
- Explain the Construction equipments for substructures and offshore structures
- Describe the principles and design of formwork

REFERENCES:

1. Peurifoyu , R. L., , Ledbette, W.B., Construction Planning , Equipment and Methods, McGraw Hill Co., 2003
2. Antill J.M., PWD, Civil Engineering Construction, Mc Graw Hill Book Co., 1982
3. Varma, M Construction Equipment and its Planning & Applications, Metropoltian Book Co.,1979
4. Nunnaly, S.W., Construction Methods and Management , Prentice – Hall, 1987
5. Ataev, S.S., Construction Technology, MIR , Pub. 1985
6. Ratay , R.T., Handbook of Temporary Structures in Construction Mc Graw Hill Book Co.,1984
7. Koerner. R.M., Construction & Geotechnical Methods in Foundation Engg, Mc Graw Hill Book Co., 1984
8. Smith ., R.C., Andres, CK., Principles & Practice of Heavy Construction , Prentice Hall ,1986

15PSE519	MATRIX METHODS FOR STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an overview on the Energy Concepts in Structures, Characteristics and Transformation of Structures.
- To teach the concepts of flexibility and stiffness method.
- To train the students to analyse beams, frames and trusses using matrix methods.

UNIT I ENERGY CONCEPTS IN STRUCTURES 9

Introduction – Strain Energy – Symmetry of The Stiffness And Flexibility Matrices – Strain Energy in Terms of Stiffness And Flexibility Matrices – Stiffness And Flexibility Coefficients in Terms of Strain Energy – Additional properties of [a] and [k] – another Interpretation of coefficients aij and kij – Betti's law – Applications of Betti's law: Forces not at the coordinates – Strain energy in systems and in Elements.

UNIT II CHARACTERSTICS OF STRUCTURES – STIFFNESS AND FLEXIBILITY 9

Introduction – Structure with Single Coordinate- Two Coordinates-Flexibility and Stiffness Matrices in Coordinates- Examples-Symmetric Nature of Matrices- Stiffness and Flexibility Matrices in Constrained Measurements- Stiffness and Flexibility of Systems and Elements-Computing Displacements and Forces form Virtual Work-Computing Stiffness and Flexibility Coefficients

UNIT III TRANSFORMATION OF INFORMATION IN STRUTURES 9

Determinate- Indeterminate Structures-Transformation of System Forces to Element Forces-Element Flexibility to System Flexibility - System Displacement to Element Displacement-Element Stiffness to System Stiffness-Transformation of Forces and Displacements in General –Stiffness and Flexibility in General –Normal Coordinates and Orthogonal Transformation-Principle of Contregradience

UNIT IV THE FLEXIBILITY METHOD 9

Statically Determinate Structures –Indeterminate Structures-Choice of Redundant Leading to Ill and Well Conditioned Matrices-Transformation to One Set of Redundant to Another-Internal Forces due to Thermal Expansion and Lack of Fit-Reducing the Size of Flexibility Matrix-Application to Pin-Jointed Plane Truss-Continuous Beams-Frames-Grids.

UNIT V THE STIFFNESS METHOD 9

Introduction-Development of Stiffness Method- Stiffness Matrix for Structures with zero Force at some Coordinates-Analogy between Flexibility and Stiffness-Lack of Fit-Stiffness Matrix with Rigid Motions-Application of Stiffness Approach to Pin Jointed Plane Trusses-Continuous Beams-Frames-Grids-Space Trusses and Frames-Introduction Only-Static Condensation Technique-Choice of Method-Stiffness or Flexibility.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the concepts of strain energy in systems and elements.
- Differentiate determinate and indeterminate structures

- Compute Stiffness and Flexibility Coefficients.
- Analyse pin jointed frames and continuous beams using flexibility method.
- Analyse pin jointed frames and continuous beams using stiffness method

REFERENCES:

1. Rubinstein.F.M., " Matrix Computer Methods of Structural Analysis", Prentice Hall, Inc. N.J., 1966
2. Dr. Devadas Menon., "Advanced Structural Analysis", Narosa Publishing House, New Delhi, 2009
3. Pandit G.S. and Gupta S.P., "Structural Analysis-A Matrix Approach", Tata McGraw-Hill PublishingCompany Limited, New Delhi, 1997
4. Reddy C.S., "Basic Structural Analysis", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997

15PSE520	DESIGN OF STORAGE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the principles involved in designing storage structures.
- To train the students to design concrete and steel material retaining structures.
- To provide an overview on the principles of circular prestressing

UNIT I STEEL WATER TANKS 9

Design of rectangular riveted steel water tank – Tee covers – Plates – Stays –Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – 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 II CONCRETE WATER TANKS 9

Design of Circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of underground tanks – Design of base slab and side wall – Check for uplift.

UNIT III STEEL BUNKERS AND SILOS 9

Design of square bunker – Jansen's and Airy's theories – IS Codal provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – stiffeners.

UNIT IV CONCRETE BUNKERS AND SILOS 9

Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams – Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction

UNIT V PRESTRESSED CONCRETE WATER TANKS 9

Principles of circular prestressing – Design of prestressed concrete circular water tanks

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the principles involved in designing storage structures.
- Design rectangular steel water tanks
- Design rectangular and circular concrete water tanks
- Design steel and concrete bunkers and silos
- Discuss the principles of circular prestressing

REFERENCES:

1. Rajagopalan K., Storage Structures, Tata McGraw-Hill, New Delhi, 1998.
2. Krishna Raju N., Advanced Reinforced Concrete Design, CBS Publishers and Distributors, New Delhi, 1998.

15PSE521	REMOTE SENSING TECHNIQUES AND GIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the students to the basic concepts and principles of various components of remote sensing.
- To impart the concepts of Digital image processing.
- To provide an exposure to GIS and its practical applications in civil engineering.

UNIT I EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL 9

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein‟s Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

UNIT II PLATFORMS AND SENSORS 9

Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors.

UNIT III IMAGE INTERPRETATION AND ANALYSIS 9

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT V DATA ENTRY, STORAGE AND ANALYSIS 9

Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Modeling in GIS Highway alignment studies – Land Information System.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the principles of Remote Sensing and GIS
- Understand the application of sensors in Remote Sensing and GIS
- Analyse Remote sensing and GIS data.
- Interpret the data for modeling applications.
- Apply any standard GIS software

REFERENCES:

1. Lillesand,T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" 5th Edition., John Willey and Sons Asia Pvt. Ltd., New Delhi, 2004.
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd edition. BS Publications, Hyderabad, 2001.
3. Lo. C.P.and A.K.W.Yeung, "Concepts and Techniques of Geographic Information Systems",Prentice Hall of India Pvt. Ltd., New Delhi, 2002
4. Peter A.Burrough, Rachael A. McDonnell, " Principles of GIS", Oxford University Press, 2000 3. Ian Heywood "An Introduction to GIS", Pearson Education Asia, 2000

15PSE522	ENGINEERING FRACTURE MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the students to the basic concepts and principles of different modes of fracture failure.
- To impart the concepts of Elastic and Plastic fracture mechnaics
- To explain the concept of crack propagation and crack arrest methods.

UNIT I INTRODUCTION **9**

Review of Engineering Failure Analysis - Brittle fracture - Ductile fracture Modes of fracture failure - The Griffith energy Balance Approach - Crack tip Plasticity – Fracture toughness.

UNIT II LINEAR ELASTIC FRACTURE MECHANICS **9**

Elastic crack tip stress field Stress and displacement fields in isotropic elastic materials - Westergaard's approach (opening mode) - Plane Strain Fracture toughness (KIC) testing- Feddersen approach - Determination of R curve ,Energy released rate for DCB specimen - Anelastic deformation at crack tip - K1c Test techniques, Various test specimens - Critical energy release rate

UNIT III ELASTIC PLASTIC FRACTURE MECHANICS **9**

Limitation of K approach - Approximate shape and size of the plastic zone - Effective crack length - Effect of plate thicksness - Elastic plastic fracture concept - Crack tip opening displacement - Dugdale approach-Path independence, Critical J integral – Evaluation of CTOD - Relationship between CTOD, K1 and G1 for small scale yielding

UNIT IV FATIGUE CRACK GROWTH **9**

Fatigue crack growth to sharpen the tip - methods to determine J1cMechanism of Fatigue, Fatigue crack propagation - Paris law - Crack closure mechanism - Residual stresses at crack tip - Retardation effect fatigue crack growth test, stress intensity factor, factors affecting stress intensity factor - Variable amplitude service loading, Interaction effects

UNIT V CRACK ARREST & NUMERICAL METHODS **9**

Principles of crack arrest, crack arrest in practice, K-R Curves, Crack resistance curve, Numerical Methods and Approaches in Fracture Mechanics, Direct methods to determine fracture parameters Indirect methods to determine fracture parameters.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the concept of different modes of fracture failure
- Analyse the linear elastic fracture mechanics problems
- Explain the concept of elastic plastic fracture mechanics
- Estimate the residual life of fatigue Crack Growth in structure
- Suggest suitable crack arrest parameters using various techniques

REFERENCES:

1. Barson M. & Stanely T. Rolfe, “Fracture and Fatigue Control in Structure,” Prentice Hall Inc, USA,1987.
2. Bhushan L. Karihaloo, “Fracture Mechanics and Structural Concrete,” Longman Scientific Publishers, USA, 1972.
3. David Broek, “Elementary Engineering Fracture Mechanics, “ Martinus Nijhoff Publishers, The Hague, 1982.
4. Gdoutos E. E., “ Fracture Mechanics – An introduction,” Kluwer Academic publishers, Dordrecht, 1993.
5. Jean Lemative & Jean Louis Chboche, “Mechanics of Solid Materials,” Cambridge University Press, Cambridge,1987.
6. Knott J. F., “Fundamentals of Fracture Mechanics,” John Wiley & Sons, New York 1973.
7. Simha K. R. Y ., “Fracture Mechanics for Modern Engineering Design,” University Press (India) Ltd, Hyderabad, 2001.
8. Suresh S., “Fatigue of Materials,” Cambridge University Press, Cambridge 1991.

15PSE523	DURABILITY OF CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on behaviour of concrete structures under aggressive environment
- To provide concepts of non-destructive testing and evaluation, including a brief description of the methods available, their limitations, and interpretation of results obtained.
- To offer a better perspective of nondestructive testing methods and explores the emerging thought of including maintenance and repair of concrete structures in a comprehensive design framework.

UNIT I CONCRETE AND THE ENVIRONMENT 9

Interaction; Physical mechanisms of concrete degradation - shrinkage, thermal cracking, freeze–thaw attack, abrasion and erosion; Chemical mechanisms of concrete degradation - sulphate attack, alkali–aggregate reactions, acid attack; Corrosion of steel reinforcement in concrete - corrosion of steel in concrete, chloride ingress into concrete, carbonation

UNIT II SPECIFICATION AND DESIGN OF DURABLE CONCRETE 9

Concrete as a permeable medium**,** cement**,** aggregates**,** admixtures**,** fibres**,** specifying durable concrete**,** concrete mix design**,** special concrete

UNIT III TESTS ON CONCRETE 9

Durability - permeability, RCPT, shrinkage, heat of hydration and resistivity tests

UNIT IV CONSTRUCTION OF DURABLE CONCRETE STRUCTURES 9

Surface of concrete**,** curing**,** surface protection systems**,** cathodic protection

UNIT V SERVICEABILITY, REPAIR AND MAINTENANCE OF CONCRETE STRUCTURES 9

Serviceability of structures**,** appraisal of structures**,** in situ testing**,** laboratory testing, concrete repair products**,** repair methods**,** rehabilitation of concrete structures – general principles.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain and analyse the physical and chemical mechanisms of concrete degradation.
- Design durable concrete as per specifications
- Explain and perform various tests on concrete
- Construct durable concrete structures.

- Provide solution to repair and maintenance of concrete structures.

REFERENCES:

1. Dayaratnam.P and Rao.R, “Maintenance and Durability of Concrete Structures”, University Press, India, 1997.
2. Marios Soutsos, “Concrete Durability: A Practical Guide to The Design of Durable Concrete Structures”, Thomas Telford Publisher, 2010.
3. Peter H.Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications pvt. Ltd., 2001.
4. Santhakumar A.R., “Concrete Technology” Oxford University Press, Printed in India by Radha Press, New Delhi, 110 031, 2007.
5. Thomas Dyer. “Durable Concrete”, 1st edition, CRC Press, 2014.

15PSE524	CONSTITUTIVE MODELS AND MODES OF FAILURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on elastic and plastic theories
- To provide concepts of various mechanical and material models

UNIT I ELASTICITY **9**

Stress strain analysis – 2D problems – Cartesian and polar coordinates – generalized Hooke's law – 3D problems – energy relations

UNIT II PLASTICITY **9**

Yielding and yield surface – strain rates and failure theories – flow rule – elastic plastic and strain hardening models – beam and soil applications.

UNIT III MECHANICAL MODELS

Kelvin and Maxwell models – Visco-elasticity – Friction and Coloumb models – Series, parallel and hybrid models – Applications

UNIT IV ENERGY RELATIONS **9**

Work and energy types – energy theorems and material models – formulations, Applications in beams and simple structures.

UNIT V APPLICATIONS **9**

Engineering material models – steel and concrete – reinforced concrete- composites -one, two and three dimensional models – practical examples.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Apply elastic theories for various engineering problems.
- Apply plastic theories for various engineering problems.
- Apply various mechanical models to real life events.
- Apply energy theorems for beams and simple structures.
- Prepare engineering models for materials and structural elements.

REFERENCES:

1. Dowling, N.E., 'Mechanical Behaviour of Materials: Engineering Methods of Deformation, Fracture and Fatigue', 2nd Edition, Prentice – Hall, 1999.
2. Bedford, A.M. and Liechti, K.M., 'Mechanics of Materials', Prentice Hall, 2001.
3. Popov, E "Mechanics of Materials", Prentice Hall Reprinted Pearson Education, 2003.

15PSE525	SMART MATERIALS AND SMART STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on strain measuring techniques, smart materials and signal processing and control systems.

UNIT I INTRODUCTION 9

Introduction to Smart Materials and Structures - Instrumented structures functions and response - Sensing systems – Self -diagnosis - Signal processing consideration -Actuation systems and effectors.

UNIT–II MEASURING TECHNIQUES 9

Strain Measuring Techniques using Electrical strain gauges, Types - Resistance - Capacitance - Inductance – Wheatstone bridges - Pressure transducers - Load cells - Temperature Compensation - Strain Rosettes.

UNIT–III SENSORS 9

Sensing Technology - Types of Sensors - Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers - The LVDT - Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment- Absorptive chemical sensors - Spectroscopes - Fibre Optic Chemical Sensing Systems and Distributed measurement.

UNIT–IV ACTUATORS 9

Actuator Techniques - Actuator and actuator materials - Piezoelectric and Electrostrictive Material – Magneto structure Material - Shape Memory Alloys-Electro-rheological Fluids- Electromagnetic actuation - Role of actuators and Actuator Materials.

UNIT–V SIGNAL PROCESSING AND CONTROL SYSTEMS 9

Data Acquisition and Processing - Signal Processing and Control for Smart Structures - Sensors as Geometrical Processors- Signal Processing - Control System - Linear and Non-Linear.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Explain the functions and response of instrumented structures
- Explain the various strain measuring techniques.
- Describe the working principles of smart materials such as sensors.
- Describe the various types of actuator techniques and materials.
- Expalin about the signal processing and control systems for smart structures.

REFERENCES:

1. Brain Culshaw,”Smart Structure and Materials”, Artech House - Borton. London, 2003.

2. Srinivasan, A.V. and Michael McFarland, D., “Smart Structures: Analysis and Design”, Cambridge University Press, 2010.
3. L. S. Srinath, “Experimental Stress Analysis”, Tata McGraw Hill, 2004.
4. J. W. Dally & W. F. Riley, ”Experimental Stress Analysis”, Tata McGraw Hill Company

OPEN ELECTIVES

15PSE601	RESEARCH METHODOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an overview on selection of research problem based on the Literature review
- To enhance knowledge on the Data collection and Analysis for Research design
- To outline the importance of ethical principles to be followed in Research work

UNIT-I INTRODUCTION AND PROJECT FORMULATION 9

Objectives and types of research - Motivation and objectives – Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

UNIT-II RESEARCH DESIGN AND METHODS 9

Research design – Basic Principles- Need of research design –– Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, Experimentation. Determining experimental and sample designs.

UNIT-III DATA COLLECTION AND ANALYSIS 9

Execution of the research - Observation and Collection of data - Methods of data collection – Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-testing - Generalization and Interpretation.

UNIT-IV REPORTING AND THESIS WRITING 9

Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation – Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication.

UNIT-V RESEARCH ETHICS 9

Application of results and ethics - Environmental impacts - Ethical issues - ethical committees - Commercialisation – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Identify and Formulate the Research Problem
- Develop a research plan and a model based on the Laws and theories
- Collect and Analyse datas from various sources of Literature.
- Write thesis effectively including technical reports and other contents.
- Explain the ethical principles to be followed while patenting or obtaining copyright.

REFERENCES

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Additional reading

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
7. Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications.

15PEN602	PEDAGOGY FOR ENGINEERING EDUCATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students understand a range of cognitive capacities in human learners
- To explain the outcome-based education system
- To describe the curriculum design process

UNIT I Educational Psychology and Engineering Education 9

Learning process, Behavioural views of learning, cognitive explanations of learning, motivation and engagement, ICT in learning and teaching, facilitating the learners, Engineering education and recent trends, Educating engineers for 2020 and beyond, Research in Engineering education.

UNIT II Approaches to Learning and Teaching 9

General maxims of teaching, Teacher-centred, learner-centred and learning-centred approaches, Outcome Based Education: A broad context for quality teaching and learning, planning for quality teaching and learning, Becoming a reflective teacher.

UNIT III Learning Outcomes 9

Necessity for learning outcomes, Defining learning outcomes, learning outcomes in the cognitive domain, learning outcomes in the affective domain, learning outcomes in the psychomotor domain, Programme learning outcomes, Graduate Attributes, Programme Educational Objectives, linking learning outcomes to teaching and assessment, Programme evaluation and improvement

UNIT IV Teaching and Assessment Strategies 9

Direct instruction as teaching strategy, co-operative learning, problem-solving, industry relevant teaching, role-play, case study, technology enabled teaching, research orientation, measurement and evaluation of students' achievement, assessment of learning outcomes and programme objectives

UNIT V Curriculum Design 9

Curriculum design cycle, curriculum structure, credit and academic load, need assessment – feedback from stakeholders, concept of "Constructive alignment", the two loop approach of ABET, tuning approach of curriculum design, CDIO concept of curriculum design and implementation, Industry relevant curriculum design and implementation, concept mapping, Instructional design and delivery.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Develop pedagogical expertise through an introduction to theoretically-based teaching methods and strategies
- Write learning outcomes and link learning outcomes to appropriate assessments
- Design syllabus and lesson plans that align with objectives
- Use technology to enhance teaching and learning
- Choose teaching-learning strategies appropriate to the needs of the learners

REFERENCES:

1) Dr.Sue Duchesne, Anne McMaugh, Sandra Bochner, Kerri-Lee Krause, “Educational Psychology for Learning and Teaching”, Cengage Learning, 4th Edition, 2013.
2) Lisa R. Lattuca, Patrick T. Terenzini, J. Fredericks Volkwein, and George D. Peterson, “The Changing Face of Engineering Education” The Bridge, National Academy of Engineering, Summer 2006
3) Charles M. Vest, “Educating Engineers for 2020 and Beyond”, The Bridge, National Academy of Engineering, Summer 2006
4) Anderson, L. & Krathwohl , D. A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives . New York: Longman, 2001.
5) Blumberg, P. Developing learner-centred teaching: A practical guide for faculty. San Francisco: Jossey-Bass, 2009.
6) Teaching Support Services. Learning objectives. University of Guelph, Guelph, ntario. Retrieved from http://www.uoguelph.ca/tss/resources/idres/learningobjectives1.pdf
7) O.V. Boev, N.Gruenwald and G.Heitmann, “Engineering Curriculum Design aligned with Accrediation Standards”, Hochschule Wismar Publishers, 2013
8) Fink, D. L. Integrated course design. Manhattan, KS: The IDEA Center, 2005. Retrieved from http://www.theideacenter.org/sites/default/files/Idea_Paper_42.pdf

15PEN603	PROFESSIONAL COMMUNICATION SKILLS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarise the students with the basic concepts and techniques of communication
- To represent their ideas and problems in a simple language
- To develop basic skills
- To acquire communication skills in professionalism

UNIT I BASICS OF PROFESSIONAL COMMUNICATION 6+6

Communication: Language as a tool of communication, Levels of communication: Interpersonal, Organizational, Mass communication, Barriers to Communication, The Seven Cs of Effective Communication: Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, and Correctness

Lab activity: Interpersonal Skills (response to various situations)

UNIT II FORMS OF PROFESSIONAL COMMUNICATION 6+6

Verbal & nonverbal communication; meetings, key note address, letter of enquiry, letter of quotation, order, claim and adjustment letters; job application and resumes. D.O. Letters; letters to authorities, writing of reports, writing of proposal; project. Dissertation and thesis writing

Lab activity: Summary of a project

UNIT III PROFESSIONAL COMMUNICATION AT WORK SPOT 6+6

Words And Phrases, Select Vocabulary, Brain Storming, Pep Talks and Presentation , Conduct of Interview, Discussion, E-Mail Communication, Memo And Memo Reports, Show Cause, Notice, Agenda And Minutes Of Meeting, Brochures

Lab activity: Brain Storming, Pep Talks and Presentation, Conduct of Interview

UNIT IV MECHANICS OF PROFESSIONAL WRITING 6+6

Transcribing Numbers, Abbreviating Technical and Non-Technical Terms, Proof Reading Effective Writing, Gathering Information, Organization of The Material, Writing Abstracts And Summaries, Visual Aids, User Instruction Manual, Advertising, Marketing, Sales Promotion And Problem Solving

Lab activity: Advertising, Marketing, Sales Promotion and Problem Solving

UNIT V PROFESSIONAL MANAGEMENT SKILLS 6+6

Organizing skills, Time management, Stress management, Emotional intelligence, Audiovisual aids, Team management, Note-making, Précis writing

Lab activity: Group Discussion and Interview

TOTAL: 30(L) +30 (P) = 60 PERIODS

COURSE OUTCOMES:

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

- To evaluate and analyze the various types of professional communication
- To understand different rhetorical strategies depending on audience, purpose, and function
- To plan, draft, and revise professional level documents for evaluation
- To learn format and structure of conventional professional documents like reports, proposals, resumes, memos and letters
- To create concise, coherent, and clear documents following rules for Standard English

REFERENCES:

1) Effective Business Communication by Herta A Murphy, Herbert W Hildebrandt, Jane P Thomas, McGrawHill
2) Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, New Delhi.
3) Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press 2007, New Delhi.
4) Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.
5) How to Build Better Vocabulary by M.Rosen Blum, Bloomsbury Pub. London.
6) Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors;

15PPE604	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide adequate knowledge about FLC and NN toolbox.
- To expose the ideas about genetic algorithm.
- To provide adequate knowledge about feedback neural networks.

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction of soft computing - soft computing vs. hard computing- various types of soft computing techniques- applications of soft computing-Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- McCullochPitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training applications.

UNIT II SPECIAL ARTIFICIAL NEURAL NETWORKS 9

Counter propagation network- architecture- functioning & characteristics of counter- Propagation network-Hopfield/ Recurrent network- configuration- stability constraints-associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications-Implementation and training-Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification- inference and defuzzification- Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters-Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

UNIT V HYBRID SYSTEMS 9

Integration of neural networks and fuzzy systems, adaptive neuro fuzzy inference systems, ANN-GA-Fuzzy synergism and its application, Identification and control of linear and nonlinear dynamic systems using MATLAB-neural network toolbox. Implementation of fuzzy logic controller using MATLAB fuzzy logic toolbox.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Describe soft computing techniques and their roles in building intelligent machines.
- Identify the feasibility of applying a soft computing methodology for a particular problem.
- Apply fuzzy logic, genetic algorithm, neural networks and reasoning to handle uncertainty and solve engineering problems.

- Design a suitable soft computing technology to solve the power system /power electronics problem.
- Implement fuzzy logic controller using Matlab fuzzy logic toolbox.

REFERENCES:

1) Timothy J. Ross, “Fuzzy Logic with Engineering Applications”,3rd Edition, Wiley, 2010.
2) Zimmermann H.J, "Fuzzy set theory and its Applications", Springer international edition, 2011.
3) Chaturvedi, “Soft Computing Techniques and its Applications in Electrical Engineering”, Springer, 2008
4) Laurene V. Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms And Applications”, Pearson Education,1993.
5) David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009.
6) W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control”, MIT Press, 1996.
7) Jacek.M.Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House, 1999.
8) KOSKO.B, “Neural Networks and Fuzzy Systems”, Prentice-Hall of India Pvt. Ltd., 1994.
9) Kalyanmoy Deb, “Multi-Objective Optimization Using Evolutionary Algorithms”, Wiley, 3rd Edition, 2010.
10) Sivanandam. S.N, Deepa. S.N., “Principles of Soft Computing”, Wiley India, 2008.
11) Rajasekaran. S, Pai G.A.V, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2008.

15PCD605	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the operational safety
- To understand the safety management

UNIT I ACCIDENT INVESTIGATION AND ANALYSIS 9

Concept of an Accident, reportable and non reportable accidents, reporting to statutory authorities. Principles of accident prevention-accident investigation and analysis-Unsafe act and unsafe condition- Domino sequence-cost of accidents-permanent total disabilities, Permanent partial disabilities, Temporary total disabilities-Calculation of frequency rate and severity rate of accidents.

UNIT II ERGONOMICS AND HUMAN BEHAVIOUR 9

Introduction to ergonomics and its area of application in the work system. Anatomy, Posture and body mechanics-low back pain, risk factors for musculoskeletal disorders in the work place-behavioral aspects of posture - effectiveness. Individual differences, Factors contributing to personality, fitting the man to the job. Motivation -job satisfaction - Frustration and conflicts, reaction to frustration, emotion and frustration. Attitudes - determination of attitudes- changing attitudes.

UNIT III HAZARDS AND THEIR CONTROL 9

Physical hazards-Noise, heat, vibration, ionizing and non ionizing radiations, and effects. Chemical hazards-dusts, fumes, mist, vapor, fog, gases, types, concentration, exposure Vs dose, TLV. Mechanical hazards. Engineering control methods- use of personal protective equipments.

UNIT IV FIRE PREVENTION AND PROTECTION 9

Fire triangle-principles of fire extinguishing- various classes of fires- A, B, C, D types of fire extinguishers- Industrial fire protection systems. Sprinklers- Fire hydrants- Alarm and detection systems- other suppression systems- CO2 system, foam system and DCP system.

UNIT V SAFETY MANAGEMENT TECHNIQUES, EDUCATION AND TRAINING 9

Incident Recall Technique (IRT), disaster control, Job safety Analysis, Safety survey, safety inspection. Safety training programs, seminars, conferences, competitions- method of promoting safe practice- motivation- creating awareness, awards, celebrations, safety posters, safety displays, safety incentive scheme- domestic safety and training.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Evaluate the concept of accident prevention& accident investigation
- Identify the human behavior
- Demonstrate hazards and their control
- Prepare the fire prevention and protection

- Summarize the safety management techniques

REFERENCES:

1) Heinrich.H.W. “Industrial Accident Prevention”, McGraw Hill Company, New York, 1980.
2) John V. Grimaldi and Rollin H. Simonds, “Safety Management” , All India Travellers Book Seller, New Delhi, 1989.
3) E.J.McCormick and M.S. Sanders “Human Factors in Engineering and Design”, TMH, New Delhi, 1982.
4) Hand Book of “Occupational Safety and Health”, National Safety Council, Chicago, 1982.
5) Derek, James, “Fire Prevention Hand Book”, Butter Worths and Company, London, 1986.
6) Krishnan.N.V. “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
7) Lees, F. P. “Loss Prevention in Process Industries”, Butter Worth publications, London, 2nd Edition, 1990.
8) Dan Peterson, “Techniques of Safety Management”, McGraw Hill Company, Tokyo, 1981.
9) “Accident Prevention Manual for Industrial Operations”, N.S.C. Chicago, 1982.
10) Hunter, Gomos, “Engineering Design for Safety”, McGraw Hill Inc., 1992.

15PCD606	BUSINESS MANAGEMENT AND LEADERSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the management skills.
- To impart the students to assess, evaluate and take key management decisions.
- To impart the applications of management concepts .

UNIT I INTRODUCTION 9

Management -Meaning – Nature and principles, levels and functions, Art or Science – Management and Administration – Contributions by F.W. Tailor –Henry Fayal Development of management thought.

UNIT II PLANNING 9

Planning –Nature and purpose, Characteristics –Steps in Planning –types of planning – components . Objectives – setting objectives –MBO.

UNIT III ORGANISING 9

Organization –principles of organization structure –organization charts – departmentation - authority –responsibility –delegation of authority –centralization and decentralization –line and staff organization.

UNIT IV STAFFING 9

Motivation –Significance -Theories of Motivation. Communication process –Types – methods Barriers, Characteristics. Electronic media in Communication – Co-ordination.

UNIT V LEADERSHIP AND CONTROLLING 9

Leadership –Significance – Theories, Types and Styles of leadership. Control Steps, process and significance. Essentials of Effective Control System.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Classify the various key concepts of management.
- Demonstrate the effect of Planning
- Explain the organizing concepts
- Evaluate the motivational techniques
- Conclude the various issues related to leadership.

REFERENCES:

1) L.M. Prasad, ‘Principles and Practice of Management’, Sultan Chand & Sons. 9th edition, 2015.
2) Dinkar Pagare, ‘Business Management’, Sultan Chand & Sons., 2013.
3) Harold Koontz, and Cyril O'Donnell, ‘Essential of Management’, McGraw-Hill, 1978 - Gestion d'entreprise

15PCS607	MANAGEMENT INFORMATION SYSYTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the fundamentals of Management Information System
- To make aware the various Management Information Systems and to review the role played by MIS in business environment
- To introduce the core activities in the systems development process
- To expose MIS subsystems and technologies including software, hardware and networking and also to know about the security issues and control mechanism
- To improve the knowledge of emerging trends of Management Information Systems

UNIT I INTRODUCTION 9

Data, Information, Intelligence, Information Technology, Information System, evolution, types based on functions and hierarchy, System Analyst – Role, Functions.

UNIT II SYSTEMS ANALYSIS AND DESIGN 9

SDLC, SSLC, Systems Analysis and System Design, Tools – DFD – ER – Object modeling, DBMS – RDBMS – OODBMS.

UNIT III TYPES OF INFORMATION SYSTEM 9

Financial, Marketing, Personnel, Production, Materials Information System, DSS, EIS,KMS, GIS, International Information System.

UNIT IV SECURITY AND CONTROL 9

Security, Testing, Error detection, Controls, IS Vulnerability, Computer Crimes, Securing the Web, Intranets and Wireless Networks, Software Audit, Ethics in IT.

UNIT V NEW IT INITIATIVES 9

E- business, E-governance, ERP, SCM, e-CRM, Data warehousing and Data Mining, Business Intelligence, Pervasive Computing, CMM.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Understand the roles of System analyst
- Apply new techniques in system design
- Analyze security issues in information systems
- Create information systems with tools

REFERENCES:

1) Robert Schultheis and Mary Summer, “Management Information Systems The Managers View”, Tata McGrawHill, 2008.
2) Kenneth C. Laudon and Jane Price Laudon, “Management Information Systems – Managing the digital firm, PHI Learning / Pearson Education”, PHI, Asia, 2002.
3) Gordon Davis, “Management Information System: Conceptual Foundations, Structure and Development”, Tata McGraw Hill, 2000.
4) Haag, Cummings and Mc Cubbrey, “Management Information Systems for the Information Age”, McGraw Hill, 2005.
5) Turban, McLean and Wetherbe, “Information Technology for Management – Transforming Organisations in the Digital Economy”, John Wiley, 2007.
6) Raymond McLeod and Jr. George P. Schell, “Management Information Systems”, Pearson Education, 2007.
7) James O Brien, “Management Information Systems – Managing Information Technology in the E-business enterprise”, Tata McGraw Hill, 2002.
8) Corey Schou and Dan Shoemaker, “Information Assurance for the Enterprise – A Roadmap to Information Security”, Tata McGraw Hill, 2007.
9) Frederick Gallegor, Sandra Senft, Daniel P. “Manson and Carol Gonzales, Information Technology Control and Audit, Auerbach Publications”, 4th Edition, 2013