SEMESTER I

PSE19101 MATRIX METHODS OF STRUCTURAL ANALYSIS 3 1 0 4

COURSE OBJECTIVES

To enable the students to,

- learn the basic concepts of structural analysis.
- know about the stiffness and flexibility methods from strain energy
- know about the determinate & indeterminate structures
- analyze the frames using flexibility matrix method.
- study the applications of matrix methods

Prerequisite: Nil

UNIT I INTRODUCTION 12

Generalised measurements - Degrees of freedom, Constrained Measurements, Behaviour of structures, Principle of superposition; Stiffness and flexibility matrices - Constrained measurements; Stiffness and flexibility coefficients from virtual work.

UNIT II MATRIX ANALYSIS OF STRAIN ENERGY 12

Strain energy - Stiffness and flexibility matrices from strain energy, Symmetry and other properties of stiffness and flexibility matrices; Betti's law and its applications - Strain energy in systems and in elements.

UNIT III DETERMINATE AND INDETERMINATE STRUCTURES 12

Determinate and indeterminate structures - Transformation of element matrices to system matrices, Transformation of system vectors to element vectors, Normal coordinates and orthogonal transformations.

UNIT IV FLEXIBILITY METHOD 12

Flexibility method applied to statically determinate and indeterminate structures - Choice of redundants, Transformation of redundants, internal forces due to thermal expansion and lack of fit.

UNIT V APPLICATIONS 12

Development of the method - Internal forces due to thermal expansion and lack of fit, Application to symmetrical structures, Comparison between stiffness and flexibility methods.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- understand the concepts of structural analysis.
- analyze the structures using stiffness & flexibility matrix concepts.
- analyze the truss elements using stiffness and flexibility matrix method.
- analyze the frame by flexibility matrix method.
- understand the applications of matrix methods

REFERENCES

1. Moshe, F., Rubenstein, Matrix Computer Analysis of Structures, Prentice Hall, NewYork, 1986.
2. Rajasekaran S, Computational Structural Mechanics, Prentice Hall of India, New Delhi,2001
3. Manickaselvam V.K., Elements of Matrix and Stability Analysis of Structures, KhannaPublishers, New Delhi, 1998.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak**														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO2	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO4	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	2

PSE19102 THEORY OF ELASTICITY AND PLASTICITY 3 1 0 4

COURSE OBJECTIVES

To enable the students to,

- study the classical theory of linear elasticity for stress and strain
- obtain solutions for elasticity problems in Cartesian co-ordinates
- design equations of equilibrium in polar co-ordinates
- gain knowledge on torsion of rectangular sections and thin walled sections
- understand the plastic stress strain relations, criteria of yielding and elastic- plastic problems.

Prerequisite: Nil

UNIT I INTRODUCTION TO ELASTICITY 12

Basic concepts of deformation of deformable bodies - Displacement, Analysis of Stress and Strain, equilibrium equations, Compatibility equations, Stress strain relationship, Generalized Hooke's law, Lame's Constant

UNIT II TWO DIMENSIONAL PROBLEMS IN CARTESIAN CO-ORDINATES 12

Plane Stress and Plane Strain Problems - Airy's Stress Function, Polynomials, Direct method of determining Airy's Stress Function ; Two Dimensional Problems in Cartesian Coordinates - Bending of a Cantilever Loaded at Free End, Bending of a Beam under Uniform Loading-solution of Bi harmonic equation, St. Venant principle.

UNIT III TWO DIMENSIONAL PROBLEMS IN POLAR CO-ORDINATES 12

Equations of Equilibrium in Polar Coordinates - Two Dimensional Problems in Polar Coordinates; Bending of Curved Beam - Thick Cylinder under Uniform Pressure, Flat Plate subjected to in plane traction and Shear with Circular Hole

UNIT IV TORSION AND ENERGY THEORY 12

Torsion of Prismatic bars - Membrane Analogy of Torsion, Torsion of Rectangular Section, Torsion of Thin Tubes, Membrane analogy; Energy Methods - Principle of Virtual Work; Energy Theorems - Rayleigh's method, Rayleigh-Ritz method.

UNIT V INTRODUCTION TO PLASTICITY 12

Strain Hardening - Idealized Stress, Strain Curve; Yield Criteria - Von Misses Yield Criterion, Tresca Yield Criterion; Plastic Stress - Strain Relations (Flow Rule), Plastic Problems of beams in Bending and Torsion

TOTAL PERIODS 60

COURSE OUTCOMES

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

- calculate the stress and strain parameters
- analyse the induced stress in the two dimensional problems in Cartesian coordinates
- interpret the induced stress in the two dimensional problems in polar coordinates

- apply the energy theorem and torsion to elastic problems
- determine the physical behaviour of yield criteria of materials

REFERENCES

1. Timeshenko.S.P and Goodier.J.N, "Theory of Elasticity", McGraw Hill International Edition,2013
2. Sadhu Singh, "Theory of Elasticity" &"Theory of Plasticity", Khanna Publishers, New Delhi, 2005
3. Chandramouli P.N., "Theory of Elasticity", 1st Edition, Yesdee Publishing Pvt. Ltd., Chennai, 2017
4. Jane Helena H., "Theory of Elasticity and Plasticity", Prentice Hall Publication, New Delhi, 2017.
5. Richard. G. Budynas, Advanced Strength and Applied Stress Analysis, McGraw-Hill, New Delhi, Second Edition, 2011

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO2	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO4	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	2

PEN19101 RESEARCH METHODOLOGY AND IPR 2 0 0 2

COURSE OBJECTIVES

To enable students to

- understand the formulation of research problem
- learn about data collection and preparation process
- learn the procedure for literature survey
- learn the concept of Research proposals and Research report writing
- understand about patent rights and its importance

UNIT I RESEARCH PROBLEM FORMULATION 6

Meaning of research - Objectives of Research, Types of research, Significance of Research, Research process, Selecting the problem, Necessity of defining the problem, Meaning of Research design, Need for research design, features of a good design, Different research designs.

UNIT II SCALING AND DATA COLLECTION 6

Quantitative and Qualitative data - Scaling, Scaling Techniques, Experiments and Surveys, Collection of primary and secondary data, Data preparation process.

UNIT III LITERATURE SURVEY 6

Bring clarity and focus to your research problems - Improve your methodology, Procedure for reviewing the literature, search for existing literature, Develop a theoretical and conceptual framework, Writing up the literature reviewed.

UNIT IV RESEARCH PROPOSAL AND RESEARCH REPORT 6

Contents of a research proposal - Writing a research report, Research writing in general, Referencing, Writing a bibliography, Developing an outline, Plagiarism, Research ethics.

UNIT V INTELLECTUAL PROPERTY RIGHTS 6

Intellectual Property- Definition, WTO, Fundamentals of Patent, Copyright; The rights of the owner - Term of copyright, Register of Trademark, Procedure for trade mark, Term of trademark.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- identify research problems
- collect and prepare suitable datas for research
- do literature survey in their area of research
- write research proposals and Reports
- apply their research work for patent through IPR

REFERENCES

1. C.R Kothari and Gaurav Garg, “Research Methodology Methods and Techniques”, 4th Edition, New Age International Publishers.
2. Ranjit Kumar, “ Research Methodology”, 2nd Edition, Pearson Education, Australia.

3. M.N. Borse, " Hand Book of Research Methodology, Modern, Methods and New Techniques", Shree Niwas Publications, Jaipur.
4. Neeraj Pandey and Khushdeep Dharni, " Intellectual Property rights", PHI Learning, 2014.
5. Dr.R.Radhakrishnan and Dr.S.Balasubramanian, " Intellectual Property Rights, text and cases", Excel Books, New Delhi.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
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CO1	3	-	-	-	-	1	1	2	-	-	-	2	2	-
CO2	3	-	-	-	-	1	1	2	-	-	-	2	2	-
CO3	3	-	-	-	-	1	1	2	-	-	-	2	2	-
CO4	3	-	-	-	-	1	1	2	-	-	-	2	2	-
CO5	3	-	-	-	-	3	1	2	-	-	-	2	2	-

PSE19103 ADVANCED CONCRETE LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to,

- gain knowledge about the design high grade concrete and study the parameters affecting its performance
- know about the fresh properties of self-compacting concrete
- conduct Non Destructive Tests on existing concrete structures.
- apply engineering principles to understand behavior of structural elements..

Prerequisite: Nil

LIST OF EXPERIMENTS

1. Concrete mix design and study of mechanical properties of concrete
2. Fresh properties of Self Compacting Concrete using slump flow, L Box and V Funnel Tests
3. Behavior of Beams under flexure, Shear and Torsion.
4. Study of stress-strain curve of high strength concrete
5. Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
6. Non-Destructive testing of existing concrete members.
   - I. Rebound hammer.
   - II. Ultrasonic Pulse Velocity Tester.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design high grade concrete and study the parameters affecting its performance
- test the fresh properties of self-compacting concrete.
- test the existing concrete structures by Non Destructive Tests.
- apply engineering principles to behavior of structural elements..

REFERENCES

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.
3. L.S Srinath, “Experimental Stress Analysis”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1992.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	1	2	-	3	-	-	2	-	2
CO2	3	-	-	-	-	1	2	-	3	-	-	2	-	2
CO3	3	-	-	-	-	1	2	-	3	-	-	2	-	2
CO4	3	-	-	-	-	1	2	-	3	-	-	2	-	2

SEMESTER II

PSE19201 FINITE ELEMENT METHODS 3 1 0 4

COURSE OBJECTIVES

To enable the students to,

- equip with the finite element analysis fundamentals.
- formulate the boundary value problems into FEA.
- perform engineering simulations using finite element analysis software (ANSYS).
- understand the ethical issues related to the utilization of FEA in the industry. .
- execute the CAD interfaces, joints and connections, non-linear behavior, optimization and analysis to code.

Prerequisite: Nil

UNIT I FORMULATION OF BOUNDARY VALUES 12

Basic steps in finite element anlaysis - Boundary value problems, Approximate solutions, Variational and weighed residual methods, Ritz and Galerkin formulations; Concept of piecewise approximation and finite element; Displacement and shape functions - Weak formulation, Minimum potential Energy, Generation of stiffness matrix and load vector.

UNIT II STRESS ANALYSIS 12

Two dimensional problems - Plane stress, plane strain and axisymmetric problems, Triangular and rectangular elements, Natural coordinates, Computation of stiffness matrix for isoparametric elements; Numerical integration (Gauss quadrature) - Brick elements, Elements for fracture analysis; Introduction to plate bending and shell elements

UNIT III MESHING AND SOLUTION 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 IV DYNAMIC ANALYSIS 12

Introduction - Vibrational problems, Equations of motion based on weak form , Longitudinal vibration of bars, Transverse vibration of beams; Consistent mass matrices - Element equations, Solution of eigenvalue problems; Vector iteration methods - Normal modes, Transient vibrations, Modeling of damping, Direct integration methods

UNIT V PLATE AND SHELL ELEMENTS 12

Formation of stiffness matrix for plate bending elements of triangular and quadrilateral elements - Concept of four node and eight node isoparametric elements , cylindrical thin shell elements.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- develop finite element formulations of single degree of freedom problems and solve them
- use finite element analysis programs based upon either "p-method" or "h-method" finite element mathematical formulations
- use ansys software to perform stress, thermal and modal analysis
- compute the stiffness values of noded elements
- determine its natural frequencies, and analyze harmonically-forced vibrations

REFERENCES

1. S. S. Bhavikatti, "Finite Element Analysis", New Age International Pvt. Ltd., New Delhi,2007.
2. C. S. Krishnamoorthy, "Finite Element Analysis: Theory and Programming", Tata McGraw-Hill, 2008.
3. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", McGraw - Hill, 2005.
4. Chandrupatla, R.T. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice Hall of India, 2012.
5. Moaveni, S., "Finite Element Analysis Theory and Application with ANSYS", Prentice Hall Inc., 2003.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO2	3	2	-	2	-	2	2	-	-	-	-	-	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO4	3	2	-	2	-	2	2	-	-	-	-	-	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	2

PSE19202 STRUCTURAL DYNAMICS 3 1 0 4

COURSE OBJECTIVES

To enable the students to,

- understand the response of structural systems to time-varying dynamic loads and displacements.
- apply the behaviour and response of linear and nonlinear two degree of freedom structures with various dynamic loading, analysis with viscous dampers.
- study the behaviour and response of MDOF structures with various dynamic loading.
- determine the behaviour of structures subjected to dynamic loads such as wind, earthquake and blast.
- compute the different dynamic analysis procedures for calculating the response of structures.

Prerequisite: Nil

UNITI PRINCIPLES OF DYNAMICS 12

Vibration and its importance to structural engineering problems - Elements of vibratory systems and simple harmonic motion, Generalized mass, D'Alemberts principle; Mathematical modeling of dynamic systems - Degree of freedom, Equation of motion for S.D.O.F, Damped and undamped free vibrations, Undamped forced vibration, Critical damping; Response to harmonic excitation -Evaluation of damping , resonance, band width method to evaluate damping - Force transmitted to foundation, Vibration isolation.

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 DYNAMIC ANALYSIS OF MDOF 12

Multidegree of freedom system - undamped free vibrations, Orthogonality relationship; Approximate methods - Holzer, Rayleigh, Rayleigh - Ritz methods; mode superposition technique; Numerical integration procedure - Central Difference, Newmark's method.

UNIT IV DYNAMIC ANALYSIS OF CONTINUOUS SYSTEMS 12

Free and forced vibration of continuous systems - axial vibration of a beam, Flexural vibration of a beam; Rayleigh-Ritz method - Formulation using Conservation of Energy, Formulation using Virtual Work.

UNIT V PRACTICAL APPLICATIONS 12

Idealisation and formulation of mathematical models for wind, earthquake, blast and impact loading; Base Isolation - Principles of analysis, Linear and Non-linear.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- understand the response of structural systems to dynamic loads and displacements.
- realize the response of linear and non-linear TDOF structures with various dynamic loading.
- determine the behaviour and response of MDOF structures with various dynamic loading.
- find suitable solution for continuous system.
- understand the behaviour of structures subjected to dynamic loads such as wind, earthquake and blast

REFERENCES

1. A.K. Chopra, Dynamics of Structures - Theory and Applications of Earthquake Engineering, Pearson Education., 2014.
2. Paz Mario., Structural Dynamics - Theory and Computation, CBS Publication., 5th edition,2006.
3. Manickaselvam ,V.K., "Elementary Structural Dynamics", DhanpatRai& Sons, 2001.
4. MadhujitMukhopadhyay - Structural Dynamics Vibrations and Systems, Ane Books India Publishers, 2010.
5. Shashikant K. Duggal., Earthquake Resistant Design of Structures, Oxford University Press, 2013.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO2	3	2	-	2	-	2	2	-	-	-	-	-	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO4	3	2	-	2	-	2	2	-	-	-	-	-	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	2

PSE19203 STRUCTURAL DESIGN LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to,

- gain knowledge on fabrication, casting and testing of concrete structures
- know the in-situ strength of structures
- conduct static and dynamic test on frame and beam
- conduct Non Destructive Tests on existing concrete structures.

Prerequisite: Advanced Structural Analysis

LIST OF EXPERIMENTS

1. Fabrication, casting and testing of simply supported reinforced concrete beam for strength and deflection behaviour.
2. Testing of simply supported steel beam for strength and deflection behaviour.
3. Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading
4. Dynamic testing of cantilever steel beam
    A. To determine the damping coefficients from free vibrations.
    B. To evaluate the mode shapes.
5. Static cyclic testing of single bay two storied steel frames and evaluate
    A. Drift of the frame.
    B. Stiffness of the frame
6. Determination of in-situ strength and quality of concrete using
    A. rebound hammer
    B. Ultrasonic Pulse Velocity Tester

TOTAL PERIODS 60

COURSE OUTCOMES

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

- understand the fabrication, casting and testing of concrete structures
- gain knowledge on finding the in-situ strength of structures
- understand the static and dynamic testing of frame and beam
- test the existing concrete structures by Non Destructive Tests.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	2	2	-	3	-	-	2	-	2
CO2	3	-	-	-	-	2	2	-	3	-	-	2	-	2
CO3	3	-	-	-	-	2	2	-	3	-	-	2	-	2
CO4	3	-	-	-	-	2	2	-	3	-	-	2	-	2
CO5	3	-	-	-	-	2	2	-	3	-	-	2	-	2

PSE19204 **MINI PROJECT** **0 0 4 2**

COURSE OBJECTIVES

To enable the students to,

- work on a specific technical topic in Structural Engineering & to acquire writing abilities for seminars and conferences
- identify structural Engineering problems by reviewing literature

Prerequisite: Nil

SYLLABUS CONTENT

Mini project will have mid & end semester presentation. Mid semester presentation willinclude identification of the problem based on literature review on the topic referring to latest literature available. End semester presentation should be done along with the report on identification of the topic for the work & the methodology adopted involving scientific research, collection & analysis of data determining solutions highlighting individual's contribution. Continuous assessment of mini project at mid semester& end semester will be monitored by the departmental committee.

Similarly, the students will have to present a mini project presentation of not less than fifteen minutes and not more than thirty minutes on their respective topic. A brief copy of their presentation also should be submitted. They will defend their presentation. Evaluation will be based on the technical presentation with the report.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- trained to face an audience and to tackle any problem during group discussion in the Interviews.
- study different techniques to analyze the problem & present solution by using his/her technique applying Engineering principles.

CO PO MAPPING:

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Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	2	2	-	3	-	-	2	-	2
CO2	3	-	-	-	-	2	2	-	3	-	-	2	-	2

ELECTIVE I

PSE19151 THEORY OF PLATES 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- understand the various boundary conditions for laterally loaded plates.
- know about the rectangular plate method.
- make the students to be familiar with circular plates.
- understand the concepts of energy methods
- design the Orthotropic plates

Prerequisite: Nil

UNIT I INTRODUCTION TO PLATES THEORY 9

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

UNIT II RECATANGULAR PLATES 9

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 - plates on elastic foundation.

UNIT IV SPECIAL AND APPROXIMATE METHODS 9

Energy methods - Finite difference and Finite element methods

UNIT V ANISOTROPIC PLATES AND THICK PLATES 9

Orthotropic plates and grids - moderately thick plates.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design the laterally loaded plates with various boundary conditions.
- design the rectangular plates using various methods.
- understand the bending of circular plates.
- understand the Finite difference and Finite element methods
- designthe thick plates

REFERENCES

1. AnselC.Ugural, ”Stresses in plate and shells”, McGraw Hill International Edition, 1999.
2. Reddy J N, “Theory and Analysis of Elastic Plates and Shells”, McGraw Hill Book Company, 2006.
3. Chandrashekahara,K. “Theory of Plates”, University Press (India) Ltd., Hyderabad, 2001.
4. Bairagi, “Plate Analysis”, Khanna Publishers, 1996.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	2	-	-	-	-	1	-	2
CO2	3	2	-	-	-	-	2	-	-	-	-	1	-	2
CO3	3	2	-	-	-	-	2	-	-	-	-	1	-	2
CO4	3	2	-	-	-	-	2	-	-	-	-	1	-	2
CO5	3	2	-	-	-	-	2	-	-	-	-	1	-	2

PSE19152 ADVANCED CONCRETE TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- summarize the properties of concrete making materials such as cement, aggregates and admixtures.
- categories the properties and tests on fresh and hardened concrete.
- acquire the practical knowledge on mix design principles, concepts and methods.
- get an adequate knowledge about the special concretes and their applications in the diverse Construction field.
- study the concrete manufacturing processes, concreting methods and different special formworks.

Prerequisite: Nil

UNIT I MATERIALS FOR CONCRETE 9

Cement - Manufacturing, Types and grades of cement, Chemical composition, Hydration of cement, Micro structure of hydrated cement, Testing of cement, Special cements; Aggregates – classification, IS Specifications, properties, Grading and specified grading, Methods of combining aggregates, Testing of Aggregates; Water - Physical and chemical properties; Admixtures - Chemical & mineral Admixtures, Mineral additives.

UNIT II PROPERTIES OF CONCRETE 9

Properties of fresh concrete - Workability, Segregation, Bleeding, Latiance; Tests on fresh concrete; Properties and tests on hardened concrete - Structural properties, Strength, factors affecting the strength of Concrete; Maturity of concrete - modulus of elasticity, creep, shrinkage, factors affecting creep and shrinkage concrete; Micro structure of concrete - Micro cracking, Testing of existing and aged structures using NDT, Variability of strength in concrete; Durability of concrete - Chemical attack on concrete.

UNIT III CONCRETE MIX DESIGNS 9

Principles of mix design - Methods of concrete mix design, Factors influencing mix proportions; IS, ACI and British methods of mix design; Statistical quality control - Sampling and acceptance criteria.

UNIT IV SPECIAL CONCRETES 9

Light weight concrete and types; Fly ash concrete; Fibre reinforced concrete types & applications; Sulphur concrete; Sulphur impregnated concrete; Polymer concrete & its types; Super plasticized and hyper Plasticized concretes; Epoxy resins and screeds - properties, Their applications in rehabilitation works; High Performance concrete; high performance fibre reinforced concrete; Roller compacted concrete; Self - Concrete and its applications; Bacterial concrete; Recycled aggregate concrete; Smart concrete; Ferro cement and its applications.

UNIT V CONCRETING METHODS 9

Concrete manufacturing process - Stages of manufacturing - Transportation, placing and curing methods, Extreme weather concreting; Special concreting methods - Vacuum dewatering, Underwater concreting; Special form work types.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- execute and test the concrete made with cement, aggregates and admixtures.
- describe the properties and durability of hardened concrete.
- execute mix proportioning of concrete and describe how the strength of concrete can be modified by changing the proportions..
- use suitable concrete for different structures considering the prevailing weathering conditions.
- decide the correct concreting methods in the field depending upon the requirement and site conditions.

REFERENCES

1. Shetty.M.S., "Concrete Technology: Theory and Practice" ,S. Chand and Co. Pvt Ltd, Delhi, 2005
2. Santhakumar A.R., "Concrete Technology", Oxford University Press India, 2006.
3. Neville A.M., "Properties of Concrete ", Prentice Hall,5th Edition 2012.
4. Piett-Claude Aitcin, "High Performance Concrete", Talyor& Francis, 2011.
5. IS: 10262-2009, Indian Standard " Concrete Mix Proprotioning- Guide Lines" (First Revision)
6. Charts from ACI211.1-91-1991-American Standard Practice for normal, heavy weight and mass concrete, ACI Committee211.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	2	2	-	-	-	-	2	-	2
CO2	3	-	-	-	-	2	2	-	-	-	-	2	-	2
CO3	3	-	-	-	-	2	2	-	-	-	-	2	-	2
CO4	3	-	-	-	-	2	2	-	-	-	-	2	-	2
CO5	3	-	-	-	-	2	2	-	-	-	-	2	-	2

PSE19153 THEORY OF STRUCTURAL STABILITY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts and approximate methods of stability.
- study the stability of columns using theoretical and numerical methods.
- enumerate the lateral buckling, lateral torsional buckling and flexural torsional buckling of beams.
- study various numerical techniques and energy methods for buckling of thin plates.
- get accustomed to beam column joint behaviour and that of frames.

Prerequisite: Nil

UNIT I BUCKLING OF COLUMNS 9

States of equilibrium - Classification of buckling problems, concept of equilibrium, energy, imperfection and vibration approaches to stability analysis; Eigen value problem - Governing equation for columns; Analysis for various boundary conditions - using Equilibrium; Energy methods; Approximate methods - Rayleigh Ritz, Galerkins approach; Numerical Techniques - Finite difference Method, Effect of shear on buckling.

UNIT II BUCKLING OF BEAM-COLUMNS AND FRAMES 9

Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples; Analysis of rigid jointed frames with and without sway; Use of stability function to determine the critical load.

UNIT III TORSIONAL AND LATERAL BUCKLING 9

Torsional buckling - Combined Torsional and flexural buckling, Local buckling; Buckling of Open Sections; Numerical solutions - Lateral buckling of beams, pure bending of simply supported and cantilever beams.

UNIT IV BUCKLING OF PLATES 9

Governing differential equation - Buckling of thin plates, various edge conditions; Analysis by equilibrium and energy approach - Finite difference method.

UNIT V INELASTIC BUCKLING 9

Double modulus theory - Tangent modulus theory, Shanley's model; Eccentrically loaded inelastic Column; Inelastic buckling of plates - Post buckling behaviour of plates.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of this course the students will be able to

- analyze both static and dynamic instabilities by both theoretical and numerical methods.
- execute and work out the stability of columns and its buckling variations.
- be well versed in the lateral buckling, torsional buckling, flexural torsional buckling of various beams and non - circular sections.

- evaluate buckling of thin plates using energy methods and various numerical techniques.
- examine the behaviour of beam columns and frames with and without side sway using classical and stiffness methods.

REFERENCES

1. Timoshenko, S., and Gere., "Theory of Elastic Stability", McGraw Hill Book Company, 2012.
2. Gambhir, "Stability Analysis and Design of Structures", Springer, New York , 2004.
3. Ashwini Kumar, "Stability of Structures", Allied Publishers LTD, New Delhi, 2003
4. Iyenger.N.G.R., "Structural Stability of Columns and Plates", Affiliated East West Press,1988.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO2	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO4	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	2

PMA19151 ADVANCED MATHEMATICAL METHODS 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- analyze the treatment involved in solving differential equations by means of Laplace transformation.
- study the significance of the distribution of heat, signals and frequency.
- familiarize with single and multi-dimensional problems of variation calculus
- discuss about the suitable transformation of a function in a particular plane to another plane.
- expose the mathematical applications of vectors and tensor analysis to handle diverse problems.

Prerequisite: Nil

UNIT I LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9

Laplace transform, Definitions, properties - Transform of some simple function, Transform of error function, Dirac Delta function, Unit Step functions - Convolution theorem, Inverse Laplace Transform, Complex inversion formula, Solutions to partial differential equations; Heat equation - Wave equation.

UNIT II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9

Fourier transform: Definitions, properties - Transform of elementary functions, Dirac Delta function; Convolution theorem - Parseval's identity; Solutions to partial differential equations - Heat equation, Wave equation, Laplace and Poisson equations.

UNIT III CALCULUS OF VARIATIONS 9

Concept of variation and its properties - Euler's equation, Functional dependent on first and higher order derivatives, Functional's dependent on functions of several independent variables; Variational problems with moving boundaries - Problems with constraints; Direct methods - Ritz and Galerkin methods.

UNIT IV CONFORMAL MAPPING AND APPLICATIONS 9

Introduction to analytic functions - conformal mappings and bilinear transformations; Schwarz Christoffel transformation; Transformation of boundaries in parametric form - Physical applications , Fluid flow and heat flow problems.

UNIT V TENSOR ANALYSIS 9

Summation convention - Contravariant and covaraiant vectors, Contraction of tensors, Inner product - Quotient law, Metric tensor; Chrirstoffel symbols - Covariant differentiation, Gradient, divergence and curl.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of this course the students will be able to

- solve the differential equations using Laplace Transform by applying its boundary conditions

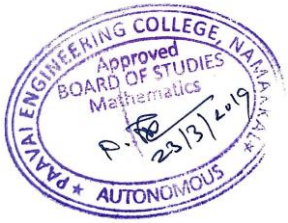
- gain knowledge in fourier transform techniques in distribution of heat and signal processing.
- understand the concepts of solving a variational problem using the Euler equation.
- solve fluid flow and heat flow problems using conformal mapping.
- apply the physical applications and simplifications of tensors.

REFERENCES

1. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Engineers", SPIE Optical Engineering press, Washington USA (1999).
2. Gupta, A.S., "Calculus of Variations with Applications", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
3. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2004.
4. Ramaniah.G. "Tensor Analysis", S.Viswanathan Pvt. Ltd., 1990.
5. SankaraRao, K., "Introduction to Partial Differential Equations", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
6. Spiegel, M.R., "Theory and Problems of Complex Variables and its Application (Schaum"s Outline Series)", McGraw Hill Book Co., 1981.
7. Lev D. Elsgolc., "Calculus of Variations" , Courier Corporation, 2012.
8. E. B. Saff, Arthur David Snider., "Fundamentals of Complex Analysis with Applications to Engineering and Science" , Prentice Hall, 2003.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	1	-	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	1	3	2



ELECTIVE II

PSE19251 STRUCTURAL HEALTH MONITORING 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- learn the fundamentals of structural health monitoring
- study the various vibration-based techniques for structural health monitoring
- make the students to be familiar with static field testing
- understand the classification of dynamic field testing
- know the materials and techniques used for repair of structures.

Prerequisite: Nil

UNIT I INTRODUCTION TO STRUCTURAL HEALTH MONITORING 9

Definition of structural health monitoring (SHM) - Motivation for SHM, SHM as a way of making materials and structures smart, factors affecting health of structures, causes of distress; Regular maintenance - concepts ,various measures, structural safety in alteration.

UNIT II VIBRATION-BASED TECHNIQUES 9

Basic vibration concepts for SHM - Local and global methods, Damage diagnosis as an inverse problem; model - based damage assessment; mathematical description of structural systems with damage - assessment of health of structures, collapse and investigation, investigation management, SHM procedures.

UNIT III STATIC FIELD TESTING 9

Types of static tests - simulation and loading methods, sensor systems and hardware requirements, static response measurement.

UNIT IV DYNAMIC FIELD TESTING 9

Types of dynamic field test - stress history data, dynamic response methods, hardware for remote data Acquisition systems; remote structural health monitoring.

UNIT V REPAIRS AND REHABILITATIONS OF STRUCTURES 9

Case studies (Site visit) - piezo-electric materials and other smart materials; electro- mechanical impedance (EMI) technique - adaptations of EMI technique.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understood the fundamentals of maintenance and repair strategies.
- decide the basic concepts of structural health monitoring.
- assess the health of structure using static field methods.
- use an appropriate remote health monitoring technique.
- suggest repairs and rehabilitation measures of the structures.

REFERENCES

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, Wiley ISTE, 2006.
2. Douglas E Adams, Health Monitoring of Structural Materials and Components-Methods with Applications, John Wiley and Sons, 2007.
3. J.P. Ou, H.Li and Z.D. Duan, Structural Health Monitoring and Intelligent Infrastructure, Vol-1, Taylor and Francis Group, London, U.K, 2006.
4. Victor Giurglutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	1	-	2
CO2	3	2	-	-	-	2	2	-	-	-	-	1	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	1	-	2
CO4	3	2	-	-	-	2	2	-	-	-	-	1	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	1	-	2

PSE19252 SMART STRUCTURES AND SMART MATERIALS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know about the smart materials
- understand the measuring techniques
- know about the different sensors
- understand the actuator techniques
- know various signal processing & control system

Prerequisite: Nil

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 LVOT - 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 orheological Fluids, Electro magnetic 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 PERIODS 45

COURSE OUTCOMES

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

- gain knowledge on the basics of smart materials
- know the applications of strain gauges
- know the applications of LVOT
- know the applications of actuators
- understand the various signal processing & control system

REFERENCES

1. Brain Culshaw – Smart Structure and Materials Artech House – Borton. London-1996.
2. L. S. Srinath – Experimental Stress Analysis – Tata McGraw-Hill, 1998.
3. J. W. Dally & W. F. Riley – Experimental Stress Analysis – Tata McGraw-Hill, 1998.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	1	2	2	-	-	-	-	2	-	2
CO2	3	-	-	-	1	2	2	-	-	-	-	2	-	2
CO3	3	-	-	-	1	2	2	-	-	-	-	2	-	2
CO4	3	-	-	-	1	2	2	-	-	-	-	2	-	2
CO5	3	-	-	-	1	2	2	-	-	-	-	2	-	2

PSE19253 PREFABRICATED STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the basic knowledge about prefabrication
- familiar with prefabricated components
- acquire the basic concepts design principles of prefabrication
- update their knowledge about joints in structural members
- design the prefabricated components for abnormal loads.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Types of prefabrication, prefabrication systems and structural schemes, Need for prefabrication, Principles, Materials; Disuniting of structures; Handling and erection - Elimination of erection stresses

UNIT II PREFABRICATED COMPONENTS 9

Production - Transportation and erection, Shuttering and mould design, Dimensional tolerances; Erection of R.C. Structures; Total prefabricated buildings - Structural behaviour of precast structures; Large panel constructions - Construction of roof and floor slabs; Wall panels; Columns; Shear walls.

UNIT III DESIGN PRINCIPLES 9

Design of cross section based on efficiency of material used - Problems in design; joint flexibility - Allowance for joint deformation; Design of construction and expansion joints.

UNIT IV STRUCTURAL MEMBERS 9

Designing and detailing of prefabricated units - industrial structures, Multi-storey buildings; Water tanks - Dimensioning and detailing of joints for different structural connections.

UNIT V DESIGN FOR ABNORMAL LOADS 9

Progressive collapse - Codal provisions, Equivalent design loads for considering abnormal effects such as earthquakes, cyclones - Importance of avoidance of progressive collapse.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- have the basic knowledge about prefabrication
- familiarity with prefabricated components
- get the basic concepts design principles of prefabrication
- update their knowledge about joints in structural members
- design the prefabricated components for abnormal loads.

REFERENCES

1. Precast Concrete Structures, Precast Concrete Structures, Second Edition by Kim S. Elliott, CRS Publishers, 2016
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., "Knowledge based process planning forconstruction and manufacturing", Academic Press Inc., 2012.
3. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design",8th Edition, Tata McGraw Hill Edition, 2011
4. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd Edition, USA 2010.
5. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.
6. IS 15916:2011 - Building Design And Erection Using prefabricated Concrete.
7. IS 11447: 1985 - Code of practice for construction with large panel prefabricates.
8. IS 1893: 2002 (Part - I)- Criteria for Earthquake Resistant Design of Structures - General.
9. IS 13920: 1993 - Ductile detailing of Reinforced Concrete Structures.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	2	2	2	-	-	-	-	2	-	2
CO2	3	-	-	-	2	2	2	-	-	-	-	2	-	2
CO3	3	-	-	-	-	2	2	-	-	-	-	2	-	2
CO4	3	-	-	-	-	2	2	-	-	-	-	2	-	2
CO5	3	-	-	-	-	2	2	-	-	-	-	2	-	2

PSE19254 EARTHQUAKE RESISTANT DESIGN 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- know the concepts of single degree freedom
- analyse building for earthquake forces
- explain the design guidelines for earthquake resistant masonry and earthen buildings
- analyse the ductility detailing
- gain knowledge on base isolation techniques

Prerequisite: Nil

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM (SDOF) 9

Introduction to Systems with single degree of freedom - Equation of motion of SDOF and its solution; Analysis of free vibrations damped and undamped; Response to harmonic, impulsive, periodic and general dynamic loading; Analysis SDOF systems with ground motion (earth quake loads)

UNIT II MULTI-DEGREE OF FREEDOM SYSTEM (MDOF) 9

Modeling of shear frames up to two degree of freedom system - Modal analysis for free vibration, Modal analysis for forced vibration with harmonic loading and determination of nodal forces from first principles

UNIT III DESIGN SEISMIC FORCES 9

Codal provisions for design as per IS 1893-2002 - Concept of response spectrum and procedure for constructing the response spectrum, Determination of lateral forces; base shear - by response spectrum method for 2 storey moment resistant frames, Calculation of drift and top storey lateral deflection, Aspects in planning and layout for regular and irregular buildings in plan and elevation; Mass and stiffness irregularity - Calculation of centre of mass and centre of rigidity for simple layouts, Computation of eccentricity and torsion in irregular buildings

UNIT IV DETAILING FOR DUCTILITY 9

Definition of Ductility - General Codal provisions for ductility detailing as per IS :13920-1993, Codal provisions for ductility detailing as per IS :13920-1993 for columns, Codal provisions for ductility detailing as per IS :13920- 1993 for beams, Codal provisions for ductility detailing as per IS :13920-1993 for foundation, Shear wall design and detailing as per IS :13920-1993

UNIT V SPECIAL TOPICS 9

Concept of seismic damage ratings - Repair and Rehabilitation techniques and seismic strengthening, Case studies in repair and rehabilitation; Passive control of vibration using base isolation techniques - Properties of base isolators and modeling procedure of base isolators using SAP and ETABS; Active control of vibration - New and favorable materials to resist seismic forces

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of this course the students will be able to

- describe ground motion and its relationship to seismic design of structures.
- Understand the concept of nodal forces
- calculate earthquake induced lateral force on the structure.
- apply the basic principles of conceptual design for earthquake resistant RC buildings and carry out the detailed design of earthquake resistant RC buildings.
- adopt vibration control methods for buildings located in earthquake zone.

REFERENCES

1. Chopra A K, "Dynamics of Structures - Theory and Applications to Earthquake Engineering", Prentice- Hall of India Pvt. Ltd., New Delhi, 2017.
2. PankajAgarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures, Prentice", Hall of India Pvt. Ltd., New Delhi, 2006.
3. Taranath B S, "Wind and Earthquake Resistant Buildings - Structural Analysis & Design", Marcell Decker, NewYork, 2005.
4. S.K.Duggal, "Earthquake Resistant Design of Structures", Prentice Hall of India, New Delhi, 2013.
5. Chen WF &Scawthorn, "Earthquake Engineering Hand book", CRC Press, 2003.
6. IS:1893 (Part I) - 2002 - Indian Standard Criteria for Earthquake Design of Structures - General Provisions and Buildings.
7. IS:4326 - 1993 - Earthquake Resistant Design and Construction of Buildings - Code of Practice.
8. IS:13920-1993 - Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of Practice.
9. IS:13827-1993 - Improving Earthquake Resistance of Earthen Buildings - Guidelines.
10. IS:13828 - 1993 - Improving Earthquake Resistance of Low Strength Masonry Buildings - Guidelines.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
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	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	2	-	-	-	-	2	2	-
CO2	3	2	-	-	-	-	2	-	-	-	-	2	2	-
CO3	3	2	-	-	-	-	2	-	-	-	-	2	2	-
CO4	3	2	-	-	-	-	2	-	-	-	-	2	2	-
CO5	3	2	-	-	2	-	2	-	-	-	-	2	2	-

ELECTIVE III

PSE16351 ENERGY EFFICIENT STRUCTURES 3 0 0 3

COURSE OBJECTIVES

- To elucidate the energy audit systems in buildings.
- To create awareness of the necessity of energy needed for structures.
- To study the different climate types and their influence in building design.
- To focus on the thermal environment of structures
- To equip the knowledge of appliances and their utilisation in buildings.

UNIT I ENERGY EFFICIENT CONCEPTS 9

Need of energy in buildings - assessment - Energy consumption pattern of various types of buildings - Factors influencing the energy use in building - Concepts of energy efficient building.

UNIT II CLIMATE 9

Study of Climate types - their influence in building design - Environmental factors affecting building design; Analysis of thermal and visual environment.

UNIT III HEAT AND LIGHT 9

Heat gain and loss phenomenon in buildings - Thermal performance parameters - Role of building enclosures, openings and materials in thermal environment; Basic principles of light and daylight - Energy efficient light design of buildings - Daylight design of buildings.

UNIT IV APPLIANCES IN BUILDINGS 9

Major appliances in building and their energy consumptions - Principles of solar heating, cooling and power (PV) systems; Integration of energy efficient appliances with the buildings.

UNIT V ENERGY AUDIT 9

Energy survey and energy audit of buildings - Calculation of energy inputs and utilization in buildings - Energy audit reports of buildings; Concepts of Green Buildings - Energy rating of buildings.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

- introduce various energy consumptions
- understand the climate and environmental factors affecting building design
- gain knowledge in design of buildings according to thermal environment
- acquire the skills in utilization of appliances and the principles behind them
- obtain the knowledge in energy audit in buildings

REFERENCES

1. Chand, I. and Bhargava,P.K., "The Climatic Data Handbook", Tata McGraw Hill Publishing Company Limited, New Delhi 1999.
2. Threlkeld, J.L,"Thermal Environmental Engineering", Printice-Hall, Englewood Cliffs, NJ, 1998.
3. Lal Jayamaha, "Energy-Efficient Building Systems: Green Strategies for Operation and Maintenance", McGraw Hill, 2007.
4. Krishnan, A., Baker, N., Yannas, S. and Szokolay, S.V., "Climate Responsive Architecture - A Design Hand Book for Energy Efficient Buildings", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2001.
5. ShahinVassigh, Jason R. Chandler, "Building Systems Integration for Enhanced Environmental Performance" J. Ross Publishing, 2011.

CODE BOOK

1. „Handbook on functional requirements of buildings", Parts 1-4, SP: 41 (S&T), Bureau of Indian Standards - 1995.

WEB LINKS

1. https://en.wikipedia.org/wiki/Green_building
2. https://www.wbdg.org/resources/efficientlighting.php
3. http://www.institutebe.com/Green-Net-Zero-Buildings/renewable-energy-advantages.aspx

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	-	1	3	3	1	-	-	1	2	1	2
CO2	1	-	-	-	1	3	3	1	-	-	1	2	1	2
CO3	1	-	-	-	1	3	3	1	-	-	1	2	1	2
CO4	1	-	-	-	2	3	3	1	-	-	1	2	1	2
CO5	1	-	-	-	2	3	3	1	-	-	1	2	1	2

PSE16352 STRUCTURES IN DISASTER PRONE AREAS 3 0 0 3

COURSE OBJECTIVES

- To know the various types of disaster caused by the nature and disaster prone areas in India.
- To gain knowledge in the response of the structure for various disaster.
- To obtain a brief knowledge about the planning and preparedness for a disaster.
- To know about the various modern materials and tools used in disaster reduction.
- To gain knowledge about the various organisations involved in disaster management.

UNIT I DISASTER 9

Introduction - Types of disasters - Disaster mitigating agencies and their organization structure at different levels; Overview of disaster situations in India; Vulnerability profile of India and vulnerability mapping including disaster prone areas, communities and places.

UNIT II RESPONSE OF THE STRUCTURE 9

Philosophy for design to resist Earthquake, Cyclone and flood -By-laws of urban and Semi-Urban areas- Traditional and modern structures. Response of dams, bridges, buildings - Testing and evaluation; Classification of structures from safety point of view; Methods of strengthening for different disasters - Qualification test.

UNITIII SEISMIC VULNERABILITY OF URBAN AREAS 9

Seismic response of R.C frames buildings with soft first storey - Preparedness and planning for an urban earthquake disaster - Tsunami and its impact - Urban settlements.

UNIT IV MODERN MATERIALS AND TECHNIQUES 9

Use of modern materials their impact on disaster reduction - Use of modern analysis, design and construction techniques - Optimization for performance - Damage surveys; Maintenance and modifications to improve hazard resistance - Different types of foundation and its impact on safety.

UNIT V DISASTER MANAGEMENT 9

Landslide hazards zonation mapping - Geo-environmental problems associates with the occurrence of landslides - Role of remote sensing, science and technology; Rehabilitation programmes - Management of Relief Camp - information systems and decision making tools, voluntary agencies and community participation - various stages of disaster Management.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

- know the various disasters, their characteristics, causes and impacts
- acquire knowledge in strengthening of structures by various methods which was affected by the disaster

- understand the response of building with soft first storey
- use of various modern methodology and tools to reduce destructions
- gain knowledge in disaster mitigating agencies

REFERENCES

1. Allen, R.T. and Edwards, S.C., "Repair of Concrete Structures", Blakie and Sons, 2005.
2. Moskvin V, "Concrete and Reinforced Structures - Deterioration and Protection", MirPublishers, Moscow, 1983.
3. Singh R.B, "Disaster Management", Rawat Publications, 2000.
4. Sachindra Narayan, "Anthropology of Disaster management", Gyan Publishing house, 2000.
5. Harsh K Gupta, "Disaster Management", Orient Blackswan Pvt. Ltd., 2003

CODE BOOKS

1. IS 1893 : 2002 (Part 1) - Criteria for Earthquake Resistant Design of Structures - General.
2. IS 4326 : 1993 - Code of Practice for Earthquake Resistant Design and Construction of Buildings

WEB LINKS

1. https://en.wikipedia.org/wiki/Emergency_management
2. http://www.wcpt.org/disaster-management/what-is-disaster-management
3. http://www.slideshare.net/chaitanyakorra/disaster-resistant-architecture

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
	Programme Outcomes (POs)													
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	3	-	1	-	-	1	1	-
CO2	2	-	-	-	-	2	3	-	1	-	-	1	1	-
CO3	2	-	-	-	-	2	3	-	1	-	-	1	1	-
CO4	2	-	-	-	2	2	3	-	1	-	-	1	1	-
CO5	2	-	-	-	-	2	3	-	1	-	-	1	1	-

PSE16353 CONSTRUCTION SAFETY AND MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To gain knowledge on the cause of accident and construction industry related laws.
- To know in detail about the safety in various aspects of construction.
- To gain knowledge on the preparation of accident report by analysing the key factors.
- To gain knowledge on construction management.
- To gain knowledge on the safety implementation by case studies**.**

UNIT I INTRODUCTION 9

Importance - Causes of accident, safety measures- Environmental issues in construction- Construction industry related laws - Occupation Safety and Health Act (OSHA), National Safety Council (NSC) - British Safety Council (BSC) - Council of industrial safety (CIS) - Loss Prevention Association (India)-Construction safety; Elements of an effective safety programmes job-Site assessment

UNIT II PLANNING 9

Safety aspects of building and plant-layout-Introduction to treatment and disposal on Industrial wastes & effluents-Planning and safe operations- Planning and site operations; Safe systems of storing in construction materials-Excavation-Demolition work-Blasting-Timbering - Scaffolding- Hoisting apparatus and conveyors-Manual handling- Safe use of Ladder- Safety in hand tools - Safety in use of mobile cranes - Trusses, girders and beams.

UNIT III ACCIDENT CAUSATION, REPORTING AND INVESTIGATION 9

Accidents and Hazards control - Cost of accidents - Accident reports - Accident reporting, investigations and statistics-Identification of the key factors-Safety organization – Types - Functions-Safety committees.

UNIT IV SAFETY MANAGEMENT IN CONSTRUCTION 9

Safety policy-safety meeting-Planning for safety and productivity-safety management techniques-Safety sampling-Safety Audit-Job safety analysis-Incident recall techniques- Safety and Health provision in the factories act.

UNIT V CASE STUDIES 9

Involvement in safety - Role of Government and voluntary agencies- Safety officers; Fire hazards and preventing methods- case studies - fire accidents.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

- understand the basic mandatory procedures to be followed in the construction industry
- know the fundamental planning and safety practices commonly implemented on construction sites

- know the key factor for causing accidents
- understand the requirements for compliance and inspection imposed for the safety in construction site
- understand the importance of agencies involved in rescue operation by various case studies

REFERENCES

1. Jimmie Hinze, "Construction safety", Prentice-Hall, 2013.
2. Herbert William Heinrich, "Industrial Accident Prevention", McGraw-Hill, 1959.
3. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, "Construction Safety and Health Management", Prentice Hall Inc., 2001.

CODE BOOKS

1. IS 3696 : 1987 (Part I) 1991 (PART II) -code of safety for Scaffolds and ladder.
2. IS 3764 : 1992 - Code of Safety for Excavation work.
3. IS 4081 : 1986 - Code of Safety for blasting and related drilling operations.
4. IS 7293 : 1974 - Safety Code for Working with Construction Machinery.
5. IS 13416 : 1992 (Part I to V)- Preventive measures against Hazards at work places.
6. IS 15883 : 2009 (Part I) - Construction Project Management.
7. SP 70 : 2001, Hand Book of Construction Safety Practices, Bureau of Indian Standards, New Delhi.

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
	Programme Outcomes (POs)													
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	2	1	-	1	1	2	-	-	2	2	-	2
CO2	-	-	2	1	-	2	1	1	-	-	-	1	-	2
CO3	-	-	2	1	-	1	1	1	-	-	2	2	-	2
CO4	-	-	2	2	-	1	1	1	-	-	2	2	-	2
CO5	-	-	2	2	-	3	3	2	-	-	-	1	-	2

PSE16354 **FINANCIAL MANAGEMENT** **3 0 0 3**

COURSE OBJECTIVES

- To familiarize the student with a wide variety of financial decision making
- To familiarize the situations focusing on financial management and accounting.
- To prepare and appraise financial statements
- To use financial calculator and excel in a variety of financial problems
- To estimate cash flows from a project

UNIT I INTRODUCTION TO FINANCIAL ACCOUNTING, BOOK KEEPING & RECORDING 9

Meaning, Scope and importance of Financial Accounting. Financial Accounting - Concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger , Cash book & Trial balance. (Practical application on tally)

UNIT II FINANCIAL STATEMENT PREPARATION, ANALYSIS & INTERPRETATION 9

Preparation of financial statement and Profit & Loss Account, Balance Sheet., Ratio Analysis - classification of various ratios (Calculation on Excel)

UNIT III INTRODUCTION TO FINANCIAL MANAGEMENT 9

Concept of business finance, Goals & objectives of financial management, Sources of financing **-** LONG TERM: shares, debentures, term loans, lease& hire purchase, retained earnings, public deposits, bonds (Types, features & utility), SHORT TERM: bank finance, commercial paper, trade credit & bills discounting, INTERNAL: Retained earnings,

UNIT IV WORKING CAPITAL MANAGEMENT 9

Concept of working Capital, significance, types; Adequacy of working capital, Factors affecting working capital needs, Financing approaches for working capital, Methods of forecasting working capital requirements, meaning &importance of accounts receivable.(Excel based)

UNIT V TIME VALUE OF MONEY & CAPITAL BUDGETING 9

Concept of time value of money, Compounding & discounting; Future value of single amount & annuity, present value of single amount & annuity; Practical application of time value technique. Capital budgeting - Nature and significance, techniques of capital budgeting – Pay Back Method, Accounting rate of return, Internal Rate of Return, DCF, Net Present Value and profitability index. (Application on Excel)

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- understand and define basic terminology used in finance andaccounts
- prepare and appraise financial statements
- compare and appraise theories that underlie current thinking in accounting, finance andinvestment; and evaluate how these theories can be and are applied in practical situations
- estimate cash flows from a project, including operating, net working capital, and capitalspending
- estimate the required return on projects of differing risk and how to use the required returnin evaluating investment decisions

REFERENCES

1. Financial, Cost & Management Accounting: Dr. P. Pariasamy, HH Publication
2. Financial Management: Khan & Jain, Tata McGraw Hill
3. Financial Management: Dr. P. C. Tulsian, S. Chand.
4. Financial Management: Ravi Kishore, Taxmann

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
	Programme Outcomes (POs)													
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	3	1	2	2	2	-	-
CO2	-	-	-	-	-	-	-	3	1	2	2	2	-	-
CO3	-	-	-	-	-	-	-	2	1	2	2	2	-	-
CO4	-	-	-	-	-	-	-	2	1	2	2	2	-	-
CO5	-	-	-	-	-	-	-	2	1	2	2	2	-	-

ELECTIVE IV

PSE16451 DESIGN OF SUB STRUCTURES 3 0 0 3

COURSE OBJECTIVES

- To assess the soil condition at a given location in order to suggest suitable foundation based upon bearing capacity.
- To compose the design of different type of shallow foundations like isolated, raft and combined footing.
- To familiarize with the design of pile foundation and pile caps.
- To outline the design of well and caissons foundations.
- To categorize various types of design of tower foundations.

UNIT I SITE INVESTIGATION, SELECTION OF FOUNDATION AND BEARINGAPACITY 9

Objectives - Methods of exploration - Depth of exploration - Sample disturbance - Factors governing location and depth of foundation - In situ testing of Soils - Plate load test; Geophysical methods - Selection of foundation- Bearing capacity of shallow foundations by Terzaghi's theory, Meyerhof's theory, and codal provisions - Bearing capacity of footing subjected to inclined and eccentric loading – Problems; Types of shear failure - General principles of foundation design – Foundations on expansive soil.

UNIT II DESIGN OF SHALLOW FOUNDATIONS 9

Types of shallow foundations - General principles of design of reinforced concrete shallow foundations - Structural design of isolated and combined footing; Structural design of rafts by conventional method; Principles of design of buoyancy raft and basement (no design problems).

UNIT III PILE FOUNDATION 9

Pile foundations - Types - General principles of design - Estimation of load capacity of piles by static and dynamic formulae - Detailing of reinforcement as per IS 2911; Design of Piles and Pile caps; Settlement analysis of pile groups - Negative skin friction - Pile load tests.

UNIT IV WELL AND CAISSON FOUNDATIONS 9

Well and caisson foundations - Structural elements of Caisson and Well foundations - Elements of well foundation - Forces acting on Caisson and well foundations; Design of individual components of Caisson and well foundation(only forces acting and design principles) - Sinking of well - Shifts and tilts in well foundations - Preventive measures.

UNIT V FOUNDATIONS OF TRANSMISSION LINE TOWERS 9

Introduction - Necessary information - Forces on tower foundations - General design criteria - Choice and type of foundation - Design procedure -Types of Foundations - Design of foundation for transmission towers.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- attain the perception of site investigation to select suitable type of foundation based on soil category
- design concepts of shallow foundation
- select suitable type of pile for different soil stratum and in evaluation of group capacity by formulation
- design different types of well foundation
- design the concepts of transmission line tower foundation

REFERENCES

1. Winterkorn. H. F., and Fang, H. Y., "Foundation Engineering Hand Book - Van Nostrard - Reinhold - 1990.
2. Tomlinson. M.J. and Boorman, R., "Foundation design and construction", VI edition, ELBS Longman, 2001.
3. Nayak. N.V., "Foundation design manual for practicing engineers", Dhanpat Rai and Sons, 1985.
4. Arora. K.R, "Soil Mechanics & Foundation Engineering", Standard Publishers & Distributors, 2005.
5. "Dynamics of Bases and Foundations" by Barken.McGraw Hill Company.

CODE BOOKS

1. IS 2911 : Part 1 : Sec 1 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles, Section 1 Driven cast in-situ concrete piles
2. IS 2911 : Part 1 : Sec 2 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles, Section 2 Bored cast-in-situ piles
3. IS 2911 : Part 1 : Sec 3 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles, Section 3 Driven precast concrete piles.
4. IS 2911 : Part 1 : Sec 4 : 1984 Code of practice for design and construction of pile foundations: Part 1 concrete piles, Section 4 Bored precast concrete piles.
5. IS 2911 : Part 2 : 1980 Code of practice for designing and construction of pile foundations: Part 2 Timber piles.
6. IS 2911 : Part 3 : 1980 Code of practice for design and construction of pile foundations: Part 3 Under reamed piles
7. IS 2911 : Part 4 : 1985 Code of practice for design and construction of pile foundations: Part 4 Load test on piles
8. IS 6403 : 1981 Code of practice for determination of bearing capacity of shallow foundations

WEB LINKS

1. http://theconstructor.org/geotechnical/site-investigation-or-soil-exploration/312/
2. http://www.gic-edu.com/908/Distance--Shallow-Foundation-Design-Settlement-Analysis-Workshop-12-PDHs
3. http://www.nptel.ac.in/downloads/105104137/

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO2	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO4	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

PSE16452 EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION 3 0 0 3

COURSE OBJECTIVES

- To define the errors in measurement and the principles of measurement using various electronic and physical testing machines.
- To dramatize with vibrating measuring instruments and digital and electronic display using different sensors.
- To define the wind flow measurement and pressure measurement and scale different models using direct model study and indirect model study.
- To measure the distress in concrete structures using various electrical and electronic machineries.
- To test various civil engineering structures using Non Destructive Testing methodologies.

UNIT I FORCES AND STRAIN MEASUREMENT 9

Choice of Experimental stress analysis methods, errors in measurements - Strain gauge - principle - types, performance and uses- 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 VIBRATION MEASUREMENTS 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 - Chart Plotters; 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.

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

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

- choose the methodology of measuring errors and strains and calibrate the machineries and equipment used in the laboratory
- operate various vibration measuring instruments and analyse the structures using digital display unit
- indicate the model using direct and indirect model analysis (Using Buckingham PI Theorem)
- measure distress in the structures using various electronic equipment
- employ advanced NDT methods in accessing the load testing of structures

REFERENCES

1. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi,1996.
2. Ganesan T.P., "Model Analysis of Structures", Universities Press (India) Ltd 2005.
3. Dalley .J.W and Riley.W.F, "Experimental Stress Analysis", McGraw Hill Book Company, N.Y. 1991.
4. Srinath.L.S, Raghavan.M.R, Ingaiah.K, Gargesha.G, Pant.B and Ramachandra.K, "Experimental Stress Analysis", Tata McGraw Hill Company,New Delhi, 1984.
5. Sirohi.R.S.,Radhakrishna.H.C, "Mechanical Measurements", New Age International (P) Ltd. 1997.

WEB LINKS

1. http://textofvideo.nptel.iitm.ac.in/112106068
2. http://nptel.ac.in/downloads/112104039
3. http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Environmental%20Air%20Pollution/air%20pollution%20(Civil)/Module-2/2.html

CO PO MAPPING:

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CO1	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO2	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO3	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO4	3	2	-	-	-	2	2	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

PSE16453 COMPUTER AIDED ANALYSIS AND DESIGN OF STRUCTURES 3 0 0 3

COURSE OBJECTIVES

- To familiarize with graphic primitives, transformations and 2-D drafting of computer graphics.
- To get practiced with computer methods of structural analysis.
- To understand the structural design concepts.
- To familiar with linear programming and CPM and PERT.
- To inculcate the students with artificial intelligence.

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 aided analysis of steel and RC Structural elements – Application of software.

UNIT III STRUCTURAL DESIGN 9

Computer aided design of steel and RC Structural elements - Detailed drawing – Bill of materials

UNIT IV OPTIMIZATION 9

Application of linear programming - Simplex algorithm - Post-optimality analysis; Project scheduling - CPM and PERT applications

UNIT V ARTIFICIAL INTELLIGENCE 9

Introduction - Heuristic search - knowledge based expert systems – Rules and decision tables – Inference mechanisms- Simple applications - Genetic algorithm and applications; Principles of Neural network - Architecture and applications of KBES - Expert system shells.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

- be familiar with 2 D drafting and can use drafting software
- perform structural analysis using analysis package
- design the structures with computer methodologies
- optimize the structural design with various computer packages and graphics
- apply artificial intelligence to real life applications

REFERENCES

1. Krishnamoorthy C.S and Rajeev S., “Computer Aided Design”, Narosa Publishing House, New Delhi, 2005.
2. Groover M.P. and Zimmers E.W. Jr.," CAD/CAM, Computer Aided Design and ManufacturiPrentice Hall of India Ltd, New Delhi, 2006.
3. Harrison H.B., “Structural Analysis and Design Vol.I and II”, Pergamon Press, 1991
4. Rao. S.S., " Optimisation Theory and Applications ", Wiley Eastern Limited, New Delhi, 2009.
5. Richard Forsyth (Ed.), “Expert System Principles and Case Studies”, Chapman and Hall, 1996.

WEB LINKS

1. http://www.colorado.edu/engineering/cas/courses.d/IFEM.d/
2. http://link.springer.com/article/10.1007%2Fs40069-012-0027-7#page-1
3. http://www.civil.northwestern.edu/people/bazant/PDFs/Papers/S12.pdf

CO PO MAPPING:

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	-	3	-	-	-	-	-	-	2	1	1
CO2	2	2	2	-	3	-	-	-	-	-	-	2	1	2
CO3	2	2	2	-	3	-	-	-	-	-	-	2	1	1
CO4	2	2	2	-	3	-	-	-	-	-	-	2	1	2
CO5	2	2	2	-	3	-	-	-	-	-	-	2	1	2

PSE16454 **DESIGN OF BRIDGES** **3 0 0 3**

COURSE OBJECTIVES

- To study the various bridge forms and typical loadings on the bridges.
- To get familiarized with the design of short span bridges.
- To possess knowledge on the design concepts of long span bridges.
- To design the prestressed concrete bridges.
- To understand the concept of designing the substructure for bridges, plate girder to IRC loadings, foundation for bridges and bearings

UNIT I DESIGN PRINCIPLES 9

General basic bridge forms - Beam, arch, suspension, various types of bridges, selection of type of bridge and economic span length, drainage, road, kerb, classification, investigation and planning; Design loads for bridges - Dead load, live load, IRC loading, IRS loading, Aashto loading, wind load, longitudinal forces, centrifugal forces, buoyancy, water current forces, thermal forces deformation and horizontal forces

UNIT II SHORT SPAN BRIDGES 9

Design of culvert, Deck slab bridge - T - Beam girder bridge – Pigeaud's Theory – Courbon's Method

UNIT III LONG SPAN BRIDGES 9

Design principles of continuous bridges - Box girder bridges and balanced cantilever bridges.

UNIT IV DESIGN OF PRESTRESSED CONCRETE BRIDGES 9

Flexural and Torsional parameters – Courbon's Theory - Distribution Coefficient 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 deflections.

UNIT V DESIGN OF PLATE GIRDER BRIDGES , BEARINGS AND SUBSTRUCTURES 9

Design of riveted and welded plate girder bridges - Wind effects - Main section, splicing, curtailment, stiffeners - Different types of bearings; Design of bearings; Design of masonry and concrete piers and abutments - Types of bridge foundations - Design of foundations - Footings - Pile foundations.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

- understand the design theories for super structure and sub structure of bridges
- design short span bridges
- understand the behaviour of continuous bridges, box girder bridges

- design prestressed concrete bridges
- design railway bridges, plate girder bridges, different types of bearings , abutments, piers and various types of foundations for Bridges

REFERENCES

1. Ponnuswamy.S “Bridge Engineering”, Tata McGrawHill, 2008.
2. Johnson Victor.D, “Essentials of Bridge Engineering”, Oxford & IBH, 2007.
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, 1994.
5. Bakht.B and Jaegar.L.G., “Bridge Analysis Simplified”, McGraw Hill, 1985.

CODE BOOKS

1. IRC:6-2010 Standard Specifications and Code of Practice for Road Bridges, Section II - Loads and Stresses (Fifth Revision).
2. IRC:18-2000 Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete) (Third Revision).
3. IRC:21-2000 Standard Specifications and Code of Practice for Road Bridges, Section III - Cement Concrete (Plain and Reinforced) (Third Revision).
4. IRC:22-2008 Standard Specifications and Code of Practice for Road Bridges, Section VI - Composite Construction (Limit States Design) (Second Revision).
5. IRC:24-2010 Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit State Method)Third Revision).
6. IRC:83-1999 (Part-I) Standard Specifications and Code of Practice for Road Bridges, Section IX - Bearings, Part I : Metallic Bearings (First Revision).
7. IRC:83-1987 (Part II) Standard Specifications and Code of Practice for Road Bridges, Section IX - Bearings, Part II: Elastomeric Bearings.
8. 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.
9. Pigeaud‟s curves

WEB LINKS

1. https://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_brid/cub_brid_lesson02.xml
2. http://handbook.uts.edu.au/subjects/49131.html
3. http://www.britannica.com/technology/bridge-engineering

CO PO MAPPING:

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CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	2	2	-	2	-	-	-	-	-	-	-	-	3	2
CO3	2	2	3	3	-	-	-	-	-	-	-	-	3	2
CO4	2	2	2	2	-	-	-	-	-	-	-	-	3	2
CO5	3	2	3	3	-	-	-	-	-	-	-	-	3	2

SEMESTER III

PSE19301 DISSERTATION PHASE I 0 0 20 10

COURSE OBJECTIVE

To enable the students to

- identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literatures.
- develop the methodology to solve the identified problems.
- prepare the project reports and conduction of reviews and viva-voce examination.

SYLLABUS

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS 180

COURSE OUTCOMES

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

- reviewed civil engineering problems available in literature
- select appropriate techniques to analyze complex civil engineering problems
- apply engineering and management principles through efficient handling of project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

CO PO MAPPING:

Mapping of Course Objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak														
Cos	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	3	-	2	-	2	3	2	1	3	2	3
CO2	3	2	1	3	-	-	-	-	3	-	1	3	2	3
CO3	2	2	1	-	-	2	-	2	2	2	1	3	2	3

LIST ELECTIVES

ELECTIVE V

PSE19551 PRESTRESSED CONCRETE STRUCTURES 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- impart knowledge on the basic principles of prestressed concrete structures
- understand the flexure and shear design for prestressed concrete beams
- gain knowledge of factors influencing deflection and anchorage zone design
- understand the performance of composite members
- gain knowledge on various prestressed concrete structural elements

Prerequisite: Nil

UNIT I INTRODUCTION 9

Historical developments; Basic principles of prestressing; Classification and types; Advantages over ordinary reinforced concrete; Materials – High strength concrete, High tensile steel; Systems and Methods of prestressing; Analysis of sections- stress concept, strength concept and load balancing concept; Losses of prestress in post-tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions for calculating flexural stresses; Permissible stresses in steel and concrete as per I.S.1343 Code; Design of sections of Type I and Type II post – tensioned and pre–tensioned beams; Check for strength limit based on I.S. 1343 Code; Design for shear based on I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9

Deflection – Factors influencing deflections; Effect of tendon profile on deflections; Short and long term deflections; Check for serviceability limit state of deflection; Anchorage zone – Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code; Design of anchorage zone reinforcement.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9

Analysis and design of composite beams; Shrinkage strain and its importance; Methods of achieving continuity in continuous beams; Analysis for secondary moments; Concordant cable and linear transformation; Calculation of stresses; Principles of design.

UNIT V MISCELLANEOUS STRUCTURES 9

Design of tension and compression members; Design of tanks, pipes and sleepers; Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- select various types of prestressing methods
- design for flexure and shear on prestressed concrete beams.
- design of anchorage zone reinforcement.
- design of composite and continuous beams.
- describe the various prestressed concrete structural elements.

REFERENCES

1. Krishna Raju N., "Prestressed concrete", Tata McGraw Hill Company, Fifth Edition, 2012.
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt Ltd., Second edition, 2014
3. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2010
4. Dayaratnam.P and Sarah P, "Prestressed Concrete Structures", Seventh Edition, Oxford and IBH 2017
5. Lin T.Y. and Ned.H. Burns, "Design of prestressed Concrete Structures", Wiley India Pvt Ltd, New Delhi, 2013.
6. IS1343 – 1980 – IS Code of Practice for Prestressed Concrete.
7. IS784 – 2001 – IS Specification for Prestressed Concrete Pipes
8. IS3370 – 1999 – Part III – IS Code of Practice for Concrete Structures for the storage of liquids
9. IS1678 – 1998 – Specification for Prestressed Concrete Pole for overhead Power Traction and Telecommunication lines.

CO PO MAPPING:

Mapping of Course Objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	-	2	-	1	-	-	-	-	2	-	2
CO2	3	2	2	-	-	-	1	-	-	-	-	2	-	2
CO3	3	2	2	-	-	-	1	-	-	-	-	2	-	2
CO4	2	2	2	-	-	-	1	-	-	-	-	2	-	2
CO5	2	2	2	-	-	-	1	-	-	-	-	2	-	2

PSE19552 ANALYSIS OF LAMINATED COMPOSITE PLATES 3 0 0 3

COURSE OBJECTIVES

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

- understand the theories for rectangular composite plates.
- analyze the composite plates using advanced methods.
- develop the computer programs for the analysis of composite plates using analytical methods.
- gain the knowledge on finite element solutions.
- know the analytical method of composite plates.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Laminated plates – geometric & physical definitions, natural and man-made composites, types & classification of composites with its applications; Displacement field approximations for Classical laminated plate theory (CLPT) and First order shear deformation theory (FSDT)

UNIT II ANALYTICAL SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING CLPT) 9

Governing equations, Navier solutions of cross-ply and angle-ply laminated simply-supported plates, Determination of stresses. Levy solutions for plates with other boundary conditions.

UNIT III ANALYTICAL SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING FSDT) 9

Governing equations, Navier solutions of cross-ply and angle-ply laminated simply-supported plates, Determination of stresses. Levy solutions for plates with other boundary conditions.

UNIT IV FINITE ELEMENT SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING CLPT) 9

Introduction to Finite Element method, Rectangular elements, formation of stiffness matrix, formation of load vector, Numerical integration, Post computation of stresses

UNIT V FINITE ELEMENT SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING FSDT) 9

Finite element model, C_0 element formulation, Post computation of stresses; Analyze the rectangular composite plates using the analytical methods.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the classical laminated theory and first order shear deformation theory.
- analyze the rectangular composite plates using CLPT.

- analyze the rectangular composite plates using FSDT.
- describe the finite element solutions for rectangular laminated plates using CLPT.
- describe the finite element solutions for rectangular laminated plates using FSDT.

REFERENCES

1. Mechanics of Laminated Composites Plates and Shells, Reddy J. N., CRC Press.
2. "Finite Element modeling of Composites and Sandwich Laminates" by S.K. Singh and A. Chakrabarti, Lambert Academic Publishing, ISBN: 978-3-659-23481-1.
3. Bairagi, "Plate Analysis", Khanna Publishers, 1996.
4. "Stresses in plates and shells" by A.C.Ugural, Mc-graw hill publication, 1999.
5. Analysis of Plates by T.K.Varadhan and K.Bhaskar,Narosa Publishing house, 1999.

CO PO MAPPING:

Mapping of Course Objectives with Program Outcomes (1/2/3 indicates the strength of correlation) 3-Strong, 2-Medium, 1- Weak														
COs	**Program outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO2	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO4	2	2	2	-	2	-	-	-	-	-	-	1	-	2
CO5	2	2	2	-	2	-	-	-	-	-	-	1	-	2

PSE19553 **FRACTURE MECHANICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- able to finding out damage tolerance by using any one of the parameters.
- manage singularity at crack tip using complex variable
- understand the important role played by plastic zone at the crack tip.
- study modern fatigue and will able to calculate the fatigue life of a component.
- study modern sophisticated experimental techniques to determine stress intensity factor.

Prerequisite: Nil

UNIT I INTRODUCTION **9**

Crack in a Structure – Griffth Criterion; Basic Fracture Mechanics - Modes of fracture failure , crack resistance- stable and unstable crack growth; Cleavage Fracture- Ductile Fracture, Fatigue Cracking

UNIT II ELASTIC CRACK AND STRESS INTENSITY FACTOR **9**

Stress and displacement fields - edge cracks , embedded cracks ;Elastic Crack tip stress field -Solution to crack problems; Effect of finite size stress intensity factor - Special cases , Irwin plastic zone correction; Actual shape of plastic zone - Plane stress , Plane strain.

UNIT III PLASTICITY AND CRACK DETECTION TECHNIQUES **9**

Shape and size of plastic zone - effective crack length, effect of plate thickness , Crack tip opening displacement; Crack propagation - effect of an overload , crack closure , variable amplitude fatigue load; Environment - assisted cracking ,Dynamic mode crack initiation and growth - various crack detection techniques.

UNIT IV CRITICAL ENERGY AND FATIGUE FAILURE **9**

Test methods for determining critical energy release rate - critical stress intensity factor, J-Integral techniques; Concept of CTOD and CMD, Fatigue Crack Growth ; Fatigue Crack Growth Test- Stress Intensity Factor, Factors Affecting Stress Intensity Factor.

UNIT V APPLICATION OF FRACTURE MECHANICS **9**

Fracture design - Selection of materials, fatigue crack growth rate curve; Stress intensity factor range; Use of crack growth law.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- specify design parameters against fracture
- ascertain whether the design is safe against fracture
- suggest methods to prevent fracture
- predict fatigue life cycles
- suggest life enhancement methods under fatigue load

REFERENCES

1. Broke D, "Elementary engineering fracture mechanics"4/e 4th edition
2. A Nadai, W. S. Hemp, "Theory of flow and fracture of solids", McGraw Hill Book Company, 1950
3. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
4. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989

CO PO MAPPING:

Mapping of Course Objectives with Program Outcomes (1/2/3 indicates the strength of correlation) 3-Strong, 2-Medium, 1- Weak														
COs	**Program outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO2	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO4	2	2	2	-	-	-	-	-	-	-	-	1	-	2
CO5	2	2	2	-	-	2	-	-	-	-	-	1	-	2

PSE19554 WIND AND CYCLONE EFFECTS ON STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the concept of wind and cyclone effects for analysis and design of structures
- know the usage of codal provisions for the wind and cyclone design of structures
- study the static and dynamic on tall buildings
- design the special structures based on wind effects
- analyse the cyclone effects on tall buildings

Prerequisite: Nil

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; modeling requirements; interpretation of results; aero dynamic and aero-elastic models.

UNIT III WIND EFFECT 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-875, ASCE and NBC code provisions – design of Tall Buildings – Chimneys – Transmission towers and steel monopoles – Industrial sheds (Roofs & Shelters)

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 PERIODS 45

COURSE OUTCOMES

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

- design high rise structures subjected wind load, even structures exposed to cyclone
- use various codal provisions for the design of structures for wind load
- describe the wind effect on a structure
- design the structure as per IS and NBC codal provision
- explain various types of cyclone effects

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. Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London,1980
4. Peter Sachs, "Wind Forces in Engineering", Pergamon Press, New York, 1978.

CO PO MAPPING:

Mapping of Course Objectives with Program Outcomes: (1/2/3 indicates the strength of correlation) 3-Strong, 2-Medium, 1- Weak														
COs	**Program outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO2	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	1	-	2
CO4	2	2	2	-	-	-	2	-	-	-	-	1	-	2
CO5	2	2	2	-	-	-	2	-	-	-	-	1	-	2

OPEN ELECTIVE

PMA19901 OPERATIONS RESEARCH 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the mathematical formulation of real-world problems as a linear programming model and apply the theoretical workings of the graphical and simplex method.
- develop various constructive techniques of Transportation and Assignment models to make effective business decisions.
- introduce the concepts of nonlinear programming problem to develop the quantitative tools for identifying, analyzing and practicing strategic decisions.
- develop various constructive techniques for the field of inventory and production management.
- impart knowledge to manage the project analysis by network models and organize the tools and techniques of CPM and PERT

UNIT I LINEAR PROGRAMMING 9

Principal components of decision problem, modeling phases, LP Formulation and graphic solution, Resource allocation problems, Simplex method.

UNIT II TRANSPORTATION AND ASSIGNMENT MODELS 9

Mathematical formulation of transportation problem; Methods for finding initial basic feasible solution, optimum solution, degeneracy; Mathematical formulation of assignment models - Hungarian Algorithm, variants of the Assignment problem.

UNIT III CLASSICAL OPTIMISATION THEORY 9

Nonlinear programming problem, Kuhn-Tucker conditions min cost flow problem, max flow problem.

UNIT IV INVENTORY MODELS 9

Inventory models, Economic order quantity models, Quantity discount models, Stochastic inventory models, Multi product models, Inventory control models in practice.

UNIT V NETWORKING MODELS 9

Network diagram representation, Critical path method, Time charts and resource levelling, PERT.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- demonstrate the mathematical formulation of real-world problems as a linear programming model and apply the theoretical workings of the graphical and simplex method.

- determine the optimal solution of maximizing the profit and minimizing the cost of both transportation and assignment problems.
- develop mathematical skills to analyse and solve Nonlinear programming problem.
- determine the optimization concepts in inventory control models.
- use CPM and PERT techniques to plan , schedule and Control project activities.

REFERENCES

1. Taha H.A., "Operations Research: An Introduction " 10th Edition, Pearson Education, 2017.
2. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2013.
3. Prem Kumar Gupta, D.S. Hira, "Operations Research", S.Chand & Company Ltd, New Delhi, 3rd Edition, 2013.
4. John W. Chinneck "Feasibility and Infeasibility in Optimization Algorithms and Computational Methods", Springer, 2013.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3

PAAVAI ENGINEERING COLLEGE, NAMAKKAL * AUTONOMOUS *
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29/6/20

PCE19901 BUSINESS ANALYTICS **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

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

UNIT I INTRODUCTION **9**

Business analytics- Overview of business analytics, scope of business analytics, business analytics process, relationship of business analytics process and organization, competitive advantages of business analytics; Statistical Tools- Statistical notation, descriptive statistical methods- data mining introduction.

UNIT II ANALYSIS **9**

Trendiness and Regression Analysis- Modeling relationships and trends in data, business analytics personnel, data and models for business analytics, problem solving, visualizing and exploring data, business analytics technology.

UNIT III MODELLING **9**

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

UNIT IV FORECASTING **9**

Forecasting Techniques- Qualitative and Judgmental Forecasting, statistical forecasting models, forecasting models for stationary time series, forecasting time series with seasonality, regression forecasting with casual variables. Monte Carlo Simulation - Monte carlo simulation using analytic solver platform, new-product development model, newsvendor model, overbooking model, cash budget model.

UNIT V DECISION MAKING **9**

Decision Analysis- Formulating decision problems, decision strategies with the without outcome probabilities, decision trees, value of information, utility and decision making.

TOTAL HOURS 45

COURSE OUTCOMES

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

- understand the knowledge of data analytics.
- demonstrate the ability of think critically in making decisions based on data and deep analytics.
- demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- demonstrate the ability to translate data into clear, actionable insights.
- understand the concept of decision making.

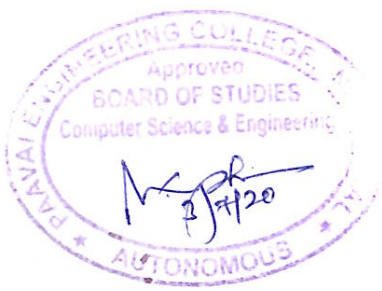
REFERENCES

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dar G.Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.
3. The PMI guide to Business Analysis
4. Business Analysis for Practitioners: Practice Guide
5. Agile and Business Analysis Practical guidance for IT Professionals

CO/PO MAPPING

(1,2,3 indicates the strength of correlation) 3-strong,2-medium,1-less

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	1	-	1	2	-	1	2	1	-
CO2	2	2	2	1	1	1	-	1	2	-	-	2	2	-
CO3	2	2	2	3	1	1	-	1	2	-	-	2	2	2
CO4	2	2	2	3	1	1	-	1	2	-	-	2	2	1
CO5	2	2	2	2	1	1	-	1	2	-	-	2	2	1



PED19901 **INDUSTRIAL SAFETY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- give exposure to various industrial safety equipment's and methods.
- understand tools used for maintenance cost and services life of equipment.
- analyze the types, causes, effects of wear reduction methods.
- enhance awareness of fault tracing concept and maintenance and types of faults in machine tools and their general causes.
- develop rudimentary ability on periodic inspection concept and needs of various mechanical and electrical equipment's.

UNIT I INDUSTRIAL SAFETY **9**

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

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING **9**

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

UNIT III WEAR AND CORROSION AND THEIR PREVENTION **9**

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

UNIT IV FAULT TRACING **9**

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

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE 9

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- differentiate the types of accident causes and preventive steps of industrial safety.
- assess the various types and applications of tools used for maintenance and its relation with economy.
- analyze the factors affect the corrosion and its prevention methods.
- identify the types of faults in machine tools and their general causes.
- analyze the various preventive maintenance of mechanical and electrical equipment's and repair cycle concepts.

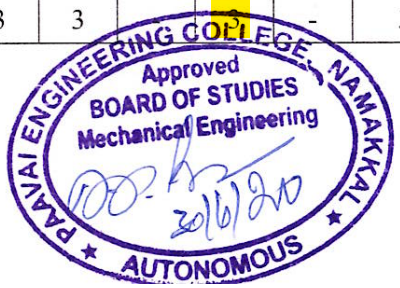
REFERENCES

1. Foundation Engineering Handbook, Hans F.Winterkorn, Hsai-yang fang, Chapman & Hall publishers London 2010.
2. Pump-hydraulic Compressors, Audels, Tata MC Graw hill Publication 2003.
3. Industrial Maintenance , H. P. Garg, S. Chand Ltd., 1987.
4. Maintenance Engineering Handbook, Higgins & Morrow, Tata MC Graw hill 1977.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	3	-	3	2	-	-	-	2	-
CO2	3	-	2	3	-	2	-	3	3	-	-	-	2	-
CO3	3	-	2	3	3	3	-	3	-	-	-	-	2	-
CO4	3	-	2	3	-	3	-	3	-	-	-	-	2	-
CO5	3	-	2	3	3	3	-	3	-	3	-	-	2	-



PED19902 **COMPOSITE MATERIALS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- give exposure on composite materials and functional requirements of reinforcement matrix.
- understand the mechanical behavior of composites and its preparation methods.
- understand various manufacturing methods of metal matrix composites.
- develop the different preparation of moulding methods.
- enhance the awareness of laminar failure criteria

UNIT I INTRODUCTION **9**

Definition – Classification and characteristics of Composite materials, advantages and application of composites; Functional requirements of reinforcement and matrix; Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS **9**

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

UNIT III MANUFACTURING OF METAL MATRIX COMPOSITES **9**

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

UNIT IV MANUFACTURING OF POLYMER MATRIX COMPOSITES **9**

Preparation of Moulding compounds and prepregs – hand layup method, autoclave method, filament winding method, compression moulding, reaction injection moulding, properties and applications.

UNIT V STRENGTH **9**

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- apply the effect of reinforcement on overall composite performance.
- assess the mechanical behavior of composites, reinforcement properties and its applications.

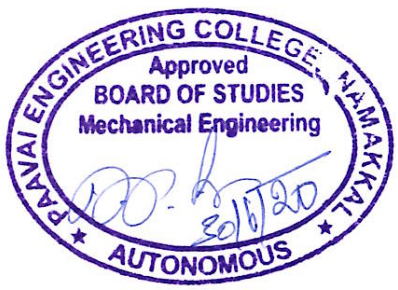
- analyze the properties and applications of different metal matrix composites manufacturing.
- implement various manufacturing methods of polymer matrix composites and its applications.
- identify the various failure appeared in the composite laminate.

REFERENCES

1. Composite Materials Design and Applications – Danial Gay, 3rd edition, CRC press, taylor and francise grove 2014.
2. Composite Materials Science and Applications – Deborah D.L. Chung, 2nd edition, springer 2010.
3. Composite Materials – Science and Engineering K.K.Chawla, 2nd edition, springer, 1998
4. Hand Book of Composite Materials-edited by George Lubin , 1st edition , van Nostrand reinhold company inc 1982.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	3	-	-	2	-	-	-	-	-	1	3	-
CO3	3	2	2	-	2	-	-	-	-	-	-	1	3	-
CO4	3	2	2	-	2	-	-	-	-	-	-	1	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	3	-



PED19903 **WASTE TO ENERGY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- give exposure on energy from industrial waste.
- understand the manufacture of charcoal and pyrolytic oil and gases.
- develop biomass gasification design, construction and operation.
- enhance the knowledge in fluidized bed combustors and operation of biomass combustors.
- impart the knowledge on biogas plant technology and biomass conversion processes.

UNIT I INTRODUCTION TO ENERGY FROM WASTE **9**

Classification of waste as fuel – Agro based, Forest residue, Industrial waste, MSW; Conversion devices – Incinerators, gasifiers, digestors.

UNIT II BIOMASS PYROLYSIS **9**

Pyrolysis – Types slow fast; Manufacture of charcoal – Methods, Yields and application; manufacture of pyrolytic oils and gases; yields and applications.

UNIT III BIOMASS GASIFICATION **9**

Gasifiers – Fixed bed system ,downdraft and updraft gasifiers; Fluidized bed gasifiers – Design, construction and operation; Gasifier burner arrangement for thermal heating; Gasifier engine arrangement and electrical power; Equilibrium and kinetic consideration in gasifier operation.

UNIT IV BIOMASS **9**

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

UNIT V BIOGAS **9**

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- differentiate the types of conversion devices and energy from waste.

- assess the various methods of manufacturing of pyrolytic oils and its applications.
- analyze the different biomass gasifier and factor considered in gasifier operations.
- identify the operations, types and design consideration of fluidized bed combustor.
- analyze the different bio gas plant, application and urban waste energy conversion.

REFERENCES

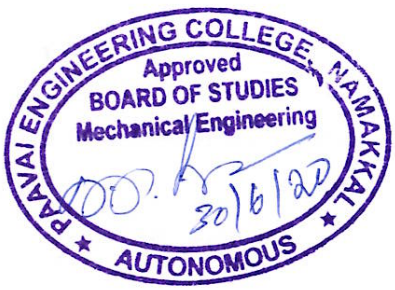
1. Non Conventional Energy, Ashok V., Desai, New age international, 1990.
2. Biogas Technology - A Practical Hand Book – K.C. Khandelwal, and S.S.Mahdi, Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1989.
3. Food, Feed and Fuel from Biomass, Devinder singh.Chahal, IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, Charles. Y. WereKo-Brobby and Essel. B. Hagan, John Wiley & Sons, Newyork 1996.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-



PSE19901 COST MANAGEMENT OF ENGINEERING PROJECTS 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- understand the costing concepts and their role in decision making
- apply project management concepts while selecting various projects
- interpret costing concepts with project execution
- analyze costing techniques and various budgetary control techniques which used in service sector
- compute solution for quantitative techniques in cost management

Prerequisite: Nil

UNIT I INTRODUCTION 9

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

UNIT II PROJECT MANAGEMENT 9

Project - meaning, Different types, why to manage, cost overruns centres, various stages of project execution, conception to commissioning; Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents; Project team- Role of each member; Importance Project site- Data required with significance, Project contracts.

UNIT III PROJECT EXECUTION AND COSTING CONCEPT 9

Project execution - Project cost control, Bar charts and Network diagram, Project commissioning; mechanical and process, Cost Behavior and Profit Planning - Marginal Costing, Distinction between Marginal Costing and Absorption Costing, Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems; Pricing strategies- Pareto Analysis, Target costing, Life Cycle Costing.

UNIT IV COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL 9

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity- Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis; Budgetary Control- Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- apply the costing concepts in decision making
- select various projects based on project management concepts

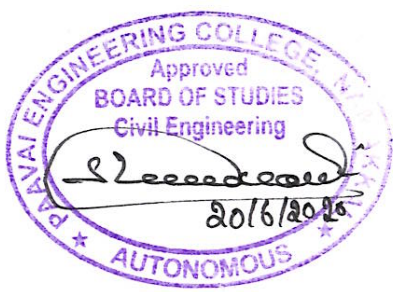
- execute the project with optimum costing concept
- use costing techniques and various budgetary control techniques in service sector
- solve quantitative techniques CPM/PERT in cost management.

REFERENCES

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 2018.
2. Charles T. Horngren and George Foster, Advanced Management Accounting, Prentice Hall of India, 2011.
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, e-book.
4. Vohra N.D., Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd, 2007.
5. Cost management by Dr. J. Made Gowda, Himalaya Publishing House, 2013.

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak**														
Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2



SEMESTER IV

PSE19401 DISSERTATION PHASE II 0 0 24 12

COURSE OBJECTIVE

To enable the students to

- carry out analytical and/or experimental research oriented work in the field of structural engineering.
- formulate / define the problem for dissertation.
- solve the identified problem based on the formulated methodology.
- develop skills to analyze and discuss the test results and make conclusions.

SYLLABUS

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS 360

COURSE OUTCOMES

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

- take up any challenging practical problem and find better solutions.
- implement concepts, tools and techniques to do quality projects
- testing , analyse and prepare the report for a given project
- write and present technical paper based on the research work.

CO PO MAPPING:

Mapping of Course Objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak														
Cos	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	-	-	-	-	-	2	1	-	2	-	2
CO2	2	2	2	-	-	-	-	-	2	1	-	2	-	2
CO3	2	2	2	-	-	-	-	-	2	1	-	2	-	2
CO4	2	2	2	-	-	-	-	-	2	1	-	2	-	2

PEN19171 ENGLISH FOR RESEARCH PAPER WRITING 2 0 0 0

COURSE OBJECTIVES

To enable students to

- To understand how to improve the writing skills and level of readability.
- To learn about what to write in each section and to understand the skills needed to write a title.
- To choose and focus on a topic of interest and to learn how to paraphrase, summarize, using correct attribution and following documentation guidelines.
- To craft a research paper in their discipline.
- To ensure the good quality of paper at first-time submission.

UNIT I PLANNING AND PREPARATION 6

Precision of Words, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness. Expressing independent thought with grace, clarity and force.

UNIT II STRUCTURE OF A PAPER 6

Details of all the parts - Clarifying Who Did What, Highlighting the Findings, Hedging and Criticizing, Skills to identify something we really need to know -some ways to find a topic - to venture out across the swamp of research without losing our bearings - Paraphrasing - Sections of a Paper, Abstract, Introduction. Introduction to Free writing.

UNIT III LITERATURE REVIEWS AND CITATIONS 6

Key skills required to - write a title, an abstract, write an introduction, write the review of the literature, conduct a literature review of all current research in their field. Review of the Literature, Methods, Results, Discussion and Conclusions - citing references correctly and avoiding plagiarism.

UNIT IV EDITING AND ORGANISING SKILLS 6

Skills required to - write the Methods, write the Discussion, write the Results, write Conclusions. - write about what we've learned truthfully so the reader really gets it in thought and expression, demonstrating a clear understanding and execution of the research.

UNIT V WRITING STANDARDS 6

Useful phrases, to ensure paper is as good as it could possibly be the first – time submission -first draft, second draft, final draft of research report, journal article, literature review, dissertation chapter, grant proposal, or other relevant document. Avoid -inadequate support of generalizations, slipshod or hurried style, poor attention to detail, straying from directions, mechanical errors, underwritten and/or marred by confused purpose, lack of organization, repetition of ideas, improper use of words, and frequent grammatical, spelling and punctuation errors.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- prepare and write a research paper in their discipline.
- be initially organized and well-versed as a researcher, reviewing in detail general versus specific and problem-solution structures.
- understand the basics of citations, avoiding plagiarism and literature reviews.

- culminate the actual crafting and revising of a research paper.
- use suitable vocabulary, grammar and punctuation to write flawless piece of writing.

REFERENCES

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

PEN19271 PEDAGOGY STUDIES 2 0 0 0

COURSE OBJECTIVES

The students will be able to

- understand the aims, objectives and educational philosophies of Education
- acquire the knowledge of Instructional objectives of teaching and teaching skills
- apply the knowledge of methods and strategies of teaching in real classroom situation
- utilize the instructional aids and tools for effective classroom teaching
- acquaint with the knowledge of professional development of teachers

Prerequisite: Nil

UNIT I EDUCATION AND ITS PHILOSOPHY 6

Education - Definition, Aims, Objectives, Scope, Educational philosophy of Swami Vivekananda, Mahatma Gandhi, Rabindranath Tagore, Sri Aurobindo and J.Krishnamoorthy, Montessori,Jean-Jacques Rousseau, Friedrich Froebel and John Dewey. Current trends and issues in Education-Educational reforms and National policy on Education-1968 and 1986-its objectives and features

UNIT II INSTRUCTIONAL OBJECTIVES AND DESIGN 6

Instructional Objectives- Taxonomy of Educational objectives- Writing of general and specific objectives. Instructional design- Planning and designing the lesson, Writing of lesson plan- meaning, its need and importance, format of lesson plan and Types of lesson plan Skills of teaching - various ways of introducing lessons, explaining skills, problem solving skills, illustrative skills, scaffolding skills, integrating ICT skills, questioning skills, Reinforcement skills, skill of probing questions, skill of stimulus variation and computation skills.

UNIT III INSTRUCTIONAL METHODS AND STRATEGIES 6

Instruction strategies – Lecture, demonstration, laboratory, Inductive method, Deductive method, Inquiry method, seminar, panel discussion, symposium, problem solving, project based learning (PBL), Learning by doing, workshop, role- play(socio-drama), Recent trends- Constructivist learning - Problem-based learning - Brain-based learning – Collaborative learning - Flipped learning - Blended learning - e-Learning trends - Video conferencing

UNIT IV INSTRUCTIONAL MEDIA 6

Key concepts in the selection and use of media in education, Developing learning resource material using different media, Instructional aids – types, uses, selection, preparation, utilization. Dale cone of Experience, Teacher's role in procuring and managing instructional Aids – Projected and non-projected aids, multimedia, video-teleconferencing etc.

UNIT V TEACHER PREPARATION 6

Teacher – roles and responsibilities, functions, characteristics, competencies, qualities,

Preparation of professional teacher, Organizing professional aspects of teacher preparation programs, Professional development of teachers-In-service training, Refresher programmes, workshop and higher studies.

TOTAL PERIODS 30

Practicum:

Writing of three lesson plans

Practice teaching for 15 days

Preparation of one teaching aid

A seminar on one educational philosophy

Assignment on any of these five units

COURSE OUTCOMES

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

- explain the educational philosophies of Education
- write instructional and specific objectives in lesson plan
- utilize the teaching skills and methods effectively
- use instructional media efficiently
- update themselves in the area of professional development

REFERENCES

1. T.V. Somashekar, G Viswanathappa and Anice James (2014), Methods of Teaching Mathematics, Hyderabad, Neelkamal publications Pvt Ltd
2. National Policy on Education 1968 and 1986- National Policy on Education 1986-Programme of Action 1992.
3. Batra, P. (2010). Social science learning in schools: Perspectives and challenges. New Delhi: Sage publications India.
4. Benjamin S., Bloom et al. (1987). Taxonomy of educational objectives. Longman Group.
5. Encyclopaedia of Modern Methods of Teaching and Learning (Vol. 1-5).
6. Karthikeyan, C. (2004). A Text book on instructional technology, RBSA
7. Siddiqui, MujibulHasan (2005). Techniques of classroom teaching A.P.H
8. Dhamija, N. (1993). Multimedia approaches in teaching social studies. New Delhi: Harman Publishing House
9. Jeffrey Bennett (2014). On Teaching Science: Principles and Strategies That Every Educator Should Know. Big Kid Science: Boulder,CO
10. Kulbir Singh. (2010). Teaching of mathematics. New Delhi: Sterling Publishers.
11. Bawa, M.S. &Nagpal, B.M. (2010). Developing teaching competencies. New Delhi: Viva Book House
12. Sharma, R.A. (2008). Technological foundation of education. Meerut: Lall Books Depot.