M.Tech (STRUCTURAL ENGINEERING)
Department of CIVIL ENGINEERING, JNTUHCEH
COURSE STRUCTURE
(Applicable for the Batch admitted from the Academic Year 2021-22 onwards)

I YEAR I SEMESTER

S.No	Code	Subject	L	T	P	Credits
1.	PC 1	Advanced Structural Analysis	3	0	0	3
2.	PC 2	Theory of Elasticity	3	0	0	3
3.	PE I	1) Theory of Thin Plates & Shells 2) Computer Oriented Numerical Methods 3) Theory of Structural Stability	3	0	0	3
4.	PE II	1) Advanced Reinforcement Concrete Design 2) Structural Health Monitoring 3) Structural Optimization	3	0	0	3
5.	Laboratory 1	Computer Aided Design Laboratory	0	1	2	2
6.	Laboratory 2	Advanced Structural Concrete Laboratory	0	1	2	2
7.	MLC	Research Methodology & IPR	2	0	0	2
8.	Audit I	Audit Course 1	2	0	0	0
TOTALCREDITS			**16**	**2**	**4**	**18**

I I YEAR II SEMESTER

S.No	Code	Subject	L	T	P	Credits
1.	PC 3	Finite Element Methods in Structural Engineering	3	0	0	3
2.	PC 4	Structural Dynamics	3	0	0	3
3.	PE III	1) AdvancedSteelDesign 2) DesignofFormwork 3) DesignofHighRiseBuildings	3	0	0	3
4.	PE IV	1) Design of Prestressed Concrete Structures 2) Design of Reinforced Concrete Foundations 3) DesignofBridges	3	0	0	3
5.	Laboratory 3	Numerical Analysis Laboratory	0	1	2	2
6.	Laboratory 4	Advanced Structural Design Laboratory	0	1	2	2
7.	MC	Technical Seminar	0	0	4	2
8.	Audit II	Audit Course 2	2	0	0	0
TOTAL CREDITS			**14**	**02**	**08**	**18**

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II YEAR I SEMESTER

S.No	C	Subject	L	T	P	Credits
1.	PE V	1) Earthquake Resistance Design of Buildings 2) Pre Engineered Buildings 3) Rehabilitation and Retrofitting of Structures	3	0	0	3
2.	Open Elective	Open Elective	3	0	0	3
3.	MC	PROJECT/ DISSERTATION PHASE - I	0	0	20	10
		TOTAL CREDITS	**6**	**0**	**20**	**16**

II YEAR II SEMESTER

S.No	Group	Subject	L	T	P	Credits
1.	MC	PROJECT/ DISSERTATION PHASE - II	0	0	32	16
		TOTAL CREDITS	**0**	**0**	**32**	**16**

Total Credit for the Programme PG Credits: = 18+ 18+16+16 = 68

Audit Course I & II

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

Open Elective offered by the department

1. Green Building Technologies (Offered by **Civil Engineering** Department)

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M.Tech. I Year I-Sem (Structural Engineering)

L	T	P	C
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ADVANCED STRUCTURAL ANALYSIS

Course Objectives:
To impart knowledge on the analysis of indeterminate structures like continuous beams, trusses and portal frames.

CourseOutcome:
The learner will be able to analyse different indeterminate structures using Matrix methods.

Pre requisites : Structural Analysis I & II

UNIT I
Introduction to matrix methods of analysis - statical indeterminacy and kinematical indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and torsional element.

Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

UNIT II
Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - banded matrix - semi bandwidth - assembly by direct stiffness matrix method.

UNIT III
Analysis of plane truss - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gables frames by flexibility method using system approach.

UNIT IV
Analysis of plane truss - continuous beams with and without settlement - plane frame including sides sway, grids and gable frames by stiffness methods, single bay – two storey, two bay single – storey.

UNIT V. Special analysis procedures - static condensation and sub structuring - initial and thermal stresses.

REFERENCES

1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Gere, CBS publications.
2. Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers.
3. Matrix method of S.A by Pandit & Gupta
4. Matrix Structural Analysis by Madhu B. Kanchi.
5. Matrix Methods of Structural Analysis by J.Meek.
6. Structural Analysis by Ghali and Neyveli.
7. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt Ltd.

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M.Tech. I Year I-Sem (Structural Engineering) **L T P C**
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THEORY OF ELASTICITY

CourseObjectives:
To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems.

Course outcomes:
The learner will be able to solve problems of elasticity and plasticity and be able to apply numerical methods to solve continuum problems.

Prerequisites: Strength of Materials I & II

UNIT-I
Introduction: Elasticity - notation for forces and stress - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis - differential equations of equilibrium 2D & 3D - boundary conditions – Strain Displacement Relations - compatibility equations – stress tensor and strain tensor.

UNIT II
Two dimensional problems in rectangular coordinates - solution by polynomials - Saint-Venants principle - determination of displacements - bending of simple beams stress function – Simply Supported and Cantilever Beams.

UNIT III
Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions Edge Dislocation - general solution of two-dimensional problem in polar coordinates - application to Plates with Circular Holes – Rotating Disk. Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section.

UNIT IV
Analysis of stress and strain in three dimensions - principal stress - stress ellipsoid - director surface - determination of principal stresses Stress Invariants - max shear stresses - Homogeneous deformation - principal axes of strain-rotation. General Theorems:Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem Strain Energy.

UNIT V
Torsion of Circular Shafts - Torsion of Straight Prismatic Bars– Saint Venants Method - torsion of prismatic bars - bars with elliptical cross sections - membrane analogy - torsion of a bar of narrow rectangular bars - torsion of shafts, tubes , bars etc.

References .
1. Theory of Elasticity by Timeshenko, McGrawhill Publications
2. Theory of Elasticity by Y.C.Fung.
3. Theory of Elasticity by Gurucharan Singh.

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THEORY OF THIN PLATES & SHELLS
(Program Elective – I)

CourseObjectives:
To impart knowledge on the behavior and design of shells and Folded plates.

CourseOutcomes:
The learner will be able to analyse and design the shells and folded plates.

Prerequisites : Theory of Elasticity, Structural Analysis

UNIT I
Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

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

UNIT III
Circular Plates: Differential Equation for symmetrical bending of Laterally loaded circular Plates – Uniformly loaded circular plates –circular plate concentrically loaded – circular plate loaded at center

UNIT IV
Shells – functional behaviour – examples – structural behaviour of shells classification of shells – Definitions – various methods of analysis of shells – merits and demerits of each method – 2D. Membrane equation.
Equations of equilibrium: Derivation of stress resultants – cylindrical shells – Flugges simulations equations.

UNIT V
Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.

Axi- Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application to spherical shell and hyperboloid of revolution cooling towers.

REFERENCES:

1. Theory of Plates & Shells –Stephen, P.Timoshenko, S.Woinowsky-Krieger – Tata MC Graw Hill Edition
2. Analysis and design of concrete shell roofs By G.S.Ramaswami. CBS publications.
3. Design of concrete shell roofs By Billington – Tata MC Graw Hill, New York
4. Shell Analysis By N.K.Bairagi. Khanna Publishers, New Delhi.
5. Design of Shells and Folded Plates by P.C. Varghese, PHI Learning Pvt. Ltd
6. Design of concrete shell roofs By Chaterjee. Oxford and IBH.,

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M.Tech. I Year I-Sem (Structural Engineering)

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COMPUTER ORIENTED NUMERICAL METHODS
(Program Elective – I)

CourseObjectives:
To impart knowledge on the methods of solving the higher order mathematical problems

CourseOutcome:
The learner will be able to solve the mathematical problems using different numerical teachiques and apply to solve the civil engineering problems.

Pre requisites : Mathematics I and II

UNIT I: Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method.
UNIT II: Eigen values and eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method, Fast Fourier Transform (FFT)
Interpolation:Linear Interpolation - Higher order Interpolation - Lagrange Interpolation– Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.
UNIT III: Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation- Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations.
UNIT IV: Numerical Differential:Difference methods based on undetermined coefficients- optimum choice of step length- extrapolation method – Partial differentiation.
Numerical Integration:Method j based on interpolation-method based on undetermined coefficient – Gauss – legrange interpolation method- radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method.
UNIT V: Ordinary Differential Equation: Euler's method – Backward Euler method – Mid point method – single step method, Taylor's series method, Runge-Kutta method – Implicit Runge Kutta method – Boundary value problem – Difference method – Shooting method.

References:

1. Numerical Methods for Scientific and Engineering Computations. M.K.Jain-S.R.K.Iyengar – R.K.Jain Willey Eastern Limited.
2. Numerical Methods by S.S.Shastry.
3. Applied numerical Analysis by – Curtis I.Gerala- Addission Wasley – published campus.
4. Numerical Methods for Engineers Stevan C.Chopra, Raymond P.Canal Mc. Graw Hill book company.
5. C Language and Numerical Methods by C.Xavier – New age international publisher.
6. Computer Based Numerical Analysis by Dr. M.Shanta Kumar, Khanna Book publishers, New Delhi.

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THEORY OF STRUCTURAL STABILITY
(Program Elective – I)

CourseObjectives: To impart knowledge to the student about the factors affecting the stability of the structures

Course Outcomes: At the end of the course, students will be able to
1. Determine stability of columns and frames
2. Determine stability of beams and plates
3. Use stability criteria and concepts for analyzing discrete and continuous systems,

Pre requisites : RCC Design and Analysis

UNIT – I
Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behavior.

UNIT – II
Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

UNIT – III
Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT – IV
Stability of Beams: lateral torsion buckling.
Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

UNIT – V
Introduction to Inelastic Buckling and Dynamic Stability.

Reference Books:

1. Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill,1981
2. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.
3. Structural Stability of columns and plates, Iyengar, N. G. R., Eastern west press Pvt. Ltd.
4. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York.

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ADVANCED REINFORCED CONCRETE DESIGN
(Program Elective – II)

Objectives:
To impart knowledge on the behavior and design on various reinforced concrete structural elements.

Outcome:
The learner will be able to design the reinforced concrete elements like continues beams, irregular slabs, flat slabs Deep beams corbels, and footings.

Prerequisites : Design of Reinforced Concrete Structures

UNIT I
Limit Analysis of R.C.Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams. Inelastic Analysis of Slabs, Moment Redistribution in Columns, Limit Analysis with Torsional Hinges.

UNIT II
Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions- Reinforcement details.

UNIT III
Ribbed slabs : Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.
Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT IV
Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456. Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels, Design of Nibs.

UNIT V
Design of Slender Columns – Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns.
Design of Foundations – Types of combined footings; Design of combined beam and slab footing for two columns, Raft Foundations: Flat Slab Rafts for Framed Buildings for Design of the Beam and Slab Raft under uniform Pressure.

REFERENCE:

1. "Reinforced Concrete Design" S. Unnikrishna Pillai & Devdas Menon; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.
2. "Advanced Reinforced Concrete" P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.
3. "Design of Reinforced Concrete Structures" by N.Subramanian, Oxford University Press.

4. "Limit State Theory and Design of Reinforced Concrete" Dr. S. R. Karve and V.L Shah. Standard Publishers, PUNE 2004.
5. Design of concrete structures – Arthus H. Nelson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
6. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
7. "Design Reinforced Concrete Foundations" P.C. Varghese Prentice Hall of INDIA Private Ltd.
8. IS 456-2000 Plain and Reinforced concrete book of Practice.
9. SP 16- Design Aids for Reinforced Concrete to IS 456
10. SP 34 - Hand Book as Concrete Reinforcement and retaining

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STRUCTURAL HEALTH MONITORING
(Program Elective –II)

Course Objectives: To understand the factors affecting the durability of the strucutres

Course Outcomes: At the end of the course, students will be able to
1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Suggest repairs and rehabilitation measures of the structure

Pre requisites : Concrete Technology

UNIT – I
Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

UNIT – II
Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.
Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

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

UNIT – IV
Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT – V
Introduction to Repairs and Rehabilitations of Structures : Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Reference Books:

1. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components_Methods with Applications,
3. Douglas E Adams, John Wiley and Sons, 2007.
4. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
5. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc,2007.

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M.Tech. I Year I-Sem (Structural Engineering)

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STRUCTURAL OPTIMIZATION
(Program Elective –II)

Course Objectives: To understand the principles and techniques for optimizing the structural response

Course Outcomes: At the end of the course, students will be able to
1. Use Variational principle for optimization
2. Apply optimization techniques to structural steel and concrete members.
3. Design using frequency constraint.

Pre requisites: RCC and numerical methods

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

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

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

UNIT –IV
Geometric Programming andStochastic Programming.

UNIT –V
Applications: Structural Steel and Concrete Members, Trusses and Frames.
Design: Frequency Constraint, Design of Layouts.

Reference Books:

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

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COMPUTER AIDED DESIGN LABORATORY

Course Objectives : The objectives of the course are to

- Learn the usage of any fundamental software for design
- Create geometries using pre-processor
- Analyseand Interpret the results using post processor
- Design the structural elements

Course Outcomes: After the completion of the course student should be able to

- Model the geometry of real world structure Represent the physical model of structural element/structure
- Perform analysis
- Interpret from the Post processing results
- Design the structural elements and system as per IS Codes

Pre-Requisites: Computer Aided Civil Engineering Drawing or AUTO CAD Principles –Excel-Structural Engineering -1 & 2

LIST OF EXPERIMENTS

1. Analysis and design of determinate and indeterminate beams using Editor & GUI (2W)
2. Analysis and design of plane frames (1W)
3. Analysis and design of space frame (1W)
4. Analysis and design of a multistoreyed building subjected to DL,LL and WL (2W)
5. Analysis and design of multistoreyed building subjected to DL,LL and EQ (2W)
6. Analysis and design of Roof trusses including WL calculation in Excel Spreadsheet (2W)
7. Analysis and design of composite industrial structure (Roof with steel structure and remaining with RCC) (2W)
8. Design of foundation (Isolated and combined) using excel spread sheet (2W)

Note: Drafting of all the exercises is to be carried out using commercially available designing software's.

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ADVANCED STRUCTURAL CONCRETE LAB

Course Objectives: The impart the knowledge to the student about the behavior concrete in the in-situ conditions

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

1. Design high grade concrete and study the parameters affecting its performance.
2. Apply engineering principles to understand behavior of structural/ elements.
3. Understand the principles of design of experiments
4. Design and develop analytical skills
5. Summarize the testing methods and equipments

Pre requisites: Concrete technology

List of Experiments/Assignments:

1. Mix Design of High Strength Concrete
2. Draw the stress-strain curve of high strength concrete
3. Fresh properties of self compacting concrete
4. Rapid chloride permeability of hardened concrete & Carbonations Studies.
5. Accelerated strength of concrete
6. Load Deflection characteristics of under reinforced concrete Beam
7. Load Deflection characteristics of over reinforced concrete Beam
8. Comparison of reinforced concrete beam with and without shear reinforcement
9. Non Destructive testing of concrete using rebound hammer & ultrasonic pulse velocity
10. Temperature effects on Compressive strength of Concrete

Reference Books:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.
3. Concrete Technology by A.R. Santhakumar, Oxford University Press.

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RESEARCH METHODOLOGY AND IPR
(Mandatory Course)

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

UNIT –I : Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations
UNIT - II: Effective literature studies approaches, analysis
Plagiarism, Research ethics,
UNIT - III: Effective technical writing, how to write report, Paper
Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee
UNIT - IV: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.
UNIT - V: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.
UNIT - VI: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:
1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

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M.Tech. I Year II-Sem (Structural Engineering)

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FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING

Objectives: The objectives of this course is to impart knowledge of

- About the fundamentals of domain discretization, interpolation, application of boundary conditions, assembly of global matrices, and solution of the resulting algebraic systems.
- Understand the core concepts of variational and weighted residual methods in FEM.
- Derive the element stiffness matrix for 1-D, 2-D and 3-D problems.
- Formulate the simple structural problems in to finite elements.

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

1 Build and analyse the FEA models for various engineering problems.
2 Identify the requirements and sources for analysis, design and evaluation.
3 Use the standard finite element software to solve the structural engineering problems.
4 Interpret the results obtained from FEA software, and arrive at the conclusions
5 To solve problems of non linear finite element

UNIT – I

Introduction to FEM: Types of Problems–Types of Materials–Elastic / Inelastic situations– Typesof forces: Body forces / Surface Traction / Point loads – Deformable bodies – Types of Deformations – Homogeneous / Non homogeneous Problems – Equations of equilibrium for elastic 2-D / 3-D continua - Equilibrium equations for 2-D / 3-D boundary elements – Boundary conditions – Strain-displacement relation for 2-D / 3-D – Stress-strain relation for 2-D / 3-D – Plane stress / Plane strain problems.

Virtual Work Formulation: Application to problems of plane trusses with static indeterminacy notexceeding three.

Finite Difference Method with Central Differences: Solving ODE's and PDE's with centraldifferences. Application to beam and plate bending problems of simple geometry.

UNIT – II

Variational Formulation: Finite Element Formulation - Stationarity of Functional–Given theFunctional or Differential equation – Number of elements limited to two.

1-D Elements: Strain-displacement relation matrix / stiffness matrix / Minimum Potential EnergyApproach / Rayleigh-Ritz Method / introduction to natural coordinates / stiffness matrix of second order bar element / Axial bar subjected to point loads, body forces and surface traction forces / Problems with kinematic indeterminacy not exceeding two.

2-D Triangular Elements: Displacement models / criterion for convergence / geometric invariance /conforming and non-conforming elements - 3-node triangular elements (CST) / determination of strain-displacement matrix / area coordinates-shape functions / determination of element stiffness and load matrices, assembling global stiffness and load matrices / Problems with kinematic indeterminacy not exceeding three.

2nd Order triangular elements: Shape functions–degradation technique / strain-displacement matrix /Expression for stiffness matrix / Load matrices due to body forces and surface traction.

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UNIT – III

Iso-parametric elements:

Quadrilateral elements: Construction of shape functions using natural coordinates/Strain-displacementmatrices/Load matrices for body force and surface traction/ Expressions for stiffness matrix, load matrices for 4-noded quadrilateral elements/ Gauss Quadrature of numerical integration / Problems with rectangular elements, kinematic indeterminacy not exceeding three.

2nd Order Quadrilateral elements: - Determination of shape functions for 2nd order quadrilateralelements and for elements of with serendipity / Strain-displacement matrices / Load matrices for body force and surface traction.

UNIT – IV

Method of Weighted Residuals:

Galerkin's Method of Weighted Residuals –Application to problems of mathematics / structuralengineering, number of trial functions not exceeding two.

Galerkin's Finite Element Method –Weak form of Trial Function - Application to problems ofmathematics / structural engineering, number of elements limited to two.

Axi-symmetric Problems: Strain-displacement relationship/stress-strain relationship / determination ofstiffness matrix for 3-noded ring element and load matrices for body force and surface traction/ Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only.

UNIT – V

Tetrahedron elements: Volume coordinates, Strain-displacement matrix, stiffness matrix, load matricesdue to body force and surface traction/ introduction to Hexahedron (brick) elements.

Non-linear Finite element analysis: Introduction–problems with material non-linearity– problemswith geometric non-linearity – problems with both material and geometric non-linearity.

Introduction to MSC Nastran: Illustration on different modules of Nastran / Structural engineeringapplications of the package/Creation of a simple 1-D model, 2-D model and a 3-D model/ analysis and post processing of the results.

Suggested Reading:

1. Cook, R. D. (1981). ―Concepts and Application of Finite Element Analysis‖, John Wiley andSons.
2. Zienkiewicz, O. C. And Taylor, R. L, (1989). ―The Finite Element Method‖, Vol.1, McGrawHill Company Limited, London.
3. Reddy, J. N, (1993). ―An Introduction to the Finite Element Method‖, McGraw Hill, NewYork.
4. Chandrupatla, T. R. And Belegundu, A. D, (2001). ―Introduction to Finite Elements in Engineering‖, Prentice Hall of India, New Delhi.
5. Seshu. P, (2003). ―Finite Element Analysis‖, Prentice Hall of India Private Limited, NewDelhi.
6. David V. Hutton, (2005). ―Fundamentals of Finite Element Analysis‖, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Bathe, K. J, (2006). ―Finite Element Procedures‖, Prentice Hall of India, New Delhi

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M.Tech. I Year II-Sem (Structural Engineering)

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STRUCTURAL DYNAMICS

Course Objectives:
To impart knowledge on the fundamental of structural dynamics and their applications.

Course Outcomes: The learner will be able to understand the equation of motion, dynamics response of single and multi degree-of freedom systems.

Prerequisites: Structural Analysis I & II, Mathematics

UNIT I:

Theory of Vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. –Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle.

UNIT II

Single Degree of Freedom Systems: Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems –Half Power (Band-Width) Method-Harmonic excitation - Vibration Isolation – Response to support motion—Force transmitted to the foundation-Transmissibility-Dynamic magnification factor – Phase angle.

Response to General Dynamic Loading– Duhamel'sIntegral-Constant Force, Rectangular load, Triangular load, Response to Periodic loading- Fourier series expression of periodic loading-Response to Fourier series loading

UNIT III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV

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

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions .

UNIT V

Random Vibrations: Statistical Description of Random functions, Probability density function, Gaussian distribution, Rayleigh Distribution, correlation, Fourier transform of the random vibration process, spectral analysis, spectral density functions, response to random excitation:SDOF system.

References:

1. Dynamics of Structures by Ray W.Clough &Joseph Penzien, Second Edition, CBS Publishers &Distributors
2. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.
3. Structural Dynamics by Mario Paz and William Leigh, Fifth Edition, Springer
4. Theory of Vibrations by W.T. Thomson , Pearson
5. Fundamentals of Structural Dynamics by Roy. R. Craig, John wiley &sons

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ADVANCED STEEL DESIGN
(Program Elective – III)

Course Objectives:
To impart knowledge on behavior and design of various connections, industrial and steel girders.

Course Outcomes: The learner will be able to design different steel structures.

Pre requisites : Design of Steel Structures&Structural Analysis

UNIT-I
SIMPLE CONNECTIONS –BOLTED PINNED AND WELDED CONNECTIONS: Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT-II Plastic Analysis:
Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section modulii shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT-III
ECCENTRIC AND MOMENT CONNECTIONS: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT-IV ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS:
Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform, Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions,Design of bracings.

UNIT-V DESIGN OF STEEL TRUSS GIRDER BRIDGES:
Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

References:

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
2. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.
3. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientitic Publishes Journals Department..
4. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.
5. Design of Steel Structures Galyord & Gaylord, Publisher : Tata Mc Graw Hill, Education. Edition 2012.
6. Indian Standard Code – IS – 800-2007.
7. Indian Standard Code – IS – 875 – Part III - 2015

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DESIGN OF FORM WORK
(Program Elective – III)

Course Objectives: To impart knowledge about the design of formwork for various structural elements

Course Outcomes: At the end of the course, students will be able to
1. Select proper formwork, accessories and material.
2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
3. Design the form work for Special Structures.
4. Understand the working of flying formwork.
5. Judge the formwork failures through case studies.

Pre requisites: Concrete Technology

UNIT- I
Introduction: Requirements and Selection of Formwork.

UNIT- II
Formwork Materials- Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

UNIT- III
Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.
Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

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

UNIT- V
Formwork Failures : Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

Reference Books:

1. Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015.
2. Concrete Technology by A.R. Santhakumar, Oxford Univ. Press
3. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.
4. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

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DESIGN OF HIGH RISE BUILDINGS
(Program Elective – III)

Course Objectives: To impart the knowledge about the various principles in the design of tall buildings

Course Outcomes: At the end of the course, students will be able to analyze a tall building for various loads

Pre requisites: Structural analysis I and II

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

UNIT II BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS: Factors affecting growth, height and structural form. High rise behaviour, Rigid frames, braced frames, In filled frames, shear walls, coupled shear walls, wall-frames, tubulars, cores, outrigger - braced and hybrid mega systems.

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

UNIT IV STRUCTURAL ELEMENTS: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

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

REFERENCES:

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

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DESIGN OF PRESTRESSED CONCRETE STRUCTRUES
(Program Elective – IV)

Course Objectives:

To impart knowledge on basics of prestressing and designing of different structural elements using Prestressing techniques.

Course Outcomes:

The learner will be able to understand the prestressing techniques, design the various structural elements using Prestressing techniques.

Prerequisites : Reinforced Concrete Design&Structural Analysis

UNIT I:

Introduction – PrestressingSystems – Pretensioning Systems – Post-tensioning Systems – High Strength Steel and Concrete - Analysis of Prestress - Resultant Stresses at a Section – Pressure Line or Thrust Line – Concept of Load Balancing .

Losses of Prestress – Loss Due to Elastic Deformation of Concrete – Shrinkage of Concrete – Creep – Relaxation of Stress in Steel – Friction – Anchorage Slip.

UNIT II:

DEFLECTIONS OF PRESTRESSED CONCRETE MEMBERS : Importance of Control of Deflections – Factors Influencing Deflection – Short-term Deflections of Uncracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012.

Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned Steel.

UNIT III:

COMPOSITE CONSTRUCTIONS: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate Flexural and shear strength of composite sections- Deflection of Composite Beams. Design of Composite sections.

UNIT IV:

PRESTRESSED CONCRETE SLABS: Types Of Prestressed Concrete Floor Slabs- Design of Prestressed Concrete One Way and Two Way Slabs.

Prestressed Concrete Pipes: Circular prestressing- Types of Prestressed Concrete Pipes- Design of Prestressed Concrete Pipes.

UNIT V:

CONTINUOUS BEAMS: Advantage of Continuous Members – Effect of Prestressing Indeterminate Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments – Concordant Cable Profile – Guyon's Theorem, Redistribution of moments in a continuous beam.

Anchorage Zone Stresses in Beams : Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel's method- Guyon's Method - Anchorage zone Reinforcement as per IS1343-2012.

References :

1. Prestressed concrete,krishnanraju N., Tata Mc Graw Hill,New Delhi.
2. Prestressed concrete by K.U.Muthu, PHI Learning Pvt.Ltd
3. Design of prestressed concrete structure,Lin T.Yand Burns..,Asia Publication house,1995.
4. Limit state design of prestressed concrete,Gutan Y..,Applied science publishers,1972.
5. IS:1343-2012-code of practice for Prestressed concrete

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DESIGN OF REINFORCED CONCRETE FOUNDTIONS
(Program Elective – IV)

Course Objectives: To impart knowledge about the design of foundations for the concrete structures

Course Outcomes: The learner will be able to understand and design various types of footings

Prerequisites: Reinforced Concrete Design&Structural Analysis

UNIT – I

Foundation Structures & Design of Centrally Loaded Isolated Footings and Column Pedestals – Introduction, Rigid and Flexible Foundations, Loads and their Effects, Design Requirements, Geotechnical Design, Empirical and Exact Methods of Analysis of foundations, Design Loads for Foundations, Recommended Approach to Structural Design of Foundations.
– Introduction, General Procedure for Design, Design of Square Footing of Uniform Depth (Pad Footing), Design of sloped Rectangular Footings, Design Procedure, Detailing of Steel, Design of Rectangular Pad Footings, Design of Plain Concrete Footings, Design of Pedestals, Design Calculation for Pedestals.

UNIT - II

Wall Footings – Introduction Simple Plain Concrete Wall Footings, Reinforced Concrete Continuous Strip Wall Footings, Design of continuous Strip Wall Footings, Design for Longitudinal Steel, R.C. T Beam Footings in Shrinkable Soils, Foundations of Partition Wall in Ground Floors, Summary.
Strip Footings Under Several Columns – Introduction, Design Procedure for Equally loaded and Equally Spaced Columns, Analysis of Continuous Strip Footing for Unsymmetric Loading, Analysis of Strip Footing with Unsymmetrical Loads, Detailing of Members.

UNIT – III

Raft Foundations – Introduction, Rigid and Flexible Foundations, common Types of Rafts, Deflection Requirements of Beams and Slabs in Rafts, General considerations in Design of Rigid Rafts, Types of Loadings and Choice of Rafts, Record of Contact Pressures Measured Under Rafts, Modern Theoretical Analysis.
Design of Flat Slab Rafts-Mat Foundations – Introduction, Components of Flat Slabs, Preliminary Planning of Flat Slab Rafts, Analysis of Flat Slab by Direct Design Method, Method of Analysis, Values for Longitudinal Distribution and Transverse, Redistribution, Shear in Flat Slabs, Bending of Columns in flat Slabs, Limitations of Direct Design Method for Mats, Detailing of Steel, Design of Edge Beam in Flat Slabs.
Beam and Slab Rafts – Introduction, Planning of the Raft, Action of the Raft, Approximate Dimensioning of the Raft, Design of the Beam and Slab Raft under Uniform Pressure, Structural Analysis for the Main Slab, Design of Secondary and Main Beams, Analysis by Winkler Model, Detailing of Steel.

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UNIT - IV

Combined Piled Raft Foundations (CPRF) – Introduction, Types and uses of Piled Rafts, , Interaction of Pile and Raft, Ultimate Capacity and Settlement of Piles, Estimation of Settlement of Raft in Soils, Allowable Maximum and Differential Settlement in Buildings, Design of CPRF System, conceptual Method of Design, Conceptual Method of Analysis, Distribution of Piles in the Rafts, Theoretical Methods of Analysis.

Circular and Annular Rafts – Introduction, Positioning of chimney Load on Annular Raft, Forces Acting on Annular Rafts, Pressures Under Dead Load and Moment, Methods of Analysis, Conventional Analysis of Annular Rafts, Analysis of Ring Beams Under circular Layout of Columns, Analysis of Ring Beam Transmitting Column Load to Annular Rafts, Detailing of Annular Raft Under Columns of a Circular Water Tank.

UNIT – V

Under-reamed Pile Foundations – Introduction, Safe Loads on Under-reamed Piles, Design of Under-reamed Pile Foundation for Load Bearing Walls of Buildings, Design of Grade Beams, Design of Under-reamed Piles Under Columns of Buildings, Use of Under-reamed Piles for Expansive Soils.

Design of cantilever and Basement Retaining Walls – Introduction, Earth Pressure and Rigid Walls, Calculation of Earth Pressure on Retaining Walls, Design of Rigid Walls, Design of Ordinary R.C. cantilever Walls, Design of cantilever Walls without Toe, Design of Basement Walls, Calculation of Earth Pressures in Clays, Design of Free Standing Basement Walls.

REFERENCES :

1. Design of Reinforced Concrete Foundations – P.C Varghese, PHI Learning Private Limited., New Delhi.
2. Design of Reinforced Concrete Structures by N.Subramaniam- Oxford University.
3. Reinforced Concrete Design by Unnikrishna Pillai and Devdas Menon, Tata Mc Graw Hill

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M.Tech. I Year II-Sem (Structural Engineering)

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DESIGN OF BRIDGES
(Program Elective – IV)

Course Objectives:
To impart knowledge about different types of bridges, their analysis and design for combination of different loading condition as per codal provisions.

Course Outcomes:
The learner will be in a position to understand and design different types of bridges.

Prerequisites: Structural Analysis I &II, Reinforced Concrete Design

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

Solid slab Bridges: Introduction-Method of Analysis and Design.

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

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

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

UNIT V.
Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers-Abutments- Design loads for Abutments.

References

1. Design of Concrete Bridges by M.G.Aswani, V.N.Vazirani and M.M.Ratwani.
2. Bridge Deck Behaviour by E.C.Hambly.
3. Concrete Bridge Design and Practice by V.K.Raina.
4. Essentials of Bridge Engineering by Johson Victor, Oxford & IBH
5. Design of Bridges by V.V.sastry, Dhanpat Rai & Co.

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M.Tech. I Year I-Sem (Structural Engineering)

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NUMERICAL ANALYSIS LAB

Course Objectives: To impart knowledge about using the MAT lab for solving the problems

Course Outcomes: At the end of the course, students will be able to
1. Understand the Matlab interface for numerical calculations
2. Hands on practice of programme interface on elemental structural analysis

Pre requisites: Numerical Methods

Syllabus Contents:
1. Introduction &Working with the MATLAB user interface
2. Exercise on Basic Mathematics(Mathematical and logical operators & Solving arithmetic equations,Matrix Operations &Trigonometric functions)**(2 weeks)**
3. Exercise on Loops , Conditional Statements& Functions**(2 weeks)**
4. Exercise on plotting graphs (Plot labeling, curve labeling and editing, 2D &3D Plots) **(2 weeks)**
5. Exercise on Differentiation& Integration Problem
6. Exercise on Differential Equations
7. Exercise on Gaussian Elimination Method
8. Exercise on Solving of Polynomial Equations (Bisection,Newton-Raphson method etc)
9. Program on Stiffness Matrix Calculations for Finite Elements (1D-Bar,beam & others)
10. Introduction to Finite Difference Method for a beam problem

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ADVANCED STRUCTURAL DESIGN LABORATORY

Course Objectives: To understand thebasis of modeling the structure in the relevant software and design it.
Course Outcomes: At the end of the course, students will be able to Analyze and Design a High Rise Multi-Storey Buildings & other Structures

Pre requisites: RCC and Steel design

List of Experiments

1. Analysis of a Bridge Deck by Grillage Analogy (2 Sessions)
2. Analysis and Design of a PEB Structure (2 Sessions)
3. Analysis and design of a Gantry Girder (2 sessions)
4. Analysis and design of a High Rise M.S Building (2 sessions)
5. Analysis and design of a HR Multistorey Building with & without shear wall (2 sessions)
6. Analysis and design of a HR Multistorey Building with Flat Slab System (2 sessions)
7. Analysis and design of Flat Slab Raft foundation(2 sessions)
8. Analysis and design of Beam Slab Raft foundation (2 sessions).

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M.Tech. II Year III-Sem (Structural Engineering)

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EARTHQUAKE RESISTANT DESIGN OF BUILDINGS
(Program Elective – V)

Objectives:
To impart knowledge on the seismology and behavior of buildings during earthquakes.

Outcomes : The learner will be able to analyse and design buildings to resist seismic forces.

Prerequisites : Structural Dynamics, Reinforced Concrete Design

UNIT - I
Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics-Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India.
Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

UNIT - II
Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures.
Twisting of Buildings – Flexible Building and Rigid Building Systems.
Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete - Design Earthquake Loads – Basic Load Combinations – Permissible Stresses.
Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method.

UNIT - III
Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods.
RC Buildings – IS Code based Method.- Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear – Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures.

UNIT - IV
Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls, Derivation of Formula for Moment of Resistance of Rectangular Shear walls – Behaviour of Coupled Shear Walls.

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UNIT - V

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

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

REFERENCES :

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
3. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
4. Masory and Timber structures including earthquake Resistant Design –Anand S.Arya, Nem chand & Bros
5. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial college Press.
6. Design of Reinforced Concrete Structures by N.Subramanian, Oxford University Press.
7. Earthquake Tips – Learning Earthquake Design and Construction C.V.R. Murty

Reference Codes:

1. IS: 1893 (Part-1) -2016. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., New Delhi.
2. IS:4326-1993, “ Earthquake Resistant Design and Construction of Building”, Code of Practice B.I.S., New Delhi.
3. IS:13920-2016, “ Ductile detailing of concrete structures subjected to seismic force” – Guidelines, B.I.S., New Delhi.

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M.Tech. II Year III-Sem (Structural Engineering)

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PRE-ENGINEERED BUILDINGS
(Program Elective – V)

Course Objectives:
To impart knowledge about pre engineered structures their analysis and design for different conditions
Course Outcomes:
The learner will be able to understand and design various components of pre engineered buildings and will be able to analyze and design the pre engineered buildings

Prerequisites : Design of Steel Structures & Structural Analysis

UNIT-I:
INTRODUCTION TO PRE-ENGINEERED BUILDINGS: Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre-Engineered buildings.

UNIT-II:
PRE-ENGINEERED BUILDING COMPONENTS: Primary System: Main frames, Gable End Frame - Secondary frame system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases,Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads. Serviceability Limits as per code.,Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/t_w, bf/t_f ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations, Analysis and Design of Rigid Frames.

UNIT-III:
PEB FRAME CONNECTION DESIGN METHODOLOGY: Rigid Frame Moment Connection, Shear Connection, High strength bolts & grades, Lever arm, bolt Patten its effect on connection design, thickness of connection plate, Selection of governing forces for connection design.

UNIT-IV:
MEZZANINE FLOOR SYSTEMS: Design of Mezzanine Beams, Columns and joists – Mezzanine decking, Different types of Mezzanine Floor systems – Grating, Chequered plate and Rigid floor System, Types of base plate Pinned , Fixed, strength bolts, different types of bolts & grades, Lever arm, bolt Patten its effect on connection design, thickness of connection plate, base plate size, Selection of governing forces for base connection design & Anchor bolt.

UNIT-V:
ANALYSIS AND DESIGN OF PRE-ENGINEERED BUILDINGS: 2D and 3D Modelling of Portal Frames, Optimization Techniques, Comparison of software output with manual calculations. Design of Cold Formed Sections i.e., Purlins and Girts, Design of Roof Sheeting , trapezoidal , Standing seam sheeting, Welding technology, Manufacturing process , Erection Procedures

REFERENCES :

1. Pre-Engineered Steel Building, K.S. Vivek and P.Vyshnavi, LAP Lamdert Academic Publishing.
2. Metal building systems: Design and Specifications, Third edition, Alexander Newman, McGraw- Hill Education.

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REHABILITATION AND RETROFITTING OF STRUCTURES
(Program Elective – V)

Objectives:
To impart knowledge about different types of determination of structures testing the structures for the deterioration of structures testing the structures for the diagnosis defects and different types of repairing methods.

Course Outcomes: After studying this course, students will be able to:

- Understand the cause of deterioration of concrete structures.
- Able to assess the damage for different type of structures
- Summarize the principles of repair and rehabilitation of structures
- Recognize ideal material for different repair and retrofitting technique

Prerequisites: Reinforced Concrete Design, Steel Design, Concrete Technology

UNIT – I
Introduction – Definition of Repair, Retrofitting, Strengthening and rehabilitation, Deterioration of Structures – Distress in Structures – Causes and Prevention, Mechanism of Damage – Types of Damage, Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake

UNIT – II
Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation, Damage Assessment,Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems,**I**nfluence on Serviceability and Durability,Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

UNIT – III
Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post- tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building, Inspection and Testing – Symptoms and Diagnosis of Distress - Damage assessment – NDT.

UNIT – IV
Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengtheningof Structures – Strengthening Methods – Retrofitting – Jacketing.

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UNIT – V

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.Health Monitoring of Structures – Use of Sensors – Building Instrumentation.

REFERENCES:

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildings, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University Press
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
6. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson, (1991).
7. "Deterioration, Maintenance and Repair of Structures ", Sidney, M. Johnson
8. "Concrete Structures – Materials, Maintenance and Repair"- Denison Campbell, Allen & Harold Roper, Longman Scientific and Technical.
9. "Learning for failure from Deficiencies in Design, Construction and Service" R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons Raiker R.N., - R&D Center (SDCPL).

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M.Tech. II Year-III Sem (Structural Engineering)

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3	0	0	3

GREEN BUILDING TECHNOLOGY
(OPEN ELECTIVE)

Course Objectives:

- Exposure to the green building concepts and their significance.
- Understand the judicious use of energy and its management.
- Enhance awareness of end-user energy requirements in the society.
- Develop suitable technologies for energy management.

Course Outcomes:

After completing this course, the student will

1. Understand the fundamentals of energy use and energy processes in building.
2. Identify the energy requirement and its management.
3. Know the Sun-earth relationship vis-a-vis its effect on climate.
4. Be acquainted with the end-user energy requirements.
5. Be familiar with the audit procedures of energy

UNIT-I

Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT-II

Indoor environmental requirement and management - Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT-III

Climate, solar radiation and their influences - Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT-IV

End-use, energy utilization and requirements - Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer.

UNIT-V

Energy management options - Energy audit and energy targeting - Technological options for energy management.

Suggested Readings*:*

1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
2. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
3. Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences and Reflections,
4. Prentice Hall of India, New Delhi.
5. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.

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M.Tech. II Year III-Sem (Structural Engineering)

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DISSERTATION PHASE – I

Course Outcomes:
1 At the end of the course, the student will be able to:
2. Identify structural engineering problems reviewing available literature.
3. Identify appropriate techniques to analyze complex structural systems.
4. Apply engineering and management principles through efficient handling of project

Syllabus Contents:
Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals contribution.

Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

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M.Tech. II Year IV-Sem (Structural Engineering)

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DISSERTATION PHASE – II

Course Outcomes: At the end of the course, the student will be able to:
1. Solve complex structural problems by applying appropriate techniques and tools.
2. Exhibit good communication skill to the engineering community and society.
3. Demonstrate professional ethics and work culture.

Syllabus Contents:
Dissertation – II will be extension of the work on the topic identified in Dissertation – I. Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along

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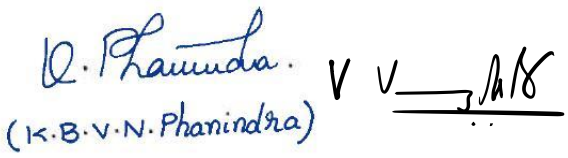
Audit Course 1 & 2

1. English for research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Research Methodology and IPR



M.Tech. I Year (Structural Engineering)

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ENGLISH FOR RESEARCH PAPER WRITING
(AUDIT I and II)

OUTCOME:
Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT- I

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

UNIT- II

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

UNIT- III

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

UNIT- IV

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

UNIT- V

Skills are needed when writing the methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions

UNIT- VI

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

REFERENCE:

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

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M.Tech. I Year (Structural Engineering)

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DISASTER MANAGEMENT
(AUDIT I and II)

Course Outcomes: Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in Specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, Planning and programming in different countries, particularly their home country or the countries they work in.

UNIT- I

Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT- II

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Manmade disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT- III

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT- IV

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering A disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports governmental and Community Preparedness.

UNIT- V

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Globaland National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

UNIT- VI

Disaster Mitigation Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

REFERENCE:

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

M.Tech. I Year (Structural Engineering)

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SANSKRIT FOR TECHNICAL KNOWLEDGE
(AUDIT I and II)

OUTCOME:
Students will be able to:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

UNIT- I
- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

UNIT- II
- Order
- Introduction of roots
- Technical information about Sanskrit Literature

UNIT- III
- Technical concepts of Engineering-Electrical, Mechanical,
- Architecture, Mathematics

REFERENCE:

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

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M.Tech. I Year (Structural Engineering)

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VALUE EDUCATION
(AUDIT I and II)

Course Outcome:
Students will be able to:

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

UNIT- I

- Values and self-development –Social values and individual attitudes.

Work ethics, Indian vision of humanism.

- Moral and non- moral valuation. Standards and principles.
- Value judgements

UNIT- II

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

UNIT- III

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

UNIT- IV

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence ,Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

REFERENCE:

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

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M.Tech. I Year (Structural Engineering)

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CONSTITUTION OF INDIA
(AUDIT I and II)

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

UNIT- I

History of Making of the Indian Constitution:

History Drafting Committee, (Composition & Working)

UNIT- II

Philosophy of the Indian Constitution:

Preamble

Salient Features

UNIT- III

Contours of Constitutional Rights & Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

UNIT- IV

Organs of Governance:

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

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UNIT- V

Local Administration:

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayat Raj: Introduction, PRI: Zilla Pachayat.
- Elected officials and their roles, CEO Zilla Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

UNIT- VI

Election Commission:

- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

REFERENCE:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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M.Tech. I Year (Structural Engineering)

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PEDAGOGY STUDIES
(AUDIT I and II)

Course Outcomes: Students will be able to understand:

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

UNIT- I

Introduction and Methodology:

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

UNIT- II

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

UNIT- III

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

UNIT-IV

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

UNIT- V.

Research gaps and future directions

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

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REFERENCE:

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

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JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. (Structural Engineering)

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STRESS MANAGEMENT BY YOGA
(AUDIT COURSE 1 & 2)

Prerequisites:- NIL

Objectives

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes:

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

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT - I

Definitions of Eight parts of yog. (Ashtanga)

UNIT - II

Yam and Niyam.

Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT - III

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii)Regularization of breathing techniques and its effects-Types of pranayam

Reference Books:-

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

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M.Tech. (Structural Engineering)

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PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(AUDIT COURSE 1 & 2)

Prerequisites:- NIL

Objectives
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes
At the end of the course, the students will be able to
- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students.

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

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

UNIT - III
Statements of basic knowledge
- Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

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

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