M. Tech (Civil Engineering)
Curriculum Structure
Specialization: STRUCTURAL ENGINEERING

Program Outcomes (POs):

After completion of the program graduates will be able to

A. Apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude

B. Identify, formulate and solve engineering problems in the domain of structural engineering field.

C. Use different software tools for Analysis and Design structural engineering domain.

D. Design and conduct experiments analyse and interpret data, for development of simulation Experiments.

E. Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

Curriculum for M.Tech (Civil) - Specialization in Structural Engineering							
Semester-I							
S.No.	**Course Type/Code**	**Subject Code**	**Subject**	**Teaching Scheme**			**Credits**
				Th	**Tuto**	**Lab**	
1.	Core-I	19B111T	Advanced Structural Analysis	3	0	0	3
2.	Core-II	19B112T	Theory of Elasticity and Plasticity	3	0	0	3
ELECTIVE –I							
3.	Program Elective-I	19B11AT	Theory and Analysis of Plates	3	0	0	3
		19B11BT	Stability of Structures				
		19B11CT	Low Cost Effective Housing Technology				
ELECTIVE –II							
4.	Program Elective-II	19B11DT	Design of Advance Concrete Structures	3	0	0	3
		19B11ET	Structural Health Monitoring, Repair and Rehabilitation of Structures.				
		19B11FT	Advanced Foundation Engineering				
5.	Core Lab-I	19B113L	Advanced Concrete Laboratory- I	0	0	4	2
6.	Core Lab-II	19B114L	Structural Design Laboratory - I	0	0	4	2
7.	MLC	19BE11T	Research Methodology and IPR	2	0	0	2
8.	Audit Course-1	19B114T	Disaster Management	2	0	0	0
Total				**16**	**0**	**8**	**18**

Note: Th - Theory; Tuto-Tutorial; Lab – Practical

Curriculum for M.Tech (Civil) - Specialization in Structural Engineering							
Semester-II							
S.No.	**Course Type/Code**	**Subject Code**	**Subject**	**Teaching Scheme**			**Credits**
				Th	**Tuto**	**Lab**	
1.	Core-III	19B121T	Structural Dynamics	3	0	0	3
2.	Core-IV	19B122T	Analysis of Shells and Folded Plates	3	0	0	3
ELECTIVE –III							
3.	Program Elective-III	19B12AT	Finite Element Analysis of Structures	3	0	0	3
		19B12BT	Earthquake Resistant Structures				
		19B12CT	Advanced Structural Steel Design.				
		19B12DT	Design of Form work				
ELECTIVE –IV							
4.	Program Elective-IV	19B12ET	Advanced Concrete Technology	3	0	0	3
		19B12FT	Soil Structure Interaction				
		19B12GT	Design of Masonry Structures				
		19B12HT	Design of Industrial Structures				
5.	Core Lab-III	19B123L	Advanced Concrete Laboratory-II	0	0	4	2
6.	Core Lab-IV	19B124L	Structural Design Laboratory-II	0	0	4	2
7.	Core	19B125P	Mini Project	0	0	4	2
8.	Audit Course-2	19BC21T	Academic and Research Report Writing	2	0	0	0
Total				**14**	**0**	**12**	**18**

Note: Th - Theory; Tuto-Tutorial; Lab – Practical

Curriculum for M.Tech (Civil) - Specialization in Structural Engineering							
Semester-III							
S.No.	**Course Type/Code**	**Subject Code**	**Subject**	**Teaching Scheme**			**Credits**
				Th	**Tuto**	**Lab**	
ELECTIVE –V							
1.	Program Elective-V	19B13AT	Experimental Stress Analysis	3	0	0	3
		19B13BT	Design of Prestressed Concrete Structures				
		19B13CT	Fracture Mechanics of Concrete Structures				
		19B13DT	Design of Bridges				
OPEN ELECTIVE							
2.	Open Elective	19B53DT	Business Analytics	3	0	0	3
		19B13ET	Industrial Safety				
		19B33DT	Operations Research				
		19BE3AT	Cost Management of Engineering Projects				
		19B33ET	Composite Materials				
		19B43DT	Wireless Communications				
		19B23ET	Energy Conservation				
3.	Dissertation	19B131P	Dissertation Phase – I	0	0	20	10
Total				**6**	**0**	**20**	**16**

Note: Th - Theory; Tuto-Tutorial; Lab – Practical

Curriculum for M.Tech (Civil) - Specialization in Structural Engineering							
Semester-IV							
S.No.	**Course Type/Code**	**Subject Code**	**Subject**	**Teaching Scheme**			**Credits**
				Th	**Tuto**	**Lab**	
1.	Dissertation	19B141P	Dissertation Phase – II	0	0	32	16
Total				--	--	32	**16**

Note: Th - Theory; Tuto-Tutorial; Lab – Practical

Audit Courses 1 & 2

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

Open Electives

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Wireless Communications
7. Energy Conservation

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(AN AUTONOMOUS INSTITUTION)

M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B111T] ADVANCED STRUCTURAL ANALYSIS

Course Objectives

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

UNIT-I

Introduction: -Indeterminacy**-**Determination of static and kinematic indeterminacies of two-dimensional and three-dimensional portal frames, pin jointed trusses and hybrid frames-coordinate systems –structural idealization. Introduction to Matrix Methods of Analysis-Flexibility and stiffness matrices-Force displacement relationships for axial force, couple, tensional moments – stiffness method of analysis and flexibility method of analysis.

UNIT-II

Analysis of Continuous Beams- stiffness method and flexibility method of analysis –continuous beams of two and three spans with different end conditions-internal hinges.

UNIT-III

Analysis of Two-Dimensional Portal Frames & Pin jointed Trusses – stiffness and flexibility method of analysis of 2D portal frames with different end conditions-plotting of bending moment diagrams. Computation of joint displacement and member forces for pin jointed trusses.

UNIT-IV

Transformation of Co-Ordinates - Local and Global co-ordinate systems-transformation of matrices from local to global coordinates of element stiffness matrix-direct stiffness method of analysis-assembly of global stiffness matrix from element stiffness matrices –static condensation-sub-structuring.

UNIT-V

Equation Solvers-solution of system of linear algebraic equations-direct inversion method-gauss elimination method-Cholesky method-banded equation solvers-frontal solution technique.

Course Outcomes

After completion of the course the students will be able to

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

TEXT/REFERENCE BOOKS:

1. Structural Analysis by Pundit & Gupta, Tata MC Graw Hill Book Company.
2. Structural Analysis by C.S.Reddy, Tata MC Graw Hill Book company
3. Cotes, R.C., Counties, M.G., and Kong, F.K., Structural Analysis, ELBS.
4. MC.Guire, Wand Gallagher, R.H., Matrix Structural analysis, John Wiley and sons.
5. John L.Meek., Matrix Structural Analysis, MC Graw Hill Book company.
6. Structural Analysis – R.C.Hibbeler, Pearson Education.

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B112T] THEORY OF ELASTICITY AND PLASTICITY

Course Objectives

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

UNIT-I

Introduction To Plane Stress And Plane Strain Analysis: Elasticity –Notation for forces and stresses-Components of stresses –components of strain –Hooke's law. Plane stress-plane strain-Differential equations of equilibrium- Boundary conditions- Compatibility equations-stress function-Boundary conditions.

UNIT-II

Two Dimensional Problems In Rectangular Coordinates: Solution by polynomials-Saint Venant's principle-Determination of displacements-bending of simple beams-application of Fourier series for two dimensional problems - gravity loading.

UNIT-III

Two Dimensional Problems In Polar Coordinates: General Equation in polar co-ordinates - stress distribution symmetrical about an axis –Pure bending of curved bars- strain components in polar coordinates-Displacements for symmetrical stress distributions-simple symmetric and asymmetric problems-General solution of two dimensional problem in polar coordinates-Application of the general solution of two dimensional problem in polar coordinates-Application of the general solution in polar coordinates.

UNIT-IV

Analysis of Stress And Strain In Three Dimensions: Principle stress - ellipsoid and stress-director surface-Determination of principle stresses- Maximum shear stresses-Homogeneous deformation-principle axis of strain rotation.

General Theorems: Balance laws - Differential equations of equilibrium- conditions of compatibility - Determination of displacement-Equations of equilibrium in terms of displacements-principle of superposition-Uniqueness of solution –the Reciprocal theorem.

UNIT-V

Torsion of Prismatical Bars: Torsion of prismatic bars- Elliptical cross section-other elementary solutions-membrane analogy-Torsion of rectangular bars-solution of torsional problems by energy method-use of soap films in solving torsional problems-hydra dynamical analogies-Torsion of shafts, tubes, bars etc.

Course Outcomes

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

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

TEXT/REFERENCE BOOKS:

1. Theory of Elasticity and Plasticity by Timoshenko, S., MC Graw Hill Book company.
2. Advanced Strength of materials by Papoov, MC Graw Hill Book company.
3. Theory of Elasticity and Plasticity by Sadhu Singh. Khanna Publishers.
4. Chen, W.F. and Han, D.J.Plasticity for structural Engineers, Springer – Verlag, New York.
5. Lubliner, J., Plasticity theory, Mac Millan Publishing Co., New York.
6. Foundations of Solid Mechanics by Y.C.Fung, PHI Publications.
7. Advanced Mechanics of Solids by L.S. Srinath, Tata MC Graw Hill Book company.

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B11AT] THEORY AND ANALYSIS OF PLATES

(PROGRAME ELECTIVE-I)

UNIT-I

Derivation of Plate Equations For Rectangular Plates –In plane bending and transverse bending effects. Plates under various loading conditions like concentrated, U.D.L and hydrostatic pressure-Naiver and Levy's type of solutions for various boundary conditions.

UNIT-II

Circular Plates: Symmetrically loaded, circular plates under various loading conditions, annular plates.

UNIT-III

Plates Under Simultaneous Bending And Stretching: Derivation of the governing equation and application to simple cases.

UNIT-IV

Orthotropic Plates: Derivation of the governing equation, applications to grillage problems as equivalent orthotropic plates.

UNIT-V

Numerical And Approximate Methods: Energy solutions by variational methods, finite difference and finite element methods of analysis for plate problems. Study of few simple cases for large deflection theory of plates.

Text Books / REFERENCE BOOKS:

1. Timoshenko, S., and Krieger, S.W., Theory of plates and shells, McGraw Hill Book company.
2. Theory of plates by Chandra Shekhara, K, Universities Press ltd
3. Szilard, R., Theory and Analysis of Plates, Prentice Hall Inc.
4. N.K.Bairagi, Plate analysis, Khanna Publishers, Delhi, 1986.

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B11BT] STABILITY OF STRUCTURES

(PROGRAME ELECTIVE-I)

UNIT-I

Formulations related to beam columns: Concept of Stability, Differential equation for beam columns –Beam column with concentrated loads –continuous lateral load –couples -beam column with built in ends –continuous beams with axial load –application of Trigonometric series – Determination of allowable stresses.

UNIT-II

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

UNIT-III

Inelastic Buckling and Torsional Buckling: Buckling of straight bars-Double modulus theory – Tangent modulus theory. Pure torsion of thin walled bar of open cross section-Non –Uniform torsion of thin walled bars of open cross section-Torsional buckling –Buckling under Torsion and Flexure.

UNIT-IV

Mathematical Treatment of Stability Problems: Buckling problem orthogonality relation –Ritz method-Timoshenko method, Galerkin method

UNIT-V

Lateral Buckling of simply supported Beams and rectangular plates: Beams of rectangular cross section subjected for pure bending. Derivation of equation of rectangular plate subjected to constant compression in two directions and one direction.

REFERNCE BOOKS:

1. Stability of metallic structure by Bleich –McGraw hill
2. Theory of Beam columns Vol I by chen& Atsuta McGraw Hill
3. Smites, Elastic stability of structures, Prentice Hall,1973
4. Timoshenko, S.and Gere. Theory of Elastic stability, McGraw Hill Book company, 1973
5. Brush and Almorth., Buckling of bars plates and shells, McGraw Hill book company ,1975
6. Chajes, A., Principles of Structural Stability Theory, Prentice Hall,1974
7. Ashwini Kumar, stability theory of structures, TATA McGraw Hill publishing company Ltd, New Delhi,1985

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B11CT] LOW COST EFFECTIVE HOUSING TECHNOLOGY

(PROGRAME ELECTIVE-I)

UNIT-I

a) Housing Scenario: Introducing - Status of urban housing - Status of Rural Housing

b) Housing Finance: Introducing - Existing finance system in India - Government role as facilitator - Status at Rural Housing Finance - Impedimently in housing finance and related issues

a) Land use and physical planning for housing:

Introduction- Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye laws - Residential Densities

b) Housing the urban poor:

Introduction - Living conditions in slums - Approaches and strategies for housing urban poor

UNIT-II

Development and adoption of low cost housing technology: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements in partial prefatroices - Adopting of total prefactcation of mass housing in India- General remarks on pre-cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall – Fly-ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

UNIT-III

Alternative building materials for low cost housing: Introduction - Substitute for scarce materials – Ferro cement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Alternative building maintenance

Low cost Infrastructure services: Introduction - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy

UNIT-IV

Rural Housing: Introduction traditional practice of rural housing continuous - Mud Housing technology Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs

UNIT-V

Housing in Disaster prone areas: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

TEXT BOOKS

1. Building materials for low – Income houses – International council for building research studies and documentation.
2. Hand book of low-cost housing by A.K.Lal – New Age International publishers.
3. Properties of concrete – Neville A.m. Pitman Publishing Limited, London.
4. Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.
5. Low cost Housing – G.C. Mathur.
6. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Ramachandra Murthy & G.Annamalai.

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B11DT] DESIGN OF ADVANCE CONCRETE STRUCTURES

(PROGRAME ELECTIVE-II)

Course Description

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

Course Objectives

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

UNIT I

Deflection of Reinforced Concrete Beams and Slabs:

Introduction -Short-term Deflection of beams and Slabs -Deflection due to -Imposed loads – Short-term deflection of beams due to applied loads- Calculation of deflection by IS 456- Deflection of continues beams by IS 456 - Deflection of Cantilevers - Deflection of Slabs

Estimation of Crack Width in Reinforced Concrete Members:

Introduction - Factors affecting Crack width in beams - Mechanism of Flexural cracking Calculation of crack widths - Simple Empirical method - Estimation of Crack width in –beams by IS 456 of BS 8110 - Shrinkage and Thermal Cracking.

UNIT II

Design of Reinforced Concrete Deep Beams:

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

UNIT III

Design of Elevated Water Tanks:

Introduction - Types of overhead water tanks- Design of Intze type water tank- design of conical or funnel shaped water tank.

Design of Shear Walls: Introduction - Classification of shear walls – Classification according to behaviour - Loads in shear walls - Design of Rectangular and flanged shear walls- Derivation of formula for moment of Resistance of Rectangular shear walls

UNIT IV

Design of Cast In-Situ Beam-Column Joints:

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

UNIT V

Bunkers and Silos:

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

Course Outcomes

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

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

Text Books

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

Reference Books

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

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B11ET] STRUCTURAL HEALTH MONITORING, REPAIR AND REHABILITATION OF STRUCTURES.

(PROGRAME ELECTIVE-II)

Course Objectives

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

UNIT-I

Influence on serviceability and Durability:-General: Quality assurance for concrete construction, As built concrete properties, strength, permeability, volume changes, thermal properties, cracking. Effects due to climate, temperature, chemicals, wear and erosion, design and construction errors, corrosion mechanism, Effects of cover thickness and cracking methods of corrosion protection, inhibitors, resistant steels, coatings cathodic protection.

UNIT-II

Maintenance and Repair Strategies: - Inspection, Structural Appraisal, Economic appraisal, components of equality assurance, conceptual bases for quality assurance schemes.

Materials for Repair: -Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete.

UNIT-III

Techniques for Repair: - Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Granite and shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

UNIT-IV

Retrofitting/Strengthening:

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

Case Studies: - Repairs to overcome low member strength, Deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure.

UNIT-V

Protection & Maintenance of Structures:

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

Long term health monitoring / structural health monitoring (SHM):

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

Course Outcomes

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

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

TEXT/REFERENCE BOOKS:

1. Concrete microstructure, Properties and materials - P Kumar Mehta and Paulo J. M. Monterio.
2. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical, U.K. 1991.
3. Handbook on Repairs and Rehabilitation of RCC buildings - CPWD, Government of India.
4. RT.Allen and S.C. Edwards, Repair of concrete Structures, Blaikie and sons, UK, 1987.
5. MS. Shetty, Concrete Technology – Theory and practice, S.Chand and company, New Delhi, 1992.
6. Santha Kumar, A.R.Training Course notes on damage assessment and Repair in low cost housing RHDC-NBO Anna University, Madras, July, 1992.
7. Raikar, R.N.learning from failures – deficiencies in Design, construction and service – R&D centre (SDCPL), Raikar Bhavan, Bombay, 1987.
8. N.Palaniappan, Estate Management, Anna Institute of Management, Madras Sep. 1992.
9. F.K.Garas, J.L.Clarke, GST Armor, Structural Assessment, Butterworths, UK April 1987.
10. A.R. Santha kumar, Concrete chemicals – Theory and applications, Indian society for construction Engineering and Technology, Madras. 1993 (In press)
11. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.
12. Structural Sensing, Health Monitoring, and Performance Evaluation by D.Huston CRC Press.
13. Structural Health Monitoring by Daniel Balageas, Claus-Peter Fritzen and Alfredo Güemes – ISTE, WILEY Co-publisher.
14. Structural Health Monitoring of Large Civil Engineering Structures by Hua-Peng Chen - Yi-Qing Ni - WILEY Publications.

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B11FT] ADVANCED FOUNDATION ENGINEERING

(PROGRAME ELECTIVE-II)

UNIT-I

Shallow Foundations-I: General requirements of foundations. types of shallow foundations and the factors governing the selection of type of shallow foundation. Bearing capacity of shallow foundations by Terzaghi's theory and Meyerhof's theory (derivation of expressions and solution to problems based on these theories). Local shear and general shear failure and their identification

UNIT-II

Shallow Foundations-II: Bearing capacity of isolated footing subjected to eccentric and inclined loads. Bearing capacity of isolated footing resting on stratified soils- Button's theory and Siva Reddy analysis. Analysis and structural design of R.C.C isolated, combined and strap footings.

UNIT-III

Deep Foundations-I: Pile foundations-types of pile foundations. Estimation of bearing capacity of pile foundation by dynamic and static formulae. Bearing capacity and settlement analysis of pile groups. Negative skin Friction, Pile load tests. Sheet Pile Walls. Cantilever sheet piles and anchored bulkheads, Earth Pressure diagram, Determination of depth of embedment in sands and clays-Timbering of trenches-Earth Pressure diagrams-forces in struts.

UNIT-IV

Deep Foundations-II: Well Foundations-Elements of well foundation. Forces acting on a well foundation. Depth and bearing capacity of well foundation. Design of individual components of well foundation (only forces acting and principles of design). Problems associated with well sinking.

UNIT-V

Foundations in Problematic Soils: Foundations in black cotton soils-basic foundation problems associated with black cotton soils. Lime column techniques-principles and execution. Under reamed piles-principle of functioning of under reamed pile-Analysis and structural design of under reamed pile. Use of Cohesive Non-Swelling (CNS) layer below shallow foundations

Text Books:

1. Analysis and Design of Foundations and Retaining Structures-Shamsher Prakash, Gopal Ranjan and Swami Saran.

Reference Books:

1. Analysis and Design of Foundations-J.E.Bowles
2. Foundation Design and Construction-Tomlinson
3. Foundation Design-Teng.
4. Geotechnical Engg – C.Venkatramaiah

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
0	0	4	2

[19B113L] ADVANCED CONCRETE LABORATORY- I

List of Experiments:

1. Workability
   (a)Slump Test
   (b)Compaction Factor Test
   (c)Vee-Bee Test
2. Flakiness Test
3. Elongation Test
4. Specific Gravity of
   (a) Cement
   (b) Coarse Aggregate
   (c) Fine Aggregate
5. Bulk density of
   (a) Fine Aggregate
   (b) Coarse Aggregate
6. Fineness Modulus of
   (a) Fine Aggregate
   (b) Coarse Aggregate
7. Compressive strength of Cement
8. Mix Design of Concrete and Casting of Specimen.
9. Young's Modulus of Concrete.
10. Fineness by Blain's apparatus for cement, Fly ash, Silica.

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
0	0	4	2

[19B114L] STRUCTURAL DESIGN LABORATORY - I

Course Objectives

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

List of Experiments

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

Course Outcomes

1. Understand the software usages for structural members.
2. Able to analyse plane, space frames and dynamic response and natural frequency for beams and frames.
3. Able to design, detailing and estimations of RC members.
4. Able to design the steel members like truss, beams and columns.

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
2	0	0	2

[19BE11T] RESEARCH METHODOLOGY AND IPR

Course Description:

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

Course Objectives:

Upon the completion of subject student will be able to-

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

UNIT I:

INTRODUCTION

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

UNIT II:

EFFECTIVE PAPER WRITING

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III:

NATURE OF INTELLECTUAL PROPERTY:

Patents, Designs, Trade and Copyright, Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

UNIT IV:

PATENT RIGHTS:

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

UNIT V:

NEW DEVELOPMENTS IN IPR

Administration of Patent System, New developments in IPR; IPR of Biological Systems, Computer Software etc,Traditional knowledge Case Studies, IPR and IITs.

Course Outcomes

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

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

Text Books

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, an AIJ Research Methodology: An Introduction

References

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
3. Mayall , "Industrial Design", McGraw Hill, 1992.
4. Niebel , "Product Design", McGraw Hill, 1974.
5. Asimov , "Introduction to Design", Prentice Hall, 1962.

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B121T] STRUCTURAL DYNAMICS

UNIT-I

Theory of Vibrations: Introduction –Elements of a vibratory system – degrees of freedom-continuous systems –lumped mass idealization –Oscillatory motion –Simple harmonic motion – pictorial representation of S.H.M - free vibrations of single degree of Freedom (SDOF) systems – undammed and Damped –Critical damping –Logarithmic decrement –Forced vibrations of SDOF systems-Harmonic excitation –Dynamic magnification factor- Bandwidth. Fundamental objective of dynamic analysis-types of prescribed loading- Methods of discretization- Formulation of the equations of motion.

UNIT-II

Single degree of Freedom System: Formulation and solutions of the equation of motion - free Vibration response –response to harmonic, periodic, Impulsive and general Dynamic loading – Duhamel integral

UNIT-III

Multi Degree of Freedom System: selection of the degree of freedom –Evaluation of structural property matrices-Formulation of the MDOF equations of motion –Undammed free vibrations-Solution of Eigen value problem for natural frequencies and mode shapes- Analysis of dynamic response –Normal coordinates –Uncoupled equations of motion –Orthogonal properties of normal modes-mode superposition procedure

UNIT-IV

Practical vibration analysis: Stodola method- Fundamental mode analysis –analysis of second and higher modes –Holzer's method –basic procedure –transfer matrix procedure

UNIT-V

Introduction to Earthquake analysis: Introduction –Excitation by rigid base translation –Lumped mass approach -SDOF and MDOF system- I.S code methods of analysis.

Continuous system: Introduction –Flexural vibrations of beams- Elementary Case-Equation of motion –Analysis of undamped free shapes of simple beams with different end conditions-principles of application to continuous beams.

REFERENCE BOOKS:

- A.K.Chopra, "Structural Dynamics for Earthquake Engineering", PearsonPublications
- Dynamics of structures by Clough &Penziem
- Structural dynamics by Mario Paz
- I.S:1893(latest)"code of practice for earthquakes resistant design of structures"
- Anderson R.A fundamentals of vibration, AmerindPublishing Co.,1972

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B122T] ANALYSIS OF SHELLS AND FOLDED PLATES

Course Objectives

1. To understand the basic equations, bending effects of plates.
2. To understand the symmetrical loading and various loading conditions of circular and annular plates.
3. To understand the simultaneous bending and stretching of plates and to develop governing equation.
4. To study the concepts of orthotropic plates, numerical, approximate methods, large deflection theory of plates.
5. To understand the analytical methods for the solution of shells.
6. To apply the numerical techniques and tools for the complex problems in shells

UNIT-I

Equations of equilibrium: Introduction, classification, derivation of stress Resultants, Principles of membrane theory and bending theory.

UNIT-II

Cylindrical shells: Derivation of governing DKJ equation for bending theory, details of Scherer's theory, Applications to the analysis and design of short shells and long shells, Introduction of ASCE manual co-efficient for design.

UNIT-III

Introduction to shells of double curvature: (other than shells of revolution) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

UNIT-IV

Folded Plates: Folded plate theory, plate and slab action, Whitney's theory, Simpson's theory for the analysis of different types of folded plates (Design is not included)

UNIT-V

Shells of double Curvature: Surfaces of revolution. Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

Course Outcomes

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

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

TEXT / REFERENCE BOOKS:

1. Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain BhawanBholaNath Nagar, Shahotra, Delhi.
2. Fundamentals of the analysis and design of shell structures by VasantS.Kelkar Robert T.Swell – Prentice hall, Inc., Englewood cliffs, new Jersy -02632.
3. N.k.Bairagi, Shell analysis, Khanna Publishers, Delhi, 1990.
4. Bollington, Ithin shell concrete structures, McGraw Hill Book company, New York, St. Louis, Sand Francisco, Toronto, London.
5. ASCE Manual of Engineering practice No.31, design of cylindrical concrete shell roofs ASC, New York.

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12AT] FINITE ELEMENT ANALYSIS OF STRUCTURES

(PROGRAME ELECTIVE-III)

UNIT-I

Introduction-Concepts of FEM –steps involved –merits &demerits –energy principles – Discretization –Rayleigh –Ritz method of functional approximation.

Elastic formulations: Stress equations-strain displacement relationships in matrix form-plane stress, plane strain and Axi-symmetric bodies of revolution with axi symmetric loading

UNIT-II

One Dimensional FEM-Stiffness Matrix for Beam and bar elements shape functions for ID elements –static condensation of global stiffness matrix-solution –Initial strain and temperature effects.

UNIT-III

Two-Dimensional FEM-Different types of elements for plane stress and plane strain analysis – Displacement models –generalized coordinates-shape functions-convergent and compatibility requirements –Geometric Invariance –Natural coordinate system-area and volume coordinates-Generation of element stiffness and nodal load matrices –static condensation

UNIT-IV

Isoperimetric formulation-Concept, Different isoperimetric elements for 2d analysis-Formulation of 4-noded and 8-noded isoperimetric quadrilateral elements –Lagrangian elements-serendipity elements

Axi-symmetric analysis –bodies of revolution-axi symmetric modelling –strains displacement relationship-formulation of axi symmetric elements.

UNIT-V

Three-Dimensional FEM-Different 3-D elements, 3D strain –displacement relationship- formulation of hexahedral and isoperimetric solid element

REFERENCE BOOKS:

1. Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla and Ashok D. Belegundu – Pearson Education Publications.
2. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata McGraw Hill Publishers Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla, Universities Press India Ltd. Hyderabad.
3. Finite element method and its application by Desai ,2012, Pearson Pubilications.
4. Finite element methods by Darrel W.Pepper, VikasPublishers
5. Finite element analysis and procedures in engineering by H.V.Lakshminaryana, 3rd edition, universities press, Hyderabad.
6. Finite element analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, New Delhi.
7. Finite element analysis by S.S. Bhavakatti-New age international publishers

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12BT] EARTHQUAKE RESISTANT STRUCTURES

(PROGRAME ELECTIVE-III)

UNIT-I

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

UNIT-II

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

UNIT-III

Design approaches: Methods of analysis – selection of analysis – equivalent lateral force procedure seismic base shear – seismic design co-efficient - vertical distribution of seismic forces and horizontal shear – twisting moment - Over turning moment – vertical seismic load and orthogonal effects lateral deflection – P- Δ characteristics effect – soil structure Interaction. Seismic – Graphs study, earthquake records for design – factors affecting Accelerogram characteristics - artificial Accelerogram – zoning map. Dynamic – analysis procedure: Model analysis – Inelastic – time history analysis Evaluation of the results.

UNIT-IV

Earthquake – Resistant design of structural Components and systems: Introduction – monolithic reinforced – concrete structures – precast concrete structures – Prestressed concrete structures – steel structures – composite – structures, masonry structures – Timber structures.

UNIT-V

Fundamentals of seismic planning: Selection of materials and types of construction form of superstructure – framing systems and seismic units – devices for reducing. Earthquake loads.

TEXT / REFERENCE BOOKS:

1. Design of earthquake resistant structures by Minoru Wakabayashi.
2. A.K.Chopra, Structural Dynamics for Earthquake Engineering", Pearson Publications.
3. R.W.Clough and 'Dynamics of structures. McGraw – Hill, 2nd edition,1992.
4. N.M Newmark and E.Rosenblueth, Fundamentals of Earthquake Engineering' prentice hall,1971.
5. David Key, Earthquake design practice for buildings." Thomas Telford,London,1988
6. R.L. Wegel, Earthquake Engg; Prentice Hall 12nd edition 1989.
7. J.A. Blume, N.M. Newmark, L.H. Corning., Design of Multi –storied Buildings for Earthquake ground motions', Portland Cement Association, Chicago,1961
8. I.S.Codes No. 1893,4326,13920.
9. Earthquake Resistant Design by PankajAgarwal.

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12CT] ADVANCED STRUCTURAL STEEL DESIGN

(PROGRAME ELECTIVE-III)

Course Objectives

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

UNIT-I

Design of self-supporting stacks/chimneys – Considerations for preliminary design (industrial requirements – thermal requirement – mechanical force requirement – wind load and dead load estimation) – Detailed estimation of wind; dead-and other accidental – loads; Analysis; Detailed design including provision of stakes /spoilers – Design of super structure only.

UNIT-II

Design of cold formed sections

Techniques and properties- Advantages, Typical profiles, stiffened and un stiffened elements, local buckling and post buckling strength, shear lagand flange curling, unusually wide flange section, short span sections, members subjected to axialtension, compression and bending. IS 801& 811 code provisions- numerical examples, beam design, column design.

UNIT-III

Design of Gantry Girder – Introduction – Loads acting on the gantry girder – permissible stresses - types of gantry girders and crane sails – crane data – maximum moments and shears – design procedure (restricted to electrically operated cranes)

UNIT-IV

Theorems of plastic analysis, applications to the cases of rectangular portal frames, Principles of optimization in structural design – Application to simple – rectangular portal frame – minimum weight design.

General methods of plastic design: combining mechanics methods, plastic moment redistribution method; Application to few cases of simple two storied rectangular portal frames including estimation of deflection.

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.

Course Outcomes

Upon completion of the course the student will be able to

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

Text Books:

1. Rama Chandra and Gehlot, V. (2007), Design of Steel Structures Vol. 1 and II, Standard Publication, New Delhi.
2. Subramanian, N. (2008), Design of Steel Structures-Limit State Design, Oxford University press, India.
3. Relevant BIS codes and international codes
4. IS 801-Cold form Structures
5. ACI 1961 Cold form Structures

Reference Books:

1. Plastic analysis of structures by B.G.Neal
2. SP-6 Plastic Analysis.
3. Plastic analysis by Gaylord and Gaylord
4. Design of steel structures by Vazarani and Ratwani
5. Analysis of Steel Structure by Manohar.
6. Analysis of Steel Structure by Pinfold
7. Analysis of Steel Structure by Arya&Azmani
8. Analysis of Steel Structure by Relevant IS codes.
9. Analysis of Steel Structure by Punmia, B.C.
10. Design of steel structures by Ramachandra

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12DT] DESIGN OF FORMWORK

(PROGRAME ELECTIVE-III)

UNIT-I

Introduction: Requirements and Selection of Formwork.

Formwork Materials- Timber, Plywood, Steel, Aluminium, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

UNIT-II

Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

UNIT-III

Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, 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, McGraw Hill India, 2015.
2. Formwork for Concrete Structures, Kumar Neeraj Jha, Tata McGraw Hill Education, 2012.
3. IS 14687: 1999, false work for Concrete Structures - Guidelines, BIS

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.

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12ET] ADVANCED CONCRETE TECHNOLOGY

(PROGRAME ELECTIVE-IV)

UNIT-I

Concrete Making Materials: Portland Hydration process Bogues compounds, different types of cement, OPC, PPC, PSC, Air entraining cement, masonry cement oil well cement, sulphate resistant cement, High alumina cement, Rapid Hardening cement, Quick setting cement, low heat cement. Aggregate in concrete: Purpose and role of aggregates, Physical, mechanical and durability properties of aggregates, special aggregate: low density, High density aggregates, aggregates for refractory concrete, abrasion resistant aggregates.

UNIT-II

Admixtures, Concreting Methods: Mineral and chemical admixtures: pulverized fuel ash, Blast furnace stag, silica fume, Rice Husk ash, metakaolin, water reducing agents, effect of water reducing agents on properties of concrete, air entraining agents and effect of air entraining agents on properties of concrete, Accelerators, retarders.

Special Purpose Admixtures: Process of manufacturing of concrete, extreme weather concreting, vacuum dewatering, under water concreting.

UNIT-III

High Strength Concrete: Introduction, Principles for production, constituent materials, properties, delivery, Q.C and testing.

High Performance Concrete: Principles, materials selection, producing HPC, mechanical properties and durability properties of HPC.

Ultra-High-performance concrete: Introduction, Principles for production of UHPC, basic material, mechanical properties of UHPC, durability.

Super-High Strength HPC: Principles, raw materials, problems with preparation techniques, strength, durability, test methods.

UNIT-IV

Non-Destructive and Durability Tests on Concrete: Penetration resistance methods, pull out test, break off test, maturity methods to evaluate corrosion of reinforcement, short pulse rador method, thermo graphic method, durability tests.

UNIT-V

Form work for concrete: Form work materials: Timber, Plywood, aluminium, Plastic forms, other materials, form work design concepts, loads form work for foundations walls, columns, beams & slabs, form work for folded plates, Domes, shells, slip form work, flying form work, flying form work, scaffolding, form work supports, formwork failures.

TEXT BOOKS:

1. Concrete Technology by M.S.Shetty. – S.Chand&Co Ltd.
2. Concrete: Micro structure, Properties and Materials – P.K.Mehta and J.M.Monteiro, Mc-Graw Hill
3. Non-Destructive Test and Evaluation of materials by J.Prasad & C.G.Krishna Das. Nair, Tata McGrawHill.
4. Form work for concrete by Neeraj Kumar Jh: Tata MC Graw Hill

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12FT] SOIL STRUCTURE INTERACTION
(PROGRAME ELECTIVE-IV)

Course Objectives

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

UNIT I

Soil-Foundation Interaction

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

UNIT II

Beam On Elastic Foundation - Soil Models

Infinite beam- Isotropic elastic half space - Analysis of beams of finite length- Classification of finite beams in relation to their stiffness.

UNIT III

Plate on Elastic Medium

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

UNIT IV

Elastic Analysis of Pile

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

UNIT V

Laterally Loaded Pile

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

Course Outcomes

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

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

Text Books

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

Reference Books

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

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12GT] DESIGN OF MASONRY STRUCTURES
(PROGRAME ELECTIVE-IV)

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

UNIT I
Masonry Units, Materials, Types & Masonry Construction
Brick, stone and block masonry units - strength, modulus of elasticity and water absorption of masonry materials -classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks

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

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

UNIT III
Design Considerations
Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels.

Load Considerations For Masonry:
Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings,freestanding wall.

UNIT IV
Design of Masonry Walls
Design of load bearing masonry for building up to 3 storeys using IS : 1905 and SP : 20 procedure.

UNIT V

Reinforced Masonry

Application, flexural and compression elements, shear walls.

Masonry Walls In Composite Action

Composite wall-beam elements, in filled frames

Course Outcomes

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

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

Text Books

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

Reference Books

1. Richard E. Klingner, Masonry Structural Design, 2nd Edition, Jennifer Eisenhauer Tanner. Mode of Evaluation: Assignments, Mid Examinations, End Examination

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B12HT] DESIGN OF INDUSTRIAL STRUCTURES

(PROGRAME ELECTIVE-IV)

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

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

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

UNIT III
WATER TANKS
Design of rectangular riveted steel water tank - Tee covers - Plates - Stays - Longitudinal and transverse beams -Design of staging - Base plates - Foundation and anchor Bolts.

UNIT IV
DESIGN OF PRESSED STEELWATER TANK
Design of stays - Joints - Design of hemispherical bottom water tank - side plates - Bottom plates - joints - Ring girder -Design of staging and foundation.

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

COMPOSITE STRUCTURES
Design of composite slabs.

Course Outcomes
After the completion of the course the students will be able to
1. Design Steel Gantry Girders.
2. Design Steel Bunkers and Silos.
3. Design Chimneys and Water Tanks.
4. Design pressed steel water tank.
5. Design of composite slabs.

Text Books

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

Reference Books

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

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
0	0	4	2

[19B123L] ADVANCED CONCRETE LABORATORY - II

1. Accelerated curing test on Concrete cubes.
2. Non-destructive test on concrete.
3. Study of effect of dosage of super plasticizer on Strength and workability of concrete.
4. Mix design of high strength concrete including casting and testing of specimens.
5. Mix design of fly ash concrete including casting and testing of specimens.
6. Determination of coefficient of permeability of concrete.
7. Determination of drying shrinkage of concrete.
8. Bending test on an RCC beam under.
   a) single point load
   b) Two-point load

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
0	0	4	2

[19B124L] STRUCTURAL DESIGN LABORATORY - II

Course Objectives:

The students will be able to understand

- The knowledge related to computer aided engineering and programming using C++.
- The application of optimization and reliability techniques to structural engineering.
- The knowledge of expert system and its application.
- Concepts of Computer Aided Design - Role of Computers in engineering process. Introduction to Hardware and Software systems for Computer Aided Engineering.
- Software Tools for CAD; Programming systems - Object Oriented Programming - introduction to C++.
- Computer modeling of Engineering systems – Data structures – pointers, Arrays, programming techniques of computer modeling of Civil Structures.
- Optimization problems - LP and NLP programming, Optimization of Structural Members, routines for reliability analysis – FOSM, AFOSM.
- Expert Systems and Artificial intelligence – Structure and features – Fundamentals of Neural Networks.
- Computer Aided Concrete Mix Design.

Self-Learning:

- Usage of software tools in the field of structural engineering.

Reference Books:

1. Fleming, J.F. (1989), Computer Analysis for Structural System, McGraw Hill Pub Co., New York.
2. Krishnamurthy, C.S. and Rajeev, S. and Rajaraman (2005), Computer Aided Design – Software and Analytical Tools, Narosa Publishing House, New Delhi.
3. Expert Systems – Adeli
4. Ranganathan, R. (1990), Reliability analysis and Design of Structures, Tata McGraw Hill, New Delhi.
5. Rao, S.S. (1984), Optimization Theory and Applications, John Wiley and Sons, New York.
6. Bhavikatti, S.S. (2003), Structural Optimisation Using Sequential Linear Programming, Vikas Publishing House Pvt. Ltd., New Delhi.

Course Outcomes

The student will have the ability to
Use programing language C++ for structural engineering applications (CO1).
Apply optimization and reliability techniques to solve structural engineering problems (CO2).
Apply expert systems and artificial intelligent systems to solve structural engineering problems (CO3).

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
0	0	4	2

[19B125P] MINI PROJECT

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

1. Identify structural engineering problems reviewing available literature.
2. Study different techniques used to analyse complex structural systems.
3. Work on the solutions given and present solution by using his/her technique applying Engineering principles.

Syllabus Contents:

Mini Project 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 highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

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M.Tech III Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B13AT] EXPERIMENTAL STRESS ANALYSIS
(PROGRAMME ELECTIVE-V)

UNIT-I

PRINCIPLES OF EXPERIMENTAL APPROACH: -

Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems.

UNIT-II

STRAIN MEASUREMENT USING STRAIN GAUGES: Definition of strain and its relation of experimental Determinations Properties of Strain-Gauge Systems-Types of Strain Gauges – Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base. Introduction to strain rosettes the three elements Rectangular Rosette – The Delta Rosette – Corrections for Transverse Strain Gauge.

UNIT-III

NON–DESTRUCTIVETESTING & BRITTLE COATING METHODS: Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete. Introduction –Coating Stress – Failure Theories –Brittle Coating Crack Patterns – Crack Detection –Types of Brittle Coating – Test Procedures for Brittle Coating Analysis – Calibration Procedures – Analysis of Brittle Coating Data.

UNIT-IV

THEORY OF PHOTOELASTICITY: Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law

UNIT-V

TWO DIMENSIONAL PHOTOELASTICITY: Introduction – Isochramic Fringe patterns- Isoclinic Fringe patterns passage of light through plane Polaris cope and Circular Polaris cope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photo elastic Materials.

Reference Books: -

1. Experimental stress analysis by J.W.Dally and W.F.Riley, College House Enterprises
2. Experimental stress analysis by Dr.Sadhu Singh, khanna Publishers
3. Experimental Stress analysis by U.C.Jindal, Pearson Publications.
4. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers.

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M.Tech III Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B13BT] DESIGN OF PRESTRESSED CONCRETE STRUCTURES

(PROGRAMME ELECTIVE-V)

UNIT-I

INTRODUCTION: Development of pre-stressed concrete –Advantages and Disadvantages of PSC over RCC –General principles of pre-stressing-pre-tensioning and post tensioning –Materials used in PSC-high strength concrete –High tension steel-Different types /methods/systems of pre-stressing.

UNIT-II

Losses of pre-stress: Estimation of the loss of pre-stress due to various causes like elastic shortening of concrete, creep of concrete, shrinkage of concrete, relaxation of steel, slip in anchorage, friction etc.

UNIT-III

Flexure & Deflections: Analysis of sections for flexure in accordance with elastic theory-Allowable Stresses-Design criteria as per I.S code of practice –Elastic design of Beams (rectangular, I and T sections) for Flexure –Introduction to partial pre-stressing. Introduction-Factors influencing deflections-short term and long-term deflections of untracked and cracked members

UNIT-IV

Shear, bond, Bearing and Anchorage: shear in PSC beams –Principal stresses –Conventional elastic design for shear-transfer of pre-stress in pre-tensioned members-transmission length –Bond stresses-bearing at anchorage –Anchorage zone stresses in post-tensioned members-Analysis and design of end blocks by Guyon, Magnel and approximate methods –Anchorage zone reinforcements.

UNIT-V

Statistically indeterminate structures: Introduction –advantages and disadvantages of continuity –Layouts for continuous beams-primary and secondary moments –Elastic analysis of continuous beams-Linear Transformation-Concordant cable profile-Design of continuous beams.

Circular pre-stressing: Introduction –Circumferential pre-stressing Design of Prestressed concrete tanks –vertical pre-stressing in tanks-Dome pre-stressing.

REFERENCE BOOKS:

1. Prestressed Concrete by S. Krishna Raju, TMH Publishers.
2. Prestressed Concrete by S. Ramamrutham, DhanpatiRaiPublications.
3. Prestressed concrete design by Praveen Nagarajan, Pearson Publications.
4. T.Y.Lin, Design of Prestressed Concrete Structures, Asian Publishing house, Bombay, 1953.
5. Y.Guyon, Prestressed Concrete, Vol.I&II, Wiley and Sons, 1960.
6. F.Leohhardt, Prestressed concrete Design and construction, Wilhelm Ernst and Shon, Berlin, 1964.
7. C.E.Reynolds and J.C. Steedman, Reinforced concrete designers' hand book, A view point publication, 1989.
8. Edward P.Nawy, Prentice Hall – Prestressed Concrete.
9. Prestressed Concrete – by Raj Gopal, NarsoaPublications.

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M.Tech III Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B13CT] FRACTURE MECHANICS OF CONCRETE STRUCTURES

(PROGRAMME ELECTIVE-V)

UNIT-I

Summary of basic problems and concepts: Introduction - A crack in a structure - The stress at a crack tip - The Griffith criterion the crack opening displacement criterion - Crack Propagation - Closure

UNIT-II

The elastic crack – tip stress field: The Airy stress function - Complex stress functions - Solution to crack problems - The effect of finite size - Special cases - Elliptical cracks - Some useful expressions

UNIT-III

The crack tip plastic zone: The Irwin plastic zone correction - The Dugdale approach - The shape of the plastic zone - Plane stress versus plane strain - Plastic constraint factor - The thickness effect

UNIT-IV

The energy principle: The energy release rate - The criterion for crack growth - The crack resistance (R Curve) - Compliance, The J integral (Definitions only)

Plane strain fracture toughness: The standard test - Size requirements - Non-Linearity – Applicability

Plane stress and transitional behaviour: Introduction - An engineering concept of plane stress - The R curve concept

UNIT-V

The crack opening displacement criterion: Fracture beyond general yield - The crack tip opening displacement - The possible use of the CTOD criterion

Determination of stress intensity factors: Introduction - Analytical and numerical methods - Finite element methods, Experimental methods (An Ariel views only)

REFERENCES:

- Elementary engineering fracture mechanics-David Broek, Battelle, Columbus laboratories, Columbus, Ohio, USA
- Fracture and Fatigue Control in Structures- John M.Barsom, Senior
- Consultant United states Steel Corporation & Stanley T.Rolfe, Ross H.Forney Professor of Engineering University of Kansas. &Stanley T.Rolfe, Ross H. Forney

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M.Tech III Semester (SE)

Th	Tuto	Lab	Credits
3	0	0	3

[19B13DT] DESIGN OF BRIDGES

(PROGRAMME ELECTIVE-V)

UNIT-I

Introduction – Classification, investigations and planning, choice of type – economic span length – IRC specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.

UNIT-II

Design of box culverts – General aspects – Design loads – Design moments, shears and thrusts – Design of critical section

Design of slab bridges – Effective width of analysis – workings stress design and detailing of slab bridges for IRC loading.

UNIT-III

T-Beam bridges – Introduction – wheel load analysis – B.M. in slab – Pigaud's theory – analysis of longitudinal girders by Courbon's theory working stress design and detailing of reinforced concrete T-beam bridges for IRC loading.

UNIT-IV

Prestressed Concrete Bridges – General features – Advantages of Prestressed concrete bridges – pretensionedPrestressed concrete bridges – post tensioned Prestressed concrete Bridge decks. Design of post tensioned Prestressed concrete slab bridge deck.

Bridge Bearings – General features – Types of bearings – forces on bearings basis for selection of bearings – Design principles of steel rocker and roller bearings and its design – Design of elastomeric pad bearing detailing of elastomeric pot bearings.

UNIT-V

Piers and Abutments – General features – Bed block – Materials for piers and abutments – types of piers – forces acting on piers – Design of pier – stability analysis of piers – general features of abutments – forces acting on abutments – stability analysis of abutments.

Bridge foundations – General Aspects – Types of foundations – Pile foundations – well foundations – caisson foundations.

TEXT/REFERENCES BOOKS:

1. Essentials of bridges engineering – D.Hohnson Victor oxford & IBH publishers co-Private Ltd.
2. Design of concrete bridges MC Aswanin VN Vazrani, MM Ratwani, Khanna publishers.
3. Bridge Engineering – S.Ponnuswamy.
4. BRowe, R.E., Concrete Bridge Design, C.R.Books Ltd., London, 1962.
5. Taylor F.W., Thomson, S.E., and Smulski E., Reinforced concrete Bridges, John wiley and sons, New York, 1955.
6. Derrick Beckett, an Introduction to Structural Design of concrete bridges, surrey University; press, Henley – Thomes, oxford shire, 1973
7. Bakht. Band Jaegar, L.G. Bridge Analysis simplified, McGraw Hill, 1985.
8. Design of Bridges – N. Krishna Raju – Oxford & IBH
9. Design of Bridge structures – FR Jagadeesh, M.A. Jaya Ram – Eastern Economy edition.

AUDIT COURSES
1 & 2

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

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
2	0	0	0

[19B114T] DISASTER MANAGEMENT

Course Objectives:

Upon the completion of subject student will be able to-

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

UNIT I:

Disaster classification

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

UNIT II:

Repercussions of Disasters:

Economic damage, loss of human and animal life, destruction of ecosystem

Disaster Prone Areas in India:

Study of seismic zones; areas prone to floods and droughts, landslides and Avalanches; areas proneto cyclonic and coastal hazards with special reference to tsunami

UNIT III:

Disaster Preparedness and Management

Preparedness: monitoring of phenomena triggering a disaster or hazard;

Evaluation of risk:

Application of remote sensing, data from meteorological and Other agencies, media reports: governmental and community preparedness.

UNIT IV:

Risk Assessment

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

Audit Course I (I Year I Semester) M.Tech. Structural Engineering (R-18)

UNIT V

Disaster Mitigation

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

Course Outcomes

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

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

Text Books

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

References

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

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M.Tech II Semester (SE)

Th	Tuto	Lab	Credits
2	0	0	0

[19BC21T] ACADEMIC AND RESEARCH REPORT WRITING

Section 1: Introduction
- Introduction to Academic & Research Report writing
- The language of Academic & Research Reports
- Thesis and Research Paper writing – A brief

Section 2: Tools and Techniques
- Introduction to Computer Aided Text Processing
- Basic Document Preparation with Latex- Part 1
- Basic Document Preparation with Latex- Part 2
- Writing Mathematical Equation with Latex
- Writing Symbolic Expression with Latex
- Preparing Tables in a Document with Latex
- Inserting Figures in a Document with Latex

Section 3: Thesis Writing-I
- Layout of the Thesis
- Contents Prior to the Chapters
- Preparation of Abstract
- Introduction section for a Thesis
- Literature review for a Thesis

Section -4: Thesis Writing-II
- Computational methodology/Experimental details
- Preliminary studies for a Thesis
- How to write Results and Discussion for a Thesis part – I
- Data Analysis (How to write Results and Discussion for a Thesis part –I
- Writing Conclusions, References and other information for a thesis

Section-5: Research Paper Writing
- Writing a Research Paper
- The Structure of a Research paper
- Abstract for a Paper
- Introduction and Methodology sections for a Paper
- How to Incorporate Figure, Tables, Equations in a Research Paper
- How to write Results and Discussion, Conclusion sections for a Paper
- Different formats for referencing
- Ways of communicating a Research Paper

Section 6: Academic and Research Report Presentation

Section 7: Mini Project on Thesis Writing (with presentation)

Section 8: Mini project on Research Paper writing (with presentation)

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M.Tech I Semester (SE)

	Th	Tuto	Lab	Credits
	2	0	0	0

[ ] SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

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

UNIT-1

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

UNIT-2

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

UNIT-3

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

Suggested Reading

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

1. Understanding basic Sanskrit language

2. Ancient Sanskrit literature about science & technology can be understood

3. Being a logical language will help to develop logic in students

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M.Tech I Semester (SE)

	Th	Tuto	Lab	Credits
	2	0	0	0

[ ] VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development

2. Imbibe good values in students

3. Let the should know about the importance of character.

UNIT-1

- 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-2

- 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-3

- 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-4

- 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.

Suggested reading

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

Course outcomes

Students will be able to

1. Knowledge of self-development

2. Learn the importance of Human values

3. Developing the overall personality

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M.Tech I Semester (SE)

Th	Tuto	Lab	Credits
2	0	0	0

[ ] CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

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

UNIT-1

History of Making of the Indian Constitution:

History

Drafting Committee, (Composition & Working)

UNIT-2

Philosophy of the Indian Constitution:

Preamble

Salient Features

UNIT-3

- **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-4

- **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

UNIT-5

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

UNIT-6

- **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.

Suggested reading

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.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

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M.Tech I Semester (SE)

	Th	Tuto	Lab	Credits
	2	0	0	0

[ ] PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

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

UNIT-1

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-2

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

UNIT-3

- 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-4

- 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-5

Research gaps and future directions

- Research design
- Contexts

- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of

Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

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M.Tech I Semester (SE)

	Th	Tuto	Lab	Credits
	2	0	0	0

[ ] STRESS MANAGEMENT BY YOGA

Course Objectives

1. To achieve overall health of body and mind

2. To overcome stress

UNIT-1

Definitions of Eight parts of yog. (Ashtanga)

UNIT-2

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-3

ASAN AND PRANAYAM

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

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

Suggested reading

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

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also

2. Improve efficiency

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M.Tech I Semester (SE)

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	2	0	0	0

[ ] PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

1. To learn to achieve the highest goal happily

2. To become a person with stable mind, pleasing personality and determination

3. To awaken wisdom in students

UNIT-1

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-2

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

UNIT-3

- 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

Suggested reading

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

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

OPEN ELECTIVES

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Wireless Communications
7. Energy Conservation

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[19OEP303] BUSINESS ANALYTICS

Course objective:

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

UNIT-I: INTRODUCTION TO BUSINESS ANALYTICS

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

UNIT-II: STATISTICS FOR BUSINESS ANALYTICS

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

UNIT-III: PREDICTIVE ANALYTICS METHODS.

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

UNIT-IV: SIMULATION, RISK ANALYSIS AND DATA MINING

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

UNIT-V: DECISION ANALYSIS

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

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

Course Outcomes:

At the end of this course students will be able to

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

Textbooks:

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

References:

1. AlbrightC.S.,WinstonWayneL.andZappeC.J(2009). DecisionMakingUsingMicrosoft Excel (India Edition). Cengage Learning.

2. Evans J. R (2013). Business Analytics Methods, Models and Decisions. Pearson, Upper Saddle River, New Jersey.

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3	0	0	3

[19OEP302] INDUSTRIAL SAFETY

Course Prerequisites: None

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

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

References:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.

2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.

4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

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3	0	0	3

[19OEP303] OPERATIONS RESEARCH

Course Prerequisites: None

UNIT-I

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

UNIT-II

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

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

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

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

Course Outcomes

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

References

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

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3	0	0	3

[19OEP304] COST MANAGEMENT OF ENGINEERING PROJECTS

Course Prerequisites: None

UNIT-I:

Introduction and Overview of the Strategic Cost Management Process

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

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

References

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

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3	0	0	3

[19OEP305] COMPOSITE MATERIALS

Course Prerequisites: None.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

MANUFACTURING OF POLYMER MATRIX COMPOSITES: Preparation of Moulding compound sand prepregs - hand layup method - Autoclave method - Filament winding method - Compression moulding - Reaction injection moulding. Properties and applications.

UNIT-V

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

Text Books

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

References

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

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3	0	0	3

[19OEP306] WASTE TO ENERGY

Course Prerequisites: None

UNIT-I

INTRODUCTION TO ENERGY FROM WASTE: Classification of waste as fuel - Agro based, Forest residue, Industrial waste - MSW - Conversion devices - Incinerators, gasifiers, digestors \

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

BIOGAS: Properties of biogas (Calorific value and composition) - Biogas plant technology 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-Biodiesel production - Urban waste to energy conversion - Biomass energy programme in India.

References

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