DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE AND SYLLABUS
(1ST – 4TH SEMESTER)

FOR

M. TECH PROGRAMME

SPECIALISATION

IN

STRUCTURAL ENGINEERING
(EFFECTIVE FROM 2010-11)

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY
(FORMLY, UNIVERSITY COLLEGE OF ENGINEERING)
BURLA – 768 018, SAMBALPUR, ODISHA

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY: BURLA
CIVIL ENGINEERING DEPARTMENT
Curriculum for M.TECH –STRUCTURAL ENGINEERING(REGULAR)

First (Autumn) Semester: -

Sub No.	Subjects	L	T	P	C
	Advanced Structural Analysis	3	1	0	4
	Advanced Reinforced Concrete Design	3	1	0	4
	Finite Element Method in Structural Engineering	3	1	0	4
	Elective – I(Group – A)	3	1	0	4
	Elective – II(Group – A)	3	1	0	4
	CAD Lab.	0	0	4	4
	Seminar – I	0	0	3	2
	Comprehensive Viva Voce-I				2
	Total =	15	5	7	28

Second (Spring) Semester: -

Sub No.	Subjects	L	T	P	C
	Advanced Design of Steel Structures	3	1	0	4
	Civil Engineering Materials	3	1	0	4
	Structural Dynamics	3	1	0	4
	Elective – III (Group – B)	3	1	0	4
	Elective - IV(Group – B)	3	1	0	4
	Structural Engineering Lab.	0	0	4	4
	Seminar – II	0	0	3	2
	Comprehensive Viva Voce-II				2
	Total =	15	5	7	28

Third (Project) Semester :-

Sub No.	Subjects	L	T	P	C
	Dissertation interim evaluation				10
	Comprehensive Viva				3
	Seminar on Dissertation				2
	Total =				15

Fourth (Project) Semester:-

Sub No.	Subjects	L	T	P	C
	Dissertation Open Defense				5
	Dissertation evaluation				20
	Total =				25

Grand Total = 96

Electives in Group – A

1. Theory of Elasticity and Plasticity
2. Composite Materials and Structures
3. Structural Connections and Composite Structures
4. Concrete Mechanics
5. Construction Management
6. Numerical Methods in Structural Engineering
7. Development of Human Resources
8. Construction Methods and Equipments

Electives in Group- B:-

1. Bridge Engineering
2. Theory of Elastic Stability
3. Theory of Plates and Shells
4. Prestressed Concrete
5. Tall Structures
6. Recent Advances in Construction Materials
7. Earthquake Analysis and Design
8. Structural Optimization
9. Project Engineering and Management.

ADVANCED STRUCTURAL ANALYSIS (3-1-0)

Module I

Matrix methods of structural analysis: Introduction, equilibrium, static and kinematic indeterminacy, kinematics, virtual work, concepts of stiffness and flexibility, analysis by displacement and force methods.

Module II

Application of flexibility method to beams and plane trusses

Module III

Application of stiffness method to beams, plane frames and plane trusses.

Module IV

Application of stiffness method to space truss, space frames and grids, basic concepts associated with computer implementation of stiffness method.

References:

1. H.C.Martin," Introduction to Matrix Methods of Structural Analysis.
2. M.B.Kanchi, "Matrix Methods of Structural Analysis", New Age International Publishers, New Delhi
3. G. Pandit & S. Gupta, "Structural Analysis, A Matrix Approach", Tata McGrawhill, New Delhi
4. Bhavikatti, "Matrix Methods of Structural Analysis", IK International Pvt Ltd

FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING (3-1-0)

Module I

Introduction: The Continuum, Equations of Equilibrium, Boundary Conditions, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems, Different methods of structural analysis including numerical methods. Basics of finite element method (FEM), different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach, Weighted residual Method.

Module II

One and Two Dimensional Problems: Detail formulation including shape functions. stress strain relations, strain displacement relations and derivation of stiffness matrices using energy approach,

Assembling of element matrices, application of displacement boundary conditions, Numerical solution of one dimensional problems using bar, truss, beam elements and frames. Derivation of shape function using Lagrange's interpolation, Pascal's triangle, Convergence criteria. Finite Element modeling of two dimensional problems using Constant strain Triangle(CST) elements, Stress strain relations for isotropic and orthotropic materials, Four nodded rectangular elements, axisymmetric solids subjected to axisymmetric loading.

Module III

Isoparametric Elements: Natural coordinates, isoparametric elements, four node, eight node elements. Numerical integration, order of integration.

Module IV

Plate Bending: Bending of plates, rectangular elements, triangular elements and quadrilateral elements, Concept of 3D modeling.

References

1. C.S. Desai and J.F. Abel, Introduction to the Finite Element Method: CBS Publishers
2. R. D. Cook., Concepts and Applications of Finite Element Analysis , Wiley.
3. O. C Zienkiewicz .and R. L. Taylor, Finite Element Method, Mc Graw Hill
4. C. S. Krishnamoorthy, Finite Element analysis-Theory and Programming, Tata Mc Hill.

ADVANCED REINFORCED CONCRETE DESIGN (3-1-0)

(Relevant IS codes are permitted in Examination)

Module I

Design of reinforced concrete structures: Methods of design, working stress design (WSD) and limit state design (LSD), Review in brief of LSD-flexure, axial-flexure, shear and torsion, Estimation of crack width and deflection of reinforced concrete beams.

Module II

Analysis and design of building frames subjected to wind load; Earthquake forces and structural response.

Module III

Ductility of reinforced structures; material ductility-steel and concrete, section ductility, member ductility, structural ductility, ductile detailing of reinforced concrete frames for seismic forces.

Module IV

Design of deep beams, Design of concrete shear walls.

References:

1 R Park and T Paulay," Reinforced Concrete Structures", John Wiley & Sons
2 P.C. Varghese, "Advanced Reinforced Concrete Design", PHI, 2nd Edition, 2002
3. A.K. Jain, "Reinforced Concrete: Limit State Design", Nemchand and Bros, 1999

ADVANCED DESIGN OF STEEL STRUCTURES (3-1-0)

(Relevant IS codes are permitted in Examination)

Module I

Limit States Design of Steel Members: Uncertainties in load and resistance; Limit States and Load and Resistance Factor Design methods

Module II

Stability criteria: stability of beams – local buckling of compression flange & web, lateral-torsional buckling, stability of columns -slenderness ratio of columns, local buckling of flanges and web, bracing of column about weak axis, method of design - allowable stress design, plastic design, load and resistance factor design;

Module III

Strength Criteria: beams –flexure, shear, torsion, columns – moment magnification factor, effective length, P-M interaction, bi-axial bending, joint panel zones;

Module IV

Drift criteria: P-Ä effect, deformation-based design; Connections: types – welded, bolted, location – beam column, column-foundation, splices.

References

1. M Bill Wong, ‘Plastic analysis and design of steel structures’,
2. N Subramanian, ‘Design of steel structures’
3. M Bruneau, CM Uang and SER Sabelli, ‘Ductile design of steel structures’

CIVIL ENGINEERING MATERIALS (3-1-0)

Module I

Cement: Portland cement, chemical composition, hydration of cement, structure of hydrated cement, mechanical strength of cement gel, water held in hydrated cement paste and heat of hydration, cements of different types.

Module II

Concrete: Factors affecting the strength of concrete, elasticity, shrinkage and creep of concrete; durability of concrete, permeability of concrete, chemical attack of concrete, air-entrained concrete and thermal properties of concrete, mechanical test of hardened concrete, light weight and high density concrete.

Module III

Mix design, statistical quality control, fibre reinforced concrete

Module IV

Metals: True stress-strain curve for mild steel in simple tension. Theories of failure and yield surfaces, Fatigue properties, Nature of fatigue failure, fatigue strength for completely reversed stresses, factors influencing fatigue strength, Temperature and Creep properties, Low temperature properties, high temperature properties, creep-stress-time-temperature relations for simple tension, and mechanics of creep in tension.

References

1. A.M. Neville, J.J. Brooks, Concrete Technology, Low Priced Edition, Pearson Education, 2004.
2. A J Martin, Mechanical behavior of engineering materials.
3. S P Timoshenko, Strength of materials- Part II
4. M. S. Shetty, Concrete technology- Theory & Practice, S.Chand & Company New Delhi, 2005

STRUCTURAL DYNAMICS (3-1-0)

Module I

Oscillatory motion; harmonic motion, periodic motion, vibration terminology, Single degree of freedom system; equation of motion, damped and undamped free vibration, response to harmonic, periodic, impulse load and general dynamic load, Duhamel's integral, vibrating measuring instruments.

Module II

Multi-degrees of freedom system: equation of motion, free vibration analysis, dynamic response and modal analysis.

Module III

Normal mode vibration of continuous beams, vibrating beams, vibrating strings, longitudinal vibration of rods, torsional vibration of rods, Euler equation for beams, effect of rotary inertia and shear deformation

Module IV

Random vibrations, random phenomena, time averaging and expected value, frequency response function.

References

1. WT Thomsen, 'Theory of vibration', CBS Publications
2. R.W. Clough and J. Penzien, 'Dynamics of Structures', McGraw-hill Inc
3. M. Paz, 'Structural Dynamics- Theory and Computation', Van Nostrand, 1985
4. A.K. Chopra, 'Dynamics of Structures: Theory and Applications to Earthquake Engineering, Printice Hall of India
5. M. Mukhopadhyay, 'Structural Dynamics Vibrations & Systems, Ane Books India.

THEORY OF ELASTICITY AND PLASTICITY (3-1-0)

Module- I

Linear elasticity; stress, strain, constitutive relations, strain displacement relations, Equilibrium and compatibility equations, stress and displacement functions,.Two dimensional problems in cartesian and polar coordinates. description of an elasticity problem as a boundary value problem, bending of beams- cantilever and simply supported beam, stress distribution for axisymmetric problems, pure bending of curved bars, effect of circular holes on stress distributions in plates.

Module- II

Stress and strain in three dimensions: Principal stresses, maximum shearing stress, principal axes of strain. Stretching of prismatical bar by its own axis. Elementary problems of elasticity in three dimension.

Module- III

Torsion of non-circular prismatic bars. Saint Venant's theory. Various analogies. Torsion of hollow and thin section. Application of energy methods.

Module- IV

Introduction to the theory of plasticity., the yield criteria of metals, stress space representation of yield criteria. stress-strain relations plastic potential, flow rules and maximum work hypothesis. Two dimensional plastic flow problems. Incompressible two dimensional flow, stresses in plastic materials in condition of plane strain, equation of equilibrium the simplest slip-line fields.

References

1. S P Timoshenko and J N Goodier, Theory of Elasticity, Mc Graw Hill
2. Hoffman and Sachs, Theory of plasticity
3. W. Johnson and P B Meller, Plasticity of Mechanical Engineers
4. C.R. Calladine, 'Plasticity for Engineers', Ellis Herwood, Chichester, U.K., 1985
5. M. Kachanov, 'Theory of Plasticity', MIR Publication.

COMPOSITE MATERIALS AND STRUCTURES (3-1-0)

Module I

Classification and characteristics of Composite Materials, advantages and limitations,

Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotropy, Orthotropy and Anisotropy; Characteristics and configurations of lamina, laminate, micromechanics and macromechanics, Constituent materials and properties.

Module II

Elastic behavior of unidirectional lamina, Strength of unidirectional lamina, Macromechanical failure theories: Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu).

Module III

Elastic Behaviour of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties.

Module IV

Bending of laminated plates: Governing equations, Deflection of simply supported rectangular symmetric angle-ply, specially orthotropic, antisymmetric cross-ply laminates.

References

1. RM Jones, ‘Mechanics of Composite Materials’, McGraw-Hill Book Company
2. IM Daniel and O Ishai, ‘Engineering mechanics of composite materials,’ Oxford university press
3. PK Mallick, ‘Fiber-reinforced composites’, Marcel Dekker inc
4. D Hull and TW Clyne, ‘An introduction to composite materials’, Cambridge University Press
5. JN Reddy, ‘Mechanics of laminated composite plates and shells: theory and analysis’, CRC Press.

STRUCTURAL CONNECTIONS AND COMPOSITE STRUCTURES (3-1-0)

Module I

Joints in reinforced concrete frame works, portals and gables, beam-column and column-slab joints, connection between prefabricated units.

Module II

Analysis of framed, seated and continuous beam to column connections in steels structures, shear transfer in square knees, straight haunched knees.

Module III

Steel-concrete composite structures: design philosophy, shear connection, simply supported composite beams and slabs. Continuous composite beams,

Module IV

Elastic and inelastic design considerations. Composite column and frames, Design of beam-column joints and rigid joints jointed composite frames. Concrete infilled thin walled closed steel sections; FRP composites.

References

CONCRETE MECHANICS (3-1-0)

Module I

Introduction: Rheological modeling of fresh concrete, constitutive equations, nonlinear elasticicity, plasticity, viscoelasticity and fracture mechanics of hardened concrete, confinement and ductility, moisture diffusion, drying shrinkage,

Module II

Solid and structural mechanics of reinforced concrete,

Module III

Skew bending, modified compression field and unified theories of RC beams under bending, shear and torsion, bond slip and phenomenon of cracking in reinforced concrete,

Module IV

Statical and dynamic analysis of RC structures, Trends.

References

CONSTRUCTION MANAGEMENT (3-1-0)

Module- I

Introduction: Foundations of Project Management, Project Life Cycle, The Project Environment, Project Selection, Project Proposal, Project Scope, Work Breakdown Structure.

Module- II

Network Scheduling, Critical Path Method, Program Evaluation & Review Technique, Planning and Scheduling of Activity Networks, Assumptions in PERT Modelling, Time-cost Trade-offs, Linear Programming and Network Flow Formulations, PERT/COST Accounting.

Module- III

Scheduling with limited resources, Resource Planning, Resource Allocation, Project Schedule Compression, Project Scheduling Software, Precedence Diagrams, Decision CPM, Generalized Activity Networks, GERT.

Module- IV

Estimation of Project Costs, Earned Value Analysis, Monitoring Project Progress, Project Appraisal and Selection, Recent Trends in Project Management.

References

1. R.L. Peurify, 'Construction planning, Equipments and Methods', Tata Mc Grawhill
2. B. Sengupta & H Guha, 'Construction management and planning', Tata Mc Grawhill
3. M Verma, 'Construction planning and management'
4. L.S. Srinath, 'PERT & CPM', East-West Press
5. S.S. Rao, 'Optimization', Tata McGrawhill

NUMERICAL METHODS IN STRUCTURAL ENGINEERING (3-1-0)

Module- I

Introduction to digital computers & Programming - an overview; Errors - polynomial approximations and interpolations - Numerical differentiation & Integration;

Module- II

Matrices - Eigenvalues and Eigenvectors - nonlinear equations

Module- III

Harmonic and biharmonic equations - solutions, convergence, completeness & stability. Finite Difference scheme - Implicit & Explicit scheme.

Module- IV

Special topics: Theory of computations, Computational complexities, B.E.M., Glimpses of Fuzzy, Neural Network, Fractal theory, surface fitting.

References

DEVELOPMENT OF HUMAN RESOURCES (3-1-0)

Module- I

Nature and scope of Human Resource Development, Training and Development,

Module- II

Human Process Intervention; T-Group, Team Building, Survey Feedback, Intergroup Realtions, Quality of Work Life,

Module- III

HR Interventions: Goal Setting, Career Development, Stress Management, Time Management; Contemporary Issues in HRD: Quality Circle,

Module- IV

Total Quality Management, ISO 9000, empowerment, Business Process Reengineering.

References

BRIDGE ENGINEERING (3-1-0)

Module- I

Introduction, historical review, engineering and aesthetic requirements in bridge design. Introduction to bridge codes. Economic evaluation of a bridge project. Site investigation and planning;. Scour - factors affecting and evaluation.

Module- II

Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures; Superstructure - analysis and design of right, skew and curved slabs. Girder bridges - types, load distribution, design. Orthotropic plate analysis of bridge decks.

Module- III

Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges. Methods of construction of RC Bridges

Module- IV

Prestressed concrete bridges and steel bridges, Fabrication, Lounching & creation, Design and construction of construction joints (use of relevant codes of practice are permitted in the examination).

References

1. Jacoby and Davis, 'Foundation of Bridges and Buildings',
2. Road bridges- IRS Sec-I, II, III
3. Dunhan, 'Foundation of Structures'
4. Concrete association of India, 'Concrete Bridges',
5. Tylor, Thomson and Smulki, 'RC Bridges',
6. IRS Codes of Practice for Railway bridges

THEORY OF ELASTIC STABILITY (3-1-0)

Module I

Buckling of elastic columns and frames (bending theory, differential equation of beam-columns, critical load of perfect columns with various end restraints, imperfect columns and Southwell plot, prestressed columns, buckling of continuous beams and frames, stiffness and flexibility matrices for beam-columns, post critical behaviour of frames).

Module II

Energy Methods (Potential energy for discrete elastic systems, bifurcation buckling at small deflections, Koiter's theory, imperfection sensitivity, indirect variation method and Euler equation, Raleigh quotient). Thin walled beams, plates and shells (potential energy and differential equations, axial torsional buckling of columns, lateral buckling of beams and arches, buckling of beams with arbitrary open cross section, buckling of rectangular plates and axi-symmetric cylindrical shells).

Module III

Introduction to inelastic buckling (perfect columns/structuresShanley's bifurcation, imperfect columns, visco-elastic buckling).

Module IV

Dynamic analysis and stability (vibration of columns or frames and divergence, non-conservative loads-follower forces, theorems of Lagrange-Dirichlet and Liapunov, stability of dynamic system, thermodynamic criteria of stable state and path, Drucker's and Illushin's postulate for stable materials).

References

1. Timoshenko, S.P., and Gere, J.M., Theory of Elastic Stability, McGraw Hill Intl Edition.
2. Simitses, G.J., and Hodges, D.H., Fundamentals of Structural Stability, Elsevier Inc.
3. Bazant, Z.P., and Cedolin, L., Stability of Structures, Dover Publications.

THEORY OF PLATES AND SHELLS (3-1-0)

Module I

Plates: Pure bending of plates, Slope and curvature of slightly bent plates, relationship between moment and curvature, strain energy in bending of plates

Module II

Energy Differential equations for symmetrical bending of circular plates under lateral loads. Uniformly loaded, concentrically loaded and loaded at the center of simply supported and fixed circular plates. Differential equation of the deflection surface and boundary conditions of laterally loaded rectangular plates by classical theory, Solutions of simply supported rectangular plates due to sinusoidal loads, uniformly distributed loads and concentrated load by Navier's Solution, Levy approach

Module III

Shells: Membrane theory of symmetrical loaded shells of revolution, Spherical shells, conical shells, Membrane theory of cylindrical shells and shells of Double curvature such as Hyperbolic paraboloids and elliptic paraboloids, conoids

Module IV

Circular cylindrical shells loaded symmetrically with respect to its axis, particular cases of symmetrical deformation of circular cylindrical shells, cylindrical tanks of uniform wall thickness

References

1. SP Timoshenko and SW Krieger, 'Theory of Plates and Shells'
2. OP Billington, Thin shell structures
3. E Ventsel and T Krauthammer, 'Thin Plates and Shells: Theory, Analysis & Applications', CRC, 1st edition, 2001
4. M.H Jawad, 'Theory and design of plate and shell structures', Kluwer Academic Publications
5. P.L. Gould, 'Analysis of shells and plates', Pearson Higher Education

PRESTRESSED CONCRETE (3-1-0)

(Relevant IS Codes are permitted in the examination)

Module I

Different systems of prestressing, Characteristics of concrete and steel, Other suitable materials, Losses in prestress, Analysis and design of section for flexure, shear and torsion, Design of flexural member, Limit state design as per IS code

Module II

Deflection of prestressed structures- short term as well as long term deflections of uncracked and cracked members

Module III

Stress distribution in end-block of post tensioned section, Magnel's method, Guyen's method, Rowe's method and IS code method

Module IV

Indeterminate structures- Principles of design of prismatic continuous beams of two equal, unequal spans with same and variable moments of inertia, Cap cable, Design concept of concordancy of cable, Secondary design consideration. Design of Pre-tensioned and post-tensioned beam

References

1. EW Bennet,'Prestressed concrete theory & design', Chapman & Hall, London-1962
2. TY Lin & H Burns Ned, 'Design of prestressed concrete structures', John Wiley & Sons, New York, 1982
3. N Krishnaraju, 'Prestressed concrete', Tata Mc-Grawhill, New Delhi- 2004
4. SK Mallik & AP Gupta, 'Prestressed concrete', Oxford & IBH, New Delhi 1988

TALL STRUCTURES (3-1-0)

Module I

Structural systems and concepts. Matrix and approximate methods, analysis of tall building frames, lateral load analysis, multi bay frames, gravity loads, settlement of foundation.

Module II

Foundation-superstructure interaction. Earthquake effects and design for ductility. Analysis of shear walls - plane shear walls, infilled frames, coupled frames, frames with shear walls.

Module III

Principle of three dimensional analysis of tall buildings; Perforated cores, pure torsion in thin tubes, bending and warping of perforated cores.

Module IV

Analysis of floor system in tall buildings, Vierendal girders, diagrid floors, elastic stability of frames and shear walls. Analysis of thermal stresses.

References

RECENT ADVANCES IN CONSTRUCTION MATERIALS (3-1-0)

Module I

Foams and light weight materials, fibre reinforced concrete, types of fibres, workability, mechanical and physical properties of fibre reinforced concrete, Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, concrete at high temperature, high strength concrete, changes in concrete with time

Module II

Corrosion of concrete in various environments, corrosion of reinforcing steel, electro chemical process, measures of protection, ferro cement, material and properties,

Module III

Polymers in civil engineering, polymers, fibres and composites, fibre reinforced plastic in sandwich pancels, modeling, architectural use and aesthetics of composites,

Module IV

Adhesives and sealants, structural elastomeric bearings and resilient seating, moisture barriers, polymer foams and polymers in building physics, polymer concrete composites.

References

EARTHQUAKE ANALYSIS AND DESIGN (3-1-0)

Module I

Characteristics of earthquakes; Earthquake response of structures; Seismology, seismic risk and hazard, Soil dynamics and seismic inputs to structures, Characterization of ground motion; lateral load calculation, base shear

Module II

Earthquake intensity and magnitude; Recording instruments and base line correction; Predominant period and amplification through soil; Response spectrum, analysis, Spectral analysis,

Module III

Idealization of structural systems for low, medium and high rise buildings; Nonlinear and push over analysis, Dynamic soil-structure interaction. Earthquake design philosophy,

Module IV

Concept of earthquake resistant design; Code provisions of design of buildings; Reinforcement detailing for members and joints, retrofitting and strengthening of structures, concept of base isolation design and structural control.

References:

1. Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition, 1992
2. Earthquake Resistant Design: Shrikhandee & Agarwal-PHI Publ
3. Newmark N.M. and Rosenblueth E., 'Fundamentals of Earthquake Engg.', Prentice Hall, 1971.
4. David Key, 'Earthquake Design Practice for Buildings', Thomas Telford, London, 1988.
5. Wiegel R.L., 'Earthquake Engg.', Prentice Hall, 1970.
6. Blume J.A., Newmark N.M., Corning L.H., 'Design of Multi-storied Buildings for Earthquake ground motions', Portland Cement Association, Chicago, 1961.
7. Proc. World Conferences on Earthquake Engg., 1956-1992.
8. I.S. Codes No. 1893, 4326, 13920 etc.

CONSTRUCTION METHODS AND EQUIPMENTS (3-1-0)

Module I

Factors affecting selection of equipments-technical and economic, construction engineering fundamentals,

Module II

Analysis of production outputs and costs,

Module III

Characteristics and performances of equipments for earth moving, erection, material transport, pile driving, dewatering,

Module IV

Concrete construction (including batching, mixing, transport and placement) and tunneling.

References

STRUCTURAL OPTIMIZATION (3-1-0)

Module I

Basic concepts, Kuhn-Tucker conditions, linear and nonlinear programming,

Module II

Integer programming, geometric programming, dynamic programming, stochastic programming,

Module III

Genetic algorithms, simulated annealing, concepts of homogenization.

Module IV

Applications in the design of reinforced concrete and steel- beams, columns, frames and plates. Treatment of shape and topology variables. Introduction to Structural Control.

References

1. Arora, J.S., Introduction to Optimization, McGraw Hill, Intl Edn, 1989.
2. Rao, S.S., Optimization: Theory and Applications, Wiley Eastern, 1992.

PROJECT ENGINEERING AND MANAGEMENT. (3-1-0)

Module I

Introduction: Foundations of Project Management, Project Life Cycle, The Project Environment, Project Selection, Project Proposal, Project Scope, Work Breakdown Structure.

Module II

Network Scheduling, Critical Path Method, Program Evaluation & Review Technique, Planning and Scheduling of Activity Networks, Assumptions in PERT Modelling, Time-cost Trade-offs, Linear Programming and Network Flow Formulations, PERT/COST Accounting.

Module III

Scheduling with limited resources, Resource Planning, Resource Allocation, Project Schedule Compression, Project Scheduling Software, Precedence Diagrams, Decision CPM, Generalized Activity Networks, GERT.

Module IV

Estimation of Project Costs, Earned Value Analysis, Monitoring Project Progress, Project Appraisal and Selection, Recent Trends in Project Management.

References

CAD LABORATORY (0-0-3)

Introduction to computer aided design and drafting.

Applications to structural engineering problems using commercial software. Individual / group projects

STRUCTURAL ENGINEERING LABORATORY-I (0-0-3)

Instruments, Properties of fresh & hardened concrete - Concrete mix design Tests on RC beam, Prestressed beam, RC slabs, RC column, Steel beam, Steel column;

NDTS - Application of acoustic emission instrument, ultrasonic test.

Biaxial and multiaxial testing. Steel-concrete composite,

Tests on fibre reinforced concrete composites. Individual/group projects.