REGULATION 2018

COURSE STRUCTURE

SYLLABUS



STRUCTURAL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

(Affiliated to Biju Patnaik University of Technology, Rourkela)

Accredited by NAAC with 'A' Grade with a CGPA of 3.28/4.00
Accredited by NBA

2 Year M.Tech Degree Programme

Regulation 2018

Vision of the Department:

To impart knowledge and excellence in Civil Engineering and Technology with global perspective and to make them ethically strong engineers to build the nation and to achieve standards of quality education with keeping in pace with rapidly changing in technology.

Mission of the Department:

- To impart latest technical knowledge of Civil Engineering with the state of art infrastructure and training methods.
- To provide global competency in the field of structural engineering with interface computer applications like Staad-Pro, AutoCAD etc.
- To make the students industry ready/suitable and to supplement the growth of the nation.

Programme Educational Objectives:

PEO-1:
To achieve a high level of technical expertise to shine in higher education / profession by obtaining knowledge in basic sciences, design and drawing and engineering principles

PEO-2:
To explore and apply the modern engineering tools for planning, design, execution and maintenance of works that is technically viable, economically and socially acceptable

PEO-3:
To develop good communication skills, team work in their responsibilities with excellence and to be ready to take up challenges in the current scenario

Programme Specific Outcomes:

1. ***PSO1:*** Analyze, Design, Construct, Maintain and Operate infrastructural projects
2. ***PSO 2:*** Assess the environmental impact of various projects and take required measures to curb environmental deterioration
3. ***PSO 3:*** Able to use latest software pertaining to various streams of Civil Engineering.

PROGRAM OUTCOMES

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage e in independent and life-long learning in the broadest context of technological change.

FIRST YEAR

FIRST SEMESTER					
		Theory		Practical	
CODE	COURSE NAME	Hours/ Week (L/T)	Credit Theory	Hours / Week (L)	Credit Practical
MSEPC1010	Theory of elasticity and plasticity		4	-	-
MSEPC1020	Elastic stability and behavior of metal structures		4	-	-
MSEPC1030	Matrix methods of analysis of structures		4	-	-
MSEPE1041	Bridge engineering		3	-	-
MSEPE1042	Advance Construction Materials				
MSEPE1051	Earthquake Resistant Design Of Structures		3	-	-
MSEPE1052	Tall Structures				
MSEPE1053	Theory of Plates and Shells				
PRACTICAL					
MSEES1160	Structural Engineering Laboratory	-	-	1	2
MSEES1170	Cad Laboratory	-	-	1	2
	TOTAL	**15**	**18**	**4**	**4**
	TOTAL CREDITS: 22				

SECOND SEMESTER					
		Theory		Practical	
CODE	COURSE NAME	Hours/ Week	Credit	Hours /	Credit
		(L/T)	Theory	Week (L)	Practical
MSEPC2010	Advanced Reinforced Concrete Design.	3-1	4	-	-
MSEPC2020	Structural Dynamics	3-1	4	-	-
MSEPE2031	Finite Element Analysis of Structures	3-0	3	-	-
MSEPE2032	Composite Structures				
MSEPE2041	Structural Optimisation	3-0	3	-	-
MSEPE2042	Advanced Steel Structures				
MSEPE2043	Soil Dynamics and Geotechnical Earthquake Engineering				
MSEPE2051	Infrastructure Engineering and Transportation Planning	3-0	3	-	-
MSEPE2052	Wind Engineering				
MSEES2160	Earthquake Eesistant Design and Detailing of Structures laboratory	-	-	1	2
MSEES2170	Comprehensive viva voce I			1	2
MSEES2180	Technical seminar			1	2
	TOTAL	**15**	**17**	**3**	**6**
	TOTAL CREDITS: 23				

SECOND YEAR

THIRD SEMESTER					
		Theory		Practical	
Code	Course name	Hours/Week (L/T)	Credit Theory	Hours / Week (L)	Credit Practical
MSEOE3011	Project Management And Costing	3-1	4	-	-
MSEOE3012	Project Planning And Construction Management			-	-
MSEOE3013	Human Resource Management			-	-
MSEES3120	Thesis part I	-	-	-	18
MSEES3130	Comprehensive viva voce II	-	-	-	2
	TOTAL	**3**	**4**		**20**
	TOTAL CREDITS: 24				

FOURTH SEMESTER					
		Theory		Practical	
CODE	COURSE NAME	Hours/Week (L/T)	Credit Theory	Hours / Week (L)	Credit Practical
MSEES4110	Seminar II	-	-	-	18
MSEES4120	Thesis II				2
MSEES4130	Comprehensive viva voce II	-	-	-	2
	TOTAL				**22**
	TOTAL CREDITS: 22				

1ST SEMESTER

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPC1010	**THEORY OF ELASTICITY AND PLASTICITY**	**3**	**1**	**0**	**4**	**A**

Pre -Requisite: Basics of Mechanics

Course Outcome

CO1	Explain the concept of elasticity, and the difference between stress and strain
CO2	Explain the terms: isotropic, orthotropic and anisotropic, as applied to materials
CO3	Conduct the transformation of plane stress or plane strain components using Mohr's circle, the method of eigen values and eigenvectors, the method of quadratic form of ellipsoids, and the method of stress or strain trajectories
CO4	Use the concepts of principal stress and principal strains

UNIT:1 **13 Hours**

Linear elasticity; stress, strain, constitutive relations, strain displacement relations, three dimensional stress and strain analysis, compatibility, stress and displacement functions.

UNIT: 2 **12 Hours**

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.

UNIT: 3 **13 Hours**

Elements of plasticity, failure & yield criterion, Equations of plasticity, plastic stress-strain relations

UNIT: 4 **13 Hours**

flow rule, velocity field, slip lines and plastic flow, incremental plasticity.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/

Books:

(1) S.P. Timoshenko & J.N.Goodier,"Theory of Elasticity", McGraw Hill-1970. (2) M.Kachanov, "Theory of Plasticity", MIR Publication. (3) C.R.Calladine, "Plasticity for Engineers", Ellis Horwood, Chichester,U.K.,1985

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPC1020	**ELASTIC STABILITY AND BEHAVIOR OF METAL STRUCTURES**	**3**	**1**	**0**	**4**	

Pre -Requisite:

Course Outcome

CO1	Apply concept of stability, static, dynamic and energy criterion of stability
CO2	Apply Trigonometric series for solving the stability of a structure
CO3	To solve differential equations for lateral buckling
CO4	To analyze lateral buckling of beams in pure bending.

UNIT:1 **(12 Hours)**

Concept of stability, static, dynamic and energy criterion of stability; Beam-columns; differential equations for beam-columns, beam-columns subjected to transverse load, beam-columns subjected to end moments, application of Trigonometric series.

UNIT:2 **(12 Hours)**

Elastic buckling of bars and frames; Euler column formula, buckling of frames, torsional buckling, pure torsion of thin-walled bars of open cross section, non uniform torsion of thin-walled bars of open cross section, buckling by torsion and flexure, warping torsion.

UNIT:3 **(12 Hours)**

Lateral buckling of beams; differential equations for lateral buckling, lateral buckling of beams in pure bending, lateral buckling of a cantilever beam and a simply supported I beam, , Torsional stability of beams bending of thin plates; bending of plates by distributed lateral load.

UNIT:4 **(10 Hours)**

Behavior of Metal Structures

Structural steel, brittle fracture and fatigue, plastic behaviour of flexural member, plastic analysis of beams and rigid frames, upper and lower bound theorems, mechanism and equilibrium methods, plastic design of beams and frames, design of light weight gauge sections

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Books:

- D.O.Brush and B.O.Almorth, " buckling of bars, plates and shells".
- Arya & Ajmani,"Design of Steel Structures "B.G.Neal," Plastic Methods of Structural Analysis",
- Galambus, T.V., " Structural Members and Frames", Prentice Hall INC.
- Trahair, N.S., "The Behaviour and Design of Steel Structures", Chapman & Hall, London-1977.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPC1030	**MATRIX METHOD OF ANALYSIS OF STRUCTURE**	**3**	**1**	**0**	**4**	

Pre -Requisite:

Course Outcome	
CO1	Analyse framed structures using flexibility and stiffness method.
CO2	Develop computer programs for analysis of framed structure.
CO3	Use effectively commercial software for analysis and design of structures.
CO4	Analyse structure having member discontinuities, curved members, non-prismatic members, elastic supports, semi-rigid connections etc.

UNIT:1 **(12 Hours)**

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

UNIT:2 **(12 Hours)**

Application of flexibility method to beams and plane trusses

UNIT:3 **(12 Hours)**

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

UNIT:4 **(12 Hours)**

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

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

(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 Kardestuncer ,

(3) "Elementary Matrix Analysis of Structures" Gere & Weaver, "Matrix Structural Analysis'

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE1041	**BRIDGE ENGINEERING**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Students should have learned the analysis and design of bridge superstructures, foundations, bearings and deck joints.
CO2	provides students with fundamental knowledge in a wide range of state-of-the-art practices, including code specifications, in bridge engineering
CO3	Understanding the components of bridges.
CO4	To analyze the different types of loads.

UNIT:1 **(10 Hours)**

Introduction and selection of type of bridges, longitudinal arrangement and economical span, bridge components, Design preliminaries: Layout, types of loads including wind and seismic loads, standard specifications for road bridges, substructures, superstructures, IRC provisions on loads and stresses, specification for single/double multi lane railway and road bridges, Abutments, piers and their foundations .

UNIT:2 **(12 Hours)**

Design of reinforced concrete slab culvert, box culvert bridge

UNIT:3 **(12 Hours)**

Tee beam and slab bridge deck, design of prestressed concrete bridge

UNIT:4 **(10 Hours)**

Design of balanced cantilever bridge, design of continuous bridge, Introduction to long span bridges

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

N.K.Raju, " Design of bridges" Oxford & IBH Publishing Co. pvt. ltd.
D.J.Victor," Essentials of bridge engineering", Oxford & IBH Publishing Co. pvt. ltd. Indian Road Congress Codes No.5,6,18,21,24, Jamnagar House, Shah Jahan Road, New Delhi

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE1042	**ADVANCED CONSTRUCTION MATERIALS**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Comprehensively explain and critique engineering principles used in advanced materials behavior.
CO2	Appraise the use of advanced materials as they affect the design process and adapt techniques in the use of advanced materials to create novel solutions to a wide range of problems.
CO3	Constructively evaluate and endeavor to improve health and safety issues as they relate to the use of materials
CO4	Explain and debate with technical and policy based evidence, complex sustainability and environmental issues related to the use of materials and design strategies and procedures which take them into account

UNIT - 1 **(15 Hours)**

Fresh concrete and its rheology. Mechanical, deformational behavior and microstructure of hardened concrete. Creep and shrinkage. Testing of concrete. mix design and properties of concrete; High strength concrete; High density and lightweight concretes; admixtures

UNIT - 2 **(13 Hours)**

Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concreting under extreme weather conditions, High strength concrete. Changes in concrete with time, Corrosion of concrete in various environments. Corrosion of reinforcing steel. Ferro-cement, material and properties.

UNIT - 3 **(12 Hours)**

Foams and light weight materials, fibrereinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete. Polymers in Civil Engineering, Polymers, fibres and composites,

UNIT - IV **(10 Hours)**

Fibre reinforced plastic in sandwich panels, modeling. Architectural use and aesthetics of composties. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building, Polymer concrete composites

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books

Neville A.M., 'Properties of concrete', 3rd ed., 1985, ELBS Lea F.M.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE1051	**EARTHQUAKE RESISTANT DESIGN OF STRUCTURES**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Summarize Engineering Seismology and discuss the causes and effects of Earthquakes.
CO2	Analyze and detail the multi-storeyed structures using I.S Codes by Response Spectrum methods
CO3	Discuss various types of irregularities of structures.
CO4	Discuss various retrofitting techniques for R.C buildings.

UNIT-1 **(12 Hours)**

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

UNIT-2 **(12Hours)**

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

UNIT-3 **(12 Hours)**

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

UNIT-4 **(12 Hours)**

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.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

- Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition, 1992
- Newmark N.M. and Rosenblueth E., 'Fundamentals of Earthquake Engg.', Prentice Hall, 1971.
- Wiegel R.L., 'Earthquake Engg.', Prentice Hall, 1970.
- Blume J.A., Newmark N.M., Corning L.H., 'Design of Multi-storied Buildings for Earthquake ground motions', Portland Cement Association, Chicago, 1961.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE1052	**TALL STRUCTURES**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Various types of materials used in tall buildings with their characteristics
CO2	Various structural systems of tall buildings constructed using Concrete, Steel and Steel/Concrete Composite material
CO3	Behaviour of various structural systems under gravity and lateral loading along with their advantages and limitations
CO4	Use of structural engineering software for analysis and design of high rise structures

UNIT-1 **(12 Hours)**

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

UNIT-II **(10 Hours)**

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

UNIT-III **(10 Hours)**

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

UNIT-IV **(12 Hours)**

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

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Bryan Stafford Smith, Alex coull, “Tall Building Structures, Analysis and Design”, John Wiley and Sons, Inc., 1991.
2. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 2011.
1.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE1053	**THEORY OF PLATES AND SHELLS**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Analyze and design thin shell structures including domes, hyperbolic, paraboloid, elliptic and cylindrical shells
CO2	Formulate Finite Element Equations for solution of the structural response of plate bending problems and obtain solutions to shell structures
CO3	Analyzing the shell behaviour
CO4	To solve the solutions of typical problems.

UNIT- I **(11 Hours)**

Plate equation and behaviour of thin plates in cartesian, polar coordinates; Isotropic and orthotropic plates, bending and twisting of plates.

UNIT- II **(11 Hours)**

Navier's solution and energy method, rectangular, circular plates with various end conditions.

UNIT- III **(13 Hours)**

Shell behaviour, shell surfaces and characteristics, classifications of shells, equilibrium equations in curvilinear coordinates, force displacement relations.

UNIT- IV **(13 Hours)**

Membrane analysis and bending theory of shells of revolution, cylindrical shells under different loads, shallow shells, solutions of typical problems.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

- S.P. Timoshenko, S.W., Krieger, 'Theory of Plates and Shells, McGraw-Hill, 1959.
- K. Chandrashekhara, "Theory of Plates,University Press, 2001
- A.C.Urugal, "Stress in plates and shells"
- N.K. Bairagi, Plate Analysis, Khanna Publishers, Delhi, 1986
- N.K. Bairagi, Shell Analysis, Khanna Publishers, Delhi, 1990

1.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPC2010	**ADVANCED REINFORCED CONCRETE DESIGN**	**3**	**1**	**0**	**4**	

Pre -Requisite:

Course Outcome

CO1	Apply Strut and Tie Model (STM) in the design of disturbed (D) regions of reinforced concrete structures, such as corbels, brackets and beams with openings.
CO2	Analyze and design of slabs using two collapse load methods – Yield Line Method and Strip Method.
CO3	Evaluate the function of structural walls and design of shear walls in buildings.
CO4	Calculate deflections at serviceability limit state and understand methods of deflection control.

UNIT -1 **(10 hours)**

Limit state design concepts in flexure, shear, torsion and combined stresses

UNIT -2 **(12 hours)**

Slender column, safety and serviceability, control of cracks and deflections.

UNIT-3. **(12 hours)**

Yield line theory analysis of slabs, work and equilibrium methods.

UNIT:4 **(12 hours)**

Introduction to limit design of beams and frames. General principles and philosophies of design with special references to the codal provisions. Serviceability and stability requirements.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

Park & Paunlay,"Reinforced Concrete Structures".*Ramakrishna & Arthur,"*Ultimate strength design for structural concrete". *B.I.S.Codes*

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPC2020	**STRUCTURAL DYNAMICS**	**3**	**1**	**0**	**4**	

Pre -Requisite:

Course Outcome	
CO1	Establishing dynamic equilibrium, the equation of motion
CO2	Continuous systems and partial differential equations for rods and beams
CO3	Solving the eigen value problem and knowledge to its properties.
CO4	Basis for the classic energy formulations such as Rayleigh-Ritz and Hamilton's principles.

UNIT -1 **(10 hours)**

Oscillatory motion; harmonic motion, periodic motion, vibration terminology, Free vibration; equations of motion-natural frequency, energy method, principle of virtual work, viscously damped free vibration, Coulomb damping, Harmonically excited vibration; forced harmonic vibration, energy dissipated by damping, equivalent viscous damping, structural damping, vibration measuring instruments

UNIT -2. **(12 hours)**

Transient vibration; impulse excitation, arbitrary excitation, Laplace transform formulation, response spectrum.

Introduction to multi degree of freedom systems; normal mode vibration, forced harmonic vibration, vibration absorber, vibration damper..

UNIT-3. **(12 hours)**

Properties of vibrating systems, flexibility matrix, stiffness matrix, stiffness to beam elements, eigen values and eigen vectors, modal matrix, modal damping in forced vibration, normal mode summation, normal mode vibration of continuous beams, vibrating string, longitudinal vibration of rods, torsional vibration of rods, Euler equation for beam, effect of rotary inertia and shear deformation.

UNIT:4 **(12 hours)**

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

Books

(1) W.T.Thomson, "Theory of Vibration with Applications"

(2) R.W. Clough & J.Penzien, " Dynamics of Structures", McGraw Hill

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE2031	**FINITE ELEMENT ANALYSIS OF STRUCTURES**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Explain the principles of current finite element modeling techniques applied to solid mechanics, dynamics heat transfer, and acoustics.
CO2	Discuss the limitations and applications of current techniques and codes to solve complex engineering problems.
CO3	Write a professional engineering report and present their problem solving outcomes using FEA.
CO4	Recognize the need to undertake lifelong learning in technical and professional engineering.

UNIT -1 **(10 hours)**

Basic principles of structural mechanics, principle of virtual work, energy principles, element properties; relation between nodal degrees of freedom and generalized ordinates , convergence requirements, natural coordinate systems, shape functions, element stiffness matrix.

UNIT -2. **(12 hours)**

Isoparametric elements; computation of stiffness matrix for isoparametric elements, direct stiffness method of analysis and solution technique, assemblage of elements, direct stiffness method, boundary conditions and reaction, basic steps in finite element analysis.

UNIT-3. **(12 hours)**

Analysis of framed structures; 2 and 3 dimensional truss element, 2 dimensional beam element, stiffness matrix for a two dimensional beam element with 6 d.o.f., element load vector, transformation matrix, computation of stress resultants, shear deformation, plane stress and plane strain analysis, nodal load vector, rectangular elements, 8 noded rectangle, isoparametric elements, axisymmetric solid element..

UNIT:4 **(12 hours)**

Three dimensional stress analysis, 8 noded isoparametric solid element, analysis of plate bending, displacement functions, various types of plate bending elements, types of isoparametric elements, analysis of shells; bilinear degenerated shell element strain-displacement matrix, stress-displacement matrix, element stiffness matrix, 8 noded shell element, analysis using finite element computer codes.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE2032	**COMPOSITE STRUCTURES**	**3**	**0**	**0**	**3**	
Pre -Requisite:						

Course Outcome	
CO1	Discuss the benefits and disadvantages of using composites in aerospace structures
CO2	Describe current and emerging applications of composites in the aerospace industry
CO3	Describe the non-destructive inspection (NDE) and structural health monitoring of composites
CO4	Demonstrate an understanding of the different materials (fibres, resins, cores) used in composites

UNIT -1 **(10 hours)**

Introduction: definition and characteristics, fibres, matrices, fibre reinforced composites, advantages and limitations, basic concepts and characteristics: isotropy, orthotropy, classification, limina and laminate, micromechanics and macromechanics, constituent materials and properties.

UNIT -2. **(12 hours)**

Elastic behaviour of unidirectional lamina: specially orthotropic and transversely isotropic material, relation between mathematical and engineering constants, stress strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, transformation of stress-strain relations in terms of engineering constants.

UNIT-3. **(12 hours)**

Elastic behaviour of multidirectional laminates, symmetric and balanced laminates, design considerations, computational procedure for finding engineering elastic properties, stress and failure analysis of multidirectional laminates.

UNIT:4 **12 hours)**

Bending of laminated composite plates, thin laminated plate theory, deflection of all edges simply supported rectangular symmetric cross-ply laminate, two opposite edges simply supported.

Books:

1. I.M. Daniel & O. Ishai,"Engineering Mechanics of Composite Materials", Oxford University

2. S.W.Tsai & H.T.Hahn, "Introduction to Composite Materials: Technomic Publishing Co.INC, USA

3. P.K.Sinha,"A short term course on Composite Materials and Structures"-1996

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE2041	**STRUCTURAL OPTIMISATION**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Understand the difference between ordinary calculus and calculus of variations as well as functions and functionals.
CO2	Get a quick grasp of the terminology of function spaces, energy spaces in particular.
CO3	Write down necessary conditions of functionals involving multiple functions; multiple derivatives of a function; one, two, or three independent variables on which the functions depend.
CO4	Appreciate energy and variational methods in mechanics as well as the interconnection between force-balance (differential equation), weak form (principle of virtual work and D' Lambert principle), and energy principles (minimum potential energy and Hamilton's principle) in mechanics.

UNIT -1 **(10 hours)**

Formulation of different types of structural optimization problems; Optimality criteria based structural optimizations;

UNIT: 2. **(12 hours)**

Computation of derivatives of response quantities w.r.t. design variables; Classical optimization;

UNIT-3. **(12 hours)**

Lagrange multiplier technique and Kuhn-Tucker conditions;

UNIT:**4** **(12 hours)**

Solution of NLP by direct methods and by series of unconstrained optimization problems and by series of linear programming problems.

Books

S.S. Rao, Optimization, Theory and Applications, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1991.

J.S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company, New York, 1989.

A.J. Morris (Editor), Foundations of Structural Optimization - A Unified Approach; John Wiley and Sons, Chichester, 1982.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE2042	**ADVANCED STEEL STRUCTURE**	**3**	**0**	**0**	**3**	-

Pre -Requisite:

Course Outcome

CO1	Understanding of the ASD and LRFD design philosophies and behavior of structural steel
CO2	Ability to analyze and design of tension members
CO3	Ability to analyze and design of beam-columns
CO4	Ability to design steel framing system and connections of a building in a team setting

UNIT 1 **12 Hrs**

Properties of steel: mechanical properties, hysteresis, ductility; Hot-Rolled Sections: compactness and non-compactness, slenderness, residual stresses; Design of steel structures:

UNIT -2 **10 Hrs**

Inelastic bending – curvature, plastic moments, design criteria - stability , strength, drift; Stability criteria: stability of beams - local buckling of compression flange & web, lateral-torsional buckling,

UNIT -3 **12 Hrs**

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

UNIT -4 **10 Hrs**

Deformation-based design; Connections: types – welded, bolted, location - beam-column, column-foundation, splices.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

TEXT BOOKS

Steel Design code Book.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE2043	**SOIL DYNAMICS AND GEOTECHNICAL EARTHQUAKE ENGINEERING**	**3**	**0**	**0**	**3**	**-**

Pre -Requisite:

Course Outcome

CO1	Develop basic competence in assessing seismic hazard and in characterizing earthquake actions;
CO2	Understand the fundamental principles of wave propagation and apply them in engineering examples;
CO3	Evaluate the liquefaction potential using a range of simplified methodologies and understand the principles of mitigation measures;
CO4	Understand the behavior of soil slopes under seismic loading and the sliding block methodologies.

UNIT -1 **12 Hrs**

Engineering problems involving soil dynamics; Role of inertia; Theory of Vibrations: Single and two-degree freedom systems, vibration-measuring instruments, vibration isolation,

UNIT -2 **10 Hrs**

Wave propagation in elastic media. General nature of soil behaviour under cyclic/dynamic loading; Field and Laboratory tests for measurement of small strained and large strain, dynamic properties of soils.

UNIT -3 **12 Hrs**

Design criteria for machine foundations, elastic homogeneous half space solutions, lumped parameter solutions. Codal provisions. Strong Ground Motion: Measurement, characterization and estimation. Dynamic soil properties; Ground response analysis; Effect of local site conditions on ground motion;

UNIT -4 **12 Hrs**

Amplification theory and ground response analysis. Densification and liquefaction of granular soils, Liquefaction: evaluation of liquefaction hazards, effects of liquefaction; Case studies. Seismic slope stability analysis, Seismic bearing capacity and earth pressures. Codal provisions. Elastic theories of soil dynamics; Wave propagation; Dynamic soil properties; Vibration isolation; Pile dynamics.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Reference:

B.C Punmia, Geotechnical Engineering

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE2051	**INFRASTRUCTURE ENGINEERING AND TRANSPORTATION PLANNING**	**3**	**0**	**0**	**3**	-

Pre -Requisite:

Course Outcome

CO1	The students after completion of this course will have an in depth knowledge in Traffic Engineering , Transport Planning, Highway Design and Construction, Sustainable Urban and Transport Development and will be efficient enough to take up projects in the field.
CO2	As the students have an hands on experience in working with the Software, live projects, field visits to various organizations and training sessions during the course of study, they will be full fledged Transport and Highway Planner.
CO3	Students will have strengthened their knowledge and technical ideas how to be efficient Transport Engineers.
CO4	Students will be enabled to have a strong analytical and practical knowledge of Planning, Designing and solving the transportation problems.

UNIT:1 **(10 Hours)**

Quick response travel evaluation procedure, TSM actions: Traffic management techniques for improving vehicular flow, preferential treatment for high occupancy modes, demand management technique for reduced traffic demand.

UNIT:2 **(10 Hours)**

Staggered hours, vehicle restrictions. Small area management: individual sites, residential neighbourhoods.

UNIT:2 **(12 Hours)**

Introduction to transportation systems. Transportation innovations, social and economic impacts of transportation. Decision makers and their options, demand modelling and prediction. Stated and Revealed Preference approaches; Modeling transportation technologies.

UNIT:4 **(10 Hours)**

Layout for buses and trucks; Bridges and Fly-overs; Guard rails; Culverts; Retaining Sides; Mix wells; Foot bridges; River Spans; Tunnels and Underpasses;

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books 1. L.R Kadyali, Traffic Engineering and Transportation Planning

Title of the subject						
Subject Code		L	T	P	C	QP
MSEPE2052	**WIND ENGINEERING**	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcome

CO1	Students will learn to assess a wind turbine site for its wind potential, energy needs, and environmental (noise and avian) impact.
CO2	Students will learn to model and design wind turbines.
CO3	Students will learn to estimate the cost of energy for a given wind turbine plant
CO4	The student will have an understanding of processes for estimating the cost per kWh of energy for a known wind turbine configuration.

UNIT:1 **(15 Hours)**

Causes and types of wind; atmospheric boundary layer and turbulence, wind velocity measurements and distribution

UNIT:2 **(12 Hours)**

Bluff-body aerodynamics, random vibrations and spectral analysis, Alongwind and acrosswind response of tall buildings, towers and slender structures,

UNIT:3 **(10 Hours)**

Aeroelastic phenomena, vibration of cable supported bridges and power lines due to wind effects, wind pressure on cooling towers,

UNIT:4 **(16 Hours)**

Design of cladding and wind damping devices, Wind tunnel simulations and tornado effects.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books

1. Y. Tamura, Wind Engineering

Title of the subject						
Subject Code		L	T	P	C	QP
MSEOE3011	**PROJECT PLANNING AND COSTING**	**3**	**1**	**0**	**4**	

Pre -Requisite:

Course Outcome

CO1	develop plans with relevant people to achieve the project's goals
CO2	break work down into tasks and determine handover procedures
CO3	estimate and cost the human and physical resources required, and make plans to obtain the necessary resources
CO4	Allocate roles with clear lines of responsibility and accountability.

Unit I **[12 hours]**

Basic Concepts in the Development of Construction Plans – Choice of Technology and Construction Method – Defining Work Tasks – Defining Precedence Relationships among Activities – Estimating Activity Durations – Estimating Resource Requirements for Work Activities – Coding Systems.

Unit II **[12 hours]**

Scheduling procedures and techniques, cost control, monitoring and accounting, quality control and safety during construction, organization and use of project information.
Introduction to Construction Management - Project Organization – Construction Economics – Economic Decision Making - Time value of money - cash flow diagrams - Evaluation Alternatives - Effect of Inflation on cash flow - Evaluation of Public Projects.
Construction contract – contract document - classification of engineering contract - bidding process - CPWD contract conditions - FIDIC form contract agreement – subcontracting - earnest money deposit - security deposit - arbitration

Unit III **[12 hours]**

Basic concepts of resource management-class of labour - labour productivity - Classification construction equipment - selection of construction equipment - methods of calculating depreciation – replacement model - material management functions - inventory management - project cost management.

Unit IV **[12 hours]**

Construction quality - inspection, quality control and quality assurance - total quality management - quality gurus and their teachings - cost of quality - ISO standards - conquas - audit - evaluation of safety - accident causation theories - foundation of a major injury - health and safety act and regulations - cost of 143 CE-Engg&Tech-SRM-2013 accidents - role of safety personnel - causes of accidents -principles of safety - safety and health management system.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Title of the subject						
Subject Code		L	T	P	C	QP
MSEOE3012	**PROJECT PLANNING AND CONSTRUCTION MANAGEMENT**	**3**	**1**	**0**	**4**	

Pre -Requisite:

Course Outcome	
CO1	To study how the owner view a project in consideration with project life cycle, construction agencies legal requirements etc.
CO2	To study the various types of organization and their impact on and suitability to construction projects
CO3	To study the design and construction procedures along with labour material and equipment utilization
CO4	To study the elements of cost of a project

Unit I **[12 hours]**

Basic Concepts in the Development of Construction Plans – Choice of Technology and Construction Method – Defining Work Tasks – Defining Precedence Relationships among Activities – Estimating Activity Durations – Estimating Resource Requirements for Work Activities – Coding Systems.

Unit II **[12 hours]**

Scheduling procedures and techniques, cost control, monitoring and accounting, quality control and safety during construction, organization and use of project information.

Introduction to Construction Management - Project Organization – Construction Economics – Economic Decision Making - Time value of money - cash flow diagrams - Evaluation Alternatives - Effect of Inflation on cash flow - Evaluation of Public Projects.

Construction contract – contract document - classification of engineering contract - bidding process - CPWD contract conditions - FIDIC form contract agreement – subcontracting - earnest money deposit - security deposit - arbitration

Unit III **[12 hours]**

Basic concepts of resource management-class of labour - labour productivity - Classification construction equipment - selection of construction equipment - methods of calculating depreciation – replacement model - material management functions - inventory

Unit IV **[12 hours]**

Construction quality - inspection, quality control and quality assurance - total quality management - quality gurus and their teachings - cost of quality - ISO standards - conquas - audit - evaluation of safety - accident causation theories - foundation of a major injury - health and safety act and regulations - cost of 143 CE-Engg&Tech-SRM-2013 accidents - role of safety personnel - causes of accidents -principles of safety - safety and health management system.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Reference Books:

1. Calin M. Popescu, ChotchaiCharoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.

2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, McGrawHill Publishing Company, New Delhi, 1998.

3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.

4. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

Title of the subject						
Subject Code		L	T	P	C	QP
MSEOE3013	**HUMAN RESOURCE MANAGEMENT**	**3**	**1**	**0**	**4**	

Pre -Requisite:

Course Outcome

CO1	Identify the human resources needs of an organization or department.
CO2	Conduct a job analysis and produce a job description from the job analysis.
CO3	Evaluate the procedures and practices used for recruiting and selecting suitable employees.
CO4	Assess training requirements and design a successful orientation and training program.

Unit I Need for Human Resources Management [12 hours]

Human Resources Management-Roles and Responsibilities, The Changing Role of HRM and Growing Professionalism within the HR Function, HRM Challenges in the Twenty-First Century, Legal issues in HRM

Matching HR Needs and People

Job Design, Job Analysis, Human Resources Planning, Understanding a Shifting Labour Market

Unit II Developing People [12 hours]

Employee Orientation and Socialization, Training and Development, Performance Management, HR's Role in Setting a Climate for People Development

Unit III Compensation and Recognition [12 hours]

Employee Compensation, Incentives and Rewards, Employee Benefits and Services, Trends in Compensation and Benefits

Unit IV Developing a Healthy Work Environment and Effective Employee Relations [12 hours]

Occupational Health and Safety Legislation - Creating a Safe Work Environment, The Human Rights Code - Establishing a Positive Work Environment, Foundations of Effective Employee Relations, Labour-Management Relations, Disciplinary and Grievance Procedures

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Reference Books:

1. Manmohan Joshi, Human Resource management