JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
(An Autonomous Institute of Govt. of M.P.)
Affiliated to Rajiv Gandhi Technological University, Bhopal (MP)

Scheme of Study and Examination (w.e.f. July 2010)

M.E. II Sem. Branch : Civil Engg. Specialization : Structural Engineering

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
					SESSIONAL EXAM				SUB TOTAL	
		L	T	P	TA	CT	TOT	ESE		
CE-133	Structural Dynamics	3	1	-	10	20	30	70	100	4
CE-134	Design of Earthquake Resistant Structures	3	1	-	10	20	30	70	100	4
CE-135	Theory of Plates & Shells and FEM Applications	3	1	-	10	20	30	70	100	4
	Elective – I (Any One)									
CE-136A	Experimental Stress Analysis									
CE-136B	Structural Optimization	3	1	-	10	20	30	70	100	4
CE-136C	Non Destructive Testing of Structures									
	Elective - II (Any One)									
CE-137A	Industrial Structures									
CE-137B	Advanced Construction Materials	3	1	-	10	20	30	70	100	4
CE-137C	Pre-stressed Concrete Design									
CE-137D	Plastic Analysis & Design									
(PRACTICAL/DRAWING/DESIGN)										
CE-138L	CAD Lab	-	-	2	60	-	60	90	150	6
CE-139L	Non Destructive Testing Lab	-	-	2	60	-	60	90	150	6
	Total	**15**	**5**	**4**	**170**	**100**	**270**	**530**	**800**	**32**

T.A. Teachers Assessment, CT- Class Test, ESE - End Semester Examination, Total Marks 800

Total Periods : 24 Total Credits : 32

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	STRUCTURAL DYNAMICS	CE-133	Min "D"	Min "D"	5.0

STRUCTURAL DYNAMICS

Unit – I : Single Degree of Freedom System : Free and forced vibrations, Linear Viscous Damper, Coulomb Damper. Response to harmonic excitation, rotating unbalance and support excitations, Vibration isolation and transmissibility, single degree of freedom system as vibro-meter and accelerometer, response to periodic and arbitrary excitation.

Unit – II : Duhamel's integral. Impulse response function, Laplace transform Fourier transform methods. Frequency response function. Phase-plane Techniques. Critical speed of rotors. Energy methods, Rayleigh's method. Equivalent viscous damping.

Unit – III : Two Degree of Freedom System. Matrix Formulation, Free Vibration, Beat phenomenon. Principle of damped and un-damped vibration absorbers.

Unit –IV : Multi Degree of Freedom System : Matrix formulation stiffness and flexibility influence coefficients, Eigenvalue problem, normal modes and their properties Matrix iteration technique for eigenvalue and eigen vactors, free and forced vibration by modal analysis.

Unit – V : Continuous System : Axial vibration of bar, torsion of shafts, transverse vibration of strings and bending vibration beams. Forced vibration. Normal mode method Lagrange's equation. Approximate methods of Rayleigh-Ritz , Galerkin etc.

Reference Books :

RW Clough, JPenzien, Dynamics of Structures
D.G. Fertia, Dyanamics and vibration of Structures
J.M. Biggs, Introduction to structural dynamics

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	DESIGN OF EARTH QUAKE RESISTANT STRUCTURES	CE-134	Min "D"	Min "D"	5.0

DESIGN OF EARTH QUAKE RESISTANT STRUCTURES

Unit – I : Sesmic Strengthening of Existing Buildings : Cases histories : learning from earthquakes, seismic strengthening procedures.

Unit – II : Torsion & Rigidity : Rigid Diaphragms, Torsional Moment center of mass and center of rigidity torsion effects. Lateral Analysis of Building Systems. Lateral load distribution with rigid floor diaphragms moment resisting frames, shear walls, lateral stiffness of shear walls, shear wall-frame combination examples.

Unit – III : Concept of Earthquake Resistant Design : Objectives of seismic design. Ductility Hysteric response & energy dissipation, response modifications factor, design spectrum, capacity design, classification of structural system, IS codal provisions for seismic design of structures, multi-storied buildings, design criteria, P-A effects. Storey drift, design examples, ductile detailing of RCC structures.

Unit – IV : Seismic Design of Special Structures : Elevated liquid storage tanks. Hydrodynamic pressure in tanks, stack like structures. IS – 1893 code provisions for bridges, superstructures. Sub structures, submersible bridges, dams. Hydrodynamic effect due to reservoir, concrete gravity dams.

Unit – V : Engineering seismology : Basic terms, seismic waves, earthquake magnitude and intensity, ground motion dynamic response of structures, normalized response spectra seismic coefficients and seismic zone coefficients.

Reference Books :

Chopra A.K. Dynamics of Structures Theory & Applications to Earthquake Engineering Prentice Hall India New Delhi – 1995

Clough & Penzien, Dynamics of Structures. McGraw Hill Book Co. Inc.

PazM Structural Dynamics, Van Nostrand Reinhold, New York

Paz M International Handbook of Earthquake Engineering Chapman & Hall New York.

IS- 1983-1984, Indian Standard Criterial for Earthquake Resistant Design of Structures B.I.S. New Delhi

IS – 4326-1993 Indian Standard code of Practice for Earthquake Resistant Design and Construction of Buildings B.I.S. New Delhi.

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	THEORY OF PLATES AND SHELLS AND FEM APPLICATION	CE-135	Min "D"	Min "D"	5.0

THEORY OF PLATES AND SHELLS AND FEM APPLICATION

Unit – I : Theory of plates : Bearing of long rectangular plates to the cylindrical surface with different edge conditions. Pure bending of plates- differential equations of equilibrium theory of small deflections of laterally loads plates. Boundary conditions, moment curvature relationship.

Unit – II : Analysis of rectangular plates, Navier's and levy solutions, exact theory of plates, symmetrical bending of circular plates continuous rectangular plates.

Unit – III : Special and approximate methods of theory of plates. Singularities, use of influence surfaces, use of infinite integrals and transforms, strain energy methods, experimental methods. FEM applications

Unit – IV : Theory of Shells : Classification of shells, Gaussian curvature, General theory of cylindrical shells, membrane theory and bending theory for cylindrical shells, long and short shells. shells with and without edge beams, fourier loading

Unit – V : Equation of equilibrium for shells of surface of revolution. Reduction to two differential equations of second order. Spherical shells membrane theory for shells of double curvature-syn-elastic and an-elastic. Cylindrical shells, Hyperbolic-parabolic shells, funicular shells. FEM applications.

Reference Books :

S. Timoshenko, S.Woinowasky K, Theory of Plates and Shells

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	EXPERIMENTAL STRESS ANALYSIS	CE-136A	Min "D"	Min "D"	5.0

EXPERIMENTAL STRESS ANALYSIS

Unit – I : Introduction to stress analysis by strain measurement, mechanical strain gages. Moire fringe method, Brittle coatings for stress indication, circuitry for resistance strain gages, calibrating strain gages, temperature compensation of circuitry indication and recording equipments, unbalance of bridge systems, balanced bridge systems, reference bridge systems, constant current strain indicators multichannel recording systems.

Unit – II : Introduction to stress analysis by photo elasticity optical theory stress optical relationship equipment and models, static stress analysis (2-D, 3-D techniques), stress analysis by photo elastic strain gages.

Unit – III : Conditions for crack growth, fracture mechanics and strength of solids, stress and displacement fields in the vicinity of crack tip the Griffith Orowan-Irwin concept stable and unstable crack growth, the integral variation principle in crack theory, some more model representations, cracks in linearly elastic bodies, stress intensity factor basic numerical methods for calculating the stress intensity factor, calculation of stress intensity factor for double cantilever beam specimen by FEM, method of section for an approximate calculation of stress intensity factor, some material characteristics used for evaluation of crack propagation resistance.

Unit – IV : Solution of some plane and three dimensional problems, constructional crack arrest, system of cracks, stress intensity factors for some practical important cases, shell with a crack trajectory.

Reference Books :

Dove, Adams, Experimental Stress analysis and Motion
Heteny Experimental stress analysis
Dally Rilay, experimental Stress analysis
VZ panon, M Morozove, Elastic Plastic fracture Mechanics

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	STRUCTURAL OPTIMIZATION	CE-136B	Min "D"	Min "D"	5.0

STRUCTURAL OPTIMIZATION

Unit – I : Introduction : Design process, role of optimization in design, optimum design problem formulation variables, constraint and objective function. Basic concepts of optimum design, Unconstrained and constrained optimum design problem. Global optimality post optimality analysis.

Unit – II : Traditional Optimization Techniques :

Linear programming Problem, solution procedure sensitivity analysis.

Non-linear programming Kuhn Tucker conditions, single variable search. Multivariable search constrained optimization (Penalty function Approach)

Introduction to geometric and dynamic programming

Unit – III : Non traditional optimization techniques :

Genetic algorithms-philosophy, positive features, operators.

Unit – IV : Structural Otimization :

Optimal design of trusses and frames.

Optimal design of thin walled columns under axial load.

Unit – V : Structural Optimization :

Compressive load panels subjected to in plane compression and shear

Grid Floor

Box beam under bending.

Reference Books :

Mazid, Optimization design of structures

Vendeo Plettes, Optimum Structural Design

S S Rao Optimization theory

J.Faraka, Optimization design of metal structures

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	NON DESTRUCTIVE TESTING OF STRUCTURES	CE-136C	Min "D"	Min "D"	5.0

NON DESTRUCTIVE TESTING OF STRUCTURES

Unit – I
Types of materials and tests

Unit – II
The variables involved, destructive and non destructive testing, correlation of properties obtained by NDT with the basic structure of matter.

Unit – III
Other properties, NDT of different materials by various techniques such as radiographic, sonic and ultrasonic, electrical and magnetic

Unit – IV
Oscilloscopic, microwave, eddy current penetration, thermal optical, holographic

Unit – V
Practical applications and advances in NDT

Reference Books :

J.F. Hinslay Non Destructive Testing, MacDonald and Evants 1959
H.B Egerton, Non Destructive Testing, Oxford University Press, 1965
Krautkramer, Ultrasonic Testing of Materials, Springer Veriag 1969
M.A. Novgoresky, Testing of Building Materials and Structures, Mir Pub 1973
Americain Society of Metals Handbook vol-II Destructive Inspection and Quality Control 1976

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	INDUSTRIAL STRUCTURES	CE-137A	Min "D"	Min "D"	5.0

INDUSTRIAL STRUCTURES

Planning of industrial structures, design of single and multi bay industrial structures in steel and concrete, Bunkers and silos. Steel water tanks and chimneys, cooling towers, large span roof structures, suspension roof structures, structural aspect of machine foundations.

Reference Books :

1. Ramchandra : Design of Steel Structures
2. Punmia and Jain : Comprehensive Design of Steel Structures.

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	ADVANCED CONSTRUCTION MATERIALS	CE-137B	Min "D"	Min "D"	5.0

ADVANCED CONSTRUCTION MATERIALS

Unit – I : Construction Material : Physical properties like strength, durability, thermal effect, sound insulation, fire resistance, corrosion, oxidation and irradiation.

Unit – II : Concrete ingredients and their properties, Design and production of concrete, details of various steps of manufacture of concrete. batching, mixing, transporting, placing compacting and curing.

Unit – III : Design and production of high strength and special concretes, ready mix concrete.

Unit - IV : New construction materials : Polymeric materials, polymer concrete, additives.

Unit – V : Admixtures in concrete, light weight, heavy and no fine concrete, ferro cement and fiber reinforced concrete, composite materials.

Reference Books :

1. A.M. Nobille, Concrete Technology, ELBS, London
2. M.L. Gambir, Concrete Technology, Tata Mc Graw Hill Book Co.
3. Peurifoy R.L. Construction planning Equipment & Methods, Mc Graw Hill Book Co.inc.
4. Verma Mahesh Construction Equipments and its planning & Application, Metropolition Book Co. New Delhi.

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	PRE-STRESSED CONCRETE DESIGN	CE-137C	Min "D"	Min "D"	5.0

PRE-STRESSED CONCRETE DESIGN

Unit – I : Pre-stressing Systems and losses of pre-stressing, introduction various systems of pre-stressing, Types of loss and their analysis.
Working Stress Design of Simple Beams : Critical load conditions allowable stresses, flexural design criteria axially pre-stressed members design of pre-stressing cable for a given cress section, design procedure based on flexure, design by load balancing method and multiple stage pre-stressing.

Unit – II : Continuous Beams : Analysis of two span beam analysis of two span beam with eccentricities at outer supports, continuous beams with variable section design of continuous beam.
Miscellaneous Structural Members : Columns subjected to combined bending and axial force, piles, poles, piers and abutments, Tension members, ring beams circular tanks and pipes pavement sleepers roads and runways.

Unit – III : Limit State Design of Beams : Limit state of strength in flexure, shear and torsion permissible stresses limit state of serviceability against deflection. Cracking and durability, design of simply supported and continuous beams.

Unit – IV : Bond and Anchorage of Pre-stressing cables Bond in pre tensioned and post tensioned construction, pre-stressing cable at centroid axis symmetric multiple cables causing axial thrust cable with eccentricity, inclined pre-stressing cable spanning stress, end zone reinforcement.

Unit – V : Pre-stressed Concrete Slabs : One way slab two way slabs, pre-stressed concrete beam slab construction, pre-stressed flat slab,
Deflection and Crack Width : Factors influencing deflection, short term deflections of un cracked members, long term deflection deflections of cracked members. Estimation of crack width using British code and FIP recommendations.

Reference Books :

1. N.Krishna Raju, Pre-stressed Concrete, Tata Mc Graw Hill Book Co.
2. P. Dayaratran, Pre-stressed Concrete Structures, Oxford & IBH Co. Delhi
3. Jain & Jai Krishna, Plain & Reinforced Concrete Vol – II Nem chand & Bros Roorkee.
4. IS 1343-980 code of Practice for Pre-stressed Concrete < Bureau of India Standards New Delhi.

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	PLASTIC ANALYSIS & DESIGN	CE-137D	Min "D"	Min "D"	5.0

PLASTIC ANALYSIS & DESIGN

Unit – I : Concept of Plastic analysis and design, plastic moment, plastic section modulus, shape factor, load factor, moment curvature relationship, redistribution of moments, characteristics of plastic hinge upper and lower bound theorem.

Unit – II : Statical and mechanism method of analysis types of mechanisms, plastic analysis of continuous beam, method for performing moment check (Plastic moment distribution)

Unit – III : Continuous beam – Plastic design of continuous beams, effect of aerial force and shear force.

Unit – IV : Portal Frames : Partial, complete and over complete collapse, plastic analysis and design of portal frames.

Unit – V : Multi-storey – Multi-bay Frames – Equilibrium equations, combination of mechanism.

Reference Books :

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	CAD LAB	CE-138L	Min "D"	Min "D"	5.0

CAD LAB

The exercises in this component shall be designed to demonstrate the basic principles outlined in different units of the theory paper. After completing the exercises the student should have developed a good grasp of the practical utilities of the theory content.

(Suggested Exercise)

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	NON DISTRUCTIVE TESTING LAB	CE-139L	Min "D"	Min "D"	5.0

NON DISTRUCTIVE TESTING LAB

The exercises in this component shall be designed to demonstrate the basic principles outlined in different units of the theory paper. After completing the exercises the student should have developed a good grasp of the practical utilities of the theory content.

(Suggested Exercise)

Dr. SHAILJA SHUKLA
DEAN
Academics
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)