

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

**S
YLLABI**

M.E. (Civil – Structure) full time two year course

PART – I (Semester – I)

Code No. of Subject	Name of the subject	Teaching Scheme hours per week			Examination Scheme Maximum marks Heads of passing			TOTAL	REMARK
		Lectures	Tut / Practical.	Total	Paper	Term work	Practical		
5001	Theory of Elasticity & Plasticity	3	1	4	100	25		125	
5002	Structural Analysis - I	3	1	4	100	25		125	
5003	Concrete Technology	3	1	4	100	25		125	
5004	Structural Dynamics & Earthquake Engineering	3	1	4	100	25		125	
5005	Elective – I	3	1	4	100	25		125	
5006	Seminar – I		1	1		25		25	
TOTAL		15	6	21	500	150		650	

PART – II (Semester – II)

Code No. of Subject	Name of the subject	Teaching Scheme hours per week			Examination Scheme Maximum marks Heads of passing			TOTAL	REMARK
		Lectures	Tut / Practical.	Total	Paper	Term work	Practical		
5007	Computational Techniques	3	1	4	100	25		125	
5008	Structural Analysis – II	3	1	4	100	25		125	
5009	Structural Analysis – III	3	1	4	100	25		125	
5010	Theory of Plates & Shells	3	1	4	100	25		125	
5011	Elective – II	3	1	4	100	25		125	
5012	Seminar – II		1	1		25		25	
TOTAL		15	6	21	500	150		650	

PART – III & PART - IV (Semester – II & IV)

Code No. of Subject	Name of the subject	Teaching Scheme hours per week			Examination Scheme Maximum marks Heads of passing			TOTAL	REMARK
		Lectures	Tut/ Practical.	Total	Paper	Term work	Practical		
5013	Dissertation Part – I	-----	6	6		50		50	
5014	Dissertation Part – II	-----	6	6		50	200	250	
TOTAL		-----	12	12	----	100	200	300	

Note: For full time course:

5005 : Elective –I is to be chosen from the following:

5005 : a) Finite Element Method

5005: b) Earthquake Engineering

5005 : c) Limit state Design of R.C.C.Structures.

5011 ; Elective –II is to be chosen from the following:

5011 : a) Structural Stability

5011 : b) Plastic Design of Steel Structures

5011: c) Inelastic Analysis of Plates.

The following are the syllabi in the various of the examination for the degree of Master of Engineering (Civil – Structure).

5001 Theory of Elasticity and Plasticity

(one paper – 3 hours – 100 marks, Term work – 25 marks)

Linear Elasticity : Generalized Hooks Law, Saint Venant’s Principle, boundary value problems, Formulation of elasticity equation, plain stress and plain strain problems. Two and three dimensional electrostatic problems in Cartesian and Cylindrical coordinates.

Plasticity: Basic concepts, yield criteria, Plastic stress – strain relations, flow and deformation theories. Drucker’s postulate, convexity of loading surfaces.

Plane stress and plane strain problems, torsion, bending of bars theoretical problems. Examples of tube under pressure, application to circular plates.

Term work : shall consist of a set of tutorials/ problems based on the about theory.

Reference books :

1. Theory of elasticity ----- Timoshenko and Goodier
2. Plasticity for Mechanical Engineers ----- Johnson w. and mellor
3. Introduction Mechanics of solid ----- Venkatraman and patel
4. Theory of problems of continuum mechanics -----G.F. Masse

5002 structural analysis – I

(one paper-03hours -100 marks , term work-25 marks)

1. Finite difference methods applied to beams, slabs and shells.
2. Finite element method : General principles’,triangular, rectangular and Isoparametric elements in the Analysis of plain stress, plane strain and plane bending problems.
3. Advance topic in Moment Distribution, Kani’s method, kloucek’s method.
4. Minimum weight design of plane frames.

Term work : shall consist of a set of tutorials/problems based on the above theory.

Reference books:

1. Finite element method in Engg. Science o.c.zienkiewicz.
2. Moment Distribution method E. Lightfoot.
3. Optimization theory and applications S.S. Rao.
4. Theory of Plates & Shells Timoshenko and Krieger
5. Numerical methods for engineering problemsN.Krishna Raju &Muthu.
6. Concept and applications of F.E.M Ghali & Neville
7. Finite Element programming R.D. Cook
8. Finite Element programming Hinton, E& Owen D.R.J.
Academic Prerss , London

5003 Con crete Techn olog y:

(One paper -03 hours -100 marks, Term Work -25 Marks)

Review of constituents of concrete and mix design and properties of concrete; High strength & High performance concrete, High density and lightweight concrete; Concreting under extreme weather conditions including temperature ; Admixtures; Polymers - in concrete; fibre reinforced concrete; Fracture mechanics of concrete; Repairs and rehabilitation of old concrete.

Term W orks: Shall consist of laboratory work based on the above.

Reference Books:

1. Properties of concrete.....A.M.Neville
2. Concrete TechnologyD.F.Orchard
3. Chemistry of Cement and concrete.....F.M.Lee.
4. Concrete technology.....M.S.Shetty.

5004 Structural Dynamics & Earthquake Engineering

(One paper -03hours-100marks,Term work25-marks)

1. systems with single degree of freedom natural frequency, period. Damping.

2. Forced oscillations – trigonometrical forcing functions – other forcing functions like

Unit impulse, rectangular function.

Response of the structure, dynamic implication factor.

Critical damping , under and over damping.

3. Multi Degree freedom system formulation of problem. Structural property

Matrices. Modal analysis – Stodola and Hozer method. Application to multistory frames with rigid girders.

4. Distributed mass system-Application to beam problems.Rayleigh-Ritz solutions. Natural frequencies of frames.

5. Elementary concepts of earthquakes. Nature of loading due to earthquake.

Response of structures. Determinist ion and stochastic approach.

6. Earthquake resistant structures- IS code provisions and applications to building frame, dams, retaining walls.

Term work : shall consist of a set of tutorials/ problems based on the above theory

Reference books :

- | | | |
|---|----|-----------------------|
| 1. Dynamics of structures | :- | Clough & Penzien. |
| 2. Fundamentals of earthquake engineering | :- | Newman & Rosenblueth. |
| 3. Dynamics of structures | :- | Mukhopadhyay |
| 4. Fundamentals of earthquake engineering | :- | A.K. Chopra. |

5005 (A) (Elective-1) Finite Element Method:

(One paper -03 hours -100 marks, Term Work -25 Marks)

General principles, discretisation of continuum, numbering of nodes for minimum band width, overall stiffness and solution of displacement unknowns, Gauss elimination techniques for solution of displacement unknowns, gauss unknowns.

Basic equations from solid mechanics, strain-displacement and stress-strain relations (plane stress and plane stress conditions) . Principle of virtual work, minimum potential energy and Rayeigh-Ritz method.

Pascal`s triangle, Selection of displacement polynomial, convergence requirements, compatibility, conforming and non-conforming elements, shape functions, Natural coordinate system.

Basic elements: Concept of single one dimensional element, two dimensional elements of triangular and quadrilateral shapes. Elements for plane stress and plane strain conditions. Explicit and Isoparametric formulations of elements in F.E.M, plate bending elements of triangular and quadiriteral shapes, cylindrical, thin shell elements. Numerical integration, Gauss quadrature

Introduction to 3 dimensional and axis symmetrical cases. Transformation of matrices from local to global axes.

TERM WORK: shall consist of a set of exercises based on theoretical formulation in prescribed course and computer application of F.E.M. of simple two dimensional problems.

Reference Books:

- 1.The Finite Element Method in Engineering Science...O.C.Ziekiewicz&Cheung
- 2.Concept and application of finite Element Analysis...M.Mukhopdhyay.

5007(B) (Elective-I) Earthquake Engineering:

(One paper -03 hours -100 marks, Term Work -25 Marks)

Characterization of ground motion, Earthquake intensity and magnitude; Recording instruments and base line correction; Predominant period and amplification through soil; Earthquake spectra foe elastic and inelastic systems; Idealization of structural superposition and direct integration; Reserve energy technique; effect of foundation/ soil on earthquake response; Analysis for torsion; Review of damages during past earthquakes and remedial measures; Reinforcement detailing for members and joints coupling; Codal Provisions.

TR EM W Shall consist of a set of exercises based on theoretical formulation in the course
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above.

Reference Books:

1. Dynamics of structures- Applications to Earthquake Engineering. :- A.K.Chopra.
2. Dynamics of structures :-R.W. Clough & J. Penzien.
3. Fundamentals of earthquake engineering :-N.W.Newmrk & E.Rosenbleuth.
4. Earthquake Design Practice for building :-D. key.
5. Earthquake Engineering :- R. L. Wiegel.
6. Design of Multistoried Buildings for Earthquake Ground Motions
J.A. Blume. N.W. Newmrk & L.H. Corning.
7. Proceedings of Wprld Conferrences on Earthquake Engineering, 1956-2002
8. I.S. codes No. 1893,4326,13920

5005 (C) (Ele ctive-1) Lim it Sta te Design of R.C. Structu re:

(One paper -03 hours -100 marks, Term Work -25 Marks)

Reinforced concrete Structures : Limit State Design of indeterminate structures, yield line theory. Application of Working stress method and limit state design of bunkers, silos, spherical and conical domes, liquid retaining structures, chimneys, cooling towers and beams curved in plan.

Prestressed Concrete: Design of sections on the basis of of limit state calculations. Reinforced Prestressed concrete, composite beams, continuous beams and frames, slabs, precast construction. Application to various structures.

TERM WORK: Shall consist of a set of exercises based on theoretical formulation in the prestressed course above.

Reference Books:

1. Reinforced concrete vol.II..... Jain & Jaikrishna
2. Prestressed concrete.....Krishna Raju N.
3. Limit State Design of Prestressed Concrete.....Guyon Y.

5006 Seminar-I

(Term work- 25 marks)

Seminar Shall be a term work submitted in the form of technical essay or a report or analysis or design on any current topic in the concerned or allied field. The candidate Will deliver a talk topic and the assessment will be made on the basis of the term work and presentation thereon, by two internal examiners one of the basis of the whom will be the guide and other appointed by the principal of the institution.

5007 Computational Techniques:

(One paper -03 hours -100 marks, Term Work -25 Marks)

Numerical solution of partial differential equations with reference to different types of grids. Solution of systems of linear and nonlinear algebraic equations. Relaxation and iteration techniques.

Solution of differential equations, initial and two point boundary value problems, Eigen value problems, Matrix algebra.

Programming fundamentals, computer oriented algorithms. Numerical solution of problems drawn from Civil and Structural Engineering.

TERM WORK: Shall consist of preparation of algorithms and computer.

Programmes with atleast two programmes run on computer.

Reference Books:

1. Advance Engineering MathematicsKreyszig
2. Numerical and Matrix in Structural EngineeringP.C. Wang
3. Introduction to Numerical Methods &
FORTRAN Programming..... T.R.McC alla
4. Mathematical Methods for Digital computers..... Anthony & Wilfy

5008 Structural Analysis-II

(One paper -03 hours -100 marks, Term Work -25 Marks)

1. Beams on elastic foundation, semiinfinite and finite beams.
2. Generalised grid structures, Analysis of right angle, skew and curved bridges.
4. Principle of multiples and substiute frame method.
5. Analysis of beam curved in plan.
6. Secondary stresses in frames and trusses

TREM WORK: shall consist of a set of tutorials/ problems based on the above theory

Reference books :

1. Moment DistributionE. Lightfoot
2. Hyperstatic structures Vol.I

5009 Structural Analysis

(One paper -03 hours -100 marks, Term Work -25 Marks)

Revision of Matrix methods for frame analysis , Flexibility and stiffness methods, comparison, application to frames, trusses, space frames and grids.

Transfer matrix methods, substructure analysis techniques, Assembly and solution of load – deflection equation methods suitable for computer application.

Term work :

shall consist of a set of tutorials/ problems based on the above theory.

Reference Books:1. Analysis of framed structuresGere & Weaver

2. Basic concept of structural Analysis..... Beaufiet

3. Matrix computer Analysis of structures M. F. Rubinstein

3. Structural Analysis of Beams and slabs.....J.Rohn (HAHN)

5010 Theory of Plates and shells:

(one paper - 3 hours - 100 marks, Term work – 25 marks)

Plates : Derivation of governing differential equation of rectangular plate subjected to bending using Kirchhoff theory . pure Bending of plates, Slopes Curvature, Relation between Moments and curvatures. Bending of Rectangular, circular and other plate of isotropic and orthotropic materials. Plates subjected to in –plane and lateral loading (only small deflection theory) i.e. Buckling of plates. Analysis and design of folded plates.

Shells : Type of surfaces, structural characteristics, geometrical criteria for different shells. Basic equation of membrane analysis of shells of revolution, elliptical, hyperbolic and paraboloidal shells of double curvatures. Bending analysis of cylindrical shells by beam theory, Finstewalder, Schorer , Flugge`s and D. K. J. theory.

TERM WORK : Shall consist of a set of tutorials/problems based on the above.

REFERENCE BOOKS :

1. Theory of plates and shells ----- Timoshenko and kreiger
2. Design of R. C. shell roofs ----- G. S. Ramaswamy
3. Theory of Analysis of plates ----- R. S. Zilard

5010(A) (Elective-II) Structural Stability:

(One paper -03 hours -100 marks, Term Work -25 Marks)

Concepts of stability , static, dynamic and energy criterion of stability; Flexibility and stiffness criteria; Buckling; snap through and post- bucking; Stability of columns and beams; Inelastic buckling; Beam-columns; Stability of frames; Matrix stiffness and finite element methods applied to stability problems; Introduction to stability of plates, shells and stiffened plates.

Term work :

shall consist of a set of tutorials/ problems based on the above theory.

Reference Books:

1. Buckling of bars, plates and shells :- Don O. Brush & B. O. Almorth.
2. Theory of elastic stability :- S.P. Timoshenko & J. M. Gere.
3. Principles of structural stability :- A. Chajes.
4. Structural stability of plates & shells :- N.G.R. Jyenger.
5. An Introduction to the elastic
Stability of structures :- G.J. Simitses
6. Stability of structures: Elastic, Inelastic ,
Fracture and damage Therioes :-Z. P. Bazant & L. cedolin.

5012(B) (Elective – II) Plastic Analysis & Design of Steel

(One paper -03 hours -100 marks, Term Work -25 Marks)

Field condition and concepts of simple plastic collapse. Idealization, collapse criteria, virtual work in elastic and plastic state. Theorems of plastic collapse, Methods of analysis of design.

Application to planar and simple space structures. Deflection to collapse. Minimum weight analysis . Variable reported loads, combined stress problems. Introduction to stability.

TERM WORK: Shall consist of a set of exercises based on theoretical formulation in the prescribed course above.

REFERENCE BOOKS:

1. steel skeleton Vol. IIJ. F. Baker
2. Plastic Method of structural Analysis.....S.B. Neal
3. Plastic Analysis of structures..... P. G. Hodge (Jr)

5012 (Elective-II) Inelastic Analysis of plates:

(One paper -03 hours -100 marks, Term Work -25 Marks)

Limit analysis of plates, lower bound and upper bound solutions, ultimate strength of reinforced concrete slabs, yield line analysis by the work method and equilibrium method. Isotropic and orthotropic reinforcement. Strip method for analysis of R.C. slabs. Load test and acceptance criteria.

TERM WORK: Shall consist of a set of exercises based on theoretical formulation in the prescribed course above.

REFERENCE BOOKS

1. Plastic and elastic design of slabs and plates ----- R.H. Wood
2. Yield line analysis of slabs ----- L. L. Joones

5012 Seminar –II

(Term Work – 25 marks)

Seminar shall be based on the topic at dissertation chosen by the candidate. He shall submit a short report on the topic and will deliver a talk thereon guide and other appointed by the Principal of the institution.

5013 Dissertation: Part I

(Term work : 50 marks)

5014 Dissertation: Part II (Term work : 50 marks, Practical Examination : 200 marks)

The dissertation shall consist of any research work done by the candidate including comprehensive and critical review of any recent development in the subject or detailed report of project work consisting of a design and/or development work that the candidate has executed.

The examinee shall submit the dissertation in triplicate to the head of the institution duly certified that the work has been satisfactorily completed.

TERM WORK: The dissertation will be assessed by two examiners appointed by the vice chancellor of the university, one of whom will be the guide.

PRACTICAL EXAMINATION: Shall consist of a defense presented by the examinee on his work in the presence of other interested teacher and students and two examiners appointed by the university.

One of whom will be the guide and the second an external examiner.

