DR. A P J ABDUL KALAM UNIVERSITY, INDORE

SYLLABUS

of

MASTER OF TECHNOLOGY (STRUCTURAL ENGINEERING)

Department of Civil Engineering

(Second Year, III SEM)

(Session- 2017-2018)

College of Engineering

Dr. A P J Abdul Kalam University, Indore

DR. A P J ABDUL KALAM UNIVERSITY, INDORE

Syllabus for Master of Technology (Structural Engineering)

Department of Civil Engineering

List of Subject (Second Year, III SEM.)

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Sub Code: MTSE 301(1) **Sub Name:** Advanced FEM & Programming **4 Credit**

UNIT 1 STRUCTURAL MODELING

Structural modeling by FEM for structures such as shear walls, core walls, bridges and cooling towers.

UNIT 2 STATIC ANALYSIS BY FEM

Iso-parametric formulation for plate and shell elements; various types of elements ; Hybrid elements; .

UNIT 3 DYNAMICS PROBLEMS

FEM in dynamic problems, consistent mass matrix; Vibration of bars, beams and plate elements.

UNIT 4 BUCKLING PROBLEMS

FEM in buckling problems, geometric matrix, buckling of struts and plate elements.

UNIT 5 COMPUTATIONAL ASPECTS

Computational aspects; interpretation of results; comparision with other methods.

Reference Books:

1. Weaver, Johnson, Finite element and structural analysis
2. HC Martin, Matrix structural analysis
3. CF Abel, CS Desai, Finite element methods
4. Buchanan, Finite element Analysis (schaum Outline S), TMH
5. Krishnamurthy, Finite element analysis, TMH

UNIT 1 SOIL EXPLORATION

Soil Exploration: Introduction, Methods of exploration, Direct Methods and techniques of exploration, Methods of boring types of samples, Disturbance of soil sample, Soil samplers and sampling techniques, Ground water observations, Boring records, Spacing and depth of bore holes, Indirect methods of soil exploration, Penetration tests, Geophysical methods, Dynamic methods, Sequence of exploration programs

UNIT 2 SHALLOW FOUNDATION

Shallow Foundations: Introduction, General Requirements, Depth of foundation, Bearing capacity, Eccentric Inclined loads, Bearing capacity of stratified soils, Settlement of footings, Settlement of footings from constitutive laws, Settlement and tilt of eccentrically loaded footings, Allowable settlement, Plate bearing test, Standard penetration test Effect of water table, shallow foundation classification, Modulus of sub-grade reaction, Beams on elastic foundation, Raft foundation.

UNIT 3 DEEP FOUNDATION

Pile Foundation: Introduction, Uses of piles, Types of piles, pile drivers, capacity of piles, Static analysis, Pile load test, Dynamic methods, Other methods, Negative skin friction, Pile group, Ultimate bearing capacity of pile groups, Settlement of pile group, Influence of pile cap. Laterally loaded piles, Ultimate resistance, Elastic methods, Pile groups under lateral load, batter pile under lateral load, Batter pile groups under inclined loads, pile under dynamic loads.

UNIT 4 COFFER DAM AND UNDERGROUND STRUCTURE

Deep Open Cuts: Introduction, Types of Coffer Dams, Design data for cellular cofferdam, Stability analysis of cofferdam, interlock stresses.
Coffer Dams: Introduction, types of Coffer Dams, Design data for cellular cofferdam, Stability analysis of cofferdam, Interlock stresses, conduits and pipes, sheet pile, underground wall.

UNIT 5 MACHINE FOUNDATION

Machine Foundations : Introduction, Criteria for satisfactory action of a machine foundation, Definitions, Degrees of freedom of a block foundation, Analysis of block foundation, Theory of linear weightless spring, Equivalent soil springs, Vertical vibration, Rocking vibration, Vibration in shear, Simultaneous rocking sliding and vertical vibrations for a foundation, Indian standard on design and construction of foundations for reciprocating machines, Foundations for impact type machines, Indian Standard on design and construction of foundations for impact type machines, Analysis of block foundation based on elastic half space theory.

References Books:

1. Bowles, Foundation: Analysis and Design, McGraw Hill Book CO. Inc.
2. Peck , R.B. , W.E. Hanson and T.H. Thornburn, Foundation Engineering, Wiley , New York

UNIT 1 BEAM –COLUMN AND MOMENT RESISTANT CONNECTIONS

Beams Columns: Short & long beam columns, effects of slenderness ratio and axial force on modes of failure, beam column under biaxial bending, strength of beam columns, local section failure & overall member failure.

UNIT 2 TORSIONAL EFFECT

Beams Subjected to Torsion and Bending: Introduction, pure torsion and warping, combined bending and torsion, capacity check, buckling check, design methods for lateral moments and torsional buckling

UNIT 3 DESIGN OF GANTRY GIRDER AND PORTAL FRAME

Introduction of loads, position of moving load for maximum effects, profile of gantry girder, limitation on vertical deflection , Design of gantry girder, design of braced portal frame

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UNIT 4 DESIGN OF BRIDGES

Elements of plate girder , self weight of plate girder , economical depth, size of flanges , shear buckling resistance of web , end panel design , anchor forces, design of connection between flange and web plates, design of bearing stiffeners, web plates for end stiffeners, design of intermediate stiffeners, connection of intermediate stiffeners to web, procedure of design of plate girder bridge, Trussed girder bridges for railways and highways (IRC & IRS loading). Bearings for bridges.

UNIT 5 DESIGN OF HIGH-RISE STRUCTURES

Design of high rise buildings, design of bunkers and silos, design of chimney: Guyed and self supporting steel stacks.

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Reference Books:

1. Morsis L.J. Plum, D.R., Structural Steel Work Design
2. Sinha D.A. , Design of Steel Structures
3. Yu, W.W. , Cold Formed Steel Structures Design

UNIT 1 INTRODUCTION OF SEISMIC EFFECT

Seismic Strengthening of Existing Buildings: Cases histories-Learning from earthquakes, seismic strengthening procedures.

UNIT 2 TORSION AND RIGIDITY

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 3 DESIGN OF EARTHQUAKE

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 code provisions for seismic design of structures, multi-storied buildings, design criteria, P-A effects, storey drift, design examples ductile detailing of RCC structures.

UNIT 4 DESIGN OF SPECIAL STRUCTURES

Seismic Design of Special Structures: Elevated liquid storage tanks, Hydrodynamic pressure in tanks, stack like structures, IS-1893 code provisions for bridges; Superstructures, substructures, submersible bridges, dams; Hydrodynamic effect due to reservoir, concrete gravity dams.

UNIT 5 ENGINEERING SEISMOLOGY

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:

1. Chopra A.K., Dynamics of Structures', Theory & Applications to Eqrthquake Engineering , Prentice Hall India, New Delhi-1995
2. Clough & Penzien, Dynamics of Structures , McGraw Hill Book CO. Inc.
3. Paz M, Structural Dynamics, , Van Nostrand Reinhold, New York
4. Paz, M, International Handbook of Earthquake Engineering, Chapman & Hall, New York.
5. IS-1893-1984, Indian Standard Criteria for Earthquake Resistant Design of Structures, B.I.S., New Delhi.
6. 6. IS-4326-1993, Indian Standard Code of Practice for Earthquake Resistant Design and Construction of Buildings, B.I.S., New Delhi.

Sub Code: MTSE 302(1) Sub Name: Stability Theory in Structural Engineering 4 Credit

UNIT 1 CONCEPTS OF STABILITY AND COLUMN BUCKLING

Concepts of Stability, Euler Buckling Load, Critical Load of Laced, Battened and Tapped columns, Inelastic Buckling of column.

UNIT 2 TORSIONAL IN BEAM AND BEAM -COLUMN

Torsional Buckling, Torsional Flexural Buckling, Lateral Instability of Beams, Beam Columns.

UNIT 3 BUCKLING BEHAVIOUR OF PLATES

Local Buckling and post buckling behaviour of plates.

UNIT 4 BUCKLING BEHAVIOUR OF SHELLS

Local Buckling and post buckling behaviour of shells.

UNIT 5 APPLICATION OF ENERGY

Application of Energy method and matrix method in stability problems.

Reference Books:

1. Theory of Elastic Stability by Timoshenko, TMH Pub.

Sub Code: MTSE 302(2) Sub Name: Design of Tall Structures 4 Credit

UNIT 1 INTRODUCTION OF TALL SRUCTURES

Behavior of tall structures under static and dynamic loads, model analysis.

UNIT 2 WIND AND EARTHQUAKE FORCES

Characteristics of Wind and Earthquake Forces. Gust Factor and Karman Vortices. Approximate and Regorlons Methods of analysis for wind and Earthquake Forces.

UNIT 3 SHEAR WALLS

Shear walls, Frame Structures, Coupled shear walls, Tabular Structures, Ductility and reinforcement details at joint.

UNIT 4 CHIMNEYS AND TOWER

Criteria for design of Chimneys, T.V. Towers and other Tall Structure.

UNIT 5 TALL STRUCTURES

Modeling of tall structures, case studies.

Reference Books:

1. Coull, Smith, Design of tall buildings
2. Taranath, Design of tall buildings

UNIT-I LOADS

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Loads and structural forms of different types of offshore structures; Elements of single d.o.f. system subjected to free and forced vibration.

UNIT-II ANALYSIS OF FORCES

Analysis for transient and steady state force; Equivalent damping for nonlinear systems; Dynamics of multi d.o.f. systems; Eigen values and vectors; Iterative and transformation methods.

UNIT-III FOURIER SERIES

Mode superposition. Fourier series and spectral method for response of single d.o.f. systems; Vibrations of bars, beams and cones with reference to soil as half space.

UNIT-IVBEHAVIOR OF CONCRETE

Behavior of concrete gravity platform as a rigid body on soil as a continuum; short and long term statistics of wind;

UNIT-V STATIC WIND LOAD

Static wind load; Effect of size, shape and frequency; Aerodynamic admittance function and gust factor, spectral response due to wind for various typres of structures; Wave loads by Morison□s equation; Static and dynamic analysis of fixed structures; Use of approximate methods.

Reference Books:

1. Brebbia C.A. Walker, Dynamic Analysis of Offshore Str., Newnes Butterworth
2. Sarpakaya T and Isaacson M., Mechanics of wave forces on offshore structures, Van Nostrand Reinhold New York,
3. Hallam M.G. Heaf N.J. and Wootton, L.R., Dynamics of Marine Structures, CIRIA Publications Underwater Engg., Group , London
4. Graff W.J., Introduction to offshore Structures, Gulf Publishing Co., Houston, Taxas
5. Clough R.W. and Penzine J., Dynamic of Structures - II Ed., McGraw Hill Book CO.
6. Simiu E. and Scanlan R.H., Wind Effects on Structures, Wiley, New York 1978
7. Codes of Practice (latest versions) , Such as API RP-2A ,Bureau Veritas etc.
8. Proceedings of Offshore Technology Conference (OTC) Behavior of Offshore Structures (BOSS) and other Conferences on offshore Engineering.

Sub Code: MTSE 302(4) Sub Name: Reliability Based Civil Engineering Design 4 Credits

UNIT 1 PROBABILITY THEORY

Probability Theory : Mutually exclusice events, set theory, sample points and sample spece, laws of probability, toal probability theorem, Bayes rule, random variablesdiscreate and continuous, jointly distributed discrete variables, marginal distribution, conditional distribution, jointly distributed continuous variables functions of random variables, moments and expectations, common probability distribution normal Iognormal, Gamma and Beta distributions, external distributions.

UNIT 2 PROPERTIES OF CONCRETE

Resistance Distribution and Parameters: Statics of properties of concrete and steel, statics of strength of bricks and mortal, Characterization of variables, allowable stresses based on specified reliability. Probabilistic Analysis of loads: Load as a stochastic process, dead load, statistical analysis of live loads-maximum sustained load intensity model, maximum total load model, wind load-probability model for wind load.

UNIT 3 STRUCTURAL RELIABILITY

Structural Reliability : General expression for reliability , expression for probability of failure: reliability when strength (S) and load (L) follow normal distribution, lognormal distribution, exponential distribution, extreme value distributions, factor of safety corresponding to a given reliability. Monte Carlo Study of Reliability: Monte Carlo Method-Inverse transformation technique, Application to columns beams and frames. Level 2 Reliability Method: Basic variables and failure surface, first order second moment methods-Hasofer and lind s method, Non normal distributions; determination of reliability index of structural elements.

UNIT 4 RELIABILITY BASED DESIGN

Reliability Based Design: Determination of partial safety checking formats, development of reliability based criteria, optimal safety factors, calibration of IS 456 and IS 800.

UNIT 5 RELIABILITY BASED STRUCTURAL SYSTEMS

Reliability of Structural Systems: System reliability, modeling of structural systems, bounds on system reliability, automatic generation of a mechanism, generation of dominant mechanisms , reliability analysis of R.C.C. and Steel Frames.

Reference Books:

1. Ranganathan, R. Reliability Analysis and Design of Structures, TMH
2. Rao. S.S. Reliability Based Design , McGraw Hill Book CO. Inc.
3. Ghosh , D.I., A Primer of Reliability Theory, john Wiley , New York
4. Lewis, E.E., Introduction to Reliability Engineering , John Wiley New Y