DEPARTMENT OF
CIVIL ENGINEERING

Scheme of Instruction and Syllabi
Of

M.E.
(Civil Engineering)

Specialization:

Earthquake Engineering

w.e.f 2016-17 (CBCS)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(Autonomous)
Affiliated to Osmania University
Hyderabad – 500 075, Telangana, INDIA

CHAITANYA BHARATHI INSTIUTE OF TECHNOLOGY

(AUTONOMOUS)-CBCS

Gandipet, Hyderabad – 500 075

INSTITUTE

Vision

To be a Centre of Excellence in Technical Education and Research

Mission

To address the Emerging Needs through Quality Technical Education and Advanced Research

DEPARTMENT

Vision

To become and stay as a centre of excellence in the field of Civil Engineering and contribute for the building up of better living environment, infrastructural facilities and protection of natural resources

Mission

To establish and maintain qualitative staff and infrastructure, monitor the quality of process such as teaching - learning, consultancy and research, maintain strong relationships with reputed Industry, academic and research organizations, produce qualitative civil engineers and thus contribute for the betterment of the society.

CHAITANYA BHARATHI INSTIUTE OF TECHNOLOGY
(AUTONOMOUS)
Gandipet, Hyderabad – 500 075

CIVIL ENGINEERING

Programme: M.E (Earthquake Engineering)

Programme Educational Objectives:

1. To train the graduates as best Structural Engineers with good comprehension of fundamentals and applications of Structural Engineering, besides keeping them abreast with the latest developments at the national and International levels.
2. To produce the graduates with sound technical background and make them industry ready.
3. To prepare the graduates competent to face the State/National and International competitive examinations/evaluation processes.
4. To provide them all requisite inputs that help them attain professional expertise and establish themselves as Structural Engineers.
5. To help them develop interest in Structural Engineering area and pursue academic/ Research assignments

Scheme of Instruction & Examination With effect from the academic year 2016- 2017

M.E. (Structural Engineering) – Civil Engineering - 4 Semesters (Full Time) (CBCS)

Semester - I

Sl. No	Subject	No. of Hrs. per week		Duration (Hrs)	Marks for		Total Mark	Credits
		Lecture	T/P/S		Internal Assessment	End Exam		
1.	Core	3	1	4	30	70	100	4
2.	Core	3	1	4	30	70	100	4
3.	Core	3	1	4	30	70	100	4
4.	Elective	3	--	3	30	70	100	3
5.	Elective	3	--	3	30	70	100	3
6.	Elective	3	--	3	30	70	100	3
7.	Laboratory-I	--	3	3	50	--	50	2
8.	Seminar - I	--	3	3	50	--	50	2
9.	Soft Skills	--	2	--	--	--	--	--
	Total	**18**	**11**		**340**	**360**	**700**	**25**

Semester - II

Sl. No	Subject	No. of Hrs. per week		Duration	Marks for		Total Mark	Credits
		Lecture	T/P/S		Internal Assessment	End Exam		
1.	Core	3	1		30	70	100	4
2.	Core	3	1		30	70	100	4
3.	Core	3	1		30	70	100	4
4.	Elective	3	--		30	70	100	3
5.	Elective	3	--		30	70	100	3
6.	Elective	3	--		30	70	100	3
7.	Laboratory - II	--	3		50	--	50	2
8.	Seminar - II	--	3		50	--	50	2
9.	Mini Project	--	2		50	--	50	1
	Total	**18**	**11**		**390**	**360**	**750**	**26**

Semester - III

Sl. No	Subject	Marks for		Total Marks	Credits
		Internal Assessment	End Exam		
1	Project Seminar* (i)Problem formulation and submission of synopsis within 8 weeks from the commencement of 3rd Semester. (50 Marks) (ii) Preliminary work on	**100**	**--**	**100**	**6**
	Total	**100**		**100**	**6**

Semester - IV

Sl. No	Subject	Marks for		Total Marks	Credits
		Internal Assessment	End Exam		
1	Project Work	**100**	**100**	**200**	**12**

Note: Six core subjects, Six elective subjects, Two Laboratory Courses and Two Seminars, Mini Project and Soft Skills should normally be completed by the end of semester II.

* Project seminar presentation on the topic of Dissertation only, 50 marks awarded by the project guide and 50 marks by the internal committee

Credit requirements for the award of degree, lower limit and upper limit of credits for registration by a student in a semester Credit Requirement for the award of M.E/M. Tech. Degree is 69

Department of Civil Engineering
Scheme of Instructions Earthquake Engineering

S. no	Code No	Subjects	Period per week		Duration of exam in Hrs.	Marks			Credits
			L	T/P		Main Exam	Internal		
							Ses	Ass	
Core Subjects									
1.	16CEC201	Earthquake Resistant design of Buildings	3	1	3	70	20	10	4
2.	16CEC202	Seismic Hazard Assessment	3	1	3	70	20	10	4
3.	16CEC203	Earthquake Resistant design of Special structures	3	1	3	70	20	10	4
4.	16CEC204	Seismic Evaluation & Retrofitting of Structures	3	1	3	70	20	10	4
5.	16CEC103	Finite Element Methods	3	1	3	70	20	10	4
6.	16CEC106	Structural Dynamics	3	1	3	70	20	10	4
Elective Subjects									
7.	16CEE201	Advanced Structural Dynamics	3		3	70	20	10	3
8.	16CEE202	Advanced Mechanics of Materials	3		3	70	20	10	3
9.	16CEE203	Reliability based design	3		3	70	20	10	3
10.	16CEE204	Earthquake Resistant Design of Bridges	3		3	70	20	10	3
11.	16CEE205	Strong motion Seismology	3		3	70	20	10	3
12.	16CEE206	Instrumentation and model testing techniques	3		3	70	20	10	3
13.	16CEE207	Soil Dynamics & Machine Foundations	3		3	70	20	10	3
14.	16CEE208	Earthquake Resistant Design of Masonry Structures	3		3	70	20	10	3
15.	16CEE102	Theory of Shells & Folded Plates	3		3	70	20	10	3
16.	16CEE103	Neural, Fuzzy & Expert Systems	3		3	70	20	10	3
17.	16CEC104	Theory of plates	3		3	70	20	10	3
18.	16CEC105	Tall Buildings	3			70	20	10	3
19.	16CEE106	Structural Optimization	3		3	70	20	10	3
20.	16CEE107	Advanced Steel Design	3		3	70	20	10	3
21.	16MTE101	Statistics and Numerical Methods.	3		3	70	20	10	3
DEPARTMENTAL REQUIREMENTS									
22.	16CEC107	Structural Engineering Lab		3	3		50		2
23.	16CEC108	Computer Aided Analysis & Design Lab		3	3		50		2
24.	16CEC205	Seminar – I (ISem)		3			50		2
25.	16CEC206	Seminar – II (II Sem)		3			50		2
26.	16EG104	Soft Skills Lab		2	Satisfactory/ unsatisfactory				
27.	16CEC207	Mini Project		2			50		1
28.	16CEC208	Project Seminar (III Sem)		3			100		6
29.	16CEC209	Dissertation(III & IV Sem)			#		*		12

16CEC201 EARTHQUAKE RESISTANT DESIGN OF BUILDING

No. of Credits	4
Instruction	3(L) + 1(T)
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I
Basic Concepts: Seismic performance of structures during earthquakes; Lessons learnt from past earthquakes; Ground motion parameters, Microzonation;

Ductile detailing: Concept of ductility; Detailing of structures as per IS13920.

UNIT – II
Seismic Analysis of Buildings: Equivalent static analysis, Response spectrum analysis and Time history analysis of multi storey structures;

UNIT – III
Seismic Design Philosophy: Seismic design consideration in buildings - Regular and Irregular structures, Concept of equal displacement and equal energy principles; Capacity based design of structures;

UNIT – IV
Design of buildings with shear walls: Design of building with shear walls and coupled shear walls; Effect of openings; Design specifications and I.S. codes

UNIT – V
Seismic Provisions for Structural Steel Buildings: Materials, connections, joints and fasters; Columns, ordinary, intermediate and special moment resisting frame; Concentrically and eccentrically braced frames.

Suggested Books:

Sl. No.	Name of Authors / Books / Publishers	Year of Publication/Reprint
1.	Pauley, T. and Priestley, M.J.N “Seismic Design of Reinforced Concrete and Masonry Buildings”, John-Wiley & Sons.	1992
2.	Drysdale, R.G. Hamid, A. H. and Baker, L.R “Masonry Structure: Behaviour and Design”, Prentice Hall, Englewood Cliffs.	1994
3.	Schneider, R.R. and Dickey, W.L. “Reinforced Masonry Design”, 3nd Ed., Prentice Hall.	1994
4.	Edmund Booth, “Concrete Structure in earthquake regions – Design & Analysis” Longman Scientific & Technical.	1994
5.	“Seismic Evaluation and retrofit of concrete building – Vol. I & II”, Applied Technology Council, California, ATC 40.	1996
6.	Penelis, George G., and Kappos, Andreas J., E & F. N., Spon, “Earthquake Resistant Concrete Structures”,.	1997
7.	“Building Seismic Safety Council”, Federal Emergency Management Agency, Washington, D.C, FEMA 356, 2000, FEMA 440 / ATC 55, 2005, FEMA 310	1998
8.	Amrhein, J. E. “Reinforced Masonry Engineering Handbook”, Masonry Institute of America, CRC Press.	1998
9.	Allan Willians, “Seismic Design of Building & Bridges”, Oxford University Press.	2003
10.	Robert E. Englekirk “Seismic Design of Reinforced and Precast Concrete Buildings”, John-Wiley & Sons.	2003
11.	Steven L. Krammer “Geotechnical Earthquake Engineering”, Low Priced Edition, First Indian Reprint, Prentice-Hall International Series in Civil Engineering and Engineering Mechanics, Pearson Education.	2003
12.	Edmund Booth and David Key, Tomas Telford, “Earthquake Design Practice for Buildings”,.	2006

16CEC202 **SEISMIC HAZARD ASSESSMET**

No. of Credits	4
Instruction	3(L) + 1(T)
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I

Introduction: Seismic hazard and risk, definition of seismic hazard, types of magnitudes, MCE,DBE, SSE, OBE, MPE, site specific design earthquake parameters.

Earthquake Catalogues: Existing important earthquake catalogues, historical andinstrumental seismicity, magnitude homogenisation, regression methods, orthogonal regression analysis, declustering and completeness models, minimum magnitude of completeness.

UNIT – II

Ground Motion Prediction Equations: Strong motion attenuation relationships, dependentand independent parameters, PGA and spectral accelerations, elastic and inelastic response spectra, displacement spectra, periods of interest.

Earthquake Recurrence Models: Statistical properties of an earthquake sequence, fore shocks and aftershocks, asperity and barrier models, size distribution of earthquakes, temporal and spatial distributions, Gutenberg-Richter relationship, migration of seismicity.

UNIT – III

Temporal Distribution of Earthquakes: Poissonian model, time dependent Poisson process, characteristic earthquake model, periodicity, conditional probabilities, Gamma distribution, Weibul distribution, Gaussian distribution, log normal distribution, Markov and semi-Markov models, Gumbel distributions and mixed Gumble distribution; Time and slip predictable earthquake models; Use of ANN models.

UNIT – IV

Seismic Hazard Assessment: Deterministic and probabilistic seismic hazard assessment, seismotectonic modelling; Line, point and volume sources, random seismicity method, seismotectonic province method, geological slip rate method, Zoneless seismic hazard estimation, spatial and size uncertainties, prediction of strong ground motion, mean annual rates of exceedance and their engineering aspects, uniform seismic hazard spectra, desegregation.

UNIT – V

Uncertainties and their Treatments: Aleatory and epistemic uncertainties, uncertainties atdifferent stages of PSHA, quantification and classification of uncertainties, logic tree approaches, Monte Carlo simulations, COV maps.

Suggested Books:

Sl. No.	Name of Authors / Books / Publishers	Year of Publication/Reprint
1.	Reiter, L., "Earthquake Hazard Analysis: Issues and Insights", Columbia University Press.	1990
2.	Taylor, J.R. "An introduction to Error Analysis", 2nd edition, University Science Books.	1997
3.	Chernick, M. R., "Bootstrap methods: A practitioner's guide, in Wiley Series in Probability and Statistics," W. A. Shewhart (Editor), Wiley and Sons.	1999
4.	"Seismotectonic Atlas of India and its Environs," Geological Survey of India.	2000
5.	McGuire, R.K., "Seismic Hazard and Risk Analysis", Monograph MNO-10, Earthquake Engineering Research Institute.	2004
6.	Draper, N.R. and Smith, H., "Applied regression analysis", John Wily & Sons (Asia).	2005

16CEC203 **EARTHQUAKE RESISTANT DESIGN OF SPECIAL STRUCTURES**

No. of Credits	4
Instruction	3(L) + 1(T)
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I

Performance Based Design: Behavior of reinforced concrete members in bending - moment curvature relationship; Plastic hinge, Factors affecting rotation capacity of a section, Plastic moment - Redistribution of moments.

Performance evaluation of structures: Pushover Analysis.

UNIT – II

Overhead Water Tanks: Modelling and analysis of overhead water tanks, hydrostatic and hydrodynamic effects, earthquake resistant provisions.

UNIT – III

Cooling Towers : Seismic behaviour and design of cooling towers, analysis and design of hyperbolic cooling towers. codal provisions.

UNIT – IV

Chimneys and silos: Seismic analysis and design of short and tall stacks & chimney structures, foundation compliance, codal provisions.

UNIT - V

Vibration control techniques: Vibration Control; Tuned Mass Dampers- Principles and application, Basic Concept of Seismic Base Isolation - various Systems - Case Studies.

Suggested Reading:

Sl. No	**Name of Authors / Books / Publishers**	**Year of Publication/Reprint**
1.	Priestley, M.J.N., Calvi, G.M. and Kowalsky, M.J., “Displacement-Based Seismic Design of Structures,” IUSS Press.	2007
2.	FEMA-356, “Prestandard and Commentary for the Seismic Rehabilitation of Buildings,” Federal Emergency management Agency.	2000
3.	FEMA-450, “NEHRP Recommended provisions for Seismic Regulations for New Buildings and Other Structures,” Federal Emergency management Agency.	2003
4.	Paulay, T. and Priestley, M.J.N. “Seismic Design of Reinforced Concrete and Masonry Buildings,” John Wiley & Sons.	1992
5.	George G. Penelis and Andreas J. Kappos, “Earthquake Resistant Concrete Structures,” E & FN Spon.	1997
6.	M.J.N. Priestley, F. Seible, and G.M. Calvi, “Seismic Design and retrofit of Bridges,” John Wiley & Sons.	1996
7.	Skinner, R., Robinson ,W.H., McVerry ,G.H., “An Introduction to Seismic Isolation”, John Wiley and Sons.	1996

16CEC204 SEISMIC EVALUATION AND RETROFITTING OF STRUCTURES

No. of Credits	4
Instruction	3(L) + 1(T)
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I

Introduction: Terminology; Basic principles of seismic evaluation and retrofitting. **Qualitative Methods of Seismic Evaluation**: Rapid visual screening procedure (RVSP) and simplified evaluation of buildings; Visual inspection method and nondestructive testing (NDT) method.

UNIT – III

Quantitative Methods of Seismic Evaluation: Performance based method using nonlinear static push-over analysis (NSP) and non linear dynamic method of analysis (NDP); Estimation of seismic capacity (strength and ductility).

UNIT – III

Local and Global Methods of Seismic Retrofitting of RC Buildings: System completion; Strengthening of existing components; RC, Steel and FRP Jacketing; Addition of new components – frames, shear walls and braced frames; Introduction to supplemental energy dissipation and base isolation.

UNIT – IV

Re-evaluation of Buildings with Retrofitting Elements: Linear and Non-linear modelling; Modelling of soil and foundations.

Seismic Repair and Retrofitting of Earthquake Damaged RC Buildings: Schemes of temporary shuttering damages; Methods of repair and retrofitting.

Seismic Evaluation and Retrofitting of RC Bridges: Seismic evaluation and retrofitting techniques for reinforced concrete bridges – columns/piers, cap beams, cap beam-column joint, footing.

UNIT – V

Seismic Safety of Equipments and Accessories: Retrofitting solutions against sliding and over turning of equipments and accessories.

Case Studies in Seismic Retrofitting: Case studies RC buildings, masonry buildings, bridges, water tanks and gravity dams.

Suggested Reading:-

Sl. No.	Name of Authors / Books / Publishers	Year of Publication/Re print
1	"Seismic Evaluation and retrofit of concrete building – Vol. I & II", Applied Technology Council, California, ATC 40.	1996
2	M.J.N., Seible, F. and Calvi, G.M "Seismic Design and Retrofit of Bridges", John-Wiley & Sons.	1996
3	Penelis, George G., and Kappos, Andreas J., E & FN Spon "Earthquake Resistant Concrete Structures"	1997
4	"Rapid Visual Screening of Buildings for Potential Seismic Hazards", Federal Emergency Management Agency, Building Seismic Safety Council, Washington, D.C., FEMA 154/155	2002
5	"Evaluating the Seismic Resistance of Existing Building" ATC -14 project, Applied Technology Council, California.	2002
6	"Seismic Evaluation of Existing Building" ASCE/SEI 31-03	2003
7	"Seismic Rehabilitation of Existing Buildings" ASCE & SEI.	2007

16CEC103 **FINITE ELEMENT METHODS**

No. Of Credits	4
Instruction	3(L) + 1(T)
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

Course Objectives:

1. To provide the fundamental concepts of the theory of the finite element method.
2. To enable the students to formulate the design problems into FEA.
3. To introduce basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
4. To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems through the use of a major commercial general-purpose finite element code
5. To provide the concepts to Solve different domain problems in structural engineering.

Course Outcomes:

1. To obtain an understanding of the fundamental theory of the FEA method;
2. To develop the ability to generate the governing FE equations for systems governed by partial differential equations;
3. To understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements
4. To demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software.
5. To demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes;
6. To develop a basic understanding of the limitations of the FE method and understand the possible error sources in its use

Unit-I:- Introduction to FEM:
Types of problems–types of materials–Elastic -in-Elastic situations–types of forces: body forces- surface traction -point loads– deformable bodies–types of deformations–homogeneous,non homogeneous problems–equations of equilibrium for elastic 2-d, 3-d, continua-equilibrium equations for 2-d, 3-d boundary elements–boundary conditions–strain-displacement relation for 2-d,3-d–stress-strain relation for 2-d,3-d–plane stress, plane strain problems.
Virtual work formulation:
Application to problems of plane trusses with static indeterminacy not exceeding three.
Finite difference method with central differences:
Solving ODE'S and PDE's with central differences. Application to beam and plate bending problems of simple geometry.

Unit-II:- Variational formulation:
Finite element formulation- stationary of functional–given the functional or differential equation–number of elements limited to two.
1-D Elements :strain-displacement relation matrix ,stiffness matrix ,minimum potential energy approach ,Rayleigh-Ritz method, introduction to natural coordinates , stiffness matrix of second order bar element, Axial bar subjected to point loads, body forces and surface traction forces ,problems with kinematic indeterminacy not exceeding two.
2-D Triangular elements:
Displacement models ,criterion for convergence ,geometric invariance, conforming and nonconforming elements-3-node triangular are elements (CST), determination of strain-displacement matrix, area coordinates-shape functions, determination of assembling global stiffness and load matrices, Problems with kinematic indeterminacy not exceeding three.
2nd Order Triangular Elements:
Shape Functions, Degradation Technique ,strain-displacement matrix , Expression for stiffness matrix,Load matrices Shape functions–degradation due to body forces and surface traction.

Unit-III:- Iso-Parametric Elements Quadrilateral Elements:
Construction of shape Functions using natural coordinates, Strain-displacement matrices, Load matrices for body force and surface traction, Expressions for stiffness matrix, load matrices for 4-noded quadrilateral

elements, Gauss Quadrature of numerical integration, Problems with rectangular elements, kinematic indeterminacy not exceeding three.

2nd order quadrilateral elements:-Determination of shape functions for 2nd order quadrilateral elements and serendipity elements, Strain-displacement matrices, Load matrices for body force and surface traction.

Unit-IV:- Method of weighted residuals:
Galerkin's method of weighted residuals:
Application to problems of mathematics , structural engineering, number of trial functions not exceeding two.
Galerkin's finite element method:
Weak form of Trial Function-Application to problems of mathematics, structural engineering, number of elements limited to two.

Unit-V:- Axi-Symmetric Problems:
Strain-displacement relationship, stress-strain relationship, determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction, Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only.
Tetrahedron Elements:
Volume coordinates, Strain-displacement matrix, stiffness matrix, load matrices due to body force and surface traction ,introduction to Hexahedron (brick) elements.
Introduction to FEA Software's :
Illustration on different modules of FEA Software, Structural engineering applications of the package, Pre-Processing, Analysis and post Processing of the results.

Suggested Reading:

1. Chandrupatla, T. R. And Belegundu, A. D, (2012). "Introduction to Finite Elements in Engineering", Prentice Hall of India, New Delhi.
2. Seshu. P, (2003). "Finite Element Analysis", Prentice Hall of India Private Limited, New Delhi.

David V. Hutton, (2005). "Fundamentals of Finite Element Analysis", Tata McGraw-Hill Publishing Company Limited, New Delhi.

16CEC106 STRUCTURAL DYNAMICS

No. of Credits	4
Instruction	3(L) + 1(T)
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

Course Objectives:

1. To study the various types and characteristics of loading. Formulation of equations of motion.
2. To study the response of undamped and damped SDOF and MDOF systems under various loadings.
3. Use of approximate and iterative methods. Learn to model continuous vibratory systems.
4. Use of seismic codes in analysis and design of civil engineering structures. Dynamic response by Numerical methods

Course Outcome:

1. Understanding of the fundamental theory of dynamic equation of motions. Understanding of the fundamental analysis methods for dynamic systems. Understanding of modeling approach of dynamic response in civil engineering applications.
2. Create simple computer models for engineering structures using knowledge of structural dynamics.
3. Evaluate dynamic response analysis results and understand the possible error sources.
4. Understand modal analysis and its influence on the dynamic response of structures
5. Interpret dynamic analysis results for design, analysis and research purposes. Apply structural dynamics theory to earthquake analysis, response, and design of structures.

UNIT – I

Objective of dynamic Analysis, Types of prescribed Loading, Characteristic of a Dynamic Problem, Methods of Discretization: Lumped mass procedure, Generalized displacements.

Single Degree of Freedom Systems: Formulation of Equation of Motion: Using Alembert's Principles, Virtual Displacements, Hamiltion's Principle influence of Gravity and Ground motion on equation of motion. Generalized SDOP systems: Rigid body assemblage, Distributed Flexibility

UNIT – II

Free vibrations Response: Solution of equation of motion, Undamped and damped free vibrations, response to Harmonic Loading, Vibration isolation, Accelerometers and Displacement Meters, Resonant response and methods of measuring damping, Response to periodic loading and impulse loads.

UNIT – III

Multi Degree of Freedom Systems: Formulation of Equations of Motion: Selection of degrees of freedom, Dynamic equilibrium condition.
Evaluation of Structural Properties: Elastic properties such as flexibility and stiffness, Mass properties , Lumped mass matrix, Damping properties and External loadings.
Undamped Free Vibrations: Analysis of vibration frequencies and Mode shapes using detrimental equation method. Flexibility formulation. Orthogonality Conditions. Basic Conditions, Additional relationships, Normalizing.Analysis of Dynamic Response: Normal coordinates, Uncoupled equations of motion – damped and undamped.

UNIT – IV

Practical Vibration Analysis: Stodola Method – Fundamental mode only, Holzer Method- Fundamental Mode only.Viritional Formulation of the Equation of Motion: Generalized coordinates, Lagranges's Equation of Motion Distributed – Parameter Systems: Introduction, Beam Flexure; Elementary case, Undamped free vibrations, Analysis of Dynamic Response: Normal coordinates, Damped uncoupled equations of motion Distributed - Parameter Systems: Introduction, Beam Flexure; Elementary case, Undamped free vibrations, Analysis of Dynamic Response : Normal coordinates, damped uncoupled equations of motion.

UNIT – V

Seismic Analysis: Response Spectra (RS) Types: Construction of RS: RS for support disturbances, R.S.for Elastic Design. I.S. Codal Provisions for Earthquake Resistant R.C.C. Building design, Ductile reinforcement detailing.

Suggested Reading:-

S.No	**Name of Authors / Books / Publishers**	**Year of Publication/Reprint**
1.	Clugh and Penzien, “Dynamic of Structures”**,** Mc Graw Hill,	1982
2.	A.K. Chopra, “Dynamic of Structures”, Prentice Hall of India	1996
3.	Mario Paz, “Structural Dynamics”, CBS Pub.	1987

16CEE201 **ADVANCED STRUCTURAL DYNAMICS**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I
Nonlinear Systems: Common types of nonlinearity, material and geometric nonlinearity, cubicstiffness, bilinear stiffness and damping, piecewise linear stiffness, nonlinear damping, coulomb friction, systems with finite deflection.
UNIT – II
Dynamics of Nonlinear Systems: Concept of nonlinear vibration; State space models, phaseportraits, jump phenomenon, strange attractors and chaos parametric or self-excited oscillations; Approximate solution methods-perturbation techniques, equivalent linearization.
UNIT – III
Seismic Response of Nonlinear Systems: Inelastic earthquake analysis of multi-storeybuilding frames, Pushover Analysis, Concepts of ductility and inelastic response spectrum, ductility in a multi-storey structure.
UNIT – IV
Stability of Dynamic Systems: Concepts of stability of motion, Liapunov's criterion, Routh-Hurwitz criterion, Nyquist stability criterion; Stability of nonlinear and time varying systems.
UNIT – V
Inverse Problems in Vibrations: Review of linear algebra concepts; System identification asan inverse problem; Discrete time approach, linear discrete time models, model validity, system identification using neural networks; Continuous time approach, system identification using genetic algorithms; Updating finite element models using vibration records.

Suggested Reading

Sl. No.	Name of Authors / Books / Publishers	Year of Publication/Reprint
1.	Dordrecht, The Netherlands, Friswell , “Finite Element Model Updating In Structural Dynamics”, Kiuwer Academic Publisher.	1995
2.	Japanese Society of Civil Engineers, Dynamic Analysis and EarthquakeResistant Design, Volume 2: Methods of dynamic Analysis, Oxford & IBH Publishing Co.	2000
3.	Graham, M.L. Gladwell, “Inverse Problems in Vibration”, Springer	2004
4.	Wei-Chau Xie, Dynamic Stability of Structures, Cambridge University Press	2006
5.	T. K. Datta, Seismic Analysis of Structures, John Wiley & Sons (Asia).	2010

16CEE102 THEORY OF SHELLS AND FOLDED PLATES

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I
Introduction: Definition and Classification of shells.

Cylindrical Shells: Membrane Theory - Equilibrium equations for a differential shell element - Calculation of stresses and displacements due to dead loads and snow loads for circular cylindrical shell.

UNIT-II
Bending Theory- Necessicity of bending theory (i) D.K.J. theory Assumption -Equilibrium equations for a differential element-stress strain relations -Moment curvature relations - Derivation of D.K.J. Differential and characteristics equations - Roots of the Characteristics equation - Expression for defection (ii) Schorer theory , Assumptions - Equilibrium equations for a differential shell element – Stress strain relations Moment curvature relations - Derivation of Schorer differential and characteristic equations -Roots of the characteristic equation, Expression of defection.

UNIT-III
Beam Theory- Assumptions and range of their validity - Outline of the beam arch analysis - Advantages of beams theory over other theories

UNIT-IV
Shells of Doubles Curvature: Membrane theory of shells of revolution - Equilibrium equations for a differential shell element - Calculation of Stresses in a spherical dome due to uniform load over the surface and due to concentrated load around a skylight opening. Shells of translation equilibrium equations for a differential shell element. Puncher's stress function, derivation of a differential equation from equations of equilibrium using purchaser's stress function calculation of tresses in hyperbolic parabolids with straight edges under uniform load over the surface.

UNIT-V

Folded Plates: Assumptions - structural behaviour - Resolutions of ridge loads- Edge sheers - Stress distribution - Plate deflections and rotations Effect of joint moments - Analysis of V sshped folded plates using (i) Simpson and (ii) Whitney methods.

Suggested Reading:

S.No.	**Name of Authors / Books / Publishers**	**Year of Publication/Reprint**
1.	S. Thimoshenko& W. Krieger, "Theory of Plates, & Shells" Mc . Graw Hill.	1959.
2.	G. S. Rama Swamy, "Design and Construction of Concrete shell roofs", CBS Pub	1986
3.	J.Ramchandran,"Thin Shells Theory and Problems", Universities Press	1993.

16CEE103 **NEURAL, FUZZY AND EXPERT SYSTEMS**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I

Introduction: Brief introduction to the study of artificial intelligence:" An insight to the concept of natural intelligence followed by the development of artificial neural networks, fuzzy logic systems and expert systems tools. Demonstration of the importance of artificial neural networks, fuzzy logic, and expert systems with the help of at least two practical examples of Civil Engineering for each study. Importance of nuero-fuzzy systems

UNIT – II

Neural Networks: Components of artificial neural networks -neurons, inputs, outputs, error, error propagation, hidden layers threshold logic, weights: bias, noise, momentum, rate of learning, training and testing-Hebb's rule, Delta rule - Supervised learning – Generalized delta rule- unsupervised learning.

Types of Neural Networks - Perceptions - feed forward back propagation networks - Hop field networks.

UNIT – III

Fuzzy sets: Crispness vagueness, uncertainty, and fuzzy sets. Basic Definitions and operations of Fuzzy sets, approximate reasoning, and membership function.

Fuzzy Relations: Fuzzy relation and fuzzy composition, fuzzy aggregation procedures, Dominance Matrix, Weight ages, applications of Fuzzy sets to civil engineering problems, and pattern recognition.

UNIT-IV

Expert systems: Structure of expert systems, Knowledge of acquisition, Knowledge organization, methods of representing knowledge, types of inference engines, reasoning under uncertainty, various types of expert system tools, heuristics, search mechanism, expert system Development and hybrid expert systems.

UNIT-V

Exposure to Software Packages: Neural networks (Matlab tool kit)–fuzzy logic - expert systems (L5 object)Applications of Artificial Neural Networks, Fuzzy logic and expert systems in Civil Engineering- Case studies with atIeast one problem on each aspect of ANN, FL and Expert systems

Suggested Reading:

S.No.	**Name of Authors / Books / Publishers**	**Year of Publication/Reprint**
1.	Zimmerman. H.J., KIuwer,“Fuzzy Sets, Decision Making, and Expert Systems", Academic Publications, Boston.	1987.
2.	Adeli H., Chapman“Expert Systems in Construction and Structural Engineering"	1988.
3.	Elaine Rich, Juda Pearl, Heuristics, “Artificial Intelligence and Expert System",	
4.	Freeman, J.A., and Skapura“Neural Networks Algorithms, Applications and Programming” D.M. Addition-Wesley, Reading MA	1991.

16CEE202 **ADVANCED MECHANICS OF MATERIALS**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT-I:

THEORIES OF STRESS AND STRAIN: Definition of Stress at a point. Stress notation, Symmetry of stress components, stress acting on arbitrary planes, Normal stress and shear stress on an Oblique Plane. Transformation of stress, Mean and Deviator stresses, Plane stress, Plane strain.

UNIT-II:

PRINCIPAL STRESSES AND STRAINS: Principal stresses, principal values and directions, octahedral stress,Strain of a line element, Final directions of a line element, Rotation between two line elements, Principal strains. Strain compatibility relations, strain displacement relations, Limitations on the use of uni-axial stress-strain data

UNIT-III:

INELASTIC MATERIAL BEHAVOUR: Nonlinear material response, models of uni-axial stress-strain curves. Yield Criteria general concepts, yielding of ductile metals, Failure Criteria- maximum shear stress (Tresca), and Distortional energy density (von Mises) criterion. Mohr-Coulomb yield criterion, Drucker –Prager yield criterion, Hill's criterion for orthotropic materials. Elastic-plastic bending, fully plastic moment, shear effect on inelastic bending, modulus of rupture, comparison of yield criteria and interpretation of failure criteria for general yielding.

UNIT-IV:

FLEXIBILITY METHOD OF ANALYSIS: Introduction, Fundamentals of Flexibility method. Analysis of beams, trusses, plane frames and grid frames. Temperature changes, prestrains, and support displacements. Flexibilities of prismatic members.

UNIT-V:

STIFFNESS METHOD: Introduction, Fundamentals of Stiffness method. Analysis of beams, trusses, plane frames and grid frames. Temperature changes, prestrains, and support displacements. Stiffness of prismatic members.

Text Books:-

1. Arthur P. Boresi and Richard J. Schmidt, Advanced Mechanics of Materials, Sixth Edition (2011), Wiley Student Edition.
2. William Weaver, Jr. and James M. Gere, Matrix Analysis of Framed Structures, Second Edition (1986), CBS Publishers and Distributors.

REFERENCE BOOKS:

1. Timoshenko and Goodier,J. N.,Theory of Elasticity, Third Edition (2010),McGraw Hill Education.
2. Sadhu Singh,Theory of Elasticity, (1995), , Khanna publishers, New Delhi.
3. Pandit and Gupta,Matrix Methods of Structural Analysis, Second Edition (2000), Tata McGraw Hill.
4. R. C. Hibbeler,Structural Analysis, Eight Edition(2012), , Pearson.
5. P.N. Chandramouli, Continuum Mechanics, Yesdeep Publishing pvt. Ltd.

16CEE106 **STRUCTURAL OPTIMIZATION**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT-I

Introduction: General Introduction: basic theory and elements of optimization - Terminology and definitions - Basic principles and 'procedure of optimization.

Classical Methods of Optimization: Trial and error method, Monte-Carlo method and Lagrangian Multiplier Method - illustrative examples. Linear Programming: Introduction, terminology, standard form of linear programming problem, geometrical interpretation, canonical form of equation graphical and algebraic methods of solving L.P. problems, illustrative examples.

UNIT- II

Linear Programming: Simplex, methods, Dual formulations illustrative examples.

Network analysis: Introduction to network theory, transportation and assignment models - formulation of mathematical models and solutions- applications to Civil Engineering problems.

UNIT - III

Non Linear programming: Unconstrained and constrained methods of optimization on- .Univariate search, Steepest Descent Methods, Kuhn- Tucker conditions – Penalty functions, slack variables and Lagrangian Multiplier methods - illustrative examples

Geometric and Dynamic Programming : illustrative Examples.

UNIT- IV

Structural Optimization: structural design of rectangular timber , and reinforced concrete beams - Optimization applied to concrete mix proportioning - procedure of optimization for reinforced concrete deep beams.

UNIT-V

Structural Optimization: Optimum structural design of reinforced concrete T and L beams - Optimization of planner trusses - Procedure of optimization for structural grid and slab - floor systems

Suggested Reading:

Sl. No.	**Name of Authors / Books / Publishers**	**Year of Publication/Reprint**
1.	S.S. Rao, "Engineering Optimization", New Age Internationals	1999
2.	Paul, J.O., John Wiley & Sons"Systems Analysis for Civil Engineers”	1988

16CEE204 EARTHQUAKE RESISTANT DESIGN OF BRIDGES

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I

Performance of RC Bridges in Past Earthquakes: Types of failures and lessons learnt;Terminology related to bridges.

General Concept and Seismic Design Principles: Earthquake loading and analysis; Forcedbased design and displacement based design including the concept of performance based design.

UNIT – II

Conceptual Design of Bridges: Constraints, bent configuration; Superstructure pierconnection, superstructure-abutment connection; Foundation systems.

Mathematical Modelling of RC Bridges: Modelling of super structure, substructure andbearings; Modelling of foundations; Concept of non-linear modelling of bridge components.

UNIT – III

Seismic Analysis of RC Bridges: Seismic coefficient method of analysis; Response spectrumanalysis, time history method, push-over analysis.

Seismic Design Codes of RC Bridges: Seismic design provision based on Indian codes (IRC-6,IS 1893); Major international codes (ASTHO, CALTRANS, EURO, NZ and JSCE).

UNIT – IV

Seismic Design of RC Bridges: Capacity based design of piers; Design and ductile detailing ofpiers; Joints, footings and pile caps; Movement design, unseating prevention systems, bearing; Design using isolation and energy dissipation devices.

UNIT –V

Seismic Design concept of pre stressed concrete bridges: Design of girder section – maximum and minimum pre stressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

Suggested Books:

Sl. No.	Name of Authors / Books / Publishers	Year of Publi-cation/Reprint
1.	"Earthquake Engineering for Concrete Dams: and Research Needs"National Academy Press.	1990
2.	Seible F., Calvi G.M "Seismic Design and Retrofit of Bridges", John Wileyand Sons.	1996
3.	"Design specifications of Highway Bridges", Part V. Seismic Design, PWRI.	1998
4.	Mark Yashinsky and Karshenas, M.J. "Fundamentals of Seismic Protectionfor Bridges", Earthquake Engineering Research Institute.	2003
5.	Allan Willians "Seismic Design of Building & Bridges", Oxford UniversityPress.	2003
6.	Robin Fell, Patrick Macgregor, David Stapleton Graeme Bell, "GeotechnicalEngineering of Dams" A.A. Balkeme Publishers.	2005
7.	Author: George Jay Holombo, "Seismic Design of Precast Girder Bridges" Publisher : University of California, San Diego,	1999
8.	Author : Mark Yashinsky and Karshenas, M.J., "Fundamentals of Seismic Protection for Bridges" Publisher : Earthquake Engineering Research Institute.	

16CEE205 **STRONG MOTION SEISMOLOGY**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I

Introduction: Definitions, basic concepts and historical development in the field of StrongMotion Seismology (SMS); Characteristics of Strong Ground Motion (SGM); SGM parameters based on amplitude, frequency content and duration of shaking.

Physics of the SGM Earthquake Source: Representation theorems; Source effect in the near-field and far-field; Aki's scaling law of seismic spectrum, Brune's model and finite source models.

UNIT – II

Measurement of SGM: Principle and theory of accelerometer, forced balanced accelerometer,seismoscope and structural response recorder; Construction and working of analog and digital accelerographs; Seismic alarm/circuit tripping and control devices.

Processing and Interpretation of Accelerogram: Digitization of accelerogram, digitizationerrors and filtering to control these errors; transducer correction; Routine processing and double integration of accelerogram; Computation of frequency spectra and response spectra.

UNIT – III

Factors Affecting SGM: Asperity, Barrier and Stochasticω-square models to explain the highfrequency SGM; Effect of radiation pattern, fault type and directivity on SGM; Various type of scaling laws, differences in the scaling laws of interplate and intraplate earthquakes; Modification of SGM due to propagation path effects such as geometrical spreading, scattering and attenuation; Basin response and site effects including nonlinearity.

UNIT – IV

Strong Motion Instrument Arrays: Principles of site selection for favorable array locations;Source mechanism and wave propagation arrays; Various types of local effects arrays to study site effects; Operation and maintenance of strong motion arrays; Indian strong motion program.

UNIT – V

Strong Motion Attenuation Models: General form of attenuation model relating specific SGMparameter to seismological parameters; Description of various earthquake source parameters (e.g., size, focal mechanism, stress drop) and strong motion parameters that enter into regression; Hanging wall and footwall effects; Various types of source to site distances; Different classifications of local site conditions, site classifications based on shear wave velocity (e.g.,30-meter velocity and effective velocity); Effect of site location and tectonic environment on SGM; Analysis and interpretation of random errors.

Theoretical Models for Estimation of SGM: Stochastic models, synthetic Green's function and empirical Green's function models to predict SGM.

Suggested Reading:-

Sl. No.	Name of Authors / Books / Publishers	Year of Publication/Reprint
1.	Iwan, W.D, Proceedings of the International Workshop on Strong-Motion Earthquake Instrument Arrays held at Honolulu, Hawaii, May 2-	1978
2.	Hudson, D.E., "Reading and Interpreting Strong Motion Accelerogram," Earthquake Engineering Research Institute.	1979
3.	Aki, K. and Richard, P. G., "Quantitative Seismology, Theory and Methods", Vol. I and II, W. H. Freeman & Co.	1980
4.	Bolt, B. A., "Seismic Strong Motion Synthetics", Academic Press.	1987
5.	Kramer, S.L., "Geotechnical Earthquake Engineering", Prentice Hall, Upper Saddle River.	1996
6.	Lee, W.H.K., Kanamori, H., Jennings, P.C., and Kisslinger, C. "International Hank Book of Earthquake and Engineering Seismology," (Part B), Academic Press.	2003

16CEC104 **THEORY OF PLATES**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT-I

Pure Bending of Plates: Pure and Cylindrical Bending; Relations between slope and curvature of slightly bent plates Moment-curvature relations in pure bending. Strain energy in pure bending. Symmetrical Bending of Circular Plates: Differential equation of equilibrium. Uniformly loaded plates at center. Circular plates with circular holes at the center

UNIT- II

Buckling of plates: Calculation of critical loads - Buckling of simply supported rectangular plates - uniformly compressed in one and two directions with different edge conditions. Web Buckling.

UNIT-III

Small Deflections of Laterally Loaded Plates: Differential equation of equilibrium: Boundary conditions. Solution of simply supported rectangular plates under various loading conditions Viz unormaly distributed load (full or partial) concentrated load by Navier's approach. . Levy type solution for rectangular plates under U.D.L . With all four edges simply supported or two opposite edges simply supported and other two fixed.

UNIT -IV

Approximate Methods for Rectangular Plates: Stain energy approaches, Rayleigh-Ritz method. Finite difference method for simply supported or fixed rectangular plates carrying UDL (full or partial) or central point load.

UNIT-V

Bending of Orthotropic Plates:. Differential equation of the bent plate. Application of the theory to simply supported rectangular (i) Laminates (ii) RC slabs (iii) grids.

Suggested Reading:

1. Theory of plates and shells", S. Timoshenko and W. Krieger., Me Graw Hill.
2. “Theory of plates and Shells", R.H. Wood.
3. “Theory of plates and shells", Zienkiwicz, Me Graw Hill Co

16CEE207 **SOIL DYNAMICS & MACHINE FOUNDATIONS**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT – I

Introduction: Scope and objective; Nature and types of dynamic loading; Importance of soildynamics.

Vibration theory - SDOF:Vibration of elementary systems; Degrees of freedom (SDOF andMDOF systems); Equation of motion for SDOF system; Types of vibrations; Earthquake excitation; Undamped and damped free vibrations; Torsional vibration; Critical damping; Decay of motion; Undamped and damped forced vibration; Constant force and rotating mass oscillators.

UNIT – II

Vibration theory - MDOF:Dynamic magnification factor; Transmissibility ratio; Non-harmonic, arbitrary, impact and other types of forced vibrations; Duhamel's integral; Taxing of vehicles on uneven roads; Vibration isolation; Vibration measuring instruments; Equation of motion for MDOF system.

Wave Propagation : Longitudinal and torsional waves in infinitely long rod; Solution for one-dimensional and three-dimensional equations of motion; Waves in semi-infinite body; Waves in layered medium; Earthquake waves – P-wave, S-wave, Rayleigh wave and Love wave; Locating earthquake's epicenter.

UNIT – III

Dynamic Soil Properties: Stresses in soil element; Determination of dynamic soil properties;Field tests; Laboratory tests; Model tests; Stress-strain behavior of cyclically loaded soils; Estimation of shear modulus; Modulus reduction curve; Damping ratio; Linear, equivalent-linear and non-linear models; Ranges and applications of dynamic soil tests; Cyclic plate load test; Liquefaction; Screening and estimation of liquefaction; Simplified procedure for liquefaction estimation; Factor of safety; Cyclic stress ratio; Cyclic resistance ratio; CRR correlations with SPT, CPT, SASW test values.

UNIT – IV

Machine Foundations: Types of machines; Basic design criteria; Methods of analysis; Mass-Spring-Dashpot model; Elastic-Half-Space theory; Tschebotarioff's reduced natural frequency method; Types of foundations; Modes of vibrations; Vertical, sliding, torsional (yawing) and rocking (and pitching) modes of oscillations; Design guidelines as per codes; Typical design problems.

UNIT – V

Soil Improvement Techniques: Basic concept of soil improvement due to dynamic loading;Various methods; Mitigation of liquefaction

Dynamic Soil-Structure Interaction: Dynamic earth pressures; Force and displacement basedanalysis; Pseudo-static and Pseudo-dynamic analysis; Guidelines of various design codes; Dynamic analyses of various geotechnical structures like retaining wall, soil slope, railway subgrade and ballast using MSD model.

Suggested Reading

1. Shamsher Prakash, “Soil Dynamics”, McGraw-Hill Book Company.
2. Braja M. Das, “Principles of Soil Dynamics”, PWS-KENT Publishing Company.
3. Steven L. Kramer, “Geotechnical Earthquake Engineering”, Prentice Hall Inc.
4. D. D. Barkan, “Dynamics of Bases and Foundations”, McGraw-Hill Book Company.
5. E. E. Richart et al. “Vibrations of Soils and Foundations”, Prentice Hall Inc.
6. Tien Hsing Wu, “Soil Dynamics”, Allyn and Bacon Inc.

16CEE105 **TALL BUILDINGS**

No. of Credits	3
Instruction	4periods per week
Duration of Main Examination	3 Hours
Main Examination	70 Marks
Sessional	30 Marks

UNIT-I
Introduction:
Design Principles for Lateral Load resistance, ductility considerations in earthquake resistant design of concrete buildings, construction methods, choice of materials, cladding systems and their design principles, types of foundations for tall buildings.

UNIT-II
Wind Loads:
Introduction to wind, characteristics of wind, Computation of wind loads on buildings as per IS code methods, Wind Tunnel testing, Introduction to Computational Fluid Dynamics.

UNIT-III
Seismic Loads:
Introduction to Earthquakes, Characteristics of Earthquake, Computation of seismic loads on tall buildings – Response Spectrum Method, , Vibration Control – active control & passive control, Liquefaction effects of earthquake, Introduction to Time history Analysis and Pushover analysis.

UNIT – IV
Structural systems:
Necessity of special structural systems for tall buildings, Structural Systems for **Steel Buildings -** Braced frames, Staggered Truss System, Eccentric Bracing System, Outtrigger & Belt truss system, Tube Systems**;** Structural Systems for **Concrete Buildings -** shear walls, frame tube structures, bundled tube structures**;** Design of shear wall as per IS code

UNIT- V
Special Topics :
Second order effects of gravity loading, Creep and shrinkage in columns, Differential shortening of columns, Floor levelling problems, Panel zone effects, P-Delta analysis

Suggested Reading:
Taranath B. S., "*Structural Analysis and Design of Tall Buildings*", McGraw-Hill Book Company, 1988.
2. Simlu E, "*Wind Effect on Structures: An Introduction to Wind Engineering*",Wile & Sons, 1978.
3. Fintel, M, "*Hand Book of Concrete Engineering*", Von Nostrand, 1974.
4. Emilio Rosenblueth, "*Design of Earthquake Resistant Structures*", Pentech Press Ltd., 1990.
5. Schuellar, W, "*High Rise Building Structures*" , John Wiley & Sons Inc, 1977.
6. Bryan Stafford Smith & Alex Coull, "*Tall Building Structures: Analysis & Design*", Wiley India Pvt Ltd, 1991.
7. Lynn S. Beedle, "*Advances in Tall Buildings*", CBS Publishers and Distributors Delhi, 1996.

16CEC108 COMPUTER AIDED ANALYSIS AND DESIGN OF STRUCTURES

Credits	2
Instruction	3 periods per week
Sessional	50 Marks

List of Experiments

1. Design of beams.
2. Design of slabs.
3. Design of column.
4. Design of footing.
5. Analysis and design of steel roof truss.
6. Analysis and design of buildings for wind and earthquake loads.
7. Program for flexibility method of analysis.
8. Program for stiffness method of analysis.

16CEC 206 **SEMINAR – II (II Sem)**

Credits	2
Instruction	3 periods per week
Sessional	50 Marks

Code16 EG 104 **SOFT SKILLS LAB**

Instruction	2 periods per week
Duration of Assessment	3 Hrs
Final Assessment	50 Marks

Course Objectives: To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To be competent in verbal aptitude.

Course Outcomes: The students will be able to

1. Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to mange time effectively and deal with stress.
4. Make the transition smoothly from campus to corporate. Also use media with etiquette and know what academic ethics are.
5. Correct and complete sentences, have a good vocabulary and comprehend passages confidently

Exercise 1

Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Elements of effective presentation – Structure of presentation – Presentation tools – Body language

Creating an effective PPT

Exercise 2

Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets

Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3

Personality Development – Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

Exercise 4

Corporate Culture – Grooming and etiquette, corporate communication etiquette.

Academic ethics and integrity

Exercise 5

Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary.

Reading comprehension

Suggested Reading:

1. Leena Sen , "Communication Skills", Prentice-Hall of India, 2005
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
5. Gulati and Sarvesh, " Corporate Soft Skills", New Delhi: Rupa and Co. , 2006
6. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004
7. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Aggarwal
8. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989

16CEC 207 **MINI PROJECT**

Instruction	2 Periods per week
Sessional	50 Marks
Credits	1

Outcomes:

Students are able to

1. Formulate a specific problem and give solution
2. Develop model/models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained and write the documentation in standard format

Objectives:

First year ME students will each do a 14-week mini project, each generally comprising about one week of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment (see assessment information below). Each student will be allotted to a Faculty supervisor for mentoring.

Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original. Mini projects should have inter disciplinary/ industry relevance. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling. All the investigations are clearly stated and documented with the reasons/explanations. All the projects should contain A clear statement of the research objectives, background of work, Literature review, techniques used, prospective deliverables, benefit from this [line of] research, Detailed discussion on results, Conclusions and references.

Assessment:

1. 50 % of marks for a scientific report on the project.
   Regarding the formatting and structure, the report should be written as a journal article using the style file of a journal appropriate for the field of the research (which journal format is most appropriate should be agreed between student and supervisor). Regarding content, the report should be understandable by your fellow students, so the introduction and literature review could be a bit more detailed than in a research paper. The results and discussions are in elaborate form and at end conclusions and include references.

2. 50 % of marks for an oral presentation which will take place at the end of the semester and evaluation by a committee consist of Supervisor, one senior faculty and Head of the department or his nominee.

16CEC208 **PROJECT SEMINAR**

Instruction	3 periods per week
Sessional	50 Marks
No. of Credits	3

Each student will be attached to a faculty member, (guide) for Project Seminar during the Third Semester. The student will carry out the project which may be development of Software / Hardware / Simulation studies / Design / Analysis /Experimental related to his / her Specialization: The work will be monitored regularly by the guide. At the end of the Semester, student will write the report on the work done and submit to the guide. Student has to present his / her work before two faculty members (one guide and other to be appointed by Chairman BOS) on a fixed day during last week of the semester in which project seminar is offered. The sessional marks will be awarded jointly by these two examiners based on the report, the presentation and vica voce.

16CEC209 DISSERTATION (III & IV Sem)

Instruction	
University Examination	Viva Voce
Marks	100+100
No. of Credits	12

***Excellent / Very Good / Good / Satisfactory / Unsatisfactory**