GOVT. COLLEGE OF ENGINEERING AURANGABAD

CURRICULUM

M. Tech. (Structural Engineering)

FULL –TIME &PART TIME (With Effect From 2018-19)

Department of Applied Mechanics

DEPARTMENT OF APPLIED MECHANICS

CBCS-AICTE CURRICULUM

M.Tech. (STRUCTURAL ENGINEERING)

FULL –TIME & PART TIME PROGRAMME

(Academic Year: 2018-19 Onwards)

GOVERNMENT COLLEGE OF ENGINEERING AURANGABAD

GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Applied Mechanics

M. Tech. (Full-Time) in Structural Engineering

(CBCS-AICTE Course 2018-19 onwards)

Teaching and Evaluation Scheme

SEMESTER-I

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
							Theory			Term Work	Practical/Viva-voce	Total
			L	T	P		Test	TA	ESE			
1	GE-51001	Research Methodology	2	-	-	2	20	20	60	-	-	100
2	AM-51001	Theory of Elasticity & Plasticity	3	-	-	3	20	20	60	-	-	100
3	AM-51002	Structural Dynamics and Earthquake Engineering	3	-	-	3	20	20	60	-	-	100
4	AM-51003 to AM-51009	Program Elective I*	3	-	-	3	20	20	60	-	-	100
5	AM-51010 to AM-51016	Program Elective II*	3	-	-	3	20	20	60	-	-	100
6	SW-51001 to 51008	Audit Course	2	-	-	--						
7	AM-51017	Lab.-CAD in Structural Engineering	-	-	4	2				25	25	50
8	AM-51018	Lab- Advanced Concrete Technolgy	-	-	4	2				25	25	50
		Total Semester I	**16**		**08**	**18**	**100**	**100**	**300**	**50**	**50**	**600**

Approved in XIX th Academic Council, dated 27/07/2018

*** A minimum of 6 students and a maximum of 12 students can register for the course**

List of Program Electives-I:

1) AM-51003: Prestressed Concrete Design
2) AM-51004: Advance Concrete Technology
3) AM-51005: Numerical Methods and Optimization Techniques
4) AM-51006-:
5) AM-51007
6) AM-51008
7) AM-51009

List of Program Electives-II:

1) AM-51010: Design of Bridges
2) AM-51011: Stability of Structure
3) AM-51012: Soil Structure Interaction
4) AM-51013 :
5) AM-51014
6) AM-51015
7) AM-51016

List of Audit Courses:

1.SW51001- English for Research Paper Writing
2. SW51002- Disaster Management
3. SW51003 Sanskrit for Technical Knowledge
4. SW51004-Value Education
5. SW51005Constitution of India
6. SW51006-Pedagogy Studies
7. SW51007-Stress Management by Yoga
8. SW51008- Personality Development through Life Enlightenment Skills.

Approved in XIXth Academic Council, dated 27/07/2013

SEMESTER-II

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/Viva-voce	Total
							Test	TA	ESE			
1	AM-51019	Finite Element Analysis of Structures	3	-	-	3	20	20	60	-	-	100
2	AM-51020	Advanced Design of Structures	3	-	-	3	20	20	60	-	-	100
3	AM-51021 to AM-51026	Program Elective III*	3	-	-	3	20	20	60	-	-	100
4	AM-51027 to AM-51032	Program Elective IV*	3	-	-	3	20	20	60	-	-	100
5	AM-51033 to AM-51038	Program Elective V*	3	-	-	3	20	20	60	-	-	100
6	AM-51039	Lab.-Structural Dynamics & Earthquake Engineering	-	-	4	2				25	25	50
7	AM-51040	Lab- Model Testing	-	-	4	2				25	25	50
8	AM-51041	Mini Project with Seminar	--	-	4	2				50	50	100
9	AM-51042	Industrial Internship	--	--	--	--	--	--	--	--	--	--
		Total Semester II	**15**		**12**	**21**	**100**	**100**	**300**	**100**	**100**	**700**

AM-51042: Industrial Internship is a non-credit mandatory course to be completed during vacation after II and III semester and during III semester if open elective is completed in earlier semesters.

*** A minimum of 6 students and a maximum of 12 students should register for the course**

Approved In XIXth Academic Council, dated 27/07/2018

List of Program Elective III:

1) AM-51021: Advanced Seismic Analysis and Design
2) AM-51022: Mechanics of Composite material
3) AM-51023: Analysis of Plates and Shells
5) AM-51024
6) AM-51025
7) AM-51026

List of Program Elective IV:

1) AM-51027: Fracture Mechanics
2) AM-51028: Design of High-Rise Structures
3) AM-51029: Structural Assessment and Rehabilitation
4) AM-51030:
5) AM-51031
6) AM-51032

List of Program Elective V:

1) AM-51033: Environment Impact Assessment and Green Building
2) AM-51034: Project Planning & Management
3) AM-51035: Economics and Finance for Engineers
5) AM-51036
6) AM-51037
7) AM-51038

SEMESTER III

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/Viva-voce	Total
							Test	TA	ESE			
1	AM-61001	Open Elective	3	-	-	3	20	20	60	-	-	100
2	AM-61002	Dissertation I	-	-	20	10				50	50	100
		Total Semester III	**3**		**20**	**13**	**20**	**20**	**60**	**50**	**50**	**200**

*Students going for Industrial Project/Thesis will complete these courses through MOOCs.

List of Open Electives:

1. AM61001 Finite Element Method for Engineers. Business Analytics

Approved in XIXth Academic Council, dated 27/07/2018

SEMESTER IV

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/Viva-voce	Total
							Test	TA	ESE			
1	AM-61003	Dissertation II	-	-	32	16				100	150	250
		Total Semester IV	**-**	**-**	**32**	**16**				**100**	**150**	**250**
TOTAL OF ALL SEMESTERS			**34**	**--**	**72**	**68**	**220**	**220**	**660**	**300**	**350**	**1750**

Approved in XIX th Academic Council, dated 27/07/2018

GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Applied Mechanics

M.Tech (Part-Time) in Structural Engineering

(CBCS-AICTE Course 2018-19 onwards)

Teaching and Evaluation Scheme

SEMESTER-I & II

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/Viva-voce	Total
							Test	TA	ESE			
SEMESTER-I												
1	GE-51001	Research Methodology	2	-	-	2	20	20	60	-	-	100
2	AM-51001	Theory of Elasticity & Plasticity	3	-	-	3	20	20	60	-	-	100
3	AM-51002	Structural Dynamics and Earthquake Engineering	3	-	-	3	20	20	60	-	-	100
4	AM-51017	Lab.-CAD in Structural Engineering	-	-	4	2				25	25	50
		Total of Semester-I	**08**	**-**	**4**	**10**	**60**	**60**	**180**	**25**	**25**	**350**

Approved in XIXth Academic Council, dated 27/07/2018

SEMESTER-II												
5	AM-51003 to AM-51009	Program Elective I*	3	-	-	3	20	20	60	-	-	100
6	AM-51010 to AM-51016	Program Elective II*	3	-	-	3	20	20	60	-	-	100
7	AM-51019	Finite Element Analysis of Structures	3	-	-	3	20	20	60	-	-	100
8	SW51001 to SW51008	Audit Course	2	-	-	--						
9	AM-51018	Lab- Advanced Concrete Technolgy	-	-	4	2				25	25	50
Total of Semester II			**11**		**04**	**11**	**60**	**60**	**180**	**25**	**25**	**350**

*** A minimum of 6 students and a maximum of 12 students can register for the course**

List of Program Electives-I:

1) AM-51003: Prestressed Concrete Design
2) AM-51004: Advance Concrete Technology
3) AM-51005: Numerical Methods and Optimization Techniques
4) AM-51006-:
5) AM-51007
6) AM-51008
7) AM-51009

List of Program Electives-II:

1) AM-51010: Design of Bridges
2) AM-51011: Stability of Structure
3) AM-51012: Soil Structure Interaction
4) AM-51013 :
5) AM-51014
6) AM-51015
7) AM-51016

List of Audit Courses:

1.SW51001- English for Research Paper Writing
2. SW51002- Disaster Management
3. SW51003 Sanskrit for Technical Knowledge
4. SW51004-Value Education
5. SW51005Constitution of India
6. SW51006-Pedagogy Studies
7. SW51007-Stress Management by Yoga
8. SW51008- Personality Development through Life Enlightenment Skills.

Approved in XIX th Academic Council, dated 27/07/2018

SEMESTER-III & IV

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/Viva-voce	Total
							Test	TA	ESE			
SEMESTER-III												
1	AM-51020	Advanced Design of Structures	3	-	-	3	20	20	60	-	-	100
2	AM-51021 to AM-51026	Program Elective III*	3	-	-	3	20	20	60	-	-	100
3	AM-51039	Lab.-Structural Dynamics & Earthquake Engineering	-	-	4	2				25	25	50
		Total of Semester-III	**06**	**-**	**04**	**08**	**40**	**40**	**120**	**25**	**25**	**250**
SEMESTER-IV												
1	AM-51027 to AM-51032	Program Elective IV*	3	-	-	3	20	20	60	-	-	100
2	AM-51033 to AM-51038	Program Elective V*	3	-	-	3	20	20	60	-	-	100
3	AM-51040	Lab- Model Testing	-	-	4	2				25	25	50
4	AM-51041	Mini Project with Seminar	--	-	4	2				50	50	100
		Total Semester IV	**06**	**-**	**08**	**10**	**40**	**40**	**120**	**75**	**75**	**350**

*** A minimum of 6 students should register for the course**

Approved in XIXth Academic Council, dated 27/07/2013

List of Program Elective III:

1) AM-51021: Advanced Seismic Analysis and Design
2) AM-51022: Mechanics of Composite material
3) AM-51023: Analysis of Plates and Shells
5) AM-51024
6) AM-51025
7) AM-51026

List of Program Elective IV:

1) AM-51027: Fracture Mechanics
2) AM-51028: Design of High-Rise Structures
3) AM-51029: Structural Assessment and Rehabilitation
4) AM-51030:
5) AM-51031
6) AM-51032

List of Program Elective V:

1) AM-51033: Environment Impact Assessment and Green Building
2) AM-51034: Project Planning & Management
3) AM-51035: Economics and Finance for Engineers
5) AM-51036
6) AM-51037
7) AM-51038

SEMESTER V

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/Viva-voce	Total
							Test	TA	ESE			
1	AM-61001	Open Elective	3	-	-	3	20	20	60	-	-	100
2	AM-61002	Dissertation I	-	-	20	10				50	50	100
		Total Semester IV	**03**		**20**	**13**	**20**	**20**	**60**	**50**	**50**	**200**

*Students going for Industrial Project/Thesis will complete these courses through MOOCs.

List of Open Electives:

1. AM61001 Finite Element Method for Engineers. Business Analytics

SEMESTER VI

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
			L	T	P		Theory			Term Work	Practical/Viva-voce	Total
							Test	TA	ESE			
I	AM-61003	Dissertation II	-	-	32	16				100	150	250
		Total Semester IV	-	-	**32**	**16**				**100**	**150**	**250**
TOTAL OF ALL SEMESTERS			**34**	**--**	**72**	**68**	**220**	**220**	**660**	**300**	**350**	**1750**

Approved in XIXth Academic Council, dated 27/07/2018

Detailed Syllabi of All Courses

SEMESTER-I

GE 51001: Research Methodology

Teaching Scheme		Evaluation Scheme	
Theory	2 Hrs/Week	Class Test	20 Marks
Tutorial		Teacher's Assessment	20 Marks
Total Credits	2	End Semester Examination	60 Marks
		Total	100 Marks

Prerequisite: Not applicable

Course Description: The objective of this course is to expose the prospective researchers to basic methodologies and techniques of carrying out research work. The course provides detailed knowledge of developing a research plan and research design. Various statistical methods are included in this course which will be needed for a research work. Along with this, optimization techniques, modeling and simulation and soft computing techniques required for solution of a research problem are included in the course. At the end, Interpretation of result and technique of report writing will be taught to the students.

Course Outcomes:

After successful completion of the course, students will be able to:

1. Develop a research plan and define the research problem
2. Analyze the data required for research
3. Solve the mathematical model developed with the help of optimization techniques
4. Apply the knowledge to write a research paper and dissertation scientifically

Detailed Syllabus:

Unit -1:	**Introduction and Research Process:** Objectives of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Defining the Research Problem, Selecting the Problem, Technique Involved in Defining a Problem, Research Design, Important Concepts Relating to Research Design, Developing a Research Plan, Literature review, Impact factor, H-index, citations.	4 Hrs

Unit -2:	**Statistics:** Basic Concepts of Probability, Probability Axioms, Measures of Central Tendency, Measures of Dispersions, Measures of Symmetry, Measures of Peakedness. Regression Analysis – Simple Linear Regression, Multiple linear Regression, Correlation. Tests of Hypothesis and Goodness of Fit: Definition of null and alternative hypothesis, students't' distribution: properties, application with example. Chi-square distribution: definition, constants of Chi-square distribution. Application with example. F-test: example of application.	**4 Hrs**
Unit -3:	**Optimization Techniques:** Linear Programming, Simplex Method, Dual Simplex, Sensitivity Analysis. Artificial Variable Technique, Dynamic Programming, Introductory concepts of non-linear programming. **Or** **Modeling and simulation:** Introduction to modeling: Concept of system, continuous and discrete systems. Experimental Methods: Importance of experimental analysis, guidelines for designing experiments, uncertainty and error analysis, concept of uncertainty, propagation of uncertainty, planning experiments from Uncertainty analysis.	**4 Hrs**
Unit -4:	**Soft Computing:** Fuzzy logic: Introduction, Concepts. Basic Fuzzy Mathematical Operations, Fuzzy databases, Membership Functions, Fuzzy Linear Programming, And Neural Networks: Artificial Neural Networks, architectures and algorithms, Basic neuron models, Neural network models, Learning algorithms, Genetic Algorithms: Introduction to genetic algorithm, Operators, Applications.	**4 Hrs**
Unit -5:	**Interpretation and Report Writing:** Meaning of Interpretation, Techniques of Interpretation, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Writing a technical paper, plagiarism and its implications. Introduction to patents and copyrights & filing procedure.	**4 Hrs**

References:

1. Gupta. S.P., " Statistical Methods", S. Chand & Sons, New Delhi
2. Kothari C.R., "Research Methodology-Methods and Techniques", New Age International Publishers, New Delhi.
3. Gupta S.L. and Gupta Hitesh, "Research Methodology-Text and cases with SPSS applications" International Book House Pvt. Ltd., New Delhi.
5. Rao V and Rao H., "C++, Neural Networks and Fuzzy Logic", BPB Publications, New Delhi.
6. Goldberg, D.E., "Genetic Algorithms in Search, Optimization & Machine Learning", Addison Wesley Longman (Singapore) Pte. Ltd., Indian Branch, Delhi.
7. Klir George J. and Yuan Bo, "Fuzzy Sets and Fuzzy Logic", PHI Learning Pvt. Ltd, New Delhi

AM-51001: Theory of Elasticity & Plasticity

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisite: Not applicable

Course Description: This course intends to provide students a comprehensive knowledge on the theory of elasticity and plasticity. The course focuses on the five topics shown in detailed syllabus.

Course Outcomes:
After successful completion of the course, students will be able:

1. To formulate/establish the basic equations of elasticity &plasticity in Cartesian & polar coordinate system.
2. To discriminateplain stress and plain strain problems of elasticity &plasticity in Cartesian coordinate system.
3. To solve two dimensional problem of elasticity &plasticity in Cartesian & polar coordinate system.
4. To apply principles to the stress analysis under various loading conditions such as torsion and bending.
5. To comprehend failure mechanisms in materials and differentiate yielding of materials by various yielding criteria.

Detailed Syllabus:

Unit -1:	**Basics of Elasticity** Concept of stress at a point, the state of strain at a point, stress components on a rectangular parallelepiped in Cartesian coordinate system, derivation of stress equilibrium equations, strain displacement relations, strain compatibility condition and stress compatibility conditions, plane stress and plane strain problems of elasticity.	**06 Hrs**
Unit -2:	**Two-Dimensional Problems in Cartesian Co-ordinates** Introduction, Airy's Stress Function, Biharmonic equation, Solution by polynomials, Bending of a cantilever loaded at the end; Bending of a beam by uniform load, Direct method for determining Airy polynomial,Cantilever having Udl and concentrated load of the free end; Simply supported rectangular beam under a triangular load, Fourier Series, Complex Potentials, Cauchy Integral Method, Fourier Transform Method, Real Potential Methods.	**06 Hrs**

Unit -3:	**Two-Dimensional Problems In Polar Co-Ordinates** Introduction, Differential equations in polar coordinates such as equilibrium equation, Strain Displacement relations, Hooke's law, Stress function relations, compatibility equation, Stress-strain relations.Airy's stress function, Biharmonic equation, Axisymmetric problem, Thick-walled cylinder subjected, internal and external pressure, Rotating disk of uniform thickness, Circular disc with hole, Stress concentration, The effect of circular holes on stress	**06 Hrs**
Unit -4:	**Torsion of Prismatic Bars and Bending of Prismatic Beams** Torsion Assumptions and Torsion equation for general prismatic solid bars, Warping of Non-circular sections and St. Venant's theory, Prandtle's stress function approach, Torsion of Circular, Elliptical and Triangular cross-section, Torsion of thin-walled structures by membrane analogy, Torsion of rolled sections and shear flow Simple Bending, Unsymmetrical Bending, Shear Centre, Solution of Bending of Bars by Harmonic Functions, Solution of Bending Problems by Soap-Film Method	**06 Hrs**
Unit -5:	**Theory of Plasticity** Introduction, Basic Concepts, , Physical assumptions,Failure theories, Yield Criteria (Tresca, Von-Mises), Yield Surface, equivalent stress and equivalent strain, Plastic work, Flow Rule-Plastic Potential, Elastic-Plastic and plastic stress-strain relations, Plastic Flow of anisotropic materials Viscoelasticity and Viscoplasticity:Introduction, Viscoelastic models (Maxwell, Kelvin-Voigt, Generalized Maxwell and Kelvin models), Viscoelastic stress-strain relationships, Viscoplasticity	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

Reference Books:

1) Timoshenko.S and Goodier.J.N.," Theory of Elasticity", Mc Graw Hill Book Co., New York, Latest Edition
2) Sadhu Singh.," Theory of Elasticity", Khanna Publishers,New Delhi.Latest Edition
3) Sadhu Singh.," Theory of Plasticity", Khanna Publishers,New Delhi.Latest Edition
4) Helena H. J. , " Theory of Elasticity and Plasticity", Kindle Edition
5) Popov.E.,"Mechanics of Materials", Prentice Hall reprinted Pearson education, Latest Edition
6) Ansel.C.Ugural and Saul.K.Fenster, "Advanced Strength and Applied Elasticity," Fourth Edition

,Prentice Hall Professional technical Reference, New Jersy.

7) Chakrabarty.J, "Theory of Plasticity", Third Edition, Elsevier Butterworth -Heinmann – UK

UNIT-1	Characteristics of dynamic loading, Lumped and continuous mass models, Single-Degree-of Freedom (SDOF) systems, Free vibrations, Harmonic loading, Harmonic base motion, Resonance, Dynamic Amplification Factor, Transmissibility, Vibration Isolation. Response to general dynamic loading, Duhamel's Integral	06 Hrs
UNIT-2	Introduction to seismology, Strong motion and their measurement, characteristics of earthquake ground motion, response spectrum, displacement, pseudo-velocity and pseudo-acceleration spectra, tripartite spectra, characteristics of earthquake spectra, MCE and DBE, Construction of site Design spectra	06 Hrs
UNIT-3	Multi-Degree-of-Freedom (MDOF) systems, Formulation of equations of motion, Free-vibrations, Frequencies and mode shapes, Orthogonality of normal modes, Mode-superposition method, Modal participation, Extension to earthquake loading	06 Hrs
UNIT-4	Earthquake resistant design philosophy, Provisions of IS:1893-2016-Part-I, Estimation of earthquake forces using the code, Seismic coefficient and response spectrum analysis, asymmetrical structures, accidental eccentricity,	06 Hrs
UNIT-5	Earthquake resistant design principles, ductility, inelastic behavior, ductile detailing of RC members as per IS:13920-2016, design of beams and columns, Vibration control techniques.	06 Hrs

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

TEXT AND REFERENCE BOOKS

1. Ray W. Clough and Joseph Penziene, "Dynamics of Structures", Mc-Graw Hill, 3rd Edition, 1975.
2. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, 3rd Edition, 2007.
3. Roy R. Craig, "Structural Dynamics: An Introduction to Computer Methods", Wiley, 1981.
4. Mario Paz, "Structural Dynamics", Springer, 1997.
5. J.L.Humar, "Dynamics of Structures", Balkema, 2002.
6. Hans Anton Buchholdt, "Structural Dynamics for Engineers", Thomas Telford, 1997.
7. Dowrick D.J., "Earthquake Resistant Design for Engineers", John Wiley Publishers, Latest Edition
8. Duggal S.K., "Earthquake Resistant Design of Structures", Oxford University press, Latest Edition
9. Hosur Vinod, "Earthquake Resistant Design of Building Structures", Wiley, Latest Edition
10. IS: 1893 (Part-I) -2016, "Criteria for earthquake resistant design of structures" Bureau of Indian Standards, New Delhi

11. IS:13920-2016, "Ductile Detailing of Reinforced Concrete Structures subjected to seismic forces-code of practice" Bureau of Indian Standards, New Delhi

AM51003: Elective-I- Pre-Stressed Concrete Design

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End Semester Examination	60 Marks
		Total	100 Marks

Prerequisite: Not applicable

Course Description: This course equips the studentsto understand the mechanism of prestressing and behavior of pre-stressed concrete element. Students will be exposed to analysis of strength and behavior of prestressed concrete structures. The course will deal with limit state of design of prestressed concrete structures like beams, axially loaded members, slabs, composite sections, liquid tanks, pipes, sleepers etc. in relevance to codal provisions.

Course Outcomes:

After successful completion of the course, students will be able:

1. To analyze the stresses and determine the behavior of determinate and indeterminate prestressed concrete members.
2. To design determinate and indeterminate prestressed concrete beams.
3. To appreciate the composite behavior and design composite sections.
4. To apply prestressed concrete design concepts to various members like pipes, tanks, poles and sleepers.

Detailed Syllabus:

Unit -1:	**Analysis and Design of Determinate Prestressed Concrete Beams** Review of fundamentals of prestressing, Analysis of ultimate strengths of rectangular and flanged beams, Limit state design of rectangular and flanged beams (Type-I, Type-II, Type-III) for flexure, shear, torsion; Limit state of serviceability, Design of end block, Anchorage zone stresses in post-tensioned member.	**06 Hrs**
Unit -2:	**Design of Prestressed Concrete Slabs; Axially loaded members** Design of one way and two way prestressed concrete slabs, flat slab, Analysis and design of sections for axial tension, Design of compression member.	**06 Hrs**
Unit -3:	**Analysis of Composite section** Analysis of composite sections with precast PSC beams and cast-in-situ RC slab Stresses, Shrinkage, Deflection, and Flexural and shear strength of composite member, Design of composite member.	**06 Hrs**
Unit -4:	**Analysis and Design of Indeterminate Prestressed Concrete Elements** Analysis of continuous beams, primary and secondary moments, stresses, cable profile, line of prestress, linear transformation of cables, concordant cable profile, Analysis of ultimate load, Design of continuous beam and portal frames.	**06 Hrs**

Unit -5:	**Analysis and Design of Tanks, Pipes, Pole, and Sleepers** Analysis and design of circular tanks, pipes, Pole and railway sleepers.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References:

1. Krishna Raju N., "Prestressed Concrete", Tata McGraw Hill Company, New Delhi, Latest Edition.
2. Mallic S. K. and Gupta A. P., "Prestressed Concrete", Oxford and IBH publishing Co. Pvt. Ltd. Latest Edition.
3. Dayaratnam P., "Prestressed Concrete", Oxford and IBH,Latest Edition.
4. Rajagopalan N., "Prestressed Concrete", Alpha Science, Latest Edition.
5. Ramaswamy G. S., "Modern Prestressed Concrete Design", ArnoldHeinimen, New Delhi, Latest Edition.
6. Lin T. Y., "Design of Prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, Latest Edition.
7. David A. Sheppard, William R. and Phillips, "Plant Cast Precast and Prestressed Concrete-A Design Guide", McGraw Hill, New Delhi, Latest Edition.
8. IS 1343: 2012, Code of Practice for Prestressed Concrete, Bureau of Indian Standard, New Delhi, 2012.

AM 51004: Elective-I -Advanced Concrete Technology
(CBCS-AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Test	20 Marks
Tutorial/Practical	-	Teacher's Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisites: Not required

Course Description:

The course provides the fundamentals and advances in concrete technology. High Performance Concrete covers the information about design of concrete as per performance requirement. Information about special Concretes such as self compacting, high density, fibre reinforced etc. is included. Non destructive evaluation of concrete in the existing structures, concrete repairs, laboratory work based on concrete mix proportioning and evaluation of properties of various types of concrete are covered.

Course Outcomes:

After successful completion of this course, the student will be able to

1) Select the ingredients judiciously for making concrete
2) Classify various types of concrete
3) Design concrete mixes with desired properties
4) Evaluate the properties of concrete in the structure and investigate the causes of damage of concrete
5) Propose the methods for concrete repair

Detailed Syllabus:

Unit-1:	**Review of Concrete Technology** Review of various constituents of concrete Properties of concrete: workability, rheology, permeability, strength , elasticity, shrinkage, creep, durability	06Hrs
Unit-2:	**Concrete Mix Proportioning Methods** Abram's Law, Lyse's Rule, Glianville's work, Exposure conditions Comparative study of various concrete mix proportioning methods, Particle packing theories, Quality control.	06 Hrs
Unit-3:	**High Performance Concrete** High performance concrete (HPC): performance requirements, materials, cement-superplasticiser compatibility, methods of mix proportioning, concept of particle packing, properties in fresh and hardened state, durability of HPC	06 Hrs
Unit-4:	**Special Concretes** Self compacting concrete, High density concrete. Aerated concrete, Lightweight concrete, Concrete with recycled waste: Constituent materials, mix proportioning, properties and applications, hot weather and cold weather concreting Fibre Reinforced Concrete (FRC):Types and properties of fibers, mix proportioning and behavior in fresh and hardened state. Ferrocement.	06 Hrs

Unit-5:	**Non Destructive Evaluation and Concrete Repairs:** Non-Destructive Evaluation of Concrete: Rebound hammer test- Ultrasonic pulse velocity tests, penetration resistance, pull out test etc. Concrete Repairs: Types and causes of damages of concrete, Materials and technology for repairing damaged concrete	06Hrs

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

TEXT AND REFERENCE BOOKS

1. A M Neville, Properties of Concrete, 4th edition, 2006, ELBS with Longman, UK
2. M L Gambhir, Concrete Technology, 3rd edition, 2006, Tata McGraw Hill, New Delhi
3. M S Shetty, Concrete Technology, 2008, S. Chand & Co., New Delhi
4. R.N.Raikar, Diagnosis and treatment of structures in distress, Published by R&D Centre
   of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.
5. Raikar, R.N., "Learning from failures - Deficiencies in Design", Construction and Service - R and D Centre (SDCPL), RaikarBhavan, 1987
6. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.
7. Balaguru P.N. and Shah S.P., Fibre Reinforced Cement Composites, McGraw Hill, New Delhi
8. Hannant D.J., Fibre Cements and Fibre Concretes, John Willey and Sons, New York
9. Naaman, A.E., Ferrocement and Laminated Cementitious Composites, Techno Press, USA

AM 51005: Elective-I: Numerical Methods and Optimization Techniques (CBCS-AICTE Model)

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs./Week	Test	20 Marks
Tutorials	-	Teacher Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisite: Not applicable

Course Description: The course content mainly focuses on different numerical techniques, finding solutions to real-time problems, apply the optimization techniques in the engineering field and applying optimization techniques for solving multi task applications.

Course Outcomes: After successful completion of this course, students will be able:

1. To solve engineering problems using various computational methods.
2. To select appropriate techniques for tackling problems in structural engineering and building science.
3. To apply various optimization methods.
4. To develop capabilities of optimization programs.

Detailed Syllabus:

Unit -1:	**Calculus of variation**: Concepts of maxima and minima of functions, Constraints and Lagrange multipliers, extreme value of functional, Euler's Equations, solutions of Euler's equation, Lagrange equations generalized dynamic Excitations- constraints in dynamical systems	**06 Hrs**
Unit -2:	**Numerical solution of ordinary differential equations**: Taylor series method, Picard's method, Euler's method modified Euler's method & R.K. Method. Elliptical equations standard five point formula, diagonal five point formula –Solution of Laplace equation by Leibmann's iteration method, Poisson's equation	**06 Hrs**
Unit -3:	**Numerical solution of partial differential equations:** Parabolic equations bender – Schmidt method – bender – Schmidt recurrence Equation, crank – Nicholson difference method, Eigen values and Eigen vectors – general method – power method, spectral method	**06 Hrs**
Unit -4:	A. **Finite difference solution:** Weighted residual methods for initial value problems and boundary value problems- collocation method-sub domain method- method of least squares-Equations in two dimensions- parabolic equations- explicit finite difference method-crank-Nicholson, Implicit method- ellipse equations- finite difference method- problems with irregular boundaries. B. **Introduction to finite element method**:Weighted Residual methods, least square method, Galerkin's method – finite elements – Interpolating over the whole domain – one dimensional case, two dimensional Case – application to boundary value problems.	**06 Hrs**

Approved in XIX th Academic Council, dated 27/07/2018

Unit -5:	**Problem formulation with examples:**Single variable unconstrained optimization techniques,– Optimality criteria - interpolation methods - gradient based methods Multi variable unconstrained optimization techniques – optimality criteria Unidirectional search - direct search methods - simplex method - gradient based methods -Constrained optimization techniques –classical methods - linear programming problem.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

TEXT/REFERENCE BOOKS:

1. Curtis.F.Gerald, Applied Numerical Analysis,Addeson Wesley PublishingCompany, Latest Edition.
2. Grewal B. S., Higher Engineering Mathematics Khanna Publishers, Latest Edition, Latest Edition.
3. Xavier C., C – Language and numerical methods by, New Age InternationalPublishers, Latest Edition.
4. Jain M.K., S.K.R. Lyengar, R.K.Jain., Computational methods for partial differential equations, Latest Edition.
5. Chopra S.C. and Canale R.P. Numerical Methods for Engineers Mc Graw Hill, Latest Edition.
6. Smith G.D. Numerical solutions for Differential Equations Mc Graw Hill, Latest Edition.
7. Ketter and PrawelModern Methods for Engineering Computations" Mc Graw Hill, Latest Edition.
8. Rajasekharan S. Numerical Methods in Science and Engineering, S. Chand & company, Latest Edition.
9. Rajasekharan S., Numerical Methods for Initial and Boundary value problems," KhannaPublishers, Latest Edition.
10. Terrence J.Akai,Applied Numerical Methods for Engineers, Wiley publishers, Latest Edition.
11. Rao S. S., Engineering Optimization– Theory and Practice, New Age International, Latest Edition.
12. Deb K., Optimisation for Engineering Design – Algorithms and examples, Prentice Hall, Latest Edition.
13. Kirsch U., Optimum Structural Design, McGraw Hill, Latest Edition.
14. Arora J S. Introduction to Optimum Design, McGraw Hill, Latest Edition.

AM 51010: Elective II – Design of Bridges

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisite: Not applicable.

Course Description: The contents of the course includeanalysis, design and detailing of various types of reinforced and prestressed concrete bridges.

Course Outcomes:

After successful completion of the course, students will be able:

1. To identify various structural forms of concrete bridges.
2. To define standard loads specified by IRC for bridges.
3. To analyze and design reinforced and prestressed concrete bridges.
4. To illustrate functioning of bearings and other structural elements in bridges.

Detailed Syllabus:

Unit -1:	**General forms of various types of bridges:** Arch type, slab type, slab and beam type, plate girder type, open-web girder, suspension type, cable stayed type, etc.	**06 Hrs**
Unit -2:	**Live loads on Bridges**: Loading standards for road bridges conforming to IRC, impact factor, centrifugal force, wind loads, hydraulic forces, longitudinal forces, seismic forces, earth pressure, buoyancy, etc;	**06 Hrs**
Unit -3:	**Reinforced Concrete Bridges:** Solid slab type, slab-girder type, skew type, curved type, continuous type, balanced cantilever type, arch type	**06 Hrs**
Unit -4:	**PrestressedConcrete Bridges:** Advantages, systems of prestressing, prestress losses, preliminary dimensions, design principles, T-beams, box girders	**06 Hrs**
Unit -5:	**Substructure in Bridges:** Piers, abutments, bearings, wing walls, and foundations	**06 Hrs**

Teacher's Assessment:

Teacher's Assessment of 20 marks may be based on one or more of the following

1. Technical quizzes
2. Application development
3. Question & answer / Numerical solution
4. Group discussion
5. Other if any

References:

1. HamblyE.C, Bridge Deck Behaviour, E & FN SPON Publications, Latest Edition.
2. Raina V.K., Concrete Bridge Practice, Analysis, Design and Economics, Tata McGraw-Hills Publishing Company Limited, Latest Edition.
3. RyallM.J., ParkeG.A.R, HardingJ.E., The Manual of Bridge Engineering, Thomas Telford Publishers, Latest Edition.
4. RajagopalanR., Bridge Superstructure, Tata McGraw- Hills Publishing Company Limited, Latest Edition.
5. Ponnuswamy S., Bridge Engineering, Tata McGraw – Hills Publishing Company Limited, Latest Edition.
6. AswaniIM. G., VaziraniV.N., Ratwani M.M., Design of Concrete Bridges, Khanna Publishers, Latest Edition.
7. RakshitK. S., Design and Construction of Highway Bridges, New Central Book Agency (P) Ltd, Pune, Latest Edition.
8. Johnson VictorD. - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, Latest Edition.
9. JagadeeshT.R., JayaramM.A. - Design of Bridge Structures, Prentice-Hall of India, Latest Edition.
10. Krishna RajuN. - Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, Latest Edition.
11. David Lee – Bridge Bearings and Expansion Joints,E& FN Spon, Latest Edition.
12. Joseph E. Bowles – Foundation Analysis and Design, McGraw-Hill International Edition , Latest Edition.
13. Nainan P. Kurian – Design of Foundation Systems, Narosa Publishing House, Latest Edition.
14.IRC:6-1966, Standard Specifications and Code of Practice for Road Bridges, Section II-Loads and Stresses (3rd Revision), Indian Road Congress, New Delhi
15. IRC:18-1985, Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete) (2nd Revision), Indian Road Congress, New Delhi
16. IRC:21-1987, Standard Specifications and Code of Practice for Road Bridges, Section III-Cement Concrete (plain and Reinforced) (2nd Revision), Indian Road Congress, New Delhi
17. IRC:112-2011,
15. IS456-2000, Code of Practice for Plain and Reinforced Concrete, 4th Revision, Indian Standards Institution, New Delhi

AM-51011: ELECTIVE-II- Stability of Structures

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End Semester Examination	60 Marks
		Total	**100 Marks**

Pre-requisites: Not Applicable

Course Description:

1. Learn the buckling of columns, analysis using equilibrium, energy and approximate methods.
2. Know the stability analysis of beam-columns and frames with different loads.
3. Analyse for torsional, flexural and lateral buckling of beams.
4. Perform the buckling analysis of thin plates using different approaches.
5. Study the inelastic buckling analysis of plates.

Course Outcomes: On successful completion of this course, students will be able to-

1. Understand the analysis of buckling of columns using appropriate method.
2. Analyse the practical problems of beam-columns and frames.
3. Analyse the beams for torsional, flexural and lateral buckling.
4. Perform buckling analysis of thin plates.
5. Analyse the plates for inelastic buckling and understand the post-buckling behavior of plates.

Detailed Syllabus:

Unit -1:	**Buckling of Columns:** Buckling of columns: States of equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem. Governing equation for columns - Analysis for various boundary conditions - using Equilibrium, Energy methods. Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method - Effect of shear on buckling	**06 Hrs**
Unit -2:	**Buckling of Beam-columns and Frames** Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples Analysis of rigid jointed frames with and without sway - Moment distribution - Slope deflection and stiffness method	**06 Hrs**
Unit -3:	**Torsional and Lateral Buckling:** Torsional buckling - Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions. Lateral buckling of beams, pure bending of simply supported beam and cantilever beam,	**06 Hrs**

Unit -4:	**Buckling of Plates** Governing differential equation - Buckling of thin plates, various edge conditions - Analysis by equilibrium and energy approach - Approximate and Numerical techniques	**06 Hrs**
Unit -5:	**Inelastic Buckling** Double modulus theory - Tangent modulus theory - Shanley's model – Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behaviour of plates	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References:

1. Timoshenko, S., and Gere., —Theory of Elastic Stability‖, McGraw Hill Book Company, 1963.

2. Chajes, A. —Principles of Structures Stability Theory‖, Prentice Hall, 1974.

3. Ashwini Kumar, —Stability Theory of Structures‖, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1995.

4. Iyenger.N.G.R.,, —Structural stability of columns and plates‖, Affiliated East West Press,1986.

5. Gambhir, —Stability Analysis and Design of Structures‖, springer, New York , 2004.

AM 51012 Elective II: Soil Structure Interaction

(CBCS-AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	03Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	03	End Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisite: Not applicable

Course Description: In this course focus is on idealization of soil response to closely represent continuum behavior and interaction analysis between the soil-structure with reference to relative stiffness of beams, slabs and piles under different loading conditions.

Course Outcomes:

After successful completion of the course, students will be able:

1. To explain concept of nature and complexities of soil structure interaction.
2. To analyse soil structure interaction for different types of structural elements under various conditions of loading and subsoil characteristics.
3. To determine the pile capacities for different loading.
4. To carry out linear and non-linear analysis.
5. To solve structural interaction problems under earthquake loading.

Detailed Syllabus:

Unit -1:	**Soil Response Interaction Analysis:** Soil–foundation interaction problems, Soil behavior, Foundation behavior, Interface behavior, soil-foundation interaction analysis, soil response models, Elastic continuum, Winkler model.	**06 Hrs**
Unit -2:	**Soil Structure Interaction:** Interaction problems based on theory of sub grade reaction on beams, footings, rafts.	**06 Hrs**
Unit -3:	**Analysis of Pile and Pile Groups:** Determination of pile capacities and negative skin friction, group action of piles, Anchor piles, laterally loaded piles and pullout resistance, well foundation	**06 Hrs**
Unit -4:	**Linear and Non-Linear Analysis:** Analysis of different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.	**06 Hrs**
Unit -5:	**Engineering Applications of Dynamic Soil-Structure Interaction:** Low rise residential buildings, multistory buildings, bridges, dams, nuclear power plants, offshore structures, soil-pile-structure interactions.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References:

1. Bowels J.E.," Analytical and Computer Methods in Foundation", McGraw HillBook Co. New York, Latest Edition.
2. Desai C.S. and Christian J.T. "Numerical Methods in GeotechnicalEngineering" McGraw Hill Book Co. NewYork, Latest Edition.
3. Soil Structure Interaction, The real behavior of structures, Institution of StructuralEngineers, Latest Edition.
4. Elastic Analysis of Soil Foundation Interaction, Developments inGeotechnical Engg.vol-17, Elsevier Scientific PublishingCo., Latest Edition.
5. Selvadurai A.P.S. "Elastic Analysis of Soil-Foundation Interaction", Elsevier Scientific PublishingCompany, Latest Edition.
6. Swami Saran " Analysis & Design of substructures", Oxford& IB Publishing Co. Pvt.Ltd., Latest Edition.
7. Kurian Nainan P. "Design of Foundation System- Principles & Practices", Narosa PublishingHouse, Latest Edition.
8. Salgado, R., "The Engineering of Foundations", Tata McGraw Hill Education Private Limited, New Delhi, Latest Edition.
9. Saran, S, "Analysis and Design of Substructures", Taylor & Francis Publishers, Latest Edition.
10. Hemsley, J.A, "Elastic Analysis of Raft Foundations", Thomas Telford, Latest Edition.
11. Poulos, H.G., and Davis, E.H., "Pile Foundation Analysis and Design", John Wiley, Latest Edition.
12. Selvadurai, A.P.S., "Elastic Analysis of Soil Foundation Interaction", Elsevier, Latest Edition.
13. Kurien, N.P., "Design of Foundation Systems: Principles and Practices Narosa Publishing House, New Delhi, Latest Edition.
14. Wolf, J. P., "Dynamic Soil-Structure Interaction", Prentice-Hall, Latest Edition.
15. Cakmak, A.S. – Editor, "Soil-Structure Interaction", Developments in Geotechnical Engineering 43, Elsevier and Computational Mechanics Publications, Latest Edition.
16. Wolf, J.P., "Soil-Structure Interaction in the Time-Domain", PrenticeHall, Latest Edition.
17. Wolf, J.P. and Song C. "Finite Element Modelling of Unbounded Media", John Wiley & SonssLatest Edition.

olf, J.P.," Soil-Structure Intera

AM-51017: Lab- CAD in Structural Engineering

(CBCS AICTE Model)

Scheme of Teaching		Scheme of Evaluation	
Practical	4 Hrs/Week	Term Work	25 Marks
		Viva Voce examination	25 Marks
Total Credits	**2**	**Total**	**50Marks**

Prerequisites: Not Applicable

Course Description: The course provides the fundamentals of the use of structural engineering softwares for analysis and design of structures. The various RCC and steel structural elements are analyzed and designed by using various softwares such as STAAD-Pro/ NISA Civil/ SAP/FEAST.

Course Outcomes:

After the completion of the course, the students will be able to :

1. To recognize the different facilities available in application soft wares for analysis and design of structures
2. To analyze and design various types of components in RCC structures using the softwares
3. To analyze and design various types of components in steel structures using the softwares
4. To model, analyze and design simple structures using structural engineering softwares.

Detailed Syllabus

UNIT-1 Introduction to application Softwares: STAAD/ NISA Civil/ SAP/FEAST etc with simple examples	06 Hrs
UNIT-2 Analysis and design of RCC members: Beams, Slab, Column, Footings, Retaining walls	06 Hrs
UNIT-3 Analysis and design of Steel Structures: Trusses for roofs/ bridges, Pin Jointed Space Frame, etc	06 Hrs

Term Work:

The term work shall consist of a numerical examples of analysis and design of various RCC and steel structural elements are analyzed and designed by using various softwares such as STAAD-Pro/ NISA Civil/ SAP/FEAST. The candidate shall prepare a journal in a prescribed format .

Viva Voce Examination: Based on the term work submitted by the student, a Viva-voce examination shall be conducted by the panel of examiners. The panel of examiner consists of a course coordinator as an internal examiner and the external examiner appointed by the controller of examination.

Table 1: Mapping of Course Outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	M	H	L	--	--	M	M	--	--
CO2	H	M	M	H	L	--	--	M	M	--	--
CO3	L	M	M	L	L	--	--	H	H	M	--

H- High M – Medium L – Low

AM 51018: Lab-Advanced Concrete Technology

(CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	4 Hrs/Week	Term Work	25 Marks
Tutorial	-	Viva Voce examination	25 Marks
Total Credits	2	**Total**	**50Marks**

Prerequisites:

Course Objectives:

1. To make the students understand standard procedure of testing of properties of concrete in the hardened state.
2. To make the students understand the methods of evaluation of strength of existing concrete.

Course Outcomes:

On successful completion of the course, students will be able:

1. To test and evaluate the properties of concrete with and without fibers in fresh and hardened state.
2. To compare and appraise mix proportioning procedures of various international codes.
3. To evaluate the quality of concrete using NDT.

Term Work:

It shall consist of ,

A) Record of following experiments performed in the laboratory,

EXP. 1	Comparative experimental study of ACI, DOE and IS methods of concrete mix proportioning	4 Hrs
EXP. 2	Determination of modulus of elasticity of concrete	2 Hrs
EXP. 3	Determination of permeability of concrete	2 Hrs
EXP. 4	Determination of tensile strength of normal and fibre reinforced concrete using split	2 Hrs
EXP. 5	tension test	2 Hrs
EXP. 6	Determination of flexural strength of normal and fibre reinforced concrete	2 Hrs
EXP. 7	Determination of shear strength of normal and fibre-reinforced concrete	2 Hrs
EXP. 8	Determination of strength of concrete using NDT methods	2 Hrs

B) Report based on visit to an existing building for assessment of quality of concrete using NDT methods. 4 Hrs.

SEMESTER-II

AM 51019: Finite Element Analysis of Structures

(CBCS-AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisite: Not Applicable

Course Description: This course offers a numerical method good for solving complex structural problems based on finite element method.

Course Outcomes:

After successful completion of the course, students will be able:

1. To identify structural behavior of various types of finite elements used in structural analysis.
2. To analyze typical structural engineering problems using basic mathematical methods relevant to finite element analysis of structures.
3. To define and use various iso-parametric finite elements in structural analysis.
4. To compute error estimates in finite element analysis of structures.
5. To apply appropriate modeling considerations for solving various structural problems.

Detailed Syllabus:

Unit -1:	**Introduction to Finite Element Analysis** Introduction to finite element method, Types of finite elements, Properties of various finite elements	**06 Hrs**
Unit -2:	**VariationalMethods of Formulation** Principle of stationary potential energy, Rayleigh-Ritz method, formulation by weighted residual methods: Galerkin and other methods, Mixed formulation	**06 Hrs**
Unit -3:	**IsoparametricElements:** Triangular, quadrilateral, tetrahedral, hexahedral, etc; Numerical integrations, Static condensation, Load considerations and stress calculations, Patch test	**06 Hrs**
Unit -4:	**Error Estimation and Convergence:** Sources of error, ill-conditioning, discretization error, convergence rate, mesh revision methods	**06 Hrs**

Unit -5:	**Modeling Considerations:** Physical behavior vs element behavior, element shapes and interconnection, material properties, loads and reactions, connections in structures, boundary conditions, stress concentrations	**08 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References:

1. CookR D, MalkusD S, M E Plesha and R J Witt, Concepts and applications of finite element analysis, 4th edition, John Wiley & Sons, Inc., Singapore, Latest Edition.
2. ChandrupatlaT R and BelegunduA D, Introduction to finite elements in engineering, 3rd edition, Pearson Prentice Hall, India, Latest Edition.
3. ReddyJ N, An introduction to the finite element method, 3rd edition, Tata McGraw Hill, India, Latest Edition.
4. BatheK J, Finite element procedures, Phi Learning Private Limited, New Delhi, Latest Edition.
5. DesaiY M, EldhoT I and ShahA H, Finite element method with applications in engineering, Pearson, Delhi, Latest Edition.
6. Olgierd C. Zienkiewicz, R. L. Taylor, The Finite Element Method: Basic Formulation and Linear Problems, Volume 1, McGraw-Hill College, Latest Edition.
7. Desai / Abel, Introduction to Finite Element Method, Paperback, Latest edition.

AM-51020: Advanced Design of Structures
(CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Test	20 Marks
Tutorials	-	Teacher Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks
		Total	100 Marks

Prerequisites: Usual undergraduate course in elementary theory and design of RCC structures should have been studied earlier.

Course Description:

Objectives:

1. To make the students aware of the code provisions for design of advanced structures
2. To expose students to analysis of and design of advanced RCC structures.
3. To expose students to analysis and design of various steel structures.

Course Outcomes expected

After successful completion of the course, students will be able to:

1. Design various industrial structures using relevant codes and standards
2. Design and Detailing of RCC structures as per current Practice
3. Design and detailing of industrial steel structures as per current practice
4. Associate the design concept with overall design of advanced structures.

Detailed Syllabus:

Unit-1:	**Analysis and design of structures for storage of liquids:** Provisions of IS 3370; Durability requirements, crack width, deflection and strength analyses; various methods of analysis and design of sections. Analysis and design of liquid retaining overhead structures like water tanks circular and rectangular in plan and design of staging.	**06 Hrs**
Unit-2:	**A. Design and detailing of deep beams by IS 456.** **B. Analysis and design of reinforced shear walls:** Classification, Loads on shear walls, Design of rectangular and flanged shear walls, Moment of resistance of rectangular shear walls.	**06 Hrs**
Unit-3:	**A. Analysis and design of storage bins** Analysis and design of industrial square/circular bunkers and silos **B. Analysis and design of chimneys**	**06 Hrs**
Unit-4:	Analysis and design of industrial steel structure buildings	**06 Hrs**
Unit-5:	Plastic analysis and design for rectangular frames, gable frames. Beam columns.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References:

1. Punmia B. C., A K Jain and A K Jain, Comprehensive Design of RCC Structures, Laxmi Publications (P) Ltd, New Delhi
2. Varghese P. C., Advanced Reinforced Concrete Design, 2nd Edition, Prentice-Hall of India Pvt Ltd, New Delhi, 2005
3. Ramamrutham S., Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, New Delhi, 2007
4. Krishna Raju N., Advanced Reinforced Concrete Design, CBS Publishers & Distributors, Delhi
5. IS 456: 2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi.
6. Handbook on Concrete Reinforcement and detailing, Special Publication SP 34, Bureau of Indian Standards, New Delhi, 1987
7. IS: 800 – 2007 Code of Practice for General Construction in Steel
8. Comprehensive Design of Steel Structures, Punmia B. C., Jain A. K., Laxmi Publications(P)Ltd, New Delhi
9. Subramanian N., "Design of Steel Structure "Oxford University Press, New Delhi.
10. Duggal S. K., " Limit state Design of steel structures by Limit State Method " as per IS: 800- 2007 by Tata McGraw Hill Education Private limited New Delhi

AM-51021: Advanced Seismic Analysis and Design

(CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial		Teacher's Assessment	20 Marks
Total Credits	**03**	End Semester Examination	60 Marks
		Total	100 Marks

Prerequisite: Must have undergone course AM-51002- Structural Dynamics & Earthquake Engineering

Course Description: Earthquake resistant design is an essential requirement in the analysis and design of structures. This is a course in continuation of the course in Structural Dynamics & Earthquake Engineering. This course is intended to give an insight into the advanced aspects of earthquake analysis and design after undergoing the basic course. The course aims to expose the students to numerical solutions of equations of motion, performance based design principles. The students are also exposed to the basics base isolation systems and various vibration control techniques. At the end of the course students will be able to contribute towards research in the area during their dissertation work.

Course Outcomes:

After successful completion of the course, students will be able to:

1. Formulate analysis algorithm of MDOF structures using numerical integration methods.
2. Compute the forces in an unsymmetrical building
3. Explain the principles of performance based seismic design and obtain performance point for a given seismic demand.
4. Apply linear theory of base isolation to structures to find out the dynamic propertiers of a base isolated structure
5. Enlist different vibration control techniques and explain their behavior under seismic loading.

Detailed Syllabus:

Unit 1	**Numerical Integration of Equations of Motion** Reduction of DOF, static condensation, modeling of MDOF systems, Rayleigh-Ritz method, selection of Ritz vectors, numerical evaluation of response, time-stepping methods, Newmark-Beta method	**6 Hrs**
Unit 2	**Seismic analysis of unsymmetrical buildings** Seismic analysis of unsymmetrical structures, Centre of Mass and Centre of Stiffness, Eccentricity, Torsion, Modelling and Formulation of unsymmetrical buildings, Accidental eccentricity, Distribution of forces in buidlings due to torsion	**6 Hrs**
Unit -3:	**Performance Based Design Approach** Performance based design, Performance criteria, Push-over analysis, capacity spectrum method, performance point, Different types of hinges	**06 Hrs**

Unit -4:	**Linear theory of base isolation** Vibration control systems, passive, active, hybrid and semi-active systems, base-isolation, base-isolation principles and systems, linear theory of base-isolation	**06 Hrs**
Unit -5:	**Passive vibration control techniques** Tuned mass dampers, Tuned Liquid dampers, Viscous dampers, Friction dampers, basic formulations	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References:

1. Clough R. W. and Penziene J., "Dynamics of Structures", Mc-Graw Hill, Latest Edition
2. Chopra A. K., "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Latest Edition.
3. Paz Mario, "Structural Dynamics", Springer, Latest Edition.
4. Kramer Steven, "Geotechnical Earthquake Engineering", Pearson Education, Latest Edition
5. Dowrick D.J., "Earthquake Resistant Design for Engineers", John Wiley Publishers, Latest Edition
6. Duggal S.K., "Earthquake Resistant Design of Structures", Oxford University press, Latest Edition
7. Hosur Vinod, "Earthquake Resistant Design of Building Structures", Wiley, Latest Edition
8. IS: 1893 (Part-I) -2016, "Criteria for earthquake resistant design of structures" Bureau of Indian Standards, New Delhi
9. IS:13920-2016, "Ductile Detailing of Reinforced Concrete Structures subjected to seismic forces-code of practice" Bureau of Indian Standards, New Delhi

AM 51022: (Elective-III): Mechanics of Composite Materials
(CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks

Prerequisites:
Knowledge about Solid Mechanics

Course Description:
The course provides the information about mechanics of various types of composite materials.

Course Outcomes :
After successful completion of this course, the student will be able to

1. Understand the basic aspects of the mechanics of fiber-reinforced composite materials and failure theories of a lamina.
2. Analyze the lamina and laminates.
3. Evaluate mechanical properties of composite materials
4. Able to pursue research work in the field of laminated composites.

Unit-1:	Introduction: Definition of Fiber reinforced Composites, Applications and Various reinforcement and matrix materials.	**06 Hrs**
Unit -2:	Mechanics of a Lamina: Linear elastic stress-strain relations, Elastic constants based on micromechanics, Plane stress constitutive relations, Transformation of stresses, strains and material coefficients, thermal stresses and strains.	**06 Hrs**
Unit -3:	Laminated Composites: Types of laminated composites, Displacement field approximations for Classical Laminate theory, Laminate Strains, Stress resultants, Stiffness matrices, stresses and strains due to applied loads.Introduction to First Order Shear Deformation Theory.	**06 Hrs**
Unit -4:	Failure Theories of a Lamina: Maximum Stress Failure Theory, Maximum Strain Failure Theory, Tsai-Hill Failure Theory, Tsai-Wu Failure Theory.	**06 Hrs**
Unit -5:	Mechanical Properties Determination: Tensile properties, Compressive properties, Flexure properties, In-plane shear properties, Inter-laminar shear strength.	**06 Hrs**

TEXT AND REFERENCE BOOKS

1. R. M. Jones, Mechanics of Composite Materials, Taylor and Francis Group 1999
2. K. Kaw. Springer : Mechanics of Composite Materials: CRC Press
3. P. K. Mallick: Fiber Reinforced Composites: CRC Press.
4. Agarwal.B.D., Broutman.L.J., and Chandrashekara.K. "Analysis and Performance of Fiber Composites", John-Wiley and Sons, 2006.

5. Daniel.I.M., and Ishai.O, "Engineering Mechanics of Composite Materials", Oxford University Press, 2005
6. Hyer M.W., and White S.R., "Stress Analysis of Fiber-Reinforced Composite Materials",
7. Mukhopadhyay.M, "Mechanics of Composite Materials and Structures", Universities Press, India, 2005.

AM 51023: Elective-III–Analysis of Plates and Shells
(CBCS-AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisites: Not Applicable
Fundamentals of strength of materials, theory of elasticity and analytical and numerical methods of solving higher order partial differential equations.

Course Description:
The course provides analysis of thin plates, shells and folded plates. Students are exposed to classical theories and their applications. The content can be applied for the design of structures such as slabs, retaining walls, domes, silos, folded staircase, etc.

Course Outcomes:
After successful completion of this course, the student will be able:

1) To classify types of plates, shells and folded plates.
2) To apply methods of analysis of plates and shells.
3) To compare the results of analysis by various methods.
4) To appreciate the structural behavior of plates, shells and folded plates.

Unit-1:	**Fundamentals of analysis of plates** Review of plane stress and plane strain problems of elasticity, moment curvature relationships, Classification of plates with reference to deflection, Long rectangular thin plate with small deflections	**06 Hrs**
Unit -2:	**Analysis of rectangular plates** Kirchoff's small deflection theory of thin plates, Navier and Lavy's method, boundary conditions, lateral and in plane loading, Finite difference solution	**06 Hrs**

Unit -3:	**Analysis of circular plates** Symmetrical bending of plate, differential equation in polar coordinates, uniformly loaded and concentrically loaded plates with various boundary conditions, circular plate with a hole.	**06 Hrs**
Unit -4:	**Membrane theory of analysis of shells** Classification of shells, assumptions, analysis of shells of revolutions: circular, cylindrical, elliptical, hyperbolic and paraboloidal shells	**06 Hrs**
Unit -5:	**Analysis of shell and Folded plate** Bending theory of analysis of shells Folded plate: structural behavior, three shear equation, Simpson and Whitney's methods	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

TEXT AND REFERENCE BOOKS

1. Timoshenko and Kreiger, "Theory of Plates and Shells", Tata McGraw Hill Company, New Delhi, Latest Edition.
2. Szillard R., "Theory and analysis of plates", Prentice Hall, Latest Edition.
3. Szillard R., "Theories and applications of plate analysis: classical, numerical and engineering methods", John Wiley and Sons, Latest Edition.
4. Chandrashekhara K., "Theory of plates", University press India Ltd., Hyderabad Latest Edition.
5. Ramaswamy G.S., "Design and construction of concrete shell roofs", CBS Publishers and Distributors, India, Latest Edition.
6. Reddy J.N., "Theory and analysis of elastic plates and shells", CRC, Latest Edition.

Elective IV: AM 51027: Fracture Mechanics
(CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Lectures	3 Hrs/Week	Class Test	20 Marks
Tutorials	-----	Teacher Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks

Prerequisites:
Usual undergraduate courses strength of materials / mechanics of solids or materials should have been studied earlier.

Course Objectives:
The course on fracture mechanics is usually not taught at undergraduate level. The postgraduate students would learn the peculiar ways of structural failures due to fracture.

Course Outcomes:
The students would be able to analyze structural engineering problems involving failure due to fracture.

UNIT-1 Overview of fracture mechanics: Historical cases of failures by fracture, fracture modes	**06 Hrs**
UNIT-2 Yield criteria, crack initiation, growth and fracture mechanisms, LEFM, EPFM, life estimation	**06 Hrs**
UNIT-3 Fracture strength, Energy release rate (G), crack-tip stresses and displacements, stress-intensity-factor (K) for different geometries and loadings, relation between K and G	**06 Hrs**
UNIT-4 Plastic deformations near crack-tip, J-integral, Irwin's model, Dugdale's approach, Mixed mode fracture	**06 Hrs**
UNIT-5 Fracture toughness testing, crack arrest and repairing techniques	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

TEXT AND REFERENCE BOOKS

1. K Ramesh, Engineering Fracture Mechanics, e-book, IIT Madras, 2007
2. D Broek, Elementary Engineering Fracture Mechanics, Martinus Nijhoff Publishers, The Hague, 1982
3. T L Anderson, Fracture Mechanics: Fundamentals and Applications, CRC Press Book, 2004
4. Prashant Kumar, Elements of Fracture Mechanics, Tata McGraw-Hill, New Delhi, 2009
5. Meguid S A, Engineering Fracture Mechanics, Elsevier Applied Science, London, 1989
6. Kanninen M F and Popelar C H, Advanced Fracture Mechanics, Oxford University Press, New York, 1985
7. Gdoutos E E, Fracture Mechanics-An Introduction, Kluwer Academic Publishers, Dordrecht, 1993

AM 51028- Elective-IV : Design of High Rise Structures

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisites : Not Applicable

This subject introduces students to the special requirements necessary for the successful design of high rise buildings. The student should know the basic knowledge of structural floor, framing and foundation systems, wind and earthquake loading, structural analysis techniques including computer-aided analysis.

Course Description: This course intends to provide students a comprehensive knowledge on the high-rise structures. The course is necessary for civil engineers because now a day's many high rise structures are getting constructed due to high land cost and to accommodate more population in lesser area. The various structural systems and the methods of analysis and design will be taught in this course. The behavior of building for wind and earthquake loading and how it affects the design of structural systems and the building services will be focused in this course.

Course Outcomes: After successful completion of the course, students should be able to:

1. describe nature of designing a tall building and the role of a structural engineer in the design of tall buildings
2. differentiate various structural systems for high-rise buildings
3. Develop conceptual designs of floors using different floor systems
4. Analyze various structural systems in buildings
5. Analyze and designs foundation systems for different buildings and soil types

Unit -1:	**General Considerations** Introduction; Definition of a tall building ; Lateral load design philosophy; Concept of premium for height; Factors responsible for slimming down the weight of structural frame; Development of high□rise architecture; structural concepts	**06 Hrs**
Unit -2:	**Gravity and Lateral Load Resisting Structural Systems** High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Steel-Concrete Composite Floor Systems Aluminum Facades , Modeling for approximate analysis, accurate analysis, subsystem interaction, differential movement, creep and shrinkage effects, temperature effects and fire.	**06 Hrs**
Unit -3:	**Design Criteria** Design philosophy, static and dynamic approach, Structural systems and concepts, Effect of openings. Large panel construction. Foundation superstructure interaction. Wind effects, Nature of wind; Extreme wind conditions; Characteristics of wind; Provisions of IS875(Part3); Wind tunnel engineering – Introduction, Description, of wind tunnels; Objectives of wind tunnel tests, Rigid model studies, Aero elastic Tall building behavior during earthquakes; Philosophy of earthquake design; Provisions of IS1893(Part1).	**06 Hrs**
Unit -4:	**Stability of Tall Buildings** Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, simultaneous first order and P-Delta analysis, translational, Torsional instability. Lateral Systems for Steel Buildings, Lateral Systems for Concrete Buildings, Lateral Systems for Composite Construction	**06 Hrs**
Unit -5:	**Foundations** Introduction, bearing capacity: Shallow and deep foundations; Settlement analysis, Different types of foundations and their designs: Raft, Piles, and Well foundation; Foundations subjected to dynamic loads.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

Reference Books:

1) Taranath B. S. , "Structural Analysis and Design of Tall Buildings", McGraw-Hill, latest edition.
2) Taranath B. S. , "Steel, Concrete and Composite design of tall buildings", McGraw-
3) Hill, latest edition.
4) Smith B. S. and A.Coull, "Tall Building Structures," John Wiley & Sons, latest edition
5) Schuellar, W , "High Rise Building Structures" , John Wiley and Sons
6) Lynn S. Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi,1996.
7) Gupta Y. P., "High Rise Structures: Design and Construction Practices in middle level cities"

AM 51029 (Elective-IV): Structural Assessment and Rehabilitation (CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks

Prerequisites:
Knowledge about Concrete Technology, Structural analysis and design

Course Description:
The course provides the information about condition assessment of the structure and its rehabilitation.

Course Outcomes:
After successful completion of this course, the student will be able to

1) Estimate the causes for distress and deterioration of structures
2) Apply NDT for condition assessment of structures and identify damages in RC structures
3) Select material and rehabilitation/retrofitting strategy suitable for distress
4) Formulate guidelines for repair management of deteriorated structures

Detailed Syllabus

Unit-1:	**Introduction and Condition Survey**: Importance of structural assessment, Preliminary assessment through visual inspection methods, Various formats, Structural scores and interpretation	06Hrs
Unit -2:	**Material Condition Evaluation:** Non-Destructive evaluation tests-Concrete strength assessment-Rebound hammer test-Ultrasonic pulse velocity tests, penetration resistance, pull out tests, core sampling and testing - Chemical tests-Carbonation tests and chloride content, Corrosion potential assessment-cover meter survey, half-cell potentiometer test, resistivity measurement, Load Test, Acceptance Criteria	06 Hrs
Unit -3:	**Structural Analysis and Assessment:** Evaluation of reserve strength of existing structures, analysis necessary to identify critical sections, Detailed structural assessment for seismic loads based on IS 1893-2016 Discussion of case studies of RCC buildings subjected to distress-Identification and estimation of damage - Fire damage assessment, structural integrity and soundness assessment, interpretation and evaluation of results	06 Hrs
Unit -4:	**Repair Materials:** Selection of repair materials for concrete-Essential parameters for repair materials-Strength and durability aspects, cost and suitability aspects - Materials for repair-Premixed cement concrete and mortars, polymer modified mortars and concrete, epoxy and epoxy systems including epoxy mortars and concrete, polyester resins, coatings – FRP composites	06 Hrs

Unit -5:	**Rehabilitation and Retrofitting Methods:** Identifying a suitable repair/retrofitting option for certain damage in a structure, guniting, shotcreting, polymer concrete system, reinforcement replacement, strengthening concrete by surface impregnation, polymer and epoxy overlays, plate bonding technique, ferrocement jacketing, RCC jacketing, propping and supporting , fiber wrap technique, foundation rehabilitation methods etc.	06Hrs

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

TEXT AND REFERENCE BOOKS

1. R.N. Raikar, Learning from failures - Deficiencies in Design, Construction and Service, R and D Centre, Structural Designers and Consultants Pvt. Ltd. (SDCPL), Raikar Bhavan, Mumbai, 1987
2. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004
3. CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt of India Press, New Delhi, 2002.
4. Santhakumar A.R., "Concrete Technology" Oxford University Press, New Delhi, 2007.

Elective -V : AM 51033: Environment Impact Assessment and Green Building

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	2 Hrs/Week	Class Test	20Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	**3**	End Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisite: Not required

Course Description: The course contains environment impact assessment, environment management plan, conducting environmental audit and information about green building.

Course Outcome: After successful completion of the course, student will able to,

1. Assess environment impact.
2. Prepare environment management plan.
3. Prepare environmental audit.
4. Plan, analyze and design green building.

Detail Syllabus:

Unit -1:	General : Global and Indian Scenario,National Environmental Policy	**06 Hrs**
Unit -2:	Environmental Organizations for planning and implementation Sustainable Development	**06 Hrs**
Unit -3:	Preventive and reactive strategies for environmental pollution control.Environmental impact and risk assessment.Methodology :Adhoc, Checklist, Network, Matrix etc.	**06 Hrs**
Unit -4:	Environmental Management plan, Typical Case Studies of Environmental Impact Assessment, Environmental impact statements Environmental Audit.Environmental Legislation, Air, Water and Environmental Acts.	**06 Hrs**
Unit -5:	Introduction to Green Buildings, Site Selection & Planning, Water Conservation, Energy Efficiency, Building Materials & Resources, Indoor Environmental Quality, Innovation and Development, Green Building Case Study.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

REFERENCES:

1. A Rosencranz, S. Divan, M.I. Noble, Environmental Law and policy in India Cases, Materials and statutes, Tripathi Pvt. Ltd, Bombay,Latest Edition.
2. S. Musharaf, Legal aspects of Environmental Pollution and its management, C.B.S. Publishers, Delhi, Latest Edition.
3. Jain R. K., L.V. Urban, B. S. Staccy, H.E. Balkbach, Environmental Assessment, McGraw Hill Inc, NY, Latest Edition.
4. Rao, J. G. and Wooten, Environmental Impact Analysis, Handbook 1980.Center, L.W. Environmental Impact Assessment, New York: McGraw Hill Book Company, Latest Edition.
5. Book on Green building

Approved in XIX th Academic Council, dated 27/07/2018

Elective -V: AM 51034: Project Planning and Management

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	2 Hrs/Week	Class Test	20Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	**4**	End Semester Examination	60 Marks
		Total	**100 Marks**

Pre-requisites: Not Applicable

Course Objectives: The objective of the course to know the students basics of project management and planning.

Course Outcomes: On successful completion of this course, students will be able to-

1. Understand basics of project planning
2. Apply management methodology, monitoring and control techniques.
3. Understand environmental dimensions of a project and stresses on environment.
4. Understand project management , process management and project organization
5. Know Progress, Performance and Risk Measurement

Detailed Syllabus:

Unit -1:	**The Basics of Project Planning** Introduction, What is Project Planning?, Why do we need project planning?, Elements of project plan, . Project Scope Planning, Triangular Constraints (TQR), Delivery Schedule Planning, Project Resources Planning, Project Cost Planning, Project Quality Planning, . Supporting Plans- Risk Management Plan, Communication Plan, Procurement Plan,	**06 Hrs**
Unit -2:	**Project Management Methodology, Monitoring &Control** Management methodology, Control and Risk, Balancing the Control System, Progress Reporting System, Five Types of Status Reports, Variances, How & When To Collect Data?, How and What Information to Update, Displaying Status, Charting the Work Break down Structure(WBS) to Report Project Status	**06 Hrs**

Unit -3:	**Environmental Appraisal of Projects** Objective , Introduction, Types and Environmental Dimensions of a Project , Stresses on Environment, Environmental Impact Assessment Methodologies	**06 Hrs**
Unit -4:	**Project Management. & Project Organization** Introduction, project management and process management, Project organization and responsibilities, Organisational models, Choosing the project organization, Developing a project network plan, Time Calculations.	**06 Hrs**
Unit -5:	**Progress, Performance and Risk Measurement** Introduction, The project control process, Performance Indicators, Project monitoring ,Evaluation, and Control, Risk management and Risk Identification, Risk Analysis, Risk Response and Risk control.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References: .

1) Prasana Chandra: Projects-Planning Analysis, Selection, Implementation & Review, Tata McGraw Hill, New Delhi.
2) M.Shaghil and M. Mushtaque : Project Planning and Management Vol. 1
3) C. Choudhury : Project Management, Tata McGraw Hill, New Delhi – 1995
4) Desai, Vasant: Project Management
5) P. Gopala Krishnan and V. Rama Moorthy : Project Management

Elective-V: AM- 51035: Economics and Finance for Engineers

(CBCS- AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	2 Hrs/Week	Class Test	20 Marks
Tutorial	-	Teacher's Assessment	20 Marks
Total Credits	**3**	End Semester Examination	60 Marks
		Total	100 Marks

Prerequisite: Not Applicable

Course Description : For any construction project to be successful, it must be technically sound and the resulting benefits must exceed the cost associated with the project. This course "Economics and Finance for Engineers" basically aims at describing various aspects of engineering economics. The field of construction economics and finance deals with the systematic evaluation of cost and benefit associated with different projects. The topics in this course cover principles of engineering economy followed by basic methods for carrying out economic studies considering the time value of money. The other topics include the demonstration of different methods namely present, future and annual worth method, rate of return, break-even comparison, capitalized-cost and cost-benefit analysis for the comparison of alternatives. In addition, other topics those will be covered are different methods of depreciation, taxes, and cost analysis of construction equipments followed by cost estimating. Further, topics on financial management namely construction accounting, financial statements, financial ratios and working capital management are also included in this course. The topics will be developed in a logical sequence. For clear illustration of concepts, a number of problems will be solved. This course will definitely help the students and teachers in understanding the underlying principles and concepts in economics and finance

Course Outcomes:

After successful completion of the course, students will be able to:

1) Fundamental understanding of the concepts of Economics, namely Micro and Macro Economics.
2) Apply the Basic concepts of principle Cash flow using various Interest calculation Formulae
3) Understanding of Project planning with a specific view on project Financing.
4) Know decision making techniques based on financial guidelines.
5) Understanding how projects are framed and planned and executed

Detailed Syllabus:

Unit -1:	**Engineering Economics** Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams,Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A,A/P), Future payment compared to uniform series payments (F/A,A/F),Arithmetic gradient, Geometric gradient.	**06 Hrs**

Unit -2:	**Comparison of Alternatives** Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.	**06 Hrs**
Unit -3:	**Depreciation and Replacement Analysis** Depreciation - methods and calculation, Inflation, Taxes, Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis	**06 Hrs**
Unit -4:	**Cost Estimating** Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost.	**06 Hrs**
Unit -5:	**Financial Management:** Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.	**06 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

REFERENCES:

1. Blank, L. T. and Tarquin,A. J.,"Engineering Economy", Fourth Edition, WCB/McGraw-Hill, 1998.
2. Bose, D. C.,"Fundamentals of Financial management", 2nd ed.,PHI, New Delhi, 2010.
3. Boyer, C.B. and Merzbach, U. C.,"A History of Mathematics", 2nd ed., John Wiley & Sons, New York, 1989.
4. Gould, F.E.,"Managing the Construction Process", 2nd ed.,Prentice Hall, Upper Saddle River, New Jersey, 2002.
5. Gransberg, D. G.,Popescu, C. M. and Ryan, R. C.,"Construction Equipment Management for Engineers,Estimators, and Owners, CRC/Taylor & Francis,Boca Raton, 2006.
6. Harris, F. , McCaffer, R. and Edum-Fotwe, F.,"Modern Construction Management", 6th ed.,Blackwell Publishing, 2006.
7. Jha,K. N.,"Construction Project Management, Theory and Practice",Pearson, New Delhi, 2011.
8. Newnan, D. G.,Eschenbach, T. G. and Lavelle, J.P.,"Engineering Economic Analysis", Indian Edition, Oxford University Press, 2010.
9. Ostwald,P. F.,"Construction CostAnalysis and Estimating",Prentice Hall, Upper Saddle River, New Jersey, 2001.
10. Peterson,S. J.,"Construction Accounting and Financial Management",Pearson Education, Upper Saddle River, New Jersey, 2005.
11. Peurifoy, R. L.,Schexnayder, C. J. and Shapira,A.,"Construction Planning,Equipment, and Methods, 7th ed., Tata McGraw-Hill, New Delhi, 2010.

12. Peurifoy, R. L. and Oberlender, G. D.,"Estimating Construction Costs", 5th ed., McGrawHill, New Delhi, 2004.
13. Schexnayder, C. J. and Mayo, R.E.,"Construction Management Fundamentals", International Edition, McGraw-Hill, 2003.
14. Sullivan, W. G.,Bontadelli, J.A. and Wicks,E. M.,"Engineering Economy", 11th ed., Prentice Hall, Upper Saddle River, New Jersey, 2001.

Evaluation Pattern

Table 1: Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	H	H		----	----	----	----	----	----	----
CO2	M	H	M		----	----	----	----	----	----	----
CO3	M	H	H		----	----	----	----	----	----	----
CO4	H	H	M		----	----	----	----	----	----	----
CO5	M	H	M								

H-High, M-Medium, L-Low

AM 51039 : Lab Structural Dynamics and Earthquake Engineering

Scheme of Teaching		Scheme of Evaluation	
Practical	4 Hrs/Week	Term Work	25
Total Credits	**2**	Practical Examination/Viva Voce	25
		Total Marks	50

Prerequisite: In conjunction with theory courses Dynamics of Structures and Earthquake Resistant Design of Structures

Course Description: This is a Lab course in support to thetheory courses Dynamics of Structures and Earthquake Resistant Design of Structures

Course Outcomes:
After successful completion of the course, students will be able to:

1. Determine dynamic properties of MDOF systems and explain the behaviour
2. Determine dynamic properties of asymmetrical buildings
3. Examine the behavior of structures under base motion and correlate to behavior of structures under earthquake loading

Detailed Syllabus:

At least six experiments out of the following

1. Dynamics of a three storied building frame subjected to harmonic base motion.
2. Dynamics of a one-storied building frame with planar asymmetry subjected to harmonic base motions.
3. Dynamics of a three storied building frame subjected to periodic (non-harmonic) base motion.
4. Vibration isolation of a secondary system.
5. Dynamics of a vibration absorber.
6. Dynamics of a four storied building frame with and without an open ground floor
7. Dynamics of one-span and two-span beams.
8. Earthquake induced waves in rectangular water tanks
9. Dynamics of free-standing rigid bodies under base motions
10. Seismic wave amplification, liquefaction and soil-structure interactions.

Term Work:

The term work shall consist of a comprehensive journal consisting of records of experiments as detailed under the syllabus above.

AM 51040 : Lab Model Testing

(CBCS AICTE Model)

Scheme of Teaching		Scheme of Evaluation	
Practical	4 Hrs/Week	Term Work	25
Total Credits	**2**	Practical Examination/Viva Voce	25
		Total Marks	50

Prerequisite: Not Applicable
Course Description: This is a Lab course in to get an experience of testing of structural members

Course Outcomes:
After successful completion of the course, students will be able to:

1. Plan a testing scheme
2. Carryout scaled model testing of structural members/systems
3. Examine the behavior of structural members lie beams, columns etc., under applied loading
4. Interpret the test results and compare with analytical results and draw inferences

Detailed Syllabus:
At least test two of the following structural members in two batches

1. RCC slab
2. RCC beam
3. RCC column

Term Work:
The term work shall consist of a comprehensive journal consisting of records of testing as detailed under the syllabus above.

AM-51041: Mini Project with Seminar

(CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	0 Hrs/Week	Term Work	25 Marks
Tutorial/Practicals	4 Hrs/Week	Viva-voce	25 Marks
Total Credits	2		
		Total	50 Marks

Prerequisite: Not applicable

Course Description: The student shall collect, review, compile, comprehend, present research literature and identify the problem for the dissertation in the field of Structural Engineering.

Course Outcomes:

After successful completion of the course, students will be able:

1. To search literature from different sources to appraise the state-of-the-art.
2. To compile and prepare a technical report from the collected literature.
3. To present the literature in a comprehensive manner.
4. To identify the problem for the dissertation

Term Work:

The Mini Project with Seminar shall consist of collection of literature from a chosen field of Structural Engineering from various sources such as refereed journals, proceedings of national international conferences, PG/PhD theses etc. Based on the literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., as necessary the candidate shall define the problem for the dissertation.

The candidate shall prepare a technical report in a prescribed format and present before a panel of examiners consisting of guide and at least one faculty member of the department.

Viva Voce Examination: It consists of two parts.

Part-I: Mid-Term Evaluation for 10 Marks: A mid-term evaluations for 10 marks out of 25 marks shall be done as per the schedule given in the institute academic calendar. Student should prepare a power point presentation and present before the panel of examiners and class students and should be able to answer questions asked by the panel of examiners and class students. Panel of examiner consists of guide as internal examiner and one faculty members appointed by the DCoE as external examiners. The panel of examiner will assess the contents and presentation and give the suggestions, if any and assigns the marks out of 10. In this phase student is expected to collect and present substantial literature.

Part-II: End Semester Evaluation for 15 Marks: Student should prepare technical report in prescribed format duly incorporating suggestions of Part-I and present power point presentation before the panel of examiners and class students. The student should be able to answer the questions asked. The panel of examiner will assess the seminar contents and seminar presentation and assigns the marks out of 15. In this phase the students is expected to

define the problem for dissertation through further literature survey, case studies, data collection, surveys, pilot studies, mathematical/analytical modeling, etc., as necessary.

AM-51042: Industrial Internship

(CBCS -AICTE Model)

Duration: Minimum 8 weeks.

Pre-requisites: The basic knowledge of the various structural engineering subjects.

Course Description: The objective of the course is to expose the students to the professional practices in structural engineering, such as analysis, design, construction techniques, interpretation and execution of structural designs and drawings on site.

Course Outcomes: After successful completion of this course, students will be able –

1. To appreciate the execution of project.
2. Toapply knowledge with critical engineering judgement.
3. To practice the profession with ethics in structural engineering.

Details of the Internship:

The Industrial Internship Program(IIP) is of minimum 8 weeks duration in a chosen field of Structural Engineering to be completed during the vacations after second and third semesters with a minimum of 2 weeks in continuation during a vacation.

The course shall be administered as below:

1. The student shall chose a reputed firm.
2. The student shall supervise the working association with a concerned engineer of the firm.
3. The student shall submit a certificate issued by the concerned firm in the prescribed format.
4. The student shall prepare a technical report in the prescribed format and submit to the guide.

Evaluation:

1. The term-work shall be evaluated by the guide based on the quality of the technical report submitted.
2. The student shall give presentation before the panel of examiners consisting the guide and one faculty appointed by the Head of Department.
3. The student shall maintain a daily diary consisting of everyday activities performed.
4. Based on the presentations, the panel of examiner will give the grade as **S** for satisfactory completion and **N**for non-completion.
5. For **N** grade, the student shall complete the internship before the viva voce examination of dissertation until S grade is obtained.

SEMESTER-III

Open Electives

AM 61001:Open Elective - Finite Element Method for Engineers

(CBCS AICTE Model)

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	Class Test	20 Marks
Tutorial	------	Teacher's Assessment	20 Marks
Total Credits	3	End Semester Examination	60 Marks
		Total	**100 Marks**

Prerequisite:
The UG level courses like Solid/Fluid Mechanics, Theory of Elasticity and Plasticity, Theory of Structures/Machines, Heat Transfer, Calculus, Differential Equations, Linear Algebra, etc should have been studied earlier respectively by students of different branches of engineering.

Course Description:
This course is designed to introduce FEM as a numerical technique that employs a philosophy of piecewise approximations of solutions to problems described by differential equations. Since this method uses a mathematical structure common to various physical theories, it is intended to make students aware of the generality of the method irrespective of students' branch of engineering.

Course Outcomes:
After successful completion of the course, students will be able to:

1. Recognize basic mathematical concepts used in finite element analysis like procedures used in solution of engineering problems
2. Enumerate mathematical procedure followed for analysis of 1-D, 2-d and 3-D problems in engineering
3. Estimate errors in attempted finite element analysis of given problems
4. Solve various engineering problems using finite element method.

Detailed Syllabus:

Unit -1:	**Preliminaries:** Basic concept of FEM, Some mathematical concepts and formulae, weak formulation of boundary value problems, variational methods of approximation	**08 Hrs**
Unit -2:	**Finite element analysis of 1D problems-Part I:** Basic steps of FEA, Applications to heat transfer, fluid mechanics, solid mechanics problems; analysis of bending of beam by Euler-Bernoulli and Timoshenko theories, analysis of plane frames;	**08 Hrs**

Unit -3:	**Finite element analysis of 1D problems-Part II:** Approximation errors, various measures of errors, convergence and accuracy of solution; isoparametric formulations and numerical integration, Computer implementation	**08 Hrs**
Unit -4:	**Finite element analysis of 2D problems-Part I:** Boundary value problems, mesh generation and imposition of boundary conditions, Applications to heat transfer, fluid mechanics, solid mechanics problems; library of elements and interpolation functions, numerical integration and modeling considerations	**08 Hrs**
Unit -5:	**Finite element analysis of 2D problems-Part II & 3D problems :** Analysis of plane elasticity; flows of viscous incompressible fluids, bending of elastic plates; Computer implementation; FEA of 3D problems	**08 Hrs**

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion
5) Other if any

References:

1. J N Reddy, An Introduction to the Finite Element Method, Mc-Graw-Hill, Inc., New Delhi, 1993
2. Bathe K J, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, NJ, 1982
3. Cook R D, D S Malkus, and M E Plesha, Concepts and Applications of Finite Element Analysis, John Wiley, New York, 1989
4. Zienkiewicz O C and R L Taylor, The Finite Element Method, Vol. I, Basic Formulation and Linear Problems, McGraw-Hill, London, 1989
5. Hughes T J R, The Finite Element Method (Linear, Static and Dynamic Finite Element Analysis), Prentice-Hall, Englewood Cliffs, NJ, 1987
6. Desai C S and J F Abel, Introduction to the Finite Element Method, Van Nostrand-Reinhold, New York, 1972
7. Chandropatla T R and A D Belegundu, Introduction to Finite Elements in Engineering, Prentice-Hall, Englewood Cliffs, NJ, 1991
8. Shames I H, Mechanics of Fluids, McGraw-Hill, New York, 1962
9. Holoman J P, Heat Transfer, McGraw-Hill, New York, 1986
10. Nagotov E P, Applications of Numeric Methods to Heat Transfer, McGraw-Hill, New York, 1978
11. Kreyszig E, Advanced Engineering Mathematics, John Wiley, New York, 1988
12. Dym C L and I H shames, Solid Mechanics: A Variational approach, McGraw-Hill, New York, 1973
13. Timoshenko S P and J N Goodier, Theory of Elasticity, McGraw-Hill, New York, 1970

14. Willems N and W M Lucas, Jr., Structural Analysis for Engineers, McGraw-Hill, New York, 1978
15. Szilard R, Theory and Analysis of Plates, Prentice-Hall, Englewood Cliffs, NJ, 1974
16. Timoshenko S P and S Woinowsky-Krieger, Theory of Plates and Shells, McGraw-Hill, New York, 1959
17. Stroud A H and D Secrest, Gaussian Quadrature Formulas, Prentice-Hall, Englewood Cliffs, NJ, 1966

AM61002: Dissertation-I

(CBCS-AICTE Model)

Scheme of Teaching		Scheme of Evaluation	
Dissertation-	20 Hrs/Week	Term Work	50 Marks
Total Credits	**10**	Viva Voce	50 Marks
		Total	**100Marks**

Prerequisites: Not applicable .

Course Description:

The Dissertation work is one of the important aspects of PG education incorporating the research component in the curriculum. The student is required to study the existing literature from various sources such as refereed journals, proceedings of National/International conferences, PG , PhD theses reference book etc. of Structural Engineering. The student would identify the problem and provide solution/s through experimental/Analytical/comparative study as partial fulfillment of PG degree.

The dissertation-I mainly focuses on literature survey, identification of problem and action plan with possible outcomes for the completion of Dissertation-II

Course Outcomes: After successful completion of the course, students will be able:

1. To appraise the state-of-the-art in the chosen field through exhaustive literature survey.
2. To formulate/define the problem for dissertation
3. To compile and prepare a technical report of the collected literature and present.

Term Work:

The Dissertation-I shall consist of collection of literature from a chosen field of Structural Engineering from various sources. The candidate shall formulate/define analytical and/or experimental problem for carrying out dissertation work. The candidate shall prepare a

technical report in a prescribed format. The evaluation of the term work shall be through submission of monthly progress report of the student in prescribed format.

Viva Voce Examination: It consists of two parts.

Part-I: Mid-Term Evaluation for 25 Marks: A mid-term evaluations for 25 marks out of 50 marks shall be done as per the schedule given in the institute academic calendar. Students should prepare a power point presentation and present before the panel of examiners and class students and should be able to answer questions asked by the panel of examiners and class students. Panel of examiner consists of guide as internal examiner and at least one faculty member appointed by the Head of the Department as external examiner. The panel of examiner will assess the contents and presentation and gives the suggestions, if any and assigns the marks out of 25marks.

Part-II: End Semester Evaluation for 25 Marks: Students shall prepare a comprehensive report incorporating the suggestions of part-I, if any and make a power point presentation before the panel of examiners as above and class students and should be able to answer questions asked by the panel of examiners and class students. The panel of examiner will assess the contents and presentation and assigns the marks out of 25 marks.

SEMESTER-IV

AM61003 : Dissertation-II

(CBCS-AICTE Model)

Scheme of Teaching		Scheme of Evaluation	
Practical	32 Hrs/Week	Term Work	100 Marks
Total Credits	16	Viva Voce	150 Marks
		Total	250 Marks

Prerequisites: Students should have completed AM 61003: Dissertation-I satisfactorily.

Course Description:

The dissertation-II is a continuation of Dissertation-I and mainly focuses on solution of the defined problem through experimental/analytical/comparative study as planned.

Course Outcomes: After successful completion of the course, students will be able:

1. To appraise the additional literature in the chosen field of structural engineering.
2. To refine the formulated problem in the chosen field of structural engineering.
3. To find solution to the identified problem using appropriate methodology.
4. To interpret, discuss, debate the solution and draw conclusions.
5. To write the thesis and present before panel of examiner and peers.

Term Work:

The Dissertation-II shall consist of a complete analytical and/or experimental work in Structural Engineering containing literature survey, problem formulation, solution, results, interpretations, discussions and conclusions certified by guide and an internal evaluation committee. The candidate shall prepare a technical report in a prescribed format and submit soft bound 3-hard copies signed by the guide and submit it to the CoE for viva-voce examination. After the viva-voce examination, student shall submit 3-hard bound copies after the corrections, if any, suggested by the panel of examiners along with program exit survey in prescribed format. The evaluation of the term work shall be based on monthly progress report of the student in prescribed format and final submission.

Paper Publications:

A proof of uploading paper to SCI, Web of Science, Scopus, Indian Citation Index journal or filling patent is mandatory requirement for submission of dissertation. However, if the dissertation work is in collaboration with industry/organization/research agency, the uploading of paper/filling a patent shall not be mandatory but desirable.

Pre submission presentation:

There shall be a pre submission presentation before a panel of experts/faculty consisting of guide and faculty/experts and all PG students of the concerned class.

Viva Voce Examination:

Students should prepare a power point presentation and present it before the panel of examiners consisting of guide and the external examiner appointed by the CoE. The candidate should be able to defend his work in front of the panel of examiners and class students. The panel of examiners will assess the dissertation contents and presentation and assigns the marks out of 150.