MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABD

An Autonomous Institute Affiliated to

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra (India)

First & Second Year M. Tech.

(Structural Engineering)

Syllabus 2022-23

FACULTY OF SCIENCE AND TECHNOLOGY															
Syllabus Structure w.e.f. 2022-2023 (Choice Based Credit System)															
M.Tech. (Structural Engineering)															
Semester-I															
Course Code	Course Name Tutorial	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Lectures	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	LECT	TW/PR	TUT	Total
MTS 101	Research Methodology and IPR	3	1	-	15	15	20	50	-	-	100	3	-	1	4
MTS 102	Theory of Elasticity and Plasticity	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 103	Matrix Methods of Structural Analysis	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 104	Dynamics of Structures	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 121-124	Professional Elective-I	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 111	Lab –I (Experimental Stress Analysis)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTS 112	Lab –II (Dynamics of Structures)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTS 113	Lab-III (Computer Lab-I)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTS 114	Seminar	-	-	4	-	-	-	-	-	50	50	-	2	-	2
	Total (Semester-I)	**15**	**1**	**10**	**75**	**75**	**100**	**250**	**75**	**50**	**625**	**15**	**5**	**1**	**21**

Semester-II															
Course Code	Course Name Tutorial	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Lectures	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	LECT	TW/PR	TUT	Total
MTS 141	Optimization Techniques	3	1	-	15	15	20	50	-	-	100	3	-	1	4
MTS 142	Finite Element Analysis	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 143	Earthquake Engineering & Design of Earthquake Resistant Structures	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 144	Advanced Concrete Technology	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 161-164	Professional Elective-II	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTS 151	Lab –IV (Optimization Programming or software)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTS 152	Lab –V (Advanced Concrete Technology)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTS 153	Lab-VI (Computer Lab- II)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTS 154	Minor Project	-	-	4	-	-	-	-	-	50	50	-	2	-	2
	Total (Semester-II)	**15**	**1**	**10**	**75**	**75**	**100**	**250**	**75**	**50**	**625**	**15**	**5**	**1**	**21**
MSE- Mid Semester Exam, ESE- End Semester Exam, LECT -Lectures, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, TUT- Tutorial															
M. Tech (First Year)															
	Grand Total				**150**	**150**	**200**	**500**	**150**	**100**	**1250**	**30**	**10**	**2**	**42**

Master Copy

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Dean
Academics
Maharashtra Institute of Technology
Aurangabad.

Director
Maharashtra Institute of Technology,
Aurangabad.

Professional Elective Courses-I			
MTS 121	MTS 122	MTS 123	MTS 124
Advanced Design of Concrete Structures	Advanced Pre-stressed Concrete	Design of Foundations	Numerical Methods

Professional Elective Courses-II			
MTS 161	MTS 162	MTS 163	MTS 164
Advanced Design of Steel Structures	Structural Audit and Retrofitting Techniques	Theory of Plates and Shells	Design of Composite Construction

Master Copy

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Dean
Academics
Maharashtra Institute of Technology
Aurangabad.

Director
Maharashtra Institute of Technology,
Aurangabad.

FACULTY OF SCIENCE AND TECHNOLOGY															
Syllabus Structure w.e.f. 2022-2023 (Choice Based Credit System)															
M.Tech. (Structural Engineering)															
Semester-III															
Course Code	Course Name Tutorial	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Lectures	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	LECT	TW/PR	TUT	Total
MTS 201	MOOC Course	3	-	-	-	-	-	100	-	-	100	3	-	-	3
MTS 211	Dissertation-I	-	-	18	-	-	-		50	100	150	-	9	-	9
	Total (Semester-I)	**15**	**1**	**10**	**75**	**75**	**100**	**250**	**75**	**50**	**625**	**15**	**5**	**1**	**21**

Semester-IV															
Course Code	Course Name Tutorial	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Lectures	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	LECT	TW/PR	TUT	Total
MTE 251	Dissertation-II	-	-	24	-	-	-		100	100	200	-	12	-	12
	Total (Semester-II)			24					100	100	200	-	12	-	12
M. Tech (Second Year)															
Grand Total								100	150	200	450	3	21	-	24
Grand Total M.Tech.(Structural Engineering)															
Grand Total M. Tech		**3**	-	-	**150**	**150**	**200**	**600**	**300**	**300**	**1700**	**33**	**31**	**2**	**66**

Master Copy

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Dean
Academics
Maharashtra Institute of Technology
Aurangabad.

Director
Maharashtra Institute of Technology,
Aurangabad.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS101 Course: Research Methodology & IPR Teaching Scheme: Lectures: 3 Hrs/week Tutorial: 1 Hr/week	Credits: 3-0-1 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Unit-I	**Research Problems and Research Design** Meaning of research, types of research, steps in involved in research process, criteria of good research, importance of ethics in research, codes and policies for research ethics. Selection of research problem, steps involved in defining research problem, need for research design, types of research designs, basic principles of experimental design, formal and informal experimental design. **(05 Hrs.)**
Unit-II	**Sampling Design** Need for sampling, steps in sampling design, different types of sampling designs, sampling distributions, concept of central limit and standard error, sources of errors, population mean and proportion, sample size calculations, tests of measurements for validity, reliability and practicality **(05Hrs.)**
Unit-III	**Data collection, Processing and Analysis** Methods for collection of data, selection of data collection method, data processing operations, statistics in research, confidence level, measures of central tendency, dispersion, asymmetry and relationship. Spearman's and Pearson's coefficient of correlation, simple & multiple regression analysis, analysis of variance (ANOVA), factor analysis methods. **(08Hrs.)**
Unit-IV	**Hypothesis Test and Report Writing** Concept of research hypothesis, concept of testing of hypothesis, Parametric tests (z, t, F and chi-square tests), Hypothesis testing of means and correlation coefficient, Nonparametric tests, significance of research report writing, types of reports, structure of the research report, steps in report writing, precautions and ethics in writing report. **(07Hrs.)**
Unit-V	**Introduction to IPR** Origin and evolution of IPR to its present form and use, Different Tools of IPR and what is the nature of these rights, Balancing Rights and Responsibilities, Societal implications of IPR **(05Hrs.)**
Unit-VI	**Patents** Concept of inventions/discoveries, patents protect; benchmarks for patentability of inventions; Exceptions to patentability; Patenting issues in Biotechnology and computer based inventions, process to apply for patents in India and in other countries around the world, The steps to granting of a patent; Opposing grant of a patent; term of a patent; rights of a patent holder; challenging validity of a patent licensing of patent rights; using patent rights in the market place; compulsory license. **(06Hrs.)**

Chairman, Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	Sr. No.	Title	Author	Publication	Edition
Text Books and References	1.	Research Methodology: Methods and Techniques,	C. R. Kothari and G. Garg	New Age International, 2019	4th Edition
	2.	Research Methodology	R. Pannerselvam	PHI Learning, 2014	2nd Edition
	3.	Research Methodology- As Theoretical Approach	D. Napolean & B. Narayan	Laxmi Publications, 2014	1st Edition
	4.	Research Methods and Statistics	Bernard C. Beins & Maureen A. McCarthy	Pearson Education Inc., 2012	1st Edition
	5.	Research Methods Handbook, CLES	Stuart MacDonald & Nicola Headlam		1st Edition
	6.	Intellectual Property Rights--Unleashing the Knowledge Economy	Ganguli Prabuddha	Tata McGrawHill, 2001	1st Edition
	7.	Intellectual Property Rights	Neeraj Pandey and Khushdeep Dharni.	PHI Learning, 2014	1st Edition
	8.	Fundamentals of Intellectual Property Rights	Ramakrishna B	Notion Press, 2017	4th Edition
	9.	The Indian Patents Act 1970 (as amended in 2005)			

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F.Y. M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS102 Course: Theory of Elasticity and Plasticity Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Mechanics of solids, Theory of Structures, Structural Mechanics
Objectives	Student should be able to understand 1. Concept of stress and strain at a point, Stress equilibrium and Strain compatibility and Analyze Stress and Strain at a point with various perspectives, etc. under in three-dimensional state of stress. 2. Concept of stress and strain at a point, Stress equilibrium and Strain compatibility and Analyze Stress and Strain at a point with various perspectives, etc. under in three-dimensional state of stress.
Unit-I	**Analysis of Stresses and Strains:** State of Stress at a Point, Stress Tensor, State of Stress at a Point in Cartesian Coordinate System, Derivation of Stress Equilibrium Equations in Cartesian and Polar Coordinate System, Cauchy's Formula, Normal Stress, Shear Stress and Resultant Stress on any Inclined Plane, Transformation of Stresses, Stress Invariants, State of Pure Shear, Principal Stresses, Maximum Shear Stresses, Octahedral Stresses, Decomposition of State of Stress into Pure Shear and Hydrostatic Stress, Mohr's Circles/ Spheres for Various States of Stress, The State of Strain at a Point, Strain Displacement Relations, Strain Compatibility Condition, Volumetric Strain, Problems on Navier Lame's Equilibrium Equations, Problems on Beltrami-Michell Compatibility Equations, Boundary Value Problems in Elasticity. **(07Hrs.)**
Unit-II	**Stress-Strain Relationship:** Generalized Hooke's Law, Hooke's Law for Isotropic, Orthotropic, Plane Stress, Plane Strain and Axi-Symmetric Problems, Relations between Elastic Constants, Problems in 2D and 3D Cartesian Coordinate System, Airy's Stress Function, Bending of Beams, Straight Beams & Asymmetrical Bending, Euler Bernoulli Hypothesis, Shear Center or Center of Flexure, Shear Center in Thin-Walled Open Sections and Other Sections. **(06Hrs.)**
Unit-III	**Stress Concentration Problems:** Stress Concentration Problems such as Stress Concentration due to Circular Hole in Stressed Plate (Kirsch's Problem), Stresses under Concentrated Load acting on the Vertex of a Wedge (Michell's Problem) and Concentrated Load acting on the Free Surface of a Plate (Flamant's Problem), Axi-symmetric Problems such as Stresses in Thick Cylinders subjected to Internal and External Uniformly Distributed Pressures (Lame's Problem) **(06Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Unit-IV	**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. **(05Hrs.)**
Unit-V	**Plasticity:** Basic Equations, Similarities and Differences when Compared with Elasticity, Idealized Material Behavior, Mechanical Models, Neck Formation, Failure Theories, Modes of Failure, Failure under Static Equilibrium, Buckling, Vibrations, Yielding, Fracture, Ductile and Brittle Failure, Yield Criteria, Rankine's Theory, Saint Venant's Theory, Tresca Criteria, Beltrami's Energy Criteria, Von Mises and Hencky & Huber's Theory, Comparison of Different Theories under Axial Tension and Torsion, Various Empirical Stress-Strain Relationships. **(07Hrs.)**
Unit-VI	**Yield Criteria & Yield Surface:** Use of Factor of Safety in Design, Numerical on Bar subjected to Axial Load, Bending and Torsion, Theories of Plastic Flow, Mohr-Coulomb Yield Criteria, Drucker Prager Yield Criteria, Principal Stress Space & Yield Surface, Pi-Plane, Post Yield Stress Strain Behaviour, Plastic Stress Strain Relations, Prandtl Reuss Equation, Lavy-Mises Relation, Strain Hardening, Introduction to Visco-Elasticity and Visco-Plasticity, 1 D Models. **(05Hrs.)**

Text Books and References

Sr. No.	Title	Author	Publication	Edition
1.	Theory of Elasticity	Timoshenko and Goddier	Mc-Graw Hill Publications	Third Edition
2.	Theory of Plasticity	Timoshenko and Goddier	Mc-Graw Hill Publications	Third Edition
3.	Advanced Mechanics of Solids	L. S. Shrinath	Tata-McGraw Hill Publications	Third Edition
4.	Solid Mechanics	S M A Kazimi	Tata -McGraw Hill Publications	First revised
5.	Theory of Elasticity	Sadhu Singh	Khanna Publishers,Delhi	First revised
6.	Advanced Solid Mechanics	N K Bairagi	Khanna Publishers, New Delhi	Third Edition
7.	Elasticity Theory, Applications & Numerics	Martin Sadd	Academic Press	Third Edition
8.	Mechanics of Deformable Solids	Irving Shames	Prentice Hall	First revised
9.	Elasticity in Engineering	Scholer	McGraw Hill Publications	First revised
10.	Applied Elasticity	Wang	Dover Publications	Second Edition
11.	Theory of Plasticity	J. Chakrabarti	McGraw Hill Publications	Third Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS 103 Course: Matrix Methods of Structural Analysis Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisites	Matrix algebra, Structural Mechanics
Objectives	1. To understand the static and kinematic indeterminacy of a structure 2. To analyze plane structural systems using flexibility and stiffness matrix approach 3. To understand the effects of material and geometric non linearity on the performance of a structure
Unit-I	**Introduction** Review of Castigliano's theorems and Unit Load Method for finding the slope and deflection of a structure, basics of matrix algebra including static condensation **(04 Hrs.)**
Unit-II	**Direct Flexibility Matrix Method:** Direct Flexibility Matrix Method and its applications to Continuous Beams, Pin Jointed Frames, Rigid Jointed Frames. **(06 Hrs)**
Unit-III	**Direct Stiffness Matrix Method:** Direct Stiffness Matrix Method and its applications to Continuous Beams, Pin Jointed Frames, Rigid Jointed Frames **(06Hrs)**
Unit-IV	**Generalised Stiffness Matrix Method:** Generalised Stiffness Matrix Method and its applications to Continuous Beams, Pin Jointed Frames, Rigid Jointed Frames, issues related to implementation of matrix method of analysis **(06 Hrs)**
Unit-V	**Nonlinear Analysis:** Material and Geometric Non-Linearity, Stiffness Method with Material Non-Linearity and Geometric Non-Linearity **(10 Hrs)**
Unit-VI	**Introduction to Finite Element Analysis:** Introduction to FEM, basic steps of FEM, different approaches used in FEM, Merits and demerits, types of elements used in FEM **(04 Hrs)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

	Sr. No.	Title	Author	Publication	Edition
Text Books and References	1.	Structural Analysis– A Matrix Approach	G. S. Pandit, S. P. Gupta	Tata Mc Graw Hill Publications	Second Edition
	2.	Structural Analysis	Devdas Menon	Alpha Science	Third
	3.	Matrix Analysis of Framed Structures	Weaver W, Gere G. M.	Van Nostrand Reinhold, New York	Second
	4.	Structural Analysis	Hibbler R. C.,		First
	5.	Matrix Methods of Structural Analysis	A. S. Meghare, S. K. Deshmukh	Charotor Publishing House	Second
	6.	Finite Element Method with application in Engineering	Y. M. Desai, T.I Eldho	Pearson , Delhi	Second
	7.	Finite Element Procedures	Bathe K.J.	PHI learning pvt.ltd	Second

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F.Y. M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS104 Course: Dynamics of Structures Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02Hrs
Prerequisite	Basic understanding of structural analysis like Mechanics of Solids, Structural Mechanics I, Structural Mechanics II and knowledge of Engineering Mathematics.
Objectives	1. To understand the dynamic analysis of sdof systems, mdof systems. 2. To understand the behaviour of structure especially building to various dynamic loads: such as wind, earthquake, machine vibration and ambient vibration.
Unit-I	**Introduction** Introduction to Dynamics of Structures, Simple Structures, SDoF System, Force -Displacement Relation, Damping Force, Equation of Motion, External Force, Mass Spring Damper System, Equation of Motion: Earthquake Excitation, Combining Static & Dynamic Responses, Methods of Solution of the Differential Equation, Free Vibration: Un-damped & Viscously Damped Free Vibration, Energy in Free Vibration, Coulomb Damped Free Vibration, Response to Harmonic & Periodic Excitations, Viscously Damped Systems, Systems with Non Viscous Damping. **(06 Hrs.)**
Unit-II	**Analysis of Arbitrary Dynamic Loading** SDoF System under General Loading, Response to Unit Impulse, Arbitrary Time Varying Force, Response to Step and Ramp Forces, Response to Pulse Excitations, Rectangular Pulse, Half Sine Wave Pulse, Triangular Pulse, Response to Ground Motion, Numerical Evaluation of Dynamic Responses, Time Stepping Methods, Interpolation Methods, Newmark's Beta Method. **(06 Hrs.)**
Unit-III	**Generalized SDoF System** Generalized SDF Systems, Rigid Body Assemblages, Systems with Distributed Mass & Elasticity, Lumped Mass System, Natural Vibration Frequency by Rayleigh's method, Shape Functions. **(06 Hrs.)**
Unit-IV	**MDoF Systems** Simple Systems, Two Storey Shear Buildings, General Approach for Linear Systems, Static Condensation, Symmetric and Asymmetric systems subjected to Ground Motion, Symmetric Systems subjected to Torsional Excitations, Multiple Support Excitations, Methods for Solving Equations of Motion. **(06 Hrs.)**
Unit-V	**Dynamic Analysis and Response of Linear Systems** Systems without Damping, Natural Vibration Frequencies and Modes, Modal & Spectral Matrices, Orthogonality of Modes, Normalization of Modes, Modal Expansion of Displacements, Free Vibration Response of Damped and Undamped and Classically Damped Systems, Damping in Structures,

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	Classical Damping Matrix, Non-Classical Damping Matrix, Two DoF Systems, Modal Analysis, Modal Response Contributions. **(06 Hrs.)**
Unit-VI	**Numerical Evaluation of Dynamic Response** Time Stepping Method, Analysis of Linear and Non Linear Systems, Systems with Distributed Mass and Elasticity, Undamped motions due to Applied Forces, Undamped motion due to Support Excitation, Natural Vibration Frequencies and Modes, Modal Analysis of Forced Dynamic Response, Rayleigh Ritz Method, Formulation using Conservation of Energy, Virtual Work, Finite Difference Method, Finite Element Method, Element Degree of Freedom and Interpolation Functions, Element Stiffness, Mass and Force Matrix, Comparison of FE Solution with Exact Solution. **(06 Hrs.)**

Text Books and References

Sr. No	Title	Author	Publication	Edition
1.	Dynamics of Structures	R. W. Clough & Joseph Penziene	Mc-Grew Hill Publications	2nd Edition
2.	Dynamics of Structures: Theory & Application to Earthquake Engineering	A. K. Chopra	Prentice Hall Publications	3rd Edition
3.	Structural Dynamics	Mario Paz	CBS Publication	6th Edition
4.	Elementary Structural Dynamics	Selvam Manicka	Dhanpat Rai Publication	1st Edition
5.	Structural Dynamic Analysis	Housner V	ARC Publisher	1st Edition
6.	Structural Dynamics	Roy Craig	John-Wiley & Sons	2nd Edition
7.	Dynamics of Structures	Jagmohan L. Humar	Swets and Zeitlinger, Netherlands	2nd Edition
8.	Elements of Engineering	Jaikrisna, A. R. Chandrashekharan	South Asian Publishers	2nd Edition
9.	Structural Dynamics: Vibration and systems	Mukhopadhayay Madhujit	Ane Books India Publisher	2nd Edition
10.	Dynamics of Structures	Patrick Paultre	Wiley India	2nd Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Engineering & Technology) Syllabus of M.Tech.(Structural Engineering) Semester-I	
Course Code: MTS121 Course: Professional Elective Course-I: Advanced Design of Concrete Structures Teaching Scheme: Lectures: 3 Hrs/week	**Credits: 3-0-0** Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02Hrs
Prerequisite	Design of RC Structures
Objectives:	Students will be able to 1. Understand of Loads, Load Combinations, Shear Wall, Yield Line Theory and Prestressed Concrete. 2. Design of Form Works; Raft & Pile Foundations; Bunkers & Silos; Elevated Stored Reservoirs; Prestressed members
Unit-I	**Design Philosophy** Working Stress Design and Limit State Design; Introduction of Loads: Gravity Loads, Dead Load, Live Load, Construction Loads, Wind Load, Earthquake Load, Combination of Loadings, Dead Load and Live Load Reduction for multistoried buildings; Introduction of shear walls and different types of shear walls only; Review of Latest IS Code Provisions: IS 456. **Form Work** Design of form work for slabs, girders and columns. **(05 Hrs.)**
Unit-II	**Raft Foundation** Introduction, Limit State Design of Raft Foundation using grid beams, Review of Latest IS Code Provisions: IS 2950 (Part I) **Pile Foundations** Introduction, Limit State Design of single pile, Group of piles, Efficiency of piles, Design of Pile cap, Review of Latest IS Code Provisions: IS 2911 (Part I). **(08Hrs.)**
Unit-III	**Bunkers & Silos** Limit State Design of square and circular Bunkers; Circular Silos, deep beams. **(05 Hrs.)**
Unit-IV	**Elevated Stored Reservoir** Working Stress Design of rectangular and circular type only flat bottom, Design of Curved Beams, Design of staging for wind forces. Review of Latest IS Code Provisions: IS 3370 (All Parts) **(07Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Unit-V	**Yield Line Theory** Yield Line Theory for analysis of slabs, various patterns of yield lines, assumptions in yield line theory, characteristics of yield lines, equilibrium and virtual work method of analysis. Design of various slabs such as rectangular, triangular, circular with various edge conditions using yield line theory. **(05 Hrs.)**
Unit-VI	**Prestressed Concrete** Basic principle of Prestressing, methods and systems of Prestressing, material requirements, losses of Prestressing, analysis of Symmetrical and Unsymmetrical flanged beams, Concept of cable profile, pressure line, thrust lines. Design of one way and two-way slabs. **(04 Hrs.)**

Text Books and References

Sr. No.	Title	Author	Publication	Edition
1.	Design of Reinforced Concrete Structures (Including Limit State)	Ramamrutham S.	Dhanpat Rai Publications Company.	First
2.	Reinforced Concrete Structures (Vol- II)	B. C. Punmia A. K. Jain and Arun K. Jain	Laxmi Publications New Delhi.	Fifth
3	Fundamentals of Reinforced Concrete	N. C. Sinha and S. K. Roy	S. Chand & Co. Ltd New Delhi.	First
4	Advance RCC Design (RCC Vol- II)	S. S. Bhavikatti	New Age International Publishers.	Third
5	Advanced Reinforced Concrete Design	P. C. Varghese	Prentice Hall of India Pvt. Ltd. New Delhi.	Second
6	Limit State Design	Shah & Karve	Structures Publication Pune.	First
7	Prestressed Concrete	N. Krishna Raju	Tata Mc Graw Hill Publication Co.	Fourth
8	Design of Prestressed Concrete Structures	T. Y. Lin & Ned H. Burns	John Wiley.	Third
9	Indian Standard code of practice for plain and reinforced concrete	IS 456: 2000	Bureau of Indian Standards N ew Delhi.	Fourth
10	Code of practice for design loads (other than earthquake) for Buildings and Structures	IS 875: 1987	Bureau of Indian Standards New Delhi.	Second

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	11	Indian Standard code of practice for criteria for earthquake resistant design of Structures	IS 1893: 2016	Bureau of Indian Standards New Delhi.	Third
	12	Code of practice for design and construction of Raft Foundations [Part 1: Design]	IS 2950: 1981	Bureau of Indian Standards New Delhi.	Second
	13	Design and construction of Pile Foundations - code of practice [Part 1: Concrete Piles]	IS 2911: 1979	Bureau of Indian Standards New Delhi.	First
	14	Code of practice for Concrete Structures for Storage of Liquids [Part 2: Reinforced Concrete Structures]	IS 3370: 2009	Bureau of Indian Standards New Delhi.	First
	15	Indian Standard code of practice for Prestressed Concrete	IS 1343: 2012	Bureau of Indian Standards New Delhi.	Second

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS122 Course: Professional Elective Course-I Advanced Prestressed Concrete Teaching Scheme: Lectures: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Mechanics of Solids, Structural Mechanics, Design of Concrete Structures, Design of Steel Structures,
Objectives	Students should be able to 1. Uunderstand the concepts of pre-stressing in concrete structures, identify the materials for pre-stressing, estimate the losses and analyze the section. 2. Students should be able to analyze and design composite and various sections
Unit-I	**Introduction to prestressed Concrete** Basic principle of prestressing, Types and systems of prestressing, the Material requirement for prestressed concrete, Losses, and analysis of prestressed concrete section for all types of cable profile – an overview. **(04 Hrs)**
Unit-II	**Design of Prestressed Concrete Flexural Members and Design of Anchor Block** Design of post-tensioned PSC girder for flexural strength, shear strength, and deflection. Need of anchorages and design of anchor blocks for the PSC section by Magnel's Method, Guyon's Method and IS Code Method. **(08 Hrs)**
Unit-III	**Statically Indeterminate Structure** Analysis and Design of continuous beams and Frames including choice of cable profile, linear transformations, concordance of cable, and shift consideration. **(06 Hrs)**
Unit-IV	**Composite Structure** Analysis and Design of Composite Construction of Prestressed and in-situ Concrete Structures, Design of post-tensioned one-way, two-way PSC slab **(06 Hrs)**
Unit-V	**Design of different Prestressed Concrete Structures** Design of cylindrical and non-cylindrical PSC pipes, design of poles, sleepers, the concept of circular prestressing for water tank **(08 Hrs)**
Unit-VI	**Causes and Remedies of defects in Prestressed Concrete Sections** Causes of various defects in PSC members like cracking, bulking, deterioration, corrosion of steel in the section, the collapse of concrete at the end anchorages, congestions at the connections, dimensional tolerances, etc. and its remedial measures Importance of grouting in post-tensioned members and its technique. **(04 Hrs)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	Sr. No.	Title	Author	Publication	Edition
Text Books and References	1.	Prestressed Concrete	N. Krishna Raju	Tata Mc Graw-Hill Publishing Company.	6th edition 2018
	2.	Design of Prestressed Concrete Structures	T. Y. Lin & Nedbhurns	John Wiley & Sons	3rd edition 2017
	3.	Prestressed Concrete	S. Ramamruthm	Dhanpat Rai and Sons.	5th edition 2013
	4.	Fundamentals of Prestressed Concrete	Sinha and Roy	S. Chand Ltd.	3rd edition 2011
	5.	Prestressed Concrete	N. Rajagopalan	Narosa Publishing House.	2nd edition 2010
	6.	Modern Prestressed Concrete	James R. Libby	CBS Publishers & Distributors Pvt. Ltd.	1990
	7.	Indian Standard Code of Practice for Prestressed Concrete.	IS 1343: 2012	Bureau of Indian Standards -2012	2nd Revision
	8.	Indian Standard Code for Circular Prestressing in prestressed concrete pipes	IS 784: 2001	Bureau of Indian Standards	2001

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F.Y. M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS123 Course: Professional Elective Course-I Design of Foundations Teaching Scheme: 3 Hrs/Week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Soil Mechanics, Geo Technical Engineering, Foundation Engineering
Course Objectives	Student should be able to 1. predict soil behavior under the application of loads and come up with appropriate solutions to foundation design queries. 2. Analyze the results of in-situ tests and transform measurements and associated uncertainties into relevant design parameters. 3. Synthesize the concepts of allowable stress design, appropriate factors of safety, margin of safety, and reliability.
Unit-I	**Introduction and Soil Structure Interaction** a) Foundation objectives and their importance, Classification of foundations, Soil classification, Geotechnical design parameters, bearing capacity, Foundation settlements. b) Loads for design, Depth of foundation, and depth of soil exploration, parameters for design of foundation on various types of soil, Introduction to Soil Structure Interaction. c) Review of IS Code Provisions: IS 1892, IS 1904, IS 6403, IS 8009 (Part-I & II) **(08 Hrs)**
Unit-II	**Design of Raft Foundations** a) Types of rafts, Relative Stiffness considering: Superstructure-Foundation-Soil system, Soil-Structure Interaction approach, raft on Clayey and Sandy soils b) Review of IS Code Provisions: IS 2950 (Part-I) c) Design of Flat slab raft foundation (Rigid Method/Elastic Line Method) **(06 Hrs)**
Unit-III	**Machine Foundation** a) Introduction, machine vibrations, vibration characteristics, design consideration for machine foundations. b) Review of IS Code Provisions: IS 2974 (Part-II, III & IV) c) Design of foundations for rotary machines / impact machine **(06 Hrs)**
Unit-IV	**Pile Foundation** a) Function and Classification of piles, Static point and skin resistance capacity of a Pile, Negative skin friction, Vertically and Laterally loaded piles, Pile settlements b) Pile Cap, Pile group, Efficiency of piles in a group c) Review of IS Code Provisions: IS 2911 (all related parts) **(06 Hrs)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Unit-V	**Design of Drilled Shaft (Caissons/Well) Foundations –** 1. Drilled Shafts (Caissons/Well) Foundations: Introduction, types and applications of drilled shafts, construction procedures – dry, wet, and casing methods of construction 2. Soil-Structure interaction considerations **(06 Hrs)**
Unit-VI	**Case Studies and Failures of Foundations –** a) Review of Case Studies of – Shallow and Deep Foundations b) Review of Failures of - Shallow and Deep Foundations **(04 Hrs)**

Text Books and References

Sr. No.	Author	Title	Publication	Edition
1.	Modern Foundations: Introduction to Advance Techniques:	Kurain N.P	Tata McGraw Hill	First Edition 1 Oct. 1982
2.	Design of foundation systems Principles and Practice	Kurain N. P	Narosa Publishing house New Delhi	Third Edition 30 January 2005
3	Foundation Design Manual	Nayak N. V.	Dhanpat Rai and Sons	Seventh Edition 2018-19
4	Foundation Engineering Hand Book	Winterkorn H.F. and Fang H.Y. Ed.	Van-Nostrand Reynold	Second Edition 1991
5	Foundation Analysis and Design (4th Ed.)	Bowles J. E.	Mc. Graw – Hill NY	Fourth Edition 1996
6	Pile foundation Analysis and Design	Poulose H. G. and Davis E. H.	John-Wiley Sons Neyork	Eigth Edition 1980
7	Foundation Engineering	Leonards G. Ed.	Mc. Graw-Hill NY	Fourth Edition 1962
8	Soil Dynamics	Shamsher Prakash	McGraw Hill	First Edition 1 Januuary 1981
9	Handbook of Machine Foundations	Sreenivasalu & Varadarajan	Tata McGraw Hill	First Edition 1 July 2017
10	Drilled Shafts: Construction Procedures and Design Methods‖	O'Neil M.W. and Reese L.C.	FHWA Publication No. FHWA-IF-99-025	First Edition 1988
11	Washington D.C. USA	Federal Highway Administration		Second Edition2009.
12	—Design of Reinforced Concrete Foundations‖	P. C. Varghese	PHI Learning Pvt. Ltd. New Delhi	First Edition 1 Oct. 1982
13	IS 8009 (Part-I & II); IS 2950 (Part-I); IS 2974 (Part-II	IS 1892, IS 1904, IS 6403	III & IV); IS 2911 (all related parts	Third Edition 30 January 2005

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F.Y. M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS124 Course: Professional Elective Course -I Numerical Methods Teaching Scheme: Lectures: 03 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration):02 Hrs

Prerequisite	Engineering Mathematics
Objectives	Students should be able to 1. Understand various numerical methods to different Problems. 2. Students should be able to apply various numerical methods to different engineering Problems
Unit-I	**Introduction** Introduction and Necessity of Numerical Methods, Number representation and errors, Number in different bases, Non integer & Fraction, mantissa, exponent, normalized scientific notations, Errors in representing numbers, Inverse error analysis, Loss of Significance. **(06 Hrs)**
Unit-II	**Solution of Linear and Non-Linear Algebraic Equations Systems of Linear Algebraic Equations** Introduction, ill Conditioning, Methods of Solution (Gauss Elimination Method, LU Decomposition Method, Doolittle Decomposition Method, Gauss-Jordon Elimination Method, Gauss Seidel Method), Symmetric & Banded Coefficient Matrices, Pivoting, Diagonal Dominance, Gauss Elimination with scaled row Pivoting, Roots of Algebraic & Transcendental Equations, Fixed point iteration method, Iterative Search Method, Bisection Method, Geometrical Approach to Root Finding, Convergence towards Roots of Equation, Secant Method, False Secant/ Regula-Falsi Method, Ridder's Method, Newton Raphson Method, System of Non-Linear equations (Newton Raphson Method). **(07 Hrs)**
Unit-III	**Regression Analysis** Interpolation and Curve Fitting, Discrete Data, Lagrange's Interpolating Polynomial, Newton's Polynomial Method, Limitations of Interpolation with Polynomials, Spline Interpolation, Curve Fitting, Least Square Fit, Fitting with straight Line, Polynomial Fit, Weighted Linear Regression, Fitting Exponential Function.. **(06 Hrs)**
Unit-IV	**Numerical Integration Methods Numerical Differentiation and Integration,** Taylor's Series, Finite Difference Method, Error in Finite Difference Approximation, Richardson Extrapolation, Derivatives by Interpolation, Cubic Spline Interpolant, Numerical Integration or Quadrature, Newton Cotes Formula, Trapezoidal & Composite Trapezoidal Rule, Simpson Rule, Recursive Trapezoidal Rule, Romberg Integration, Gaussian Integration, Orthogonal Polynomial, Abscissas and Weights for Gaussian Quadrature,

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	Gauss Legendre Quadrature, Gauss Laguerre & Gauss Hermite Method, Gauss-Chebyshev Quadrature, Gauss Quadrature with Logarithmic Singularity. **(05 Hrs)**
Unit-V	**Solution of Differential Equations** Initial Value Problem, Taylor series approach, Euler's Method, Runge-Kutta Method, Second Order Runge-Kutta Method, Forth order Runge-Kutta Method, Stability of Euler's Method, Stiffness, Adaptive Runge-Kutta Method, Bulrisch Stoer Method, Numerical Methods in Structural Dynamics, Implicit and Explicit Method, Central Difference Method, Newmark-Beta Method, Wilson-Theta Method **(06 Hrs)**
Unit-VI	**Eigenvalues and Eigenvectors** Boundary Value Problem, Shooting Method, Two Point Boundary Value Problem, Eigenvalues and Eigenvectors, Symmetric Matrix Eigenvalue Problem, Inverse Power & Power Methods, Eigenvalue Problem in Structural Dynamics, Inverse vector iteration method. **(06 Hrs)**

Text Books and References

Sr. No.	Title	Author	Publication	Edition
1.	Numerical Analysis	L. Ridgway Scott.	Princeton University Press	2Revised Edition
2.	Elementary Numerical Analysis: An Algorithmic Approach	S. D. Conte Carl de Boor	Mc Graw Hill Publications	2Revised Edition
3.	An introduction to Programming and Numerical methods in MATLAB	S. R. Otto J. P. Deneir	Springer	2Revised Edition
4.	Numerical Methods in Engineering with MATLAB	Jaan Kiusalaas	Cambridge University Press.	2Revised Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of F.Y. M.Tech.(Structural Engineering) Semester-I

Course Code: MTS 111 Course: Lab – I: Experimental Stress Analysis Teaching Scheme: Practical: 02 Hr/week	Credits: 0 - 1 - 0 Term-work: 25 Marks

Prerequisite	Solid Mechanics, Theory of Elasticity
Objectives	1. To understand Non-Destructive testing of various materials for various constants using Strain Gauge Techniques. 3. To understand Non-Destructive testing of various materials for various constants using Photo-Elasticity.
Course Content:	The laboratory work consists of the experiments related to Experimental Stress Analysis: 1) Introduction to Applications of Strain Gauge Techniques: Theory on Strain Gauge based methods. 2) Analysis of Cantilever Beam using Strain Gauge based methods. 3) Analysis of Rigid Jointed Frame or Pin Jointed Frame using Strain Gauge based methods. 4) Analysis of combined Bending and Torsion using Strain Gauge based methods. 5) Applications of Photoelasticity: Demonstration of Photoelastic techniques for analysis of Plane Stress Problems. 6) Applications of Photoelasticity: Demonstration of Photoelastic techniques for analysis of Plane Stress Problems with Notch or Hole.

Text Books and References

Sr. No.	Title	Author	Publication	Edition
1.	Experimental Stress Analysis	Dr. Sadhu Singh	Khanna Publishers	2nd Edition
2.	Experimental Stress Analysis	James W. Dally, William F. Riley	Mc Graw Hill Publications	1st Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of F.Y. M.Tech.(Structural Engineering) Semester-I

Course Code: MTS 112 Course: Lab – I: Dynamics of Structures Teaching Scheme: Practical: 02 Hrs/week	Credits: 0 - 1 - 0 Term-work: 25 Marks

Prerequisite	Basic understanding of structural analysis like Mechanics of Solids, Structural Mechanics I, Structural Mechanics II and knowledge of Engineering Mathematics.
Objectives	1. To understand the dynamic analysis of sdof systems, mdof systems. 2. To understand the behaviour of structure especially building to various dynamic loads: such as wind, earthquake, machine vibration and ambient vibration.
Expt.	**Note:** The students are expected to perform any Six experiments out of list given below and submit report of the same. **Contents:**
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 motion.
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.

Text Books and References

Sr. No.	Title	Author	Publication	Edition
1.	Development of experimental setups for earthquake engineering education.	C. S. Manohar and S. Venkatesha	National Information Center of Earthquake Engineering 2006	Revision 2006
2.	Integrated matrix analysis of structure	M.Paz and W.Leigh	Kluwer Academic 2001	6th Edition
3.	Structural Dynamics and Theory and Computation	M.Paz and W.Leigh	Kluwer Academic 2001	6th Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS 114 **Course: Seminar** **Teaching Scheme:** Practical: 04 Hr/week	**Credits:** 0-2-0 **Viva voce:** 50 Marks

Objectives

1. To create awareness amongst students for latest technological aspects.
2. To improve presentation and communication skill
3. To motivate students for research in respective area

Student should deliver Seminar of the topic in front of External Examiners and Internal Examiners, Staff and student colleagues. Prior to presentation student should carry the details of literature survey from standard Text Books and References such as international journals and periodicals, recently published reference books etc. student should submit a report on same along with computer-based presentation copy to the concerned examiner/guide at the end of seminar. the assessment shall be based on selection of topic its relevance to present context, report documentation and presentation skills

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of F.Y. M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS 113 **Course: Lab-VI: Computer lab - I** **Teaching Scheme:** Practical: 2 Hr/week	**Credits:** 0-1-0 **Term-work**: 25 Marks

Prerequisite	Engineering Mathematics, Computational Languages, Theory of Structures, Design of Steel Structure, Design of RCC Structure
Objectives	Students will be able to 1. Understand of Load, Load Combinations, analysis and design using various software.

	Contents
Part A	Design of Steel Structures: Analysis and design of a Traditional building or Pre-engineered steel building or Industrial shed subjected to gravity and lateral loads.
Part B	Design of RCC Structures: Analysis and design of G+10 RCC building subjected to gravity and lateral loads

Note: Use of standard software such as STAAD Pro/ ETABS/ SAP 2000 is recommended.

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of M.Tech. (Structural Engineering)

Course Code: MTS141 Course: Optimization Techniques Teaching Scheme: Lectures: 3 Hrs/week Tutorial: 1Hr/Week	Credits: 3-0-1 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Engineering Mathematics, Numerical methods in Civil Engineering
Objectives	Students will learn different problem formulation techniques with different algorithm. Students will learn and understand constrains of optimization in research operations
Unit-I	**Introduction** Optimal Problem Formulation, Engineering Optimization Problems, Optimization Algorithms. **(02Hrs.)**
Unit-II	**Single Variable Optimization Algorithms** Optimality Criteria, Bracketing Methods, Region Elimination Methods, Point Estimation Methods, Gradient Base, Root Finding Using Optimization Techniques. **(06 Hrs.)**
Unit-III	**Multivariable Optimization Algorithms** Optimality Criteria, Unidirectional Search, Direct Search Methods, Gradient Based Methods, Computer Programs On Above Methods. **(08Hrs.)**
Unit-IV	**Constrained Optimization Algorithms** Kuhn-Tucker Conditions, Transformation Methods, Sensitivity Analysis, Direct Search for Constrained Minimization, Liberalized Search Techniques, Feasible Direction Method, Generalized Reduced Gradient Method, Gradient Projection Method, Computer Programs On Above Methods. **(08Hrs.)**
Unit-V	**Special Optimization Algorithms** Integer Programming, Geometric Programming, Genetic Algorithms, Simulated Annealing, Global Optimization, Computer Programs On Above Methods. **(08Hrs.)**
Unit-VI	**Optimization In Operations Research** Linear Programming Problem, Simplex Method, Artificial Variable Techniques, Dual Phase Method, Sensitivity Analysis **(08Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

	Sr. No.	Title	Author	Publication	Edition
Text Books and References	1.	Engineering Optimization Theory and Practice	Singiresu Rao	Wiley	5 th Edition
	2.	Optimization for Machine Learning	Suvrit Sra Sebastian, Nowozin, Stephen J. Wright	The MIT Press Cambridge Massachusetts London, England	1st Edition
	3.	Optimization for Engineering Design Algorithms and Examples	Kalyanmoy Deb	Prentice Hall	2nd Edition
	4.	Nature-Inspired Optimization Algorithms	Xin-She Yang	Elsevier ISBN: 978012416742	1st Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)

Syllabus of M.Tech. (Structural Engineering) Semester - II

Course Code: MTS 142 Course: Finite Element Analysis Teaching Scheme: Lecture: 3 Hrs/week	Credits: 3 - 0 - 0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Solid Mechanics, Numerical methods in Engineering
Objectives	To comprehend FEM as a numerical technique to solve partial differential equations representing various physical phenomena in structural engineering. To obtain a hands-on training on translating FEM formulation into computational codes in MatLab, SciLab, etc. To obtain a hands-on training on translating FEM formulation into various software like ANSYS, ABACUS, etc.
Unit-I	**Introduction to FEM & Approximate Methods:** Introduction, Overview of Various Methods to Solve Integral & Differential Equations (Point Collocation Method, Method of Least Square, Weighted Residual Method, Galerkin's Method), Variational Calculus (Hamilton's Variational Principle, Minimum Potential Energy Principle, Euler Lagrange Equation), Partial FEM (Kentorvich Method/ Finite Strip Method/ Semi-Analytical Method), Local & Global Finite Element Methods (Rayleigh-Ritz Method), Stepwise Procedure in FEM. **(06 Hrs.)**
Unit-II	**One Dimensional FE Analysis:** Application of FEM to Solve various 1-D problems (Shape Functions for 1-D Elements, Properties of Shape Functions, Lagrange Interpolating Polynomials), C0 Continuity, 1-D FE Analysis (Discretization, Selection of Shape Function, Defining Gradients of Primary Unknowns & Constitutive Equations, Derivation of Element Equations, Assembly & Application of Boundary Conditions, Computation of Primary and Secondary Unknowns), Direct Approach for Assembly, Boundary Conditions (Geometric, Natural), Concept of Sub-Structuring (Static Condensation), Stiffness Matrix for Basic Bar & Beam Element, Representation of Distributed Loading, The Assembly Process within the PMPE Approach, Element Stresses), FE Analysis of 1-D Non-Prismatic Members, Solution of Differential Equation using FEM, Solution of BIVP using Galerkin's MWR (1-D Transient Analysis). **(06 Hrs.)**
Unit-III	**FE Analysis by Direct Approach:** C1 Continuity, Formulation of 1-D Beam Element, Classical Beam Theory, Element Equation Formulation (Galerkin's Approach, Rayleigh-Ritz Approach), Derivation of Scalar Functional from Differential Equation and Vice Versa, Application to Fixed and Continuous Beams. **(06 Hrs.)**
Unit-IV	**Two-Dimensional FE Analysis:** Conditions of Symmetry & Anti Symmetry (Applications), 2-D FE Analysis, Review of Theory of Elasticity, CST Element (3-Node Triangular Element),

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

	Pascal's Triangle and Pyramid, Area Co-ordinate, Stepwise Formulation, Equivalent Load Vector, Plane Stress Problems using CST Elements, 2-D Stress Analysis using 4-noded Rectangular Element, Stepwise Formulation, Effect of Aspect Ratio, Explicit & Implicit Iso-parametric Formulation, Iso-parametric Elements for Plane Problems (Quadrilateral Element, Bilinear Element, Para-linear Element, Bi-Quadrilateral Element, Serendipity Elements, Lagrange Element), Numerical Integration, (1-D Domain, 2-D Domain, n-point Gauss Rule), Formulation of Transition Element. **(06 Hrs.)**
Unit-V	**Three-Dimensional FE Analysis:** 3-D Stress Analysis using FEM, Iso-parametric Formulation, 3-D Brick Element, Application to 3-D Analysis, FEA of Axisymmetric Solids Subjected to Axi-symmetric and Asymmetric Loads (Application of Partial FEM). **(06 Hrs.)**
Unit-VI	**Computer Implementation of FEM:** Computer Implementation of FEM, Application of FEM to Time Dependent Problems, Partial FEM, h-version of FEM, p-version of FEM, Adaptive Meshing, Exposure to Hybrid FEM (Mixed/ Hybrid Formulation, Unidirectional Composites), and Introduction to any one Software related to FEA. **(06 Hrs.)**

Text Books and References

Sr. No.	Title	Author	Publication	Edition
1.	Introduction to the Finite Element Method	C. S. Desai & J. F. Abel	CBS Publication	3rd Edition
2.	Concept and Application of Finite Element Analysis	M. Mukhopdhyay	Oxford & IBH Publishing Co. private limited	2nd Edition
3.	The Finite Element Method	O. C. Zienkiewicz & R.L.Taylor	Tata McGraw Hill	6th Edition
4.	An introduction to the Finite Element Method	J.N.Reddy	Tata McGraw Hill Publication	4th Edition
5.	Concept and Application of Finite Element Analysis	R. D. Cook	John Wiley & sons	4th Edition
6.	Fundamentals of Finite Element Analysis	Hutton D.V.	Tata McGraw Hill Publication	2nd Edition
7.	Programming in the Finite Element Method	C. S. Krishnamoorthy	Tata McGraw Hill	2nd Edition
8.	Introduction to the Finite Element in Engineering	T. R. Chandrupatla and Belegundu	Prentice Hall of India private limited.	3rd Edition
9.	Finite Element Procedures	Bathe K. J.	PHI Learning private limited	2nd Edition
10.	Introduction to the Finite Element in Engineering	Y. M. Desai	Pearson, Delhi	1st Edition
11.	Finite Element Analysis	S. S. Bhavikatti	New Age International Publication	4th Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-II	
Course Code: MTS 143 Course: Earthquake Engineering & Design of Earthquake Resistant Structures Teaching Scheme: Lecture: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Theory of Structures, Design of RCC and Steel Structure.
Objectives	The student will be able to: 1. Understand basics of response of structures to forced vibrations and free vibrations. 2. Analyse response of SDoF systems to general loading and understand various methods of evaluation of dynamic response. 3. Analyse response of structures to ground excitations, support excitations and torsional excitations
Unit-I	**Introduction to Seismology** Elements of Seismology, Terminology, structure of Earth, Causes of an earthquake, seismic waves, magnitude and intensity, seismograph, strong motion earthquake, strong motion earthquake, accelerogram, Elastic Rebound Theory, Theory of Plate Tectonics and Movement of Indian Plate, Seismic Zoning Maps of India and Comparative Study, Response Spectra, Strong Motion Characteristics. **(06 Hrs.)**
Unit-II	**Earthquake Response of Systems** Structural dynamics: Viscously damped forced systems vibrations, equations of motion, Duhamel integral. Response Spectrum Theory: construction of Design Response Spectrum, effect of foundation and structural damping on design spectrum, design spectrum of IS 1893, evaluation of lateral loads. **(04 Hrs.)**
Unit-III	**Earthquake Risk Analysis** Earthquake Effects on the Structures, Classification of Loads, Seismic Methods of Analysis, Seismic Design Methods, Seismic Damages during Past Earthquakes and Effect of Irregularities and Building Architecture on the Performance of RC Structures, Mathematical Modeling of Multi-Storied RC Buildings with Modeling of Floor Diaphragms and Soil-Foundation, Winkler model. **(06 Hrs.)**
Unit-IV	**Analysis of Seismic Forces on Building** as per latest IS: 1893 by Equivalent Static Lateral Load Method and Response Spectrum Method, Introduction to Time History Method and Performance Based Analysis. Introduction to Earthquake Mitigation devices – Isolators and dampers **(08 Hrs.)**
Unit-V	**Introduction to Ductility**, Factors Affecting Ductility, Ductility Requirements, Types of Ductility, Provisions of Ductile Detailing (IS 13920), Seismic Design and Ductile Detailing of Beam, Column, Beam Column Joint, Shear Wall, Elevated RC Circular Water Tanks. **(06 Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Unit-VI	**Seismic Retrofitting**, Sources of Weakness in RC Framed Buildings, Classification of Retrofitting Techniques, Conventional and Non-Conventional Methods, Comparative Study of Various Methods and Case Studies, IS Code Provisions for Retrofitting of Masonry Structures, Failure Modes of Masonry Structures and Repairing Techniques. **(06 Hrs.)**

Text Books and References

Sr. No.	Title	Author	Publication	Edition
1.	Earthquake Resistant Design of Structures	P. Agarwal and M. Shrikhande	Prentice-Hall Publications	Eastern Economy Edition 2014
2.	Indian Standard Criteria for Earthquake Resistant Design of Structures	IS: 1893	Bureau of Indian Standards, New Delhi.	2016
3.	Repair and Seismic Strengthening of Buildings	IS:13935	Guidelines,	2009
4.	Earthquake Resistant Design and Construction of Buildings	IS:4326	Code of Practice	2013
5.	Improving Earthquake Resistance of Low Strength Masonry Buildings,	IS:13828	Bureau of Indian Standards, New Delhi	1993 Reaffirmed 2008
6.	Improving Earthquake Resistance of Earthen Buildings	IS:13827	Bureau of Indian Standards, New Delhi	1993 Reaffirmed 2003
7.	Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force	IS:13920	Bureau of Indian Standards, New Delhi	2016
8.	Indian Standard code of practice for concrete structures for storage of liquids	IS: 3370	Bureau of Indian Standards, New Delhi	2021
9.	Dynamics of Structures	Clough and Penzin	Mc-Graw Hills Publications	1993
10.	Elements of Earthquake Engineering	Jai Krishna, A.R. Chandrashekharan and B Chandra	South Asian Publishers Pvt. Ltd.	Second Edition 2014
11.	Design of Reinforced Concrete Structures for Earthquake Resistance	Joshi P S et al	Indian Society of Structural Engineers	2001

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-II	
Course Code: MTS 144 Course: Advanced Concrete Technology Teaching Scheme: Lecture: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Building Constructions and Materials, Building Construction and Design, Concrete Technology.
Objectives	The students will be able to: 1. Understand factors of Serviceability and Durability of Structures. 2. Determine crack width, effect of crack on materials, effect of moisture on structures. 3. Understand methods for protection of steel structures and masonry structures.
Unit-I	**Admixtures and cementitious material:** Types and properties of chemical admixtures and various cementitious material, Compatibility of admixture with cement, compatibility of natural and artificial sand with cement. **(06 Hrs.)**
Unit-II	**Concrete mix proportioning:** IS10262-2019, ACI Method, British method (DOE), Merits and Demerits of all methods, Quality Assurance for Concrete Construction, Permeability, Thermal Properties and Cracking, Effects of Climate, Temperature, Chemicals, Wear and Erosion, Design and Construction Errors, Corrosion Mechanism, Effects of Cover Thickness and Cracking **(06 Hrs.)**
Unit-III	**Behaviour of concrete:** **Fresh Concrete:** Workability, Cohesiveness, Segregation, temperature, Rheology of concrete. **Hardened Concrete**: Factors affecting properties of concrete, strength of harden Concrete, Stress–Strain Relationship and Constitutive Equations, Dimensional Stability—Shrinkage and Creep, Durability **(06 Hrs.)**
Unit-IV	**Advanced Concrete**: Structural lightweight concrete, High strength concrete, high density concrete, High performance Concrete: material, properties, mixes proportions. Particle Packing Theories. **(06 Hrs.)**
Unit-V	**Special concrete**: Self-compacting concrete, Fiber reinforced concrete, Polymer concrete, Ready mix concrete. **(06 Hrs.)**
Unit-VI	**Test on Concrete:** Destructive test on concrete: compressive test, Flexural test, Shear Test, Tensile Test, Modulus of Elasticity. Non-Destructive Testing: Ultrasonic and Sonic Test, Rebound Hammer Test, Strength Evaluation of Existing Structures. **(06 Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	Sr. No.	Title	Author	Publication	Edition
Text Books and References	1.	Concrete, microstructure, properties and material	P Kumar Mehta, Paulo J.M.Monteiro	McGraw-Hill Companies.	3rd Edition
	2.	Advanced Concrete Technology	Zongjin Li, John Wiley & Sons, Inc.		2nd Edition
	3.	Concrete Technology	A R Sanathakumar	Oxford university Press	2 Edition
	4.	Properties of Concrete	Neville A. M.	Pearson	Fourth Edition
	5.	Theory and Practice	Shetty M.S. Concrete	S.Chand and Company Ltd., New Delhi	4th Edition
	6.	Theory and Practice. 2011	Gambhir M.L. Concrete Technology	McGraw Hill, New Delhi	4th Edition
	7.	Specification for Coarse and Fine Aggregates from Natural Sources for Concrete	IS: 383-1970	Bureau of Indian Standards, New Delhi.	Second Revision
	8.	Plain and Reinforced Concrete- Code of Practice	IS: 456-2000	Bureau of Indian Standards, New Delhi	3rd Revision
	9.	Indian Standard Methods of Tests for Strength of Concrete	IS : 516 – 1959	Bureau of Indian Standards, New Delhi	2nd Revision
	10.	Indian Standard Concrete Mix Proportioning-Guidelines	IS:10262-2009	Bureau of Indian Standards, New Delhi, India	4th Revision
	11.	Indian Standard Concrete Mix Proportioning-Guidelines	IS:10262-2019	Bureau of Indian Standards, New Delhi, India.	Second Revision
	12.	Standard Practice for Selecting Proportions for Normal Heavyweight, and Mass Concrete.	ACI 211.1-91	ACI Committee 211	Reapproved 2002
	13.	Methods for specifying concrete mixes.	BSI-5328	British Standard, London, United Kingdom	Part 2 :1997
	14.	Fiber Reinforced Cement Composites	Balaguru P.N and Shah S.P.	McGraw-Hill Companies.	3rd

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-II	
Course Code: MTS 161 Course: Advanced Design of Steel Structures Teaching Scheme: Lecture: 3 Hrs/week Tutorial: 0 Hr/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Design of Steel Structure
Objectives	The students will be able to: 1. Identify and compute the design loads and the stresses developed in the steel member. 2. Analyze and design the various connections and identify the potential failure modes. 3. Analyze and design various tension, compression and flexural members. 4. Understand provisions in relevant BIS Codes.
Unit-I	**Design of Beam Column** – General behaviour, Second Order moments, Elastic Torsional Buckling, Interaction between Beam-Column and Structure, Nominal Strength – Instability in the plane of Bending, Beam-Column under Biaxial Loading, Interaction equations for local capacity check, Code design procedures, Design of Beam-Columns, Beam-Column subjected to Tension and Bending, Crane Columns, Design of Eccentrically Loaded Base Plates, **(06 Hrs.)**
Unit-II	**Transmission Line Towers**: Introduction, Basic Structural configuration, Bracing systems, Loads on Towers, Estimation of loads as per IS802, Foundations for Towers. Introduction to Microwave Tower and Masts **(06 Hrs.)**
Unit-III	**Tubular Structures:** Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per codal provisions, detailing of joints. **(06 Hrs.)**
Unit-IV	Design and detailing for Earthquake loads – As per IS800:2007. **(06 Hrs.)**
Unit-V	**Castellated beams**: Concept, fabrication of the castellated beam from rolled steel section, Design of castellated beam for bending and shear. PE Buildings/Structures: Design of gable framed pre-engineered building. **(06 Hrs.)**
Unit-VI	**Introduction to Cold-Formed Steel (CFS)** Brief history of cold-formed steel usage, Manufacturing Processes, special issues in Cold formed steel (Geometric imperfections and residual stresses), Different types of buckling, review of various design codes for CFS, Review of Direct Strength Method, Effective Width Method (EWM), Design of flexural member and compression member (plain channel section) using EWM. **(06 Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Text Books and References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Design of steel structures	N Subramanian	Oxford University Press	2008
	2.	Comprehensive Design of steel structure	Punmia and Jain	Laxmi Publication, Delhi	2015
	3.	Design of steel Structures	Ram Chandra	Standard Book House, Delhi	Twentieth Edition, 2018
	4.	Design of steel structures	M Raghupathi	Tata McGraw Hill, New Delhi.	1995
	5.	Limit state design of steel structures	S K Duggal	Tata McGraw Hill Education	3rd Edition 2010
	6.	Plastic Design of Frames	Fundamentals, John Baker and Jacques Heyman	Cambridge University press	1980
	7.	Design of Steel Structures	Dayaratnam		2016
	8.	Structural Design in Steel	SarwarAlamRaz	New Age International Publishers	2020
	9.	Code of Practice for General Construction in Steel	IS: 800 - 2007	BIS, New Delhi	2007
	10.	Code of Practice for General Construction in Steel	IS: 800 - 1984	BIS, New Delhi	1984
	11.	Code of Practice for use of cold formed light gauge steel structural member's in general building construction	IS: 801 - 1975	BIS, New Delhi	Reaffirmed 1995
	12.	Cold-Formed Steel Design	W.W. Yu	John Wiley & Sons	2000
	13.	Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members	IS 801: 1975	General Building Construction	1998
	14.	Structural Use of Steelwork in Building: Code of Practice for Design of Cold Formed Thin Gauge Sections.	BS 5950-5 : 1998		1st edition 2011
	15.	Structural Analysis and Design of Tall Building	B. S. Taranath	CRC press	1991
	16.	Tall Building Structures	B. S. Smith and A. Coull	Analysis and Design, Wiley.	1985
	17.	Tall Chimneys: Design and Construction	S. N. Manohar	Tata Mcgraw-Hill	1990
	18.	Transmission Line Structures	A. R. Shanthakumar and S. S. Murthy	Tata Mcgraw-Hill,	Reaffirmed 1998

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	19.	Code of Practice for Design and Construction of Steel Chimneys	IS: 6533 ; 1989		2001
	20.	Cold-Formed Steel Structures to the AISI Specification	G.J. Hancock, T.M. Murray, D.S. Ellifritt	Marcel Dekker, Inc, New York, USA.	2016
	21.	North American Specification for the Design of Cold-Formed Steel Structural members Specifications	AISI-S100 : 2007 AISI-S100 : 2016	Washington, DC, U.S.A.	2008

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-II	
Course Code: MTS 162 Course: Structural Audit and Retrofitting Techniques Teaching Scheme: Lecture: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Concrete Technology, Material Testing and Evaluation.
Objectives	The students will be able to: 1. Gain the knowledge of Bye laws, procedure of Structural audit and study the typical problems in structures. 2. Aware of causes and types of deterioration in structures.
Unit-I	**Introduction to Structural Health Monitoring (SHM):** Introduction, Visual inspection of structure, need of structural health monitoring (SHM), advantages of SHM, causes of distress, load variation, material variations, Factors affecting health of structures, Structural health monitoring Techniques, Various measures for regular maintenance. **(06 Hrs.)**
Unit-II	**Structural Audits** Purpose of Structural Audit, Role of Engineer, Survey of structural defects, Guidelines for structural audit. Non-Destructive Testing: Ultrasonic and Sonic Test, Rebound Hammer Test, Corrosion potentiometer, Strength Evaluation of Existing Structures, Study of Structural audit reports. **(06 Hrs.)**
Unit-III	**Repair system, material and techniques:** Repair methodology, compatibility of repair material and concrete, material for repair like cement base, polymer modified, resin base, micro concrete and composite, repair techniques. **(06 Hrs.)**
Unit-IV	**Retrofitting and strengthening of concrete structures**: Design philosophy of strengthening, strengthening technique such as section enlargement, composite construction, post tensioning, stress reduction, strengthening by reinforcement, strength by FRP. **(06 Hrs.)**
Unit-V	**Various methods of Retrofitting**: Repairs using Mortars and Dry Packs, Concrete Replacement, Surface Impregnation, Rust Eliminators and Polymers Coating for Rebar during Repair, Foamed Concrete, Vacuum Concrete, Gunite and Shotcrete, Injecting materials like Epoxy, Resin, Polymer Modified Cement Slurry, Shoring and Underpinning. Propping and Supporting: False Work, Requirement of Good False Work, Design Brief for False Work, Execution Procedure. **(06 Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Unit-VI	**Various test on Retrofitting of Structures:** General Principles, Relieving Loads, Stress Reduction, Strengthening of Super Structures (Beam, Column, Slab including Joints) for Tension, Compression, Flexural, and Shear respectively, Jacketing (RCC, Plate, Fiber, Wrap), Bonded Overlays, Reinforcement Addition, Strengthening the Substructures, Increasing the Load Capacity of Footing, Strengthening of Masonry Structure **(06 Hrs.)**				
Text Books and References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Deterioration, maintenance and repair of structures	Johnson. S.M.	McGraw-Hill book company, New York,	1965/3rd
	2.	Repair of concrete structures	R. T. Allen and S. C. Edwards	Blakie and Sons, UK	1987/2nd
	3.	Concrete structures	Denison Campbell, Allen and Harold Roper	Materials, Maintenance and Repair, Longman Scientific and technical UK,	1991/3rd
	4.	Hand book on causes and prevention of cracks on buildings	SP25-84	Indian standards	2nd
	5.	Concrete Technology- Theory and Practice	M. S. Shetty	S. Chand and Company, New Delhi	1992/2nd
	6.	Structural Health Monitoring	Fu Ko Chang	Current Status and Perspectives	4thEdition
	7.	Training Course notes on Damage Assessment and repair in Low Cost Housing, RHDC–NBO	Santhakumar, A.R.	Anna University.	July, 1992/

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-II	
Course Code: MTS 163 Course: Theory of Plates and Shells Teaching Scheme: Lecture: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Mechanics of Solids, Theory of Structures.
Objectives	The students will be able to: 1. Understand and derive governing differential equation for deflected shape of rectangular plates. 2. Solve governing differential equation of deflected shape of rectangular plate for various loading and support conditions. 3. Understand and derive governing differential equation for deflected shape of circular plates.
Unit-I	**Module 1: Introduction to Plate Theory** Thin and Thick Plates, Small and Large Deflection Theory of Thin Plate, Assumptions in Analysis of Thin Plates, Slope Curvature Relations, Moment - Curvature Relations, Stress Resultants, Governing Differential Equations for Bending of Plates, Various Boundary Conditions **(04 Hrs.)**
Unit-II	**Module 2: Navier's and Levy's Solution** Rectangular Plates Subjected to Uniformly Distributed Load, Sinusoidal Load for Different Boundary Conditions. **(07 Hrs.)**
Unit-III	**Module 3: Circular Plates** Analysis of Circular Plates under Axis-Symmetric Loading, Moment Curvature Relations, Governing Differential Equation in Polar Co-Ordinates, Simply Supported and Fixed Edges, Distributed Load, Ring Load, a Plate with Hole at Center. **(07 Hrs.)**
Unit-IV	**Module 4: Introduction to Shell Structures** Classification of Shells on basis of Geometry, Thin Shell Theory, Equation of Shell Surfaces, Stress Resultants, Stress-Displacement Relations, Compatibility and Equilibrium Equations. **(04 Hrs.)**
Unit-V	**Module 5: Membrane Analysis** Equation of Equilibrium for Synclastic Shells, Solution for Shells Subjected to Self Weight and Live Load, Cylindrical Shells - Equation of Equilibrium, Open Shells with Parabolic, Circular, Elliptical Directrix, Simple Problems, Shells With Closed, Directrix-Circular, Elliptical-Simple Problems, Problems on Pipes Carrying Fluid/Liquid Under Pressure, Just Filled & Partly Filled. **(07 Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Unit-VI	**Module 6: Bending of Cylindrical Shells** Symmetrically Loaded Circular Cylindrical Shells, Beam Theory, Finsterwalder's Theory, D-K-J Theory- Donnell's Equation, Characteristic Equation, Schorer's Theory **(07 Hrs.)**				
Text Books and References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Theory of Plates and Shells	S. Timoshenko and W. Krieger	Mc Grew Hill	3 Edition
	2.	Stresses in Plates and Shells	Ansel C. Ugural	Mc Graw Hill	1st Edition
	3.	Design and Construction of Concrete Shell Roofs	G. S Ramaswamy	CBS Publications	1stEdition
	4.	Analysis of Concrete Shells	Chandrashekhara K.,	New Age International Edition	1th Edition
	5.	Analysis of Plates	Chandrashekhara K	New Age International Edition	1 Revision
	6.	Theory and Analysis of Elastic Plates and Shells	Reddy, J. N	Taylor & Francis	3rd Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-II	
Course Code: MTS 164 Course: Design of Composite Construction Teaching Scheme: Lecture: 3 Hrs/week	Credits: 3-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Prerequisite	Mechanics of Solid, Design of RCC, Concrete Technology.
Objectives	The students will be able to 1. Understand types of masonry structures. 2. Understand composition of concrete and effect of various parameters affecting strength. 3. Comprehend components of building and there purposes. 4. Comprehend the precast and pre-engineered building construction techniques.
Unit-I	Introduction of composite constructions, benefits of composite construction, Introduction to IS, BS and Euro codal provisions. Composite beams, elastic behavior of composite beams, No and Full Interaction cases, Shear Connectors, Ultimate load behavior, Serviceability limits, Effective breadth of flange, Interaction between shear and moment, Basic design consideration and design of composite beams. **(06 Hrs.)**
Unit-II	Composite floors, Structural elements, Profiled sheet decking, Bending resistance, Serviceability criterion, Analysis for internal forces and moments. **(04 Hrs.)**
Unit-III	Composite Columns, Materials, Concrete filled circular tubular sections, Non dimensional slenderness, local buckling of steel sections, Effective elastic flexible stiffness, resistance of members to axial compressions, Composite Column design, Fire Resistance. **(06 Hrs.)**
Unit-IV	Design of Multi-storeyed commercial and residential composite building, Design basis, load calculations, design of foundation, design for compression members, vertical cross bracings. **(08 Hrs.)**
Unit-V	Design of Composite beam, composite slabs with profile decks **(04 Hrs.)**
Unit-VI	Composite trusses, Design of truss, Configuration, Application range, Analysis and Design aspects and connection details. **(06 Hrs.)**

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

	Sr. No.	Title	Author	Publication	Edition
Text Books and References	1.	Composite Structures of Steel and Concrete	Johnson R. P.	Beams, Columns and Frames in Buildings, Oxford Blackwell Scientific Publications	4th Edition
	2.	INSDAG teaching resources for structural steel design		Institute for Steel Development and Growth Publishers, Calcutta	
	3.	INSDAG Handbook on Composite Construction		Multi-Storey Buildings, Institute for Steel Development and Growth Publishers, Calcutta	
	4.	INSDAG Design of Composite Truss for Building		Institute for Steel Development and Growth Publishers, Calcutta	
	5.	Code of Practice for Composite Construction in Structural Steel and Concrete	IS:11384	Bureau of Indian Standards, New Delhi. 2003	2nd Edition

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-II	
Course Code: MTS 151 **Course:** Lab –IV :Optimization Techniques Lab **Teaching Scheme:** Practical: 2 Hrs/week	**Total Credits:** 0-1-0 **Term Work:** 25 Marks

Prerequisite	Engineering Mathematics, Numerical methods in Civil Engineering
Objectives	1. To introduce the fundamentals of classical optimization techniques to the students. 2. To expose student to the theory of different non-classical optimization methods and algorithms developed for solving various types of civil engineering optimization problems. 3. The course will also enable the students to apply the various classical and non-classical optimization techniques in solving real-world optimization problems by using Matlab and MS Excel.
	Contents
	Experiments performed in the laboratory (Any Six)
1	Formulate engineering system design problem as an optimization problem.
2	By using excel solver solve unconstrained and constrained optimization problems and create excel worksheets.
3	Solve LPP by two-phase simplex method numerically and verify the results by using simulation software.
4	Solve quadratic programming problem numerically and verify results by using simulation software.
5	Verify the descent conditions for a given search direction for unconstrained optimization problem and calculate step size along search direction using Equal Interval Search method numerically and verify results by using simulation software.
6	Verify the descent conditions for a given search direction for unconstrained optimization problem and calculate step size along search direction using Golden Section Search method numerically and verify results by using simulation software.
7	Solve nonlinear optimization problems by using numerical optimization methods (indirect) steepest-descent and conjugate-gradient methods verify the results by using simulation software.
8	Solve nonlinear optimization problems by using numerical optimization methods (indirect) Newtons methods verify the results by using simulation software.
9	Solve nonlinear optimization problems by using numerical optimization methods (indirect) DFP and BFGS methods verify the results by using simulation software.

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of M.Tech. (Structural Engineering) Semester-II

Course Code: MTS 152 **Course:** Lab –V: Advanced Concrete Technology **Teaching Scheme:** Practical: 2 Hrs/week	**Total Credits:** 0-1-0 **Term Work:** 25 Marks

	Contents
Prerequisites	Building Constructions & Material, Concrete Technology.
Objectives	Students will be able to - 1) Know various types and properties of ingredients of Concrete. 2) Formulate concrete design mix for various grades of concrete.
1	Concrete mix proportioning by ACI, DOE and IS methods and its strength comparative study.
2	Report on any two Mix Designs of Special Concretes (Fiber Reinforced Concrete/ High Strength concrete / High-Performance Concrete / Self Compacting Concrete)
3	Site Visit to any existing RCC structure to assess quality of materials using NDT methods and report Submission.
4	Visit to RMC Plant and study of Special Concretes.

Text Books and References

Sr. No.	Author	Title	Publication	Edition
1	Neville A. M.	Properties of Concrete	Pearson	4 th Edition
2	Shetty M.S. Concrete	Theory and Practice	S.Chand and Company Ltd.,New Delhi.	4th Edition
3	Gambhir M.L.	Concrete Technology: Theory and Practice	McGraw Hill, New Delhi.	4th Edition
4.	IS: 383-1970	Specification for Coarse and Fine Aggregates from Natural Sources for Concrete	Bureau of Indian Standards, New Delhi	Second Revision
5.	IS: 456-2000	Plain and Reinforced Concrete- Code of Practice	Bureau of Indian Standards, New Delhi	Second Revision
6.	IS : 516 – 1959	Indian Standard Methods of Tests for Strength of Concrete	Bureau of Indian Standards, New Delhi	Second Revision

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

	7.	IS:10262-2009	Indian Standard Concrete Mix Proportioning-Guidelines	Bureau of Indian Standards, New Delhi, India.	Third Revision
	8.	IS:10262-2019	Indian Standard Concrete Mix Proportioning-Guidelines	Bureau of Indian Standards, New Delhi, India	Second Revision
	9.	ACI 211.1-91	Standard Practice for Selecting Proportions for Normal	Heavyweight, and Mass Concrete. Reported by ACI Committee 211	Reapproved 2002
	10.	BSI-5328	Methods for specifying concrete mixes	British Standard, London, United Kingdom	Part 2 - 1997

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)

Syllabus of M.Tech. (Structural Engineering) Semester-II

Course Code: MTS 153 **Course: Lab-VI: Computer lab -II** **Teaching Scheme:** Practical: 2 Hr/week	**Credits: 0-1-0** **Term Work: 25 Marks**

Prerequisite	Engineering Mathematics, Computational Languages, Theory of Structures, Design of Steel Structure, Design of RCC Structure
Objectives	Students will be able to understand of Load, Load Combinations, analysis and design using various software.

Unit	**Contents**
1	Analysis of following structural members using general purpose FEA software. 1) Linear Static Analysis of a Cantilever Beam. 2) Frequency or Modal analysis of a Cantilever Beam. 3) Analysis of a Plate for plane stress condition.

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech. (Structural Engineering) Semester-I	
Course Code: MTS 154 **Course: Minor Project (Problem Based Learning)** **Teaching Scheme:** Practical: 04 Hr/week	**Credits:** 0-2-0 **Oral:** 50 Marks
Student shall undergo field training / industrial training / internship during winter vacation after Semester I for Four weeks. Training session shall be guided and certified by structural design consultant. Evaluation shall be based on report and power point presentation. A neat, detailed report on activities carried out during training is expected towards the evaluation of Minor project.	

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech.(Structural Engineering) Semester-III	
Course Code: MTS 201 **Course: MOOC** **Course Scheme: Online Course** **(Minimum 12 Weeks)** **Teaching Scheme:** 3 Hr/Week	**Credits:** 3-0-0 **End Semester Exam:** 100 Marks

It is mandatory for the student to complete one MOOC course related to the program of study. The student will have to complete the MOOC course which will be available on the SWAYAM portal (Free online education portal). Registered MOOC courses should not have similar or overlapping content to that of the regular courses in the curriculum of the program. The credits can be given to the students after successful completion of the MOOC course of 12 weeks or more.

The credits will be transferred by the evaluation in terms of assignments or examinations or viva-voce. In case the student is unable to clear MOOC Course examination, the student will have to appear for an Institute-level examination for the respective MOOC course.

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech.(Structural Engineering) Semester-III	
Course Code: MTS 211 **Course: Dissertation – I** **Teaching Scheme:** Practical: 18 Hr/week	**Credits:** 0-9-0 **Term-work:** 50 Marks **Oral:** 100 Marks

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

Term-work: The dissertation part – I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the authority, one of whom will be the guide and other will be a senior faculty member from the department.

Oral: The dissertation part-I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the authority, one of whom will be the guide and other will be a senior faculty member from the department.

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M.Tech.(Structural Engineering) Semester-IV	
Course Code: MTS 251 **Course: Dissertation-II** **Teaching Scheme:** Practical: 24 Hr/week	**Credits:** 0-12-0 **Term-work:** 100 Marks **Viva voce:** 100 Marks

The dissertation part-II will be in continuation of dissertation part-I and shall consists of a report on the research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and /or development work that the candidate has executed. The examinee shall submit the dissertation in triplicate to the head of the institution duly certified by the guide and the concerned head of the department and the Director that the work has been satisfactorily completed.

Term-work:
The dissertation will be assessed by two examiners appointed by the authority, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-Voce:
It shall consist of a defense presented by the examinee on his/her research work in the presence of the examiners appointed by the authority, one of whom will be the guide and other will be an external examiner of another university / industry expert.

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy

Chairman Board of Studies
Civil Engineering
MIT Aurangabad
(An Autonomous Institute)

Master Copy