



Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

NAAC A+ Accredited

Approved by AICTE, New Delhi, Govt. of Maharashtra
(An Autonomous Institute Affiliated to RTM Nagpur University,



Department of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

M.Tech (Structural Engineering)

Structure & Curriculum

From

Academic Year 2024-25

As per NEP

Vision of Institute

“To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management”

Mission of Institute

[M1] To strive for rearing standard and stature of the students by practicing high standards of Professional ethics, transparency and accountability.

[M2] To provide facilities and services to meet the challenges of Industry and Society.

[M3] To facilitate socially responsive research, innovation and entrepreneurship.

[M4] To ascertain holistic development of student and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To forge learning Center of Excellence in the field of Civil Engineering

Mission of the Department

[MD1] To promote academic and ethical development while upholding high standards.

[MD2] To provide advance facilities with the skills needed to face Industry and societal challenges.

[MD3] To promote socially responsible research, innovation, and entrepreneurship in the field of Civil Engineering.

[MD4] To foster the holistic development of both students and faculty members by inculcating a blend of knowledge and professional work methods for overall progress.

Program Education Objectives (PEO)

PEO No	Program Educational Objectives Statements
	The graduates will be able to
PEO 1	Analyze and design civil engineering structures while keeping social awareness and ethical responsibilities in mind.
PEO 2	Demonstrate leadership abilities in supporting sustainable practices in Civil Engineering
PEO 3	Exhibit a commitment to lifelong learning, staying updated on developing technologies and industry trends, and adjusting to the evolving world of Civil Engineering.
PEO 4	Execute proficiency in creative problem-solving and innovation, demonstrating an entrepreneurial attitude within the context of Civil Engineering.

Program Outcomes (PO)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

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Scheme of Instructions

Scheme of Instructions for First Year M. Tech. Programme in Structural Engineering

Semester – I (w.e.f.: AY 2024-25)

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PCC	MSE21101	Theory of Elasticity and Plasticity	4	-	-	4	4	20	20	-	60	100
2.	PCC	MSE21102	Structural Dynamics	4	-	-	4	4	20	20	-	60	100
3.	PEC	MSE21103-06	Professional Elective - I	4	-	-	4	4	20	20	-	60	100
4.	PEC	MSE21107-10	Professional Elective - II	4	-	-	4	4	20	20	-	60	100
5.	PCC	MSE21111	Advanced Matrix Analysis	4	-	-	4	4	20	20	-	60	100
6.	PCC	MSE21112	Structural Dynamics Laboratory	-	-	2	2	1	-	-	25	25	50
			Total	20	-	2	22	21	100	100	25	325	550

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment

ESE- End **Semester** Examination (For Laboratory: End Semester Performance)

*- Professional Elective.

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Scheme of Instructions

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Semester – II (w.e.f.: AY 2024-25)

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PCC	MSE21201	Finite Element Analysis	4	-	-	4	4	20	20	-	60	100
2.	PCC	MSE21202	Theory of Plates & Shell	4	-	-	4	4	20	20	-	60	100
3.	PEC	MSE21203-06	Professional Elective - III	4	-	-	4	4	20	20	-	60	100
4.	PEC	MSE21207-10	Professional Elective – IV	4	-	-	4	4	20	20	-	60	100
5.	PCC	MSE21211	Advanced R.C.C. Laboratory	-	-	2	2	1	-	-	25	25	50
6.	FC	MSE21212	Research Methodology#	3	-	-	3	3	-	-	25	25	50
			Total	19	-	2	21	20	80	80	50	290	500

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

*- Professional Elective.

Students are expected to complete it online by appearing NPTEL/Swayam Certification for 03 credits. Weekly 02 Hrs Theory in which students are expected to work on mathematical modeling, Seminar on IPR, Patent filing, Removing Plagiarisms, etc. will be done.

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Scheme of Instructions for Second Year M. Tech. Programme in Structural Engineering

Semester – III (w.e.f.: AY 2024-25)

Sr. No.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1	PROJ	MSE22301	Dissertation Phase-I	-	-	20	20	10	-	-	100	100	200
2	PEC	MSE22302	MOOC course (8-12)\$	-	-	-	-	3	-	-	-	-	-
3	PEC	MSE22303	Structural Health Monitoring and Rehabilitations of Structures	3	-	-	3	3	20	20	-	60	100
			Total	3	-	20	23	16	20	20	100	160	300

Note:

1. MSE2302 will be decided by respective Guide in Consultation with Program Coordinator. Course is mandatory for student and his dissertation phase I will be considered incomplete without this Mandatory MOOC Course.
2. In Case, the course offered online are not completely relevant with the topic of dissertation then any course suggested by NASSCOM on recent technologies can be opted by candidate.
3. \$ Programme coordinator will provide list of 03 MOOC courses of minimum 08 weeks duration (as per availability). Students are expected to complete any one out of three courses in order to get the required credits.

L- Lecture

T-Tutorial

P-Practical

CT1- Class Test 1

TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2

ESE- End Semester Examination (For Laboratory End Semester performance)

PROGRESSIVE TOTAL CREDITS= 41+16 = 57

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Scheme of Instructions

Scheme of Instructions for Second Year M. Tech. Programme in Structural Engineering

Semester – IV (w.e.f.: AY 2024-25)

Sr. No.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PROJ	MSE22401	Dissertation Phase- II	-	-	32	32	16	-	-	100	200	300
			Total	-	-	32	32	16	-	-	100	200	300

TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

PROGRESSIVE TOTAL CREDITS= 57+16 = 73

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Scheme of Instructions



Scheme of Instructions for First Year/Second Year M. Tech. Programme in Structural Engineering

List of Professional Elective Courses

Semester - I		Semester-II	
Professional Elective - I	Professional Elective - II	Professional Elective- III	Professional Elective - IV
Theory of Structural Stability	Advanced Design of Steel Structures	Advances in Concrete Technology	Design of Advanced Concrete Structures
Theory of Thin Plates and Shells	Design of Composite Construction	Design of Formwork	Advanced Design of Foundations
Structural Optimization	Disaster Management and Mitigation	Design of High-Rise Structures	Soil Structure Interaction
Structural Design of Environmental and Hydraulic Structures	Design of Earthquake Resistant Structures	Earth Retaining Structures	Design of Industrial Structure


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	Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441 108 NAAC Accredited with A+ Grade (An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)			
Program: M. Tech. Structural Engineering				
Semester-I	MSE21101: Theory of Elasticity and Plasticity			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	---		CT-II	20 Marks
Total Credits	4		CA	-----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Structural Analysis, Steel Structures, Steel Design			Total Marks	100 Marks
Course Contents				
Unit I	Analysis of Stress and strain in 2 dimensions: Introduction, Types of forces, Components of Stresses and strains, Stress-strain relation, Plane stress and plane strain at a point, Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress function			
Unit II	Analysis of stress and strain in 3 dimensions: Components of stress, principal stresses, stress invariants, Maximum shearing stress, Differential equation of equilibrium, Boundary conditions and compatibility equations.			
Unit III	Bending of cantilever of narrow rectangular section loaded at end, bending of simply supported beam with uniform load, torsion of non-circular sections, Elliptical cross-section.			
Unit IV	Differential equation for beam, columns with concentrated loads, continuous lateral loads and couples for simply supported ends, Application of trigonometric series, Lateral bucking of beams. Buckling of simply supported rectangular plates uniformly compresses in middle plane.			
Unit V	Energy method for elastic buckling of columns, Approximate method, buckling of columns on elastic foundation, Columns with intermediate compressive forces and distributed axial load Elastic stability of columns --- eigenvalue problem; buckling modes and critical load; beam columns; beam-columns with elastic restraints; effect of initial curvature; buckling of bar on elastic foundation; buckling of frames; inelastic stability; lateral buckling of beams in pure bending; torsional buckling; combined flexural-torsional buckling.			
Text Books				
T.1	Theory of Elasticity, 3rd Edition, Authored by Timoshenko, S.P. and Goodier, J.N Mc-Graw Hill Publication, New Delhi, 1999			
T.2	Theory of Elastic Stability, 2nd Edition, Authored by S.P. and Gere J. M., Mc-Graw Hill Company, New Delhi, 200			
T.3	Computational Elasticity-Theory of Elasticity, Authored by Ameen,M. First Addition Hill Publication, New Delhi, 1999			
Reference Books				

R.1	A General theory of elastic stability Authored by Michael Thompson Hill Publication 2007
R.2	Theory of Stability of Continuous Elastic Structures Authored by Antonio Grimaldi and Mario Como Hill Publication – 2001
R.3	Theory of Elastic Stability (Civil Engineering) 2ndKindle Edition Authored by Stephen P. Timoshenko, James M. Gere Hill Publication 2002
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105177/
2	https://nptel.ac.in/courses/105/105/105105173/
3	https://nptel.ac.in/courses/105/105/105105173/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21101.1	Apply the concept of plane stress and plane strain at a point	PO1, PO2	3	9
MSE21101.2	Analysis of stress and strain in 2 and 3 dimensions	PO1, PO2, PO3	4	9
MSE21101.3	Solve differential equation for analysis of beam and column	PO1, PO2	3	9
MSE21101.4	Compare bending concept for narrow rectangular section	PO1, PO2, PO3	4	9
MSE21101.5	Integrate compressive forces and distributed axial load	PO1, PO2, PO3,	6	9


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Program: M. Tech. Structural Engineering				
Semester-I	MSE21102 Structural Dynamics			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	-----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: RCC Structures, Advanced Steel Design.			Total Marks	100 Marks
Course Contents				
Unit I	Analysis of undamped and viscously damped, single degree freedom systems. Fundamentals of Rigid/Deformable body dynamics			
Unit II	Introduction to vibrations due to earthquake, Study of IS 1893-1984 and 2000 applicable to buildings and water tanks.			
Unit III	Response of single degree freedom systems to harmonic loading support motion and transmissibility Duhamel's integral.			
Unit IV	Free vibrations of lumped mass multi degree freedom systems, shear buildings orthogonality criteria Rayleigh's method.			
Unit V	Dynamic analysis of systems with distributed properties, Approximate design method Transformation factors. Liquification, Response of continuous systems to dynamic loads. Energy Principle.			
Text Books				
T.1	Structural Dynamics: Theory and Computation 6 th edition Authored by Mario Paz springer - 2008.			
T.2	Fundamentals of structural dynamics Authored by Roy R Craig Wiley publication -2006			
T.3	Structural Dynamics Authored by Yong Bai and Zhao-Dong Xu Wiley publication -2019			
Reference Books				
R.1	Structural dynamics Authored by Joseph W. Tedesco Cambridge University Press-2018			
R.2	Dynamics of Structures Authored by Anil Kumar CRC Press -2009			
R.3	Dynamics of Structures, Authored by S. Chopra – Person Publication -2020			
Useful Links				

1	https://nptel.ac.in/courses/105/105/105105162/
2	https://nptel.ac.in/courses/105/105/1051051778/
3	https://nptel.ac.in/courses/105/105/1051051778/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21102.1	Apply the concept of Multiple degree of freedom to damped and undamped oscillating conditions.	PO1, PO2	3	9
MSE21102.2	Analyse the Vibration analysis technics to R.C.C Structures with IS code study.	PO1, PO2, PO3	4	9
MSE21102.3	Formulate the structural dynamics theory to analyse the response of single degree freedom systems and design of structure.	PO1, PO2, PO3	5	9
MSE21102.4	Develop the equation of motion for vibratory systems and solving for the free and forced response.	PO1, PO2, PO3	6	9
MSE21102.5	Solve problem on Dynamic analysis with distributed properties & loading by Energy Principle, Rayleigh-Ritz method.	PO1, PO2, PO3,	5	9


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Program: M. Tech. Structural Engineering				
Semester-I	MSE21103: (PE-I) Theory of Structural Stability			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	---
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Solid Mechanics. Reinforced Cement Concrete Structures			Total Marks	100 Marks
Course Contents				
Unit I	Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behavior			
Unit II	Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling			
Unit III	Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members			
Unit IV	Stability of Beams: lateral torsion buckling.			
Unit V	Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.			
Text Books				
T.1	Theory of Plates and Shells Authored by Timoshenko, McGraw Publication New York. -2004			
T.2	Theory and Analysis of Plates Authored by P. Szilard, Prentice Hall publication -2001			
T.3	Theory of Plates Authored by K. Chandrasekhara, University Press Publication 2003			
Reference Books				
R.1	Manual of Principles of Structural Stability Theory, Authored by Alexander Chafes, Prentice Hall, New Jersey-2000			
R.2	Numerical Methods for Engineering Problems, Authored by N. Krishna Raju & K. U Muthu, Mac-Millan publishers -2009			
R.3	Theory of Elasticity Stability Authored by Timoshenko and Gere. Dover Publications-2008			
Useful Links				

1	https://nptel.ac.in/courses/127/105/127105018/
2	https://nptel.ac.in/courses/105/108/105108124/
3	https://nptel.ac.in/courses/105/108/105108122/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21103.1	Apply the concept of stability of discrete and continuous system	PO1, PO2	3	9
MSE21103.2	Design the stability of columns by considering the buckling and torsion effect	PO1, PO2, PO3	6	9
MSE21103.3	Examine the stability of various frame	PO1, PO2, PO3	4	9
MSE21103.4	Judge the stability of beam and plate	PO1, PO2, PO3	5	9
MSE21103.5	Evaluate the buckling and dynamic stability for inelastic materials	PO1, PO2, PO3,	5	9


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Program: M. Tech. Structural Engineering				
Semester-I	MSE21104: (PE-I) Theory of Thin Plate and Shell			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	-----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Advanced Steel Design, Structural Analysis-I			Total Marks	100 Marks
Course Contents				
Unit I	Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions			
Unit II	Small Deflection Theory of Thin Rectangular Plates: Assumptions, Derivation of governing differential equation for thin plates, Boundary conditions, simply supported plate and sinusoidal load, Navier's solution, Application to different cases, Levy's solution for various boundary conditions subjected to different loadings			
Unit III	Circular Plates: Symmetrical loading, Relations between slope, deflection, moments and curvature – Governing differential equation, uniformly loaded plates with clamped and simply supported edges, Central hole, bending by moments and shearing forces uniformly distributed			
Unit IV	Plates on Elastic Foundations: Governing differential equation, deflection of uniformly loaded simply supported rectangular plate, Navier and Levy type solutions, large plate loaded at equidistant points by concentrated forces P.			
Unit V	Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type. Axi-Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application spherical shell and hyperboloid of revolution cooling towers			
Text Books				
T.1	Theory of Plates and Shells Authored by Timoshenko, McGraw Publication NewYork. -2004			
T.2	Theory and Analysis of Plates Authored by P. Szilard, Prentice Hall publication -2001			
T.3	Theory of Plates Authored by K. Chandrasekhara, University Press Publication 2003			
Reference Books				
R.1	Manual of Principles of Structural Stability Theory, Authored by Alexander Chafes, Prentice Hall, New Jersey-2000			

R.2	Numerical Methods for Engineering Problems, Authored by N. Krishna Raju & K. U Muthu, Mac-Millan publishers -2009
R.3	Theory of Elasticity Stability Authored by Timoshenko and Gere. Dover Publications-2008
Useful Links	
1	https://nptel.ac.in/courses/105/108/105108122/
2	https://nptel.ac.in/courses/127/105/127105018/
3	https://nptel.ac.in/courses/105/108/105108122/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21104.1	Apply the concept of cylindrical bending and slope in slightly bent plate	PO1, PO2	3	9
MSE21104.2	Judge the boundary condition subjected to structural loadings	PO1, PO2, PO3	5	9
MSE21104.3	Evaluate the moments and shearing forces for circular section	PO1, PO2	5	9
MSE21104.4	Analyze the problems pertaining to beams on elastic foundation	PO1, PO2, PO3	4	9
MSE21104.5	Design the Governing equation for buckling plate	PO1, PO2, PO3,	6	9


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Program: M. Tech. Structural Engineering				
Semester-I	MSE21105: (PE-I) Structural Optimization			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Analysis -I, RCC Structures, Concrete Technology			Total Marks	100 Marks
Course Contents				
Unit I	Introduction: Simultaneous Failure Mode and Design, Classical External Problems			
Unit II	Calculus of Variation: Variational Principles with Constraints,			
Unit III	Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,			
Unit IV	Geometric Programming and Stochastic Programming.			
Unit V	Applications: Structural Steel and Concrete Members, Trusses and Frames. Design: Frequency Constraint, Design of Layouts.			
Text Books				
T.1	Evolutionary Structural Optimization Authored by Grant P. Steven and Y. M. Xia Wiley Publication 2000			
T.2	Theory of Plates, 1st Edition, Authored by Chandrasekhara K, Universities Press (India) Ltd, Hyderabad,2001			
T.3	Theory of Plates and Shells, 2nd Edition, Authored by S.W Timoshenko S.P and Krieger, McGraw-Hill Book Company, New Delhi, 1970.			
Reference Books				
R.1	An Introduction to Structural Optimization Authored by Anders Klarbring and Peter W. Hill Publication 2010			
R.2	Structural Optimization Authored by Keith M. MacBain and William CRC Press – 2003			
R.3	Elements of Structural Optimization Authored by Manohar P. Kamat and Raphael T. Haftka CRC Press Publication -2000			
Useful Links				
1	https://nptel.ac.in/courses/105/108/105108127/			
2	https://nptel.ac.in/courses/127/105/127105018/			
3	https://nptel.ac.in/courses/105/108/105108122/			


	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21105.1	Execute Variational principle for optimization	PO1, PO2	3	9
MSE21105.2	Apply optimization techniques to structural steel and concrete members.	PO1, PO2, PO3	3	9
MSE21105.3	Analyze liner programming concept with respect structural optimization	PO1, PO2, PO3	4	9
MSE21105.4	Compare the Geometric programming and stochastic programming	PO1, PO2, PO3	4	9
MSE21105.5	Design of concrete members by using frequency constraint.	PO1, PO2, PO3,	6	9


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Program: M. Tech. Structural Engineering				
Semester-I	MSE21106 (PE-I) Structural Design of Environmental and Hydraulic Structures			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Structural Dynamics, RCC Structures, Concrete Technology			Total Marks	100 Marks
Course Contents				
Unit I	Analysis and Design of Over Head Water Tanks.			
Unit II	Design of Under Ground Tanks.			
Unit III	Design of jack well/Pump house / approach bridges. / Box culvert, Application of box culvert			
Unit IV	Design of pretreatment units - aerators, flash mixer, sand filters.			
Unit V	Design considerations including loads such as traffic load, backfill load, live load etc. for Appurtenances like man-holes, concrete bedding and thrust blocks for sewers, rising mains etc.			
Text Books				
T.1	A Circular Storage Tanks and Silos, Authored by GhaliE & F N Spon, publication -2000)			
T.2	Introduction and Design of Environmental structures authored by David A Cornwell and Mackenzie L Davis CRC Press-2007			
T.3	R.D.,Designof liquidretaining concretestructure, authored by S Anchor,Published by CRC (2000)			
Reference Books				
R.1	Jain, S.K. & Jaiswal, O.R., GuidelinesManual for seismic design of liquid storage tanks, NICEE, IITK, 2004			
R.2	Guidelines Manuals for seismic design of liquid storage tanks, PublishedNICEE, 2010			
R.3	Introduction and Design of Environmental structures Authored by David A Cornwell and Mackenzie L Davis AP Publication -2009			
Useful Links				
1	https://nptel.ac.in/courses/105/105/105105162/			
2	https://nptel.ac.in/courses/127/105/127105018/			
3	https://nptel.ac.in/noc/courses/105/#ongoing			

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21106.1	Apply the design concept of tanks	PO1, PO2	3	9
MSE21106.2	Evaluate the methods for design of underground tank	PO1, PO2, PO3	5	9
MSE21106.3	Examine the effects of jack well pump	PO1, PO2, PO3	4	9
MSE21106.4	Defend the units of aerators	PO1, PO2, PO3	5	9
MSE21106.5	Modify the design consideration including traffic loads and backfill loads	PO1, PO2, PO3,	6	9


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Nagpur (M.S.)



	Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441 108 NAAC Accredited with A+ Grade (An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)			
Program: M. Tech. Structural Engineering				
Semester-I	MSE21107: (PE-II) Advanced Design of Steel Structures			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	-----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Structural Analysis, Steel Design			Total Marks	100 Marks
Course Contents				
Unit I	Eccentric and Moment connections: Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections – Welded Bracket Connections – Moment Resistant Connections.			
Unit II	Tabular Structures: Properties of steel tubes, design of tension member and compression members, design of welded connections, design of flexural members, analysis and design of tabular trusses including purlins and supports.			
Unit III	Bridges: Introduction, steel used in bridges, classification of steel bridges load & load combination, Analysis and design of girder bridge, plate girder bridges, truss bridges, gusseted connection			
Unit IV	Forces acting on chimney, design of self-supporting welded and bolted chimney and components including design of foundation.			
Unit V	Design of industrial shed considering gravity and wind load/ gantry Girders.			
Text Books				
T.1	RamChandra Design of Steel structures Vol-I & Vol-II Std. book house / Rajsons Publication Pvt. Ltd., Delhi, 2006			
T.2	Gaylords, E.H. & Gaylords, C. N., Design of Steel Structures, Blackwell, 1994.			
T.3	Dayaratnam P., Design of Steel Structures, Wheeler Publications, Allahabad, 1992			
Reference Books				
R.1	Ghosh, — Analysis and Design practice of Steel Structurel, (Forthcoming), Phi Publisher, New Delhi			
R.2	Design of Steel Structures, Wheeler Publications, Allahabad, 1994			
R.3	Design of Eccentric Connection Raj Publication Pvt. Ltd., Delhi, 2009			
Useful Links				

1	https://nptel.ac.in/courses/105/105/105105162/
2	http://www.digimat.in/nptel/courses/video/105105162/L45.html
3	https://nptel.ac.in/noc/courses/105/#ongoing

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21107.1	Modify the design concept of eccentric connection	PO1, PO2	6	9
MSE21107.2	Create tabular structures with supports and connections	PO1, PO2, PO3	6	9
MSE21107.3	Design the various components of bridges	PO1, PO2, PO3	6	9
MSE21107.4	Classify the design consideration including loads and storage vessels	PO1, PO2, PO3	6	9
MSE21107.5	Compose the various concept related to industrial sheds	PO1, PO2, PO3,	6	9


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Program: M. Tech. Structural Engineering				
Semester-I	MSE21108 (PE-II) Design of Composite Construction			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	-----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Steel Structures, Reinforced Cement Concrete Structures. Advanced Concrete Structures.			Total Marks	100 Marks
Course Contents				
Unit I	Introduction Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Introduction to steel, concrete composite construction, Codes, Composite action, Serviceability and Construction issues in design.			
Unit II	Design of composite Members Analysis and Design of Cement Composite Structural Elements - Ferrocement, SIFCON And Fibre Reinforced Concrete. Design of composite beams, slabs, columns, beam and columns, Design of composite trusses.			
Unit III	Design of connection Shear connectors – Types – Design of connections in composite structures – Design of shear connectors – Partial shear interaction.			
Unit IV	Composite Box Girder Bridge Introduction - behavior of box girder bridges - design concepts			
Unit V	Case Studies Case studies on steel - concrete composite construction in buildings - seismic behavior of composite structures			
Text Books				
T.1	Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings Authored by Roger P. Johnson, Yong C. Wang Fourth Edition Wiley Publication 2018			
T.2	Composites for Construction: Structural Design with FRP Materials Authored by C Bank Wily Publication -2001			
T.3	Composite Structures: Design, Mechanics, Analysis, Manufacturing, and Testing Authored by Manoj Kumar Buragohain CRC Publication -2000			
Reference Books				
R.1	“Shear Connection and Concrete Beams, Slabs, Columns and Frames for Buildings”, Vol.I, Authored by Johnson R.P. Blackwell Scientific Publications, 2002			
R.2	Composite Steel and Concrete Structural Members, Fundamental behavior”, Manual Authored by Bradford M.A. “Pergamon press, Oxford, 1999			

R.3	Introduction to the Design and Analysis of Composite Structures: An Engineers Practical Guide published in 2014
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105162/
2	https://nptel.ac.in/courses/105/105/105105164/
3	https://nptel.ac.in/courses/105/105/1051051228/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21108.1	Apply the concept of serviceability and construction issue in design	PO1, PO2	3	9
MSE21108.2	Design the composite members for structures	PO1, PO2, PO3	6	9
MSE21108.3	Compare the shear connection required in structures	PO1, PO2, PO3	4	9
MSE21108.4	Analyses the composite box girder bridge	PO1, PO2, PO3	4	9
MSE21108.5	Evaluate the seismic behavior of composite structures	PO1, PO2, PO3,	5	9


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Program: M. Tech. Structural Engineering					
Semester-I	MSE21109: (PE-II) Disaster Management and Mitigation				
Teaching Scheme			Examination Scheme		
Theory	4 Hrs/week		CT-I	20 Marks	
Tutorial	-		CT-II	20 Marks	
Total Credits	4		CA	-----	
Duration of ESE: 3Hrs			ESE	60 Marks	
Pre-Requisites: Concrete Technology, Building Construction.			Total Marks	100 Marks	
Course Contents					
Unit I	Types of disaster: Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters				
Unit II	Important disasters: Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management, drought types and its management, Social Economics and Environmental impact of disasters.				
Unit III	Mitigation techniques of Disaster: Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warning Systems, Building design				
Unit IV	Training program on disaster management: Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, Mini project on disaster risk assessment and preparedness for disasters				
Unit V	Institutional arrangements: The Disaster Management Act and National Policy on Disaster Management. Disaster risk reduction, Climate change and disasters.				
Text Books					
T.1	Disaster Management Guidelines, GOI-UND Disaster Risk Program (2013-2019)				
T.2	Damon, P. Copola, (2018) Introduction to International Disaster Management, Butterworth Heineman.				
T.3	Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi				
Reference Books					
R.1	Murthy D.B.N. (2016) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.				

R.2	Modh S. (2018) Managing Natural Disasters, Mac Millan publishers India LTD
R.3	Chatterjee S. (2015) Disaster management and Risk Reduction, Environmental Knowledge, Narosa Publishing House, Delhi
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105163/
2	https://nptel.ac.in/courses/105/105/105105163/
3	https://nptel.ac.in/courses/105/105/105105178/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21109.1	Evaluate the factor affecting natural and manmade disaster.	PO1, PO2	5	9
MSE21109.2	Compare the economical and environmental impact of disaster.	PO1, PO2, PO3	4	9
MSE21109.3	Analyze the disaster management cycle.	PO1, PO2, PO3	4	9
MSE21109.4	Demonstrate the preparedness for disaster.	PO1, PO2, PO3	3	9
MSE21109.5	Modify the institutional management technique.	PO1, PO2, PO3,	6	9


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Program: M. Tech. Structural Engineering				
Semester-I	MSE21110: (PE-II) Design of Earthquake Resistant Structures			
Teaching Scheme			Examination Scheme	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
Total Credits	4		CA	----
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: RCC Structures, Steel Structures.			Total Marks	100 Marks
Course Contents				
Unit I	Engineering geology of earthquakes: Faults, Propagation of earthquake waves, quantification of earthquake, magnitude, energy intensity of earthquake, accelerograph, scalogram, recording and analysis of earthquake records, seismicity of the world, Analysis and interpretation of earthquake data, determination of magnitude, epicenter, epicenter distances focal depth, focal mechanism, seismic zoning			
Unit II	Causes or sources of earthquake damage: Damage due to ground failure, History of apast earthquakes, generation of response spectrum from available earthquake records, Evolution of seismic risk, Concept of response spectra, generation of site-specific spectrum, characteristics of earthquake ground motion.			
Unit III	Strength, ductility and energy absorption: Ductility of reinforced members subjected to flexure. Axial loads & shear detailing of RCC members beam column, Beam-column joints for ductile behaviours, IS code previsions			
Unit IV	Guideline for achieving efficient seismic resistant design: Special aspects in multi-story buildings, effect of torsion, flexible first story, P-delta effect, soil-structure, interaction on building response. Drift limitation.			
Unit V	Seismic design principles of retaining walls – Concept of Seismic design of bridges – Seismic design of bearings Seismic Control of Structures: Base isolation- Tuned mass dampers Study of IS: 1893, IS:13920 for analysis and ductile design of RCC structures and other related code			
Text Books				
T.1	Earth quake Engineering –Authored by S K Duggal Oxford University Press Publication 2007			
T.2	Seismic Architecture: The architecture of earthquake resistant structures- Authored by Prof Lunge. Pearson Education Press Publication-2009			
T.3	Earthquake Resistance design of Structures authored by Pankaj Agrawal Raj Publication -2006			
Reference Books				
R.1	Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2 nd Edition., Pearson Education Publication Pvt. Ltd, New Delhi, 1995			
R.2	Basic Elements of Earthquake Engineering -Authored by Asadour H. HadjianWiley Publication -2019			

R.3	Advanced Soil Dynamics and Earthquake Engineering Authored by Bharat Bhushan Prasad PHI Publication – 2009
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105162/
2	https://nptel.ac.in/courses/105/105/1051051778/
3	https://nptel.ac.in/courses/105/105/1051051775/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE21110.1	Apply the concept of Propagation of earthquake waves	PO1, PO2	3	9
MSE21110.2	Examine the causes and sources of earth quake	PO1, PO2, PO3	4	9
MSE21110.3	Evaluate the moments and shear detailing of RCC member	PO1, PO2, PO3	5	9
MSE21110.4	Design the special aspect in multistoried building	PO1, PO2, PO3	6	9
MSE21110.5	Design the structure by using IS 1893	PO1, PO2, PO3,	6	9


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Program: M. Tech. Structural Engineering					
Semester-I		MSE21111: Advanced Matrix Analysis			
Teaching Scheme				Examination Scheme	
Theory	4 Hrs/week			CT-I	20 Marks
Tutorial	-			CT-II	20 Marks
Total Credits	4			CA	-----
Duration of ESE: 3Hrs				ESE	60 Marks
Pre-Requisites: Structural Analysis, RCC Structures, Advance Concrete Structures				Total Marks	100 Marks
Course Contents					
Unit I	Stiffness method for plane truss, beams and plane frames				
Unit II	Stiffness method for plane grid and space frames				
Unit III	Effect of shear deformation. Internal member end releases				
Unit IV	Analysis for member loading (self, temperature & imposed), inclined supports, lack of fit, initial joints displacements, Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems				
Unit V	Solution technique with banded & skyline technique, band minimization, frontal techniques				
Text Books					
T.1	J. M. Matrix Method of Structural Analysis 3rd Edition Authored by Gere, W. and Weaver New York Wiley Publication 2000				
T.2	Matrix Method of Structural Analysis, 1st edition, Authored by Meghre A.S. & Deshmukh S.K. Charotar publishing house, Anand, 2003				
T.3	Matrix Method of Structural Analysis, 2nd Edition; Authored by Kanchi, M. B., John Willey & Sons, Publication 2006				
Reference Books					
R.1	Matrix Analysis of Structures 2nd Edition Authored by Aslam Kassimali AP Publication 2006				
R.2	Matrix Method of Structural Analysis, 1stedition, Authored by A.S. & Deshmukh CharotarPublishing house, Anand, 2007				
R.3	Matrix Analysis of Structures Authored by Robert E. Sennett Wiley publication -2007				
Useful Links					
1	https://nptel.ac.in/courses/105/108/105108122/				
2	https://nptel.ac.in/courses/127/105/127105018/				
3	https://nptel.ac.in/courses/105/108/105108122/				

	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
MSE21111.1	Apply the concept of stiffness method for plane truss	PO1, PO2	3	9	2
MSE21111.2	Evaluate the method for analysis of space frame	PO1, PO2, PO3	5	9	2
MSE21111.3	Analyze the effect of shear deformation internal member and end release	PO1, PO2, PO3	4	9	4
MSE21111.4	Judge dynamics analysis of system with distributed properties	PO1, PO2, PO3	5	9	2
MSE21111.5	Design the solution techniques with banded sky line technique	PO1, PO2, PO3,	6	9	2



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Program: M. Tech Structural Engineering						
Semester	Course Code	Name of Course	L	T	P	Credits
I	MSE21112	Structural Dynamics Laboratory	-	-	2	1
Pre-Requisites: Structural Dynamics, RCC Structures, Advanced Steel Design						
List of Experiment						CO
1	Study the concept of undamped and viscous damped					CO1
2	Calculation of horizontal seismic force of building using IS 1893-1984					CO2
3	Dynamic of two-story building frame subjected to harmonic base motion					CO3
4	Dynamic response of four-story building frame using base harmonic motion					CO3
5	To determine the damp natural frequency					CO4
6	To calculate the lateral water force of a water tank due to earth quake shock					CO5
7	To observe liquefaction of soil					CO5
Text Books						
T.1	Earthquake Resistant Design for Engineers and Architects, 3 rd Edition 1989					
T.2	Earth quake resistance design of Structure – S K Duggal					
T.3	Seismic Architecture: The architecture of earthquake resistant structures- Book by Mentor Lunge.					
T.4	Experimental Structural Dynamics: An Introduction to Book by Robert Emerson Coleman					
Reference Books						
R.1	Computational Dynamics —Theory of Elasticity, First Addition 2007					
R.2	Penzien, —Dynamics of Structures, McGraw Hill, 1994					
R.3	Structural Dynamics of Earthquake Engineering: Theory and Application Book by Sagathevan Rajasekhara					
R.4	Experimental Structural Dynamics: An Introduction to Book by Robert Emerson Coleman					
Useful Links						
1	https://nptel.ac.in/courses/105/105/105105162/					
2	https://nptel.ac.in/courses/105/105/1051051778/					
3	https://nptel.ac.in/noc/courses/105/#ongoing					
	Course Outcomes		PO/PSO	CL	Lab Sessions	
MSE21112.1	Apply the concept of Propagation of earthquake waves		PO1, PO2	3	2	

MSE21112.2	Examine the causes and sources of earth quake	PO1, PO2, PO3	4	2
MSE21112.3	Evaluate the moments and shear detailing of RCC member	PO1, PO2, PO3	5	4
MSE21112.4	Design the special aspect in multistoried building	PO1, PO2, PO3	6	2
MSE21112.5	Design the structure by using IS 1893	PO1, PO2, PO3,	6	2


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