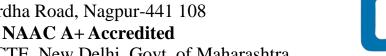




Wardha Road, Nagpur-441 108



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.	Course		G Tita		<b>T</b>		Contact	G 114		F	Exam Schem	ie	
No.	Category	Course Code	Course Title	L	T P Contact Hrs/week Cree	Credits	CT - 1	CT - 2	TA / CA	ESE	TOTAL		
1.	PCC	MSE21101	Theory of Elasticity and Plasticity	4	-	-	4	4	20	20	1	60	100
2.	PCC	MSE21102	Structural Dynamics	4	-	-	4	4	20	20	ı	60	100
3.	PEC	MSE21103-06	Professional Elective - I	4	-	-	4	4	20	20	1	60	100
4.	PEC	MSE21107-10	Professional Elective - II	4	-	-	4	4	20	20	1	60	100
5.	PCC	MSE21111	Advanced Matrix Analysis	4	-	-	4	4	20	20	1	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)

<sup>\*-</sup> Professional Elective.

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# **Scheme of Instructions**

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

**Semester – II (w.e.f.: AY 2024-25)** 

Sr.	Course	G G I	C 15.41		Œ	n	Contact	G 114		E	Exam Schem	ie	
No.		Course Code	Course Title	L	T P Hrs/week		Credits	CT - 1	CT - 2	TA / CA	ESE	TOTAL	
1.	PCC	MSE21201	Finite Element Analysis	4	ı	i	4	4	20	20	-	60	100
2.	PCC	MSE21202	Theory of Plates & Shell	4	ı	i	4	4	20	20	-	60	100
3.	PEC	MSE21203-06	Professional Elective - III	4	1	1	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	-	ı	3	3	-	-	25	25	50
			Total	19	ı	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)

# 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.

<sup>\*-</sup> Professional Elective.

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# **Scheme of Instructions**

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

**Semester – III (w.e.f.: AY 2024-25)** 

Sr.	Course	Course Code Course Title I T D Contact Credit		G 124	Exam Scheme								
No.	Category	CourseCode	Course Title	L	T	P	Hrs / week	( rodite —		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.	Course	CourseCode	Course Title	Ţ	т	D	Contact	Credits		Е	xam Schem	ie	
No.	Category	CourseCode	Course Title	L	1	P	Hrs / week	Credits	CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PROJ	MSE22401	Dissertation Phase- II	1	-	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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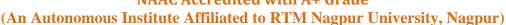
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Program: M. Tech. Structural Engineering

Semester-I	MSE21101: Theory of Elasticity and Plasticity
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<b>Teaching Scheme</b>			Examinati	on Scheme
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial			CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE	: 3Hrs		ESE	60 Marks
Pro-Poquisitos	• Structural A	nalysis Staal Structuras Staal Dasign	<b>Total Marks</b>	100 Morks

**Pre-Requisites:** Structural Analysis, Steel Structures, Steel Des

sign	

#### 100 Marks

#### **Course Contents**

	Analysis of Stress and strain in 2 dimensions: Introduction, Types of forces, Components of Stresses
TI:4 T	and strains, Stress-strain relation, Plane stress and plane strain at a point, Differential equation of
Unit I	equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress
	function

# 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 **Unit II** equations.

#### with uniform load, torsion of non-circular sections, Elliptical cross-section. Unit III

# 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.

Bending of cantilever of narrow rectangular section loaded at end, bending of simply supported beam

# Energy method for elastic buckling of columns, Approximate method, buckling of columns on elastic foundation, Columns with intermediate compressive forces and distributed axial load

# Unit V

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**

**Unit IV** 

T.1	Theory of Elasticity, 3rd Edition, Authored by Timosnenko, 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
1,2	Company, New Delhi,200
T.3	Computational Elasticity-Theory of Elasticity, Authored by Ameen,M. First Addition Hill
1.5	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.
14.5	Timoshenko, James M. Gere Hill Publication 2002
Useful L	inks
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	<b>Apply</b> the concept of plane stress and plane strain at a point	PO1, PO2	3	9
MSE21101.2	<b>Analysis</b> of stress and strain in 2 and 3 dimensions	PO1, PO2, PO3	4	9
MSE21101.3	<b>Solve</b> 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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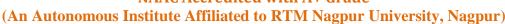
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**Program: M. Tech. Structural Engineering** 

Semester-1   MSE21102 Structural Dynamics	Semester-I	MSE21102 Structural Dynamics
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<b>Teaching Scheme</b>			Examinati	on Scheme
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: RCC Structur		res, Advanced Steel Design.	<b>Total Marks</b>	100 Marks

## **Course Contents**

Unit	Analysis of undamped and viscously damped, single degree freedom systems. Fundamentals of Rigid/Deformable body dynamics
Unit	Introduction to vibrations due to earthquake, Study of IS 1893-1984 and 2000 applicable to buildings and water tanks.
Unit 1	Response of single degree freedom systems to harmonic loading support motion and transmissibility Duhamel's integral.
Unit	Free vibrations of lumped mass multi degree freedom systems, shear buildings orthogonality criteria Rayleigh's method.
Unit	Dynamic analysis of systems with distributed properties, Approximate design method Transformation factors. Liquification, Response of continuous systems to dynamic loads. Energy Principle.
T-04 1	l

# **Text Books**

T.1	Structural Dynamics: Theory and Computation 6 <sup>th</sup> 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	<b>Apply</b> the concept of Multiple degree of freedom to damped and undamped oscillating conditions.	PO1, PO2	3	9
MSE21102.2	<b>Analyse</b> the Vibration analysis technics to R.C.C Structures with IS code study.	PO1, PO2, PO3	4	9
MSE21102.3	<b>Formulate</b> the structural dynamics theory to analyse the response of single degree freedom systems and design of structure.	PO1, PO2, PO3	5	9
MSE21102.4	<b>Develop</b> the equation of motion for vibratory systems and solving for the free and forced response.	PO1, PO2, PO3	6	9
MSE21102.5	<b>Solve</b> problem on Dynamic analysis with distributed properties & loading by Energy Principle, Rayleigh-Ritz method.	PO1, PO2, PO3,	5	9

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<b>Program:</b>	M. Tech. Structural Engineering
Semester-I	MSE21103: (PE-I) Theory of Structural Stability

<b>Teaching Scheme</b>			Examinati	on Scheme
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESI	E: 3Hrs		ESE	60 Marks
Pre-Requisites: Solid Mechani		nics. Reinforced Cement Concrete	<b>Total Marks</b>	100 Marks

<b>Pre-Requisites:</b>	Solid Mechanics. Reinforced Cement Concrete	Total Marks	100 Marks
Structures			

# **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 Roo	, re

# Text Books

T.1	Theory of Plates and Shells Authored by Timoshenko, McGraw Publication New York2004
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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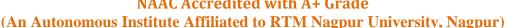
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Program: M. Tech. Structural Engineering

**Semester-I** | MSE21104: (PE-I) Theory of Thin Plate and Shell

<b>Teaching Scheme</b>			Examinati	on Scheme
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	1		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE: 3Hrs			ESE	60 Marks
<b>Pre-Requisites:</b> Advanced S		teel Design, Structural Analysis-I	<b>Total Marks</b>	100 Marks

## **Course Contents**

Course Contents			
	Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations,		
Unit I	Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions		
Unit II	<b>Small Deflection Theory of Thin Rectangular Plates:</b> 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	<b>Circular Plates:</b> 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	<b>Plates on Elastic Foundations:</b> 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.		
	Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic		
	paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.		

## **Text Books**

Unit V

T.1	Theory of Plates and Shells Authored by Timoshenko, McGraw Publication NewYork2004
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

theory. Application spherical shell and hyperboloid of revolution cooling towers

Axi-Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane

#### **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 L	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 O	ptimization
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Teaching Scheme			Examinati	on 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, R	CC Structures, Concrete Technology	<b>Total Marks</b>	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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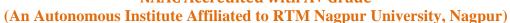
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Program:	<b>M.</b> '	l'ech.	Structural	<b>Engineering</b>

Semester-I	MSE21106 (PE-I)	Structural Design of Environmental and Hydraulic Structures

<b>Teaching Scheme</b>			Examinati	on Scheme
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE: 3Hrs			ESE	60 Marks
<b>Pre-Requisites:</b> Structural Dyn		rnamics, RCC Structures, Concrete	Total Marks	100 Mr. J.

Technology

Total Marks	100 Marks
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## **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., Guidelines Manual 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

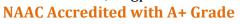
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(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Program: M. Tech.	Structural	<b>Engineering</b>
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Semester-I MSE21107: (PE-II) Advanced Design of Steel Structures

<b>Teaching Scheme</b>			<b>Examination Scheme</b>	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Structural A		nalysis, Steel Design	<b>Total Marks</b>	100 Marks

## **Course Contents**

Eccentric and Moment connections: Beams - Column Connections- Connections Subjected to

Unit I	Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Bracket
	Connections. Bolted Moment Connections – Welded Framed Connections – Welded Bracket
	Connections – Moment Resistant Connections.
	Tabular Structures: Properties of steel tubes, design of tension member and compression
Unit I	members, design of welded connections, design of flexural members, analysis and design of
	tabular trusses including purlins and supports.

# Bridges: Introduction, steel used in bridges, classification of steel bridges load & load **Unit III** 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
	compor	nents in	clud	ing design	of found	datio	on.					

#### Unit V Design of industrial shed considering gravity and wind load/ gantry Girders.

## **Text Books**

	T.1	Pvt. Ltd.,, Delhi, 2006
	T.2	Gaylords, E.H. & Gaylords, C. N., Design of Steel Structures, Blackwell, 1994.
1		

#### 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 L	inks

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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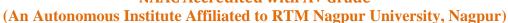
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<b>Program:</b>	M. Tech.	Structural	<b>Engineering</b>

Semester-I	MSE21108 (	(PE-II) Design	of Comp	osite Construction
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<b>Teaching Scheme</b>			Examinati	on Scheme
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE	E: 3Hrs		ESE	60 Marks
<b>Pre-Requisites</b>	: Steel Structi	ures, Reinforced Cement Concrete	Total Marks	100 Mork

Structures. Advanced Concrete Structures.

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 ConcreteBeams, 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 L	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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(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Semester-I	MSE21109: (PE-II) Disaster	Management and Mit	igation

Teaching Scheme			<b>Examination Scheme</b>	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE: 3Hrs			ESE	60 Marks
<b>Pre-Requisites:</b> Concrete Tec		chnology, Building Construction.	<b>Total Marks</b>	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 Warming 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				
Т 1	D'			

T.1	Disaster Management Guidelines, GOI-UND Disaster Risk Program (2013-2019)
T.2	Damon, P. Copola, (2018) Introduction to International Disaster Management, Butterworth
1.2	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

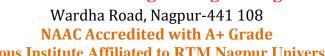
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# Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Pood Marray 444 100





•	(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)							
Program: M. Tech. Structural Engineering								
Semester	P-I MSE21110: (PE-II) Design of Earthquake Resistant Structures							
Tea	ching Scheme					<b>Examination Scheme</b>		
Theor	y 4 Hrs/w	reek				CT-I	20 Marks	
Tutori	al -					CT-II	20 Marks	
Total Cr	edits 4					CA		
Duration of	of ESE: 3Hrs					ESE	60 Marks	
Pre-Requ	iisites: RCC St	tructur				<b>Total Marks</b>	100 Marks	
				irse Contents				
Unit I	quantification scalogram, receinterpretation	of eacording	rthquake, mag and analysis of	es: Faults, Propositude, energy Fearthquake recetermination of ic zoning	intensity of ords, seismici	earthquake, a ty of the world,	ccelerograph, Analysis and	
Unit II	earthquakes, go	enerati Concept	on of response of response sp	damage: Dama spectrum from sectra, generation	available eartl	nquake records	, Evolution of	
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	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 Boo	ks							
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 Res	sistance	design of Strue	ctures authored	by Pankaj Ag	rawal Raj Publ	ication -2006	
Reference	e Books							
R.1	Change A. K. Dynamics of Structures Theory & Application to Forthquake Engineering							
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 L	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		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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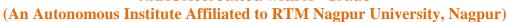
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Program: M. Tec	h. Structural	<b>Engineering</b>
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Semester-I	MSE21111:	Advanced Matrix Analysis
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<b>Teaching Scheme</b>			<b>Examination Scheme</b>	
Theory	4 Hrs/week		CT-I	20 Marks
Tutorial	-		CT-II	20 Marks
<b>Total Credits</b>	4		CA	
Duration of ESE: 3Hrs			ESE	60 Marks
Pre-Requisites: Structural Analysis, RCC Structure		nalysis, RCC Structures, Advance	Total Marks	100 Marks

Concrete Structures

,	I otal 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

#### Matrix Method of Structural Analysis, 2nd Edition; Authored by Kanchi, M. B., John Willey & T.3 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

0.00		
1		https://nptel.ac.in/courses/105/108/105108122/
2	2	https://nptel.ac.in/courses/127/105/127105018/
3	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 Laborator	y	-	-	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 Boo	ks						
T.1	Earthquake Resistant Design for Engineers and Architects, 3 <sup>rd</sup> 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 toBook by Robert Emerson Coleman						
Reference	e 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 toBook 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/r	noc/courses/105/#ongoing			1	Г	
		Course Outcomes	PO/PS	O	CL	,	Lab

	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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