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Department of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

M.Tech (Structural Engineering)

Structure & Curriculum

From

Academic Year 2022-23

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 enhance and empower the capability of youth in education, research and entrepreneurship, capable of offering the innovative solution to the challenges faced in the Civil Engineering domain

Mission of the Department

- To develop capable civil engineering graduates by imparting quality education and training.
- To nurture youth to face challenges and offer solutions in the research domain of civil engineering.
- To promote overall development of the students by enhancing their skills to become self-sufficient by offering industrial exposure.
- To develop leadership skills and engage in the process of lifelong learning.
- To create infrastructure and human services in a sustainable way, to achieve social and environmental needs.

Program Education Objectives (PEO)

- The graduates will be able to apply principles of advanced Mathematics and Engineering sciences to analyze and solve civil engineering problems.
- Create sustainable environment to plan infrastructure for social needs.
- Design and execute civil engineering projects.
- Develop as a leader and to inculcate team spirit to execute ethically the projects.
- Adopt emerging technologies for lifelong learning.

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 – II (w.e.f.: AY 2021-22)

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	MSE1201	Finite Element Analysis	3	1	-	4	4	15	15	10	60	100
2.	PCC	MSE1202	Theory of Plates & Shell	3	1	-	4	4	15	15	10	60	100
3.	PEC	MSE1203-06	Professional Elective - III	3	-	-	3	3	15	15	10	60	100
4.	PEC	MSE1207-10	Professional Elective – IV	3	-	-	3	3	15	15	10	60	100
5.	PCC	MSE1211	Advanced R.C.C. Lab	-	-	2	2	1	-	-	25	25	50
6.	PCC	MSE1212	Advanced Steel Lab	-	-	2	2	1	-	-	25	25	50
7.	FC	MSE1213	Research Methodology	2	-	-	2	2	-	-	25	25	50
8.	MCC	MAU1202	Research Paper Writing	2	-	-	2	Audit	-	-	-	-	-
			Total	16	2	04	22	18	60	60	115	315	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 / Audit Course / Open Elective (list is provided at the end of structure)

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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	Structural Health Monitoring and Rehabilitations of Structures	Design of High-Rise Structures	Soil Structure Interaction
Design of Environmental Structures	Design of Earthquake Resistant Structures	Earth Retaining Structures	Design of Industrial Structure

List of Open Electives

Semester - I
Open Electives
MCSXX01: Business Analytics
MIPXX05: Industrial Safety
MMBXX06: Operation Research
MSEXX02: Cost Management of Engineering Projects
MSEXX03: Composite Materials
MIPXX04: Waste to Energy

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Program: M.Tech. Structural Engineering

Semester-II | MSE1201: Finite Element Analysis

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	1 Hrs/week	**CT-II**	15 Marks
Total Credits	**4**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Engineering Mechanics, Strength of Materials, Structural Analysis		**Total Marks**	**100 Marks**

Course Contents

Unit I	Principles and discretization, Elements stiffens/mass formulation based on direct, variation and weighted residual techniques.
Unit II	Shape function, convergence, displacement formulation for rectangular, triangular elements in Cartesian coordinates, Application to 1D, 2D stress analysis.
Unit III	Natural coordinates, ISO parametric elements, Numerical integration, Convergence of Isoperimetric elements, Application to 1D, 2D and 3D problem.
Unit IV	Isoperimetric elements for two-dimensional and axis symmetric stress analysis for plane stress/strain problems.
Unit V	Constraint Equations (Penalty method, Lagrangian method), Patch test, mathematical modeling of structures.

Text Books

T.1	A.S. Meghre and Ms. K.M. Kadam. Finite Element Method In Structural Analysis, Khanna Publisher
T.2	Rajasekaran S, Finite Element Analysis in Engineering Design, S. Chand & Co. Ltd. New Delhi, 1999.
T.3	Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991

Reference Books

R.1	Zienkiewicz O.C. and Taylor R.L., The Finite Element Method (Volume -I), 1st Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1989.
R.2	Cook R. D., Concepts and Applications of Finite Element Analysis, 3rd Edition, Wiley India Text books, Wiley India Pvt Limited, New Delhi, 1989.

Useful Links

1	https://nptel.ac.in/courses/105/105/105105041/
2	https://nptel.ac.in/courses/105/108/105108141/#

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1201.1	**Organize** with the discretization of Elements.	PO1, PO2, PO3	3	9
MSE1201.2	**Evaluate** the stress analysis.	PO1, PO2, PO3	5	10
MSE1201.3	**Analyse** the Isoparametric elements for evaluating the problems.	PO1, PO2, PO3	4	8
MSE1201.4	**Estimate** the plane stress/strain problems by applying the two-dimensional and axis symmetric stress analysis.	PO1, PO2, PO3	5	9
MSE1201.5	**Design** the Modeling techniques on plates.	PO1, PO2, PO3	6	9

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Semester-I | MSE1202: Theory of Plates & Shell

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	1 Hrs/week	**CT-II**	15 Marks
Total Credits	**4**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
		Total Marks	**100 Marks**

Pre-Requisites: Engineering Mechanics, Strength of Materials, Structural Analysis, Reinforced Concrete Structures.

Course Contents

Unit I	Introduction, Moment curvature relation in pure bending, Symmetrical bending of laterally loaded circular plates, uniformly loaded circular plates with clamped and simply supported edges, Governing differential equations of thin rectangular plates with various boundary conditions & loading.
Unit II	Laterally loaded rectangular plates, Differential equation of the deflection surface (Lagrange's equation). Boundary conditions, simply supported plates under sinusoidal loading. Navier's solution. Finite difference method, Finite element method for plate analysis, Mathematical formulation of plate elements, shape functions and element stiffness matrices
Unit III	General shell geometry. Classification, equation of equilibrium, stress resultants under deed load and snow load for circular, cycloidal, catenary, and parabolic cylindrical shells.
Unit IV	Bending theory of cylindrical shells. Finster walder theory, schorer's theory.
Unit V	Membrane theory of cylindrical shells, (Parabolic, Catenary, Cycloid, Circular, hyperbolic).Approximate analysis of cylindrical shells by beam arch method.

Text Books

T.1	Theory and Design of Plate and Shell Structures by Maan Jawad
T.2	Theory of Plates and Shells by Bhavikatti S. S.
T.3	Theories of Plates and Shells: Critical Review and New Applications by Reinhold Kienzler and Holm Altenbach.

Reference Books

R.1	Timoshenko S.P and Krieger S.W, Theory of Plates and Shells, 2nd Edition, McGraw-Hill Book Company, New Delhi,1970.
R.2	Chadrashekhara K, Theory of Plates, 1st Edition, Universities Press (India) Ltd, Hyderabad,2001.
R.3	Ramaswamy, G. S, Design of Concrete Shells,KriegerPubl.Co.,1984
R.4	R. Szilard. Theories and Applications of Plate Analysis: Classical, Numerical and Engineering Methods. John Wiley & Sons, Inc.

Useful Links

1	https://onlinecourses.nptel.ac.in/noc21_ce59/preview
2	https://ocw.mit.edu/courses/mechanical-engineering/2-081j-plates-and-shells-spring-2007/readings/lecturenote.pdfb

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1202.1	**Classify** the equations of thin rectangular plates with boundary conditions & loadings.	PO1, PO2, PO3	3	9
MSE1202.2	**Analyze** the plates with application of analysis on plates theories.	PO1, PO2, PO3	4	10
MSE1202.3	**Illustrate** the classification of shells for loading conditions.	PO1, PO2, PO3	3	10
MSE1202.4	**Design** the Bending theory.	PO1, PO2, PO3	6	8
MSE1202.5	**Evaluate** the Beam & Arch method for analysis of cylindrical shells.	PO1, PO2, PO3	5	8

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Semester-II | MSE1203 :Elective III-**Advances in Concrete Technology**

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	---	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Concrete Technology, Building Construction & Materials, Computer Aided Drawing, Construction Technology.		**Total Marks**	**100 Marks**

Course Contents

Unit I	Steel fibers reinforced concrete Properties, Aspect ratio, strength, durability of fiber reinforced plastics other types of fibers and their applications.
Unit II	Light weight concrete. Ferro cement concrete, their types, foam concrete, workability durability, and composition, application. Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete.
Unit III	Fly ash blended concrete, replacement procedures, effect of admixtures, adhesives, bond strength, and durability applications.
Unit IV	High-grade concrete, high strength concrete, termite concrete.
Unit V	Concrete admixture. Accelerators, retarders, ND Testing of materials.

Text Books

T.1	Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
T.2	Shetty M. S, Concrete Technology, S. Chand Publisher.

Reference Books

R.1	Neville A. M., Properties of Concrete, Pearson Education Limited.
R.2	Rafatsiddhequi , Special Concretes, Galgotia Publications.
R.3	M Gambhir, Concrete Technology, Tata Mcgraw Hill Education Private Limited.

Useful Links

1	https://nptel.ac.in/courses/113/102/113102080/
2	https://nptel.ac.in/courses/105/102/105102088/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1203.1	**Analyze** the properties of Steel fibers R. C. concrete	PO1, PO2, PO3	4	9
MSE1203.2	**Apply** the Modern methods doe concrete Mix design and to evaluate the performance.	PO1, PO2, PO3	4	10
MSE1203.3	**Analyze** and estimate the performance of concrete under various partial replacements.	PO1, PO2, PO3	5	10
MSE1203.4	**Design** the high strength &highgrade concrete.	PO1, PO2, PO3	6	8
MSE1203.5	**Apply** the knowledge of recent modern materials used in concrete technology.	PO1, PO2, PO3	4	8

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Semester-II | MSE1204:Elective-III-Design of Formwork

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	---	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Concrete Technology, Building Construction & Materials, Reinforced Concrete Structures.		**Total Marks**	**100 Marks**

Course Contents

Unit I	**Introduction to formwork**: Types of formwork, Requirement of formwork , Selection of formwork, Trenchless technology
Unit II	**Formwork materials**: Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Types of supports, Horizontal and Vertical Formwork Supports.
Unit III	**Formwork Design:** Concepts, Formwork Systems and Design for Foundations, Walls, Columns Slab and Beams
Unit IV	**Formwork Design for Special Structures:** Shells, Domes, Folded Plates, Overhead Water Tanks, Tower, Bridges.
Unit V	**Flying Formwork:** Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues, Pre and Post Award, Formwork Issues in Multi-Story Building Construction.

Text Books

T.1	Formwork for Concrete Structures By Robert L Peurifoy and Garold D Oberlender

Reference Books

R.1	Formwork for Concrete Structures, Peurify, McGraw Hill Publication India
R.2	Formwork for Concrete Structures, Kumar Neeraj Jha, Tata McGraw Hill Education.
R.3	IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS

Useful Links

1	https://nptel.ac.in/courses/105/104/105104030/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1204.1	**Apply** the knowledge for composing the formwork.	PO1, PO2, PO3	3	9
MSE1204.2	**Analyse** the material used for formwork.	PO1, PO2, PO3	4	9
MSE1204.3	**Design** the formwork.	PO1, PO2, PO3	6	10
MSE1204.4	**Design** the formwork for special structures.	PO1, PO2, PO3	6	8
MSE1204.5	**Design** the Flying Formwork	PO1, PO2, PO3	6	9

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Semester-I | MSE1205: Elective III-Design of High-Rise Structures

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial		**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
		Total Marks	**100 Marks**

Pre-Requisites: Concrete Technology, Building Construction & Materials, Reinforced Concrete Structures.

Course Contents

Unit I	Performance of buildings, behaviors of various types of buildings in past earthquakes. Modes of failures influence of unsymmetrical, infill walls, foundations, soft story & detailing of reinforcements in buildings.
Unit II	Frames shear walled buildings, mathematical modeling of building with different structural systems Analysis of frames shear walled buildings, Analysis of coupled shear walled building.
Unit III	Special aspects in Multi-story buildings, Effect of torsion, flexible first story ,P-delta effect, soil-structure interaction on building response, drift limitation.
Unit IV	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 behaviors, IS code provisions.
Unit V	Design of multi-story buildings with bracings & infills. Tall Buildings, Structural Concept, Configurations.

Text Books

T.1	Paulay, T. & Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
T.2	Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
T.3	Structural Analysis and Design of Tall Buildings: Steel and Composite Construction 1st Edition, by Bungale S. Taranath,2011

Reference Books

R.1	Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994
R.2	Outrigger Design for High-Rise Buildings (Ctbuh Technical Guide), by Hi Sun Choi , Goman Ho , Leonard Joseph , Neville Mathias , 4 April 2014

R.3	Design Of Modern High rise Reinforced Concrete Structures, by Hiroyuki Aoyama,2002
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc20_ar10/preview
2	https://nptel.ac.in/courses/124/107/124107012/
3	https://onlinecourses.nptel.ac.in/noc10_ar20/preview

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1205	**Analyze** performance of Buildings with seismic conditions	PO1, PO2, PO3	4	9
MSE1205	**Create** the mathematical model of structural system	PO1, PO2, PO3	6	10
MSE1205	**Evaluate** the effects on multistoried buildings	PO1, PO2, PO3	5	10
MSE1205	**Appraise** Strength, ductility and energy absorption of reinforced members	PO1, PO2, PO3	5	8
MSE1205	**Design** of multi-story buildings with bracings & infills.	PO1, PO2, PO3	6	8

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Semester-I | MSE1206 Elective III-Earth Retaining Structures

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial		**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
		Total Marks	**100 Marks**

Pre-Requisites: Concrete Technology, Building Construction & Materials, Reinforced concrete structures, Fluid Mechanics, Geotechnical Engineering.

Course Contents

Unit I	**Earth Pressure Theories:** Rankine's and Coulomb's Earth pressure theories for cohesive and cohesion less soils, stresses due to compaction and surcharge loads.
Unit II	**Conventional Retaining Wall:** Types of retaining walls, Stability (sliding, overturning, bearing capacity & overall) of gravity and cantilever walls, Analysis and design of cantilever type retaining walls, Proportioning of retaining walls, Effect of backfill material and drainage, Static and pseudo-static analyses
Unit III	**Flexible Walls:** Sheet pile walls, Construction methods- Cantilever and Anchored sheet pile wall.
Unit IV	**Reinforced Soil Walls/Mechanically Stabilized Earth:** – Failure mechanisms Pullout and rupture failures, Analysis methods, Limit equilibrium method- Internal and external stability, Static and seismic analyses.
Unit V	**Braced Cuts:** Lateral earth pressure in braced cuts, Design of various components, Stability of braced cuts, base heave and stability, yielding and settlement of ground surrounding excavation.

Text Books

T.1	Clayton, C.R.I., Woods, R.I., Bond, A.J., Milititsky, J. – Earth Pressure and Earth-retaining structures, CRC Press, Taylor and Francis group, 2013.
T.2	Budhu, M. – Foundations and Earth retaining structures, John Wiley & Sons, Inc., 2008.
T.3	Earth Pressure and Earth-Retaining Structures, By Chris R.I. Clayton, Rick I. Woods, Andrew J. Bond,Jarbas Milititsky,2013

Reference Books

R.1	Bowles, J.E. – Foundation Analysis and Design, 5th Edition, BBS Publisher, 2009.

R.2	Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012
R.3	Analysis and Design of Foundations and Retaining Structures Subjected To Seismic Loads ,by Swami Saran, 2020
Useful Links	
1	https://nptel.ac.in/content/storage2/courses/105101083/download/lec26.pdf
2	https://nptel.ac.in/content/storage2/courses/105101083/download/lec27.pdf
3	https://nptel.ac.in/content/storage2/courses/105108075/module8/Lecture31.pdf

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1206.1	Apply the knowledge of Earth Pressure Theories.	PO1, PO2, PO3	4	9
MSE1206.2	Analyse and evaluate the behavior of Conventional Retaining Wall	PO1, PO2, PO3	5	10
MSE1206.3	Design the Flexible Walls and construction methods.	PO1, PO2, PO3	6	9
MSE1206.4	Formulate the stabilization and to analyse the failure mechanisms.	PO1, PO2, PO3	6	9
MSE1206.5	Analyse and design of various components of braced cuts.	PO1, PO2, PO3	5	8

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Semester-I | MSE1207 Elective-IV-Design of Advanced Concrete Structures

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	-	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Concrete Technology, Reinforced Concrete Structures, Advanced Concrete Technology.		**Total Marks**	**100 Marks**

Course Contents

Unit I	Basic philosophy of concrete materials, Concrete Mix Design, Basic philosophy of Design of concrete structures, Design of single and multibay structures in concrete.
Unit II	Portal Frames, Spaceframes, large span roof structures, Bunkers and Silos, pressure vessels and chimneys, Flat slab, Grid floors.
Unit III	Folded Plates, Reinforcement detailing for members and joints detailing; Codal provisions.
Unit IV	Basic philosophy of foundation design, raft foundations, pile foundations & well foundations,
Unit V	Prestressing of concrete structures, Analysis and design of determinate & indeterminate beams, Concordant Cables, Design of end blocks.

Text Books

T.1	Design of Reinforced Concrete Foundations by Varghese P.C
T.2	Design of Reinforced Concrete Structures by N Subhamanyam
T.3	Advanced Reinforced Concrete Design, CBS; 3rd edition, by RAJU N.K. ,2016

Reference Books

R.1	Advanced Reinforced Concrete Design by N. Krishna Raju
R.2	Karve, S. R. and Shah, V. L., Limit State Theory and Design of Reinforced Concrete PVG Prakashan, Pune.
R.3	Punmia, Reinforced Concrete Structures Vol. 1 and 2, Standard Book House NewDelhi.

Useful Links

1	https://onlinecourses.nptel.ac.in/noc20_ce39/preview
2	https://www.digimat.in/nptel/courses/video/105105105/L18.html
3	https://www.digimat.in/nptel/courses/video/105106176/L01.html

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1207.1	Apply basic principles of concrete mix design in the advanced concrete structures.	PO1, PO2, PO3	3	9
MSE1207.2	Analyse the Frames & advanced storage structures	PO1, PO2, PO3	4	9
MSE1207.3	Evaluate the forces coming on plates w. r t. codal provisions	PO1, PO2, PO3	5	9
MSE1207.4	Illustrate the knowledge of Foundation design.	PO1, PO2, PO3	3	9
MSE1207.5	Evaluate & analyses the effect of the stresses coming on concretestructure.	PO1, PO2, PO3	5	9

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Semester-I | MSE1208 Elective-IV-Advanced Design of Foundations

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial		**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Concrete Technology, Reinforced Concrete Structures, Advanced Concrete technology.		**Total Marks**	**100 Marks**

Course Contents

Unit I	Design of isolated and combined footings, proportioning of footing for equal settlements.
Unit II	Theory of Sub grade reaction beam on elastic foundation, Foundation subjected to eccentric loads
Unit III	Design of rafts – I. S. code method, introduction to various methods.
Unit IV	Floating foundations, analysis and design of pile foundations, negative skin friction, group action in piles, design of pile cap.
Unit V	Foundation on Rocks: Code provisions for design of foundations resting on rocks Analysis and design of simple machine foundation using I.S. code.

Text Books

T.1	Karuna Moy Ghosh, Foundation Design in practice, PHI Learning Pvt. Ltd, New Delhi 2012
T.2	P. C. Varghese, Design of Reinforced Concrete Foundations, PHI Learning Pvt. Ltd., New Delhi, 2009.
T.3	Advanced Foundation Engineering Geotechnical Engineering Series , CBS Publishers,By Murthy V.N.S. 2022

Reference Books

R.1	Sawmi Saran, Analysis and Design of Sub structures, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
R.2	Kurain N.P, Design of foundation systems-Principles and Practice, Narosa Publishing house, New Delhi, 2005.
R.3	Analysis, Design And Construction Of Foundations, Taylor & Francis Ltd,by Cheng Yung Ming, 2021

Useful Links

1	https://nptel.ac.in/courses/105/108/105108069/
2	https://onlinecourses.nptel.ac.in/noc22_ce32/preview
3	https://onlinecourses.nptel.ac.in/noc21_ce39/preview

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1208.1	Analyse the footings with different loading conditions.	PO1, PO2, PO3	3	9
MSE1208.2	Evaluate the effect of eccentric loads on Foundation.	PO1, PO2, PO3	4	10
MSE1208.3	Apply the Knowledge of I. S. code Method in Raft Foundation Design.	PO1, PO2, PO3	5	10
MSE1208.4	Analysis and design of pile foundations	PO1, PO2, PO3	3	8
MSE1208.5	Analysis and design of machine foundation	PO1, PO2, PO3	5	8

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Program: M. Tech. Structural Engineering

Semester-II | MSE1209: Soil Structure Interaction

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	-	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
		Total Marks	**100 Marks**

Pre-Requisites: Engineering Mechanics, Geotechnical Engineering, Hydrology & Water Resources.

Course Contents

Unit I	**Soil-Foundation Interaction:** Introduction to soil-foundation interaction problems, Soil behavior, Foundation behavior, Interface behavior, Scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic-plastic behavior, Time dependent behavior.
Unit II	**Beam on Elastic Foundation Soil Models:** Infinite beam, Two parameters models, Isotropic elastic half space model, Analysis of beams of finite length, Classification of finite beams in relation to their Stiffness, combined footings.
Unit III	**Plates on Elastic Continuum:** Thin and thick rafts, Analysis of finite plates, Numerical analysis of finite plates.
Unit IV	**Analysis of Axially and Laterally Loaded Piles and Pile Groups:** Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap, Load deflection prediction for laterally loaded piles, Sub grade reaction and elastic analysis, Interaction analysis, Pile-raft system.
Unit V	**Ground Foundation:** Structure Interaction: Effect of structure on ground-foundation interaction, Static and dynamic loads.

Text Books

T.1	Selvadurai, A. P. S. Elastic Analysis of Soil-Foundation Interaction, 1979
T.2	Rolando P. Orense, Nawawi Chouw & Michael J. Pender – Soil-Foundation-Structure Interaction, CRC Press, 2010 Taylor & Francis Group, London, UK.
T.3	Das, B. M. – Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)

Reference Books

R.1	Soil Structure Interaction – The real behavior of structures, the institution of structural engineers, London, March 1989.
R.2	Poulos, H. G., and Davis, E. H. – Pile Foundation Analysis and Design, 1980

R.3	Scott, R. F. – Foundation Analysis, Prentice Hall, Englewood Cliffs, 1981
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105200/
2	https://NPTEL : NOC:Soil Structure Interaction (Civil Engineering) (digimat.in)
3	https://NPTEL : NOC:Soil Structure Interaction (Civil Engineering) (digimat.in)

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1209.1	Apply the knowledge Of Two parameter Elastic Modeling to analyse the behavior of Soil under loading.	PO1, PO2, PO3	3	8
MSE1209.2	Categorized the behavior of beam under Elastic Foundation Soil Models.	PO1, PO2, PO3	4	10
MSE1209.3	Formulate the Plates on Elastic Continuum	PO1, PO2, PO3	6	9
MSE1209.4	Compare the behavior of pile under loading conditions.	PO1, PO2, PO3	5	10
MSE1209.5	Point out the effect of structure on ground-foundation interaction under Static and dynamic loading conditions.	PO1, PO2, PO3	4	8

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Program: M. Tech. Structural Engineering

Semester-II	MSE1210 :Elective-IV-Design of Industrial Structure

Teaching Scheme		**Examination Scheme**	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	-	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Engineering Mechanics, Steel Structures. Reinforced Concrete Structures,		**Total Marks**	**100 Marks**

Course Contents

Unit I	Planning of Industrial Structures types of industrial structures different components of Industrial structures Bracings of Industrial Buildings Design of Steel Industrial Buildings.
Unit II	Thin Walled / Cold Formed Steel Members: Definitions Local Bucking of Thin Elements Post Buckling of Thin Elements Light Gauge Steel Columns and Compression Members Form-Factor for Columns and Compression Members Behavior of Stiffened Elements Under Uniform Compression Multiple Stiffened Compression Elements Effective Length of Light Gauge Steel Compression Members Light Gauge Steel Tension Members.
Unit III	R.C. Bunkers & Silos: Introduction Janssen's Theory Airy's Theory Design of Square, Rectangular and Circular Bunkers; Design of Silos. Design of Gantry Girder.
Unit IV	R.C. Chimneys: Introduction Wind Pressure Stresses in Chimney Shaft Due to Self-Weight and Wind Stresses in Horizontal Reinforcement Due to Wind Shear Stresses Due to Temperature Difference Combined Effect of Self Load, Wind and Temperature Stresses in Horizontal Reinforcement Problems.
Unit V	Design Principles of Cylindrical Shells & Design Problems.

Text Books

T.1	Design of Steel Structures, By Ram Chandra and Virendra Gehlot vol-II, 2007.
T.2	Design of Steel Structures, By Duggal - Tata McGraw-Hill publishers – 2010
T.3	Analysis and Design: Practice of Steel Structures—Karuna Ghosh– PHI Learning Pvt. Ltd. Delhi

Reference Books

R.1	Advanced Reinforced Concrete Design, By N. Krishna Raju (CBS Publishers & Distributors) 2005.
R.2	Design of Steel Structures Paperback – by Ramamurtham S. 1 January 2015
R.3	Illustrated Design of Reinforced Concrete Buildings (G+3)" by Dr. V.L. Shah and Dr. S.R. Karve, 'Structures Publications', Pune 411009.

Useful Links

1	https://nptel.ac.in/courses/105/106/105106113/
2	https://www.digimat.in/nptel/courses/video/105103094/
3	https://www.digimat.in/nptel/courses/video/105105105/

	Course Outcomes	PO/PSO	CL	Class Sessions
MSE1210.1	Apply the Knowledge of Industrial structures Bracing for the analysis of Industrial Buildings.	PO1, PO2, PO3	3	8
MSE1210.2	Categorized the Thin Walled / Cold Formed Steel Members under the uniform compression.	PO1, PO2, PO3	4	9
MSE1210.3	Formulate the R.C. Bunkers & Silos as per the IS code.	PO1, PO2, PO3	6	10
MSE1210.4	Compare the combine effects of Combined Effect of Self Load, Wind and Temperature Stresses.	PO1, PO2, PO3	5	9
MSE1210.5	Point Out Design Principles of Cylindrical Shells.	PO1, PO2, PO3	4	9

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Semester	Course Code	Name of Course	L	T	P	Credits
II	MSE1211	Advanced RCC Laboratory	-	-	2	1

Pre-Requisites: Structural Dynamics, RCC Structures

	List of Experiment	CO
1	Review of IS 456, IS 962 Basics of Limit State Design (Beams, Columns, Slabs) Design of Multistoried buildings	**CO1, CO2**
2	Design for axial force, flexural, shear and combined effects	**CO2, CO3, CO4**
3	Slabs (one way & two way) and slabs on grades. Preliminary sizing and modeling of RC structures	**CO3, CO4, CO5**

Text Books

T.1	"Limit State Design of Reinforced Concrete" author by P.C. Vergese,2nd edition, Prentice Hall Publishers, 2008.
T.2	"Advanced Reinforced Concrete Design" author by Varghese, P.C. 2nd edition REPRINT Phi Learning Private Limited.
T.3	"Reinforced Concrete Design" author by Pillai, S. Unnikrishna, Menon, Devdas 3rd edition REPRINMT Mc Graw Hill
T.4	"Structural Design And Drawing : Reinforced Concrete And Steel" author by Raju N. Krishna 3rd edition REPRINT Universities Press Pvt. Ltd

Reference Books

R.1	"Reinforced Concrete Structures (Vol-I)", author by Punmia B.C., Ashok Kumar Jain., Arun Kumar Jain, 2nd edition, Laxmi Publications Pvt Ltd, NewDelhi, 2007
R.2	"Design Of Reinforced Concrete Structures" author by Ramamrutham,S. & Narayan, R. 12th edition REPRINDT hanpatrai Publications (P) Ltd.
R.3	"Prestressed Concrete" author by N. Krishana Raju, 5th edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2012
R.4	"Fundamentals Of Reinforced Concrete" author by Sinha, N.C., Roy, S.K., 3rd edition REPRINT S. Chand publication
R.5	Relevant IS codes: IS 456, IS 1893-2016, IS 13920-2016

Useful Links

1	https://nptel.ac.in/courses/105/105/105105104/

	Course Outcomes	PO/PSO	CL	Lab Sessions
MSE1112.1	**Understand** basic concepts of limit state design method.	PO1, PO2	2	2
MSE1112.2	**Explore** various analysis and design concepts through critical review of IS codes.	PO1, PO2, PO3	3	2
MSE1112.3	**Analyze** the response of RC elements subjected to various combination of loads	PO1, PO2,PO3	4	4
MSE1112.4	**Evaluate** the design and detailing of RCC structural elements required for buildings and design of one way and two way slab.	PO1, PO2, PO3	5	2
MSE1112.5	**Create** computational structural analysis and design of RC structures using structural analysis and design software.	PO1, PO2, PO3,	6	2

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Program: M. Tech Structural Engineering

Semester	Course Code	Name of Course	L	T	P	Credits
II	MSE1212	Advanced Steel Laboratory	-	-	2	1

Pre-Requisites: Structural Dynamics, RCC Structures

	List of Experiment	CO
1	Review of IS 800	**CO1, CO2**
2	Elementary Design of Beam including open web sections	**CO2, CO3, CO4**
3	Elementary Design of various types of truss.	**CO3, CO4, CO5**
4	Design of Plate Girders	**CO3, CO4, CO5**
5	Structural Fasteners and Connections (Bolted/ Welded Connections all types)	**CO3, CO4, CO5**

Text Books

T.1	"Fundamentals of Structural Steel Design", authored by M. L. Gambhir, McGraw Hill Education, 2013
T.2	"Design of Steel Structures", authored by N. Subramanian, OXFORD University Press, First Edition, 2008
T.3	"Limit State Design of Steel Structures", authored by S. K. Duggal, McGraw Hill Education Private Limited, 2011
T.4	"Design of steel structure" authored by L.S. Negi, Tata Mc Graw hills Publisher Co. Ltd, New Delhi, 1986.

Reference Books

R.1	"Stability Analysis and Design of Steel Structure",authored By M. L. Gambhir, McGraw Hill Education, 2004.
R.2	"Design of steel structure "authored by S. S. Bhavikatti, dreamtech, distributed by Willey, 2009.
R.3	"Design of steel structure" authored by A. S. Arya and J.L. Ajmani, Nem chand bros, Roorkee, 2011.
R.4	"Design of steel structure" authored by P Dayaratnam , S. Chand of Co. Delhi 2003 edition,2012.
R.5	Relevant IS code for analysis and design: IS 800

Useful Links

1	https://nptel.ac.in/courses/105/105/105105162/
2	https://nptel.ac.in/courses/105/104/105104030/

	Course Outcomes	PO/PSO	CL	Lab Sessions
MSE1212.1	**Understand** basic concepts of structural steel design	PO1, PO2	2	2
MSE1212.2	**Explore** various analysis and design concepts through critical review of IS 800	PO1, PO2, PO3	3	2
MSE1212.3	**Analyze** the response of steel beams and carrying design as per IS 800	PO1, PO2,PO3	4	4
MSE1212.4	**Evaluate** the design of structural steel systems like truss and plate girders.	PO1, PO2, PO3	5	2
MSE1212.5	**Create** computational structural analysis and design of steel structures and connections using structural analysis and design program.	PO1, PO2, PO3,	6	2

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