Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

M.Tech.(Structural Engineering)

Semester-III

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Session: 2022-23)

Shri Rawatpura Sarkar University, Raipur, Chhattisgarh

Faculty of Engineering

Two Years M.Tech. Programme

Scheme of Teaching and Examination

M.Tech. Third Semester Structural Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2022-2023)

S.No.	Course Code	Course Title	Hours / Week			Credits	Maximum Marks			Sem End Exam Duration (Hrs)
			L	**T**	**P**		Continuous Evaluation	Sem End Exam	Total	
1	MENSE301T	Structural Dynamics	3	1	-	4	30	70	100	3
2	MENSE302T	Elective-III	3	1	-	4	30	70	100	3
3	MENSE303P	Technical Paper Writing and Seminar	-	-	4	2	100	-	100	-
4	MENSE304P	Pre-dissertation (Literature Review/ Problem Formulation/ Synopsis	-	-	20	10	140	60	200	-
	Total Contact Hr Per Week: 32		**Total Credit: 20**				**Grand Total Marks:**		**500**	

L: Lecture T: Tutorial P: Practical

Elective-III

S.NO.	Course Title
1	Optimization Techniques
2	Theory of Plates and Shells
3	Pre-Stressed Concrete

M.Tech. (Structural Engineering)
Semester-III
2022-23

Course Title	**Structural Dynamics**				
Course Code	**MENSE301T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Structural Analysis**				
Course Objectives	**This course will enable students to:** • Introduce fundaments of vibrations of SDOF system • Introduce damped and undamped system • Introduce free and forced vibration • Introduced free and forced vibration of MDOF system • Introduced free and forced vibration of continuous system				
Course Contents	**UNIT-I** **Basic Concepts:** Types and sources of dynamic loads, Methodology for dynamic analysis, Study of IS1893, fundamentals of rigid and deformable dynamics. **UNIT-II** **Single Degree Of Freedom Systems:** Free and forced response, effect of damping, Analysis of undamped and viscously damped single degree of freedom. Response of single degree freedom systems to Harmonic loading, support motions and Transmissibility, Duhamel's integral. **UNIT-III** **Multi –Degree Of Freedom Systems:** Free vibrations of lumped mass multi degree freedom systems, analysis of undamped and viscously damped multi degree of freedom. Rayleigh's method, Orthogonally criteria. **UNIT-IV** **Idealization Of Structures:** Mathematical models, Mode superposition methods, Distributed mass properties. **UNIT-V** **Application To Earthquake Engineering:** Introduction to vibrations due to earthquake, Response spectra. Response spectrum method for seismic design of structures.				
Course Outcomes	**After the completion of course**: • Appreciate the theory of vibrations • Computer simulation of structure subjected to dynamic load.				

	• Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response. • Basic understanding of fundamental analysis methods for dynamic systems Interpret dynamic analysis results for design, analysis and research purposes • Apply structural dynamics theory to earthquake analysis, response, and design of structures.
Text Books	1. Chopra, A. K., Dynamics of Structures - Theory and Applications to Earthquake Engineering, Second Edition, Prentice Hall, 2001. 2. Rao, S. S., Mechanical Vibrations, Third Edition, Addison-Wesley Publishing Co., 1995
Reference Books	1. Clough, R. W., and J. Penzien, Dynamics of Structures, Second Edition, McGraw-Hill, 1993. 2. Mario Paz, Structural Dynamics – Theory and Computations, Third Edition, CBS publishers, 1990.

M.Tech. (Structural Engineering)
Semester-III
2022-23

Course Title	**Optimization Techniques**				
Course Code	**MENSE302T (Elective-III)**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Mathematical Programming**				
Course Objectives	**This course will enable students to:** • Use Mat lab to implement important optimization methods. • Learn efficient computational procedures to solve optimization problems. • Cast engineering minima/maxima problems into optimization framework.				
Course Contents	**UNIT-I** **Optimization Techniques:** Basic Concepts and introduction of engineering optimization, single-variable optimization, Multivariable optimization with no constraints, equality constraints and inequality constraints. **UNIT-II** **Linear Programming**: Basic concepts of Linear programming, Applications of Linear Programming, standard forms of a Linear programming problems, solution of a system of linear simultaneous equations, Decomposition principle, Quadratic programming. **UNIT-III** **Non Linear Programming**: Basic concepts of Non-linear programming, Uni-modal function, Elimination methods, Interpolation methods, classification of unconstrained minimization methods- Direct search methods, Indirect search methods, characteristics of a constrained problem-Direct methods, Indirect methods. **UNIT-IV** **Geometric Programming:** Unconstrained minimization problem, constrained minimization, Applications of Geometric programming. **UNIT-V** **Special Optimization Techniques**: Separable programming, transformation of a non-linear function to separable form, multi objective optimization, calculus of variations, optimal control theory.				
Course Outcomes	**After the completion of course:** • Be able to use Matlab to implement optimization algorithms. • Be able to model engineering minima/maxima problems as optimization problems.				

	• Identify appropriate equipment replacement technique to be adopted to minimize maintenance cost by eliminating equipment break-down. • Apply the knowledge of game theory concepts to articulate real-world competitive situations to identify strategic decisions to counter the consequences. • Demonstrate the various selective inventory control models to analyse and optimize inventory systems. • Explain the theoretical workings of dynamic programming method to find shortest path for given network.
Text Books	1. Rao S.S., Engineering Optimization Theory and Practice, New Age Publishers, Delhi 2. Deb K., Optimization for Engineering Design, Algorithms & examples, Prentice Hall of India, Delhi
Reference Books	1. Arora J.S., Introduction to optimum Design, TMH, Delhi 2. Fox R.L., Optimization methods for Engineering Design, Addison Wesley Publishing

M.Tech. (Structural Engineering)
Semester-III
2022-23

<table>
<tr><td>Course Title</td><td colspan="5">Theory And Plates And Shells</td></tr>
<tr><td>Course Code</td><td colspan="5">MENSE302T (Elective-III)</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Structural Analysis</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
Understand the basic concept, mathematical modeling, behavior and analysis of plate and shell structures.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Basic Concepts: The fundamental elasticity equations. Theory of elasticity and real structures. The fundamental elasticity problems. Boundary conditions. Compatibility equations. Applications. Calculation of displacement components. The plane stress and plane strain problem.

UNIT-II
Analysis of Plates: Equation of equilibrium and deformation of plates, Bending of rectangular plates and circular plates. Energy method, finite difference and finite element methods for solution of plate bending problems.

UNIT-III
Folded Plates: Analysis and design of folded plates, Detailing of Reinforcement in folded plates.

UNIT-IV
Analysis of Shells: Geometry of shells, Classification of Shells, membrane theory of circular and cylindrical shells, Introduction to the bending theory of shells.

UNIT-V
Cylindrical Shells: Analysis and design of cylindrical shells, Detailing of Reinforcement in shells</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
Understand the behavior of plates and analytical techniques to solve the two dimensional structural engineering problems and ability to construct the mathematical models of structural systems.
Apply differential equations for the calculation of response of two dimensional problems.
The learner will be able to understand the behavior of plates for loadings and boundary conditions.
Identify, formulate and solve theoretical problems with structural plate and</td></tr>
</table>

	shell. • Understand behaviour of plates under bending and twisting.
Text Books	1. Timoshenko S.P. and Woinoswski-Krieger S., Theory of Plates and Shells. McGraw-Hill. 2. Gould Philipp L., Analysis of Shells and Plates. Springer Verlag New York.
Reference Books	1. Reddy J. N.,Theory and Analysis of Elastic Plates. Taylor and Francis, London. 2. Szilard R., Theory and Analysis of Plates. Prentice-Hall, Englewood Cliffs.

M.Tech. (Structural Engineering)
Semester-III
2022-23

Course Title	**Pre-Stressed Concrete**				
Course Code	**MENSE302T (Elective-III)**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Basic understanding of Structural Analysis**				
Course Objectives	**This course will enable students to:** • This course deals with the introduction and design of prestressed concrete members.				
Course Contents	**UNIT-I** **Introduction And Codal Provisions:** Principles of Prestressing, types and systems of prestressing, need for High Strength materials, Analysis methods losses, deflection (short-long term), camber, cable layouts. Behaviour under flexure, - codal provisions (IS, British ACI and DIN), ultimate strength. **UNIT-II** **Design Principles:** Design of flexural members, Design for Shear, bond and torsion. Design of End blocks and their importance, Design of tension members, application in the design of prestressed pipes and prestressed concrete cylindrical water tanks. **UNIT-III** **Design of Compression Members:** Design of compression members with and without flexure, its application in the design piles, flag masts and similar structures. **UNIT-IV** **Continuous Beams:** Application of prestressing in continuous beams, concept of linear transformation, concordant cable profile and cap cables. **UNIT-V** **Composite Beams**: Composite beams, analysis and design, ultimate strength, their applications. Partial prestressing, its advantages and applications.				
Course Outcomes	**After the completion of course:** • Understanding of the behavior of prestressed concrete structures which is an advanced topic of civil engineering. • Knowledge of calculation of effect of prestressing on statically determinate structures and statically indeterminate structures. • Design, analysis, detailing and construction of prestressed concrete structural. • Develop knowledge of contemporary issues • Use the techniques, skill, and modern engineering tools necessary for pre-				

	tensioning technology and post-tensioning technology.
Text Books	1. Prestressed Concrete by Krishna Raju, Tata McGraw Hill Publishing Co. 2. Fundamentals of Prestressed Concrete by N.C.Sinha & S.K.Roy S.Chand & Co.
Reference Books	1. T.Y.Lin, Design of Prestressed Concrete Structures, John Wiley and Sons, Inc. 2. Evans, R.H. and Bennett, E.W., Prestressed Concrete, Champman and Hall, London.

M.Tech. (Structural Engineering)
Semester-III
2022-23

Course Title	**Technical Paper Writing And Seminar**				
Course Code	**MENGE303P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**4**	**2**	
Prerequisites	**Nil**				
Course Objectives	**This course will enable students to:** • Describe the research process. • Outline the elements of a thesis/dissertation. • Select a research topic of importance to the profession. • Effectively work with their academic advisor and graduate committee. • Develop and follow an appropriate timeline for completion of the thesis/dissertation. • Identify an appropriate theory base for their research. • Develop a conceptual model relevant to their research.				
Course Contents	• Each student will select a topic in the area of geo-tech engineering and related area in the state of art area & technical development. • The topic will be decided by the Student, Guide and Departmental research committee. • Each student will make seminar presentation with audio/video aids, for the duration of 45 minutes and seminar work shall be in form of report to be submitted by the students at the end of the semester. • This report copies must be duly signed by guide and Head of Department. Attendance of all students for all seminars is compulsory. • Define the statement of research problem • Literature survey, familiarity with research journals • Broad knowledge off the available techniques to solve the problems • Technical writing skills • Presentation skills				
Course Outcomes	**After the completion of course:** • Acceptable with minor or no revisions (no further approval required) • Acceptable with major revisions in content or format not acceptable				
Reference	1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the				

Books	selected topic of research. 2. Roberts, C. M. (2010). The dissertation journey. Thousand Oaks, CA: Corwin.

M.Tech. (Structural Engineering)
Semester-III
2022-23

Course Title	**Pre-dissertation (Literature Review/ Problem Formulation/ Synopsis)**				
Course Code	**MENGE304P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**20**	**10**	
Prerequisites	**Nil**				
Course Objectives	**This course will enable students to:** • Demonstrate the skills for good presentation and technical report writing skills. • Apply engineering and management principles while executing the project.				
Course Contents	• Each student will select a topic in the area of geo-tech engineering and related area in the state of art area & technical development. • Every student will carry out dissertation under the supervision of a Supervisor. • The topic shall be approved by a committee constituted by the Head of the concerned department. • Every student will be required to present two seminar talks, First at the beginning of the Dissertation (Phase-I)to present the scope of the work and to finalize the topic, and second towards the end of the semester, presenting the work carried out by him/her in the semester. • The committee constituted will screen both the presentations and work. • Define the statement of research problem • Literature survey, familiarity with research journals • Broad knowledge off the available techniques to solve the problems • Technical writing skills • Presentation skills				
Course Outcomes	**After the completion of course:** • Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. • Students will be able to use different experimental techniques. • Students will be able to use different software/computational/analytical tools. • Students will be able to design and develop an experimental set up/equipment/test rig. • Students will be able to conduct tests on existing set ups/equipments and draw				

	logical conclusions from the results after analyzing them. • Students will be able to either work in a research environment or in an industrial environment.
Reference Books	1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. 2. Roberts, C. M. (2010). The dissertation journey. Thousand Oaks, CA: Corwin.