SUNRISE UNIVERSITY ,ALWAR

CIVIL ENGINEERING DEPARTMENT

COURSE-M. TECH. BRANCH- STRUCTURAL ENGINEERING

1ST YEAR

SEMESTER - I

Code	Subject	Hrs. /Week				Exam Hrs.	Maximum Marks			
		L	T	P		MS 1	MS2	ENDTERM	IA	Total
Theory										
1MSE01	Advanced Structural Analysis	3	1	0	3	10	10	60	20	100
1MSE02	Theory of Thin Plates and Shells	3	1	0	3	10	10	60	20	100
1MSE03	Structural Dynamics	3	1	0	3	10	10	60	20	100
1MSE04	Research Methodology & Information Patent Right	2	1	0	3	10	10	60	20	100
Practicals&Sessionals										
Code	**Subject**	**Hrs. /Week**				**Exam Hrs.**	**IA (60%)**		**EA (40%)**	**Total**
		L	T	P		MP1* 30%	MP2* 30%	Pr.W 40%		
1MSE05	Computer Aided Design Lab	0	0	2	3	30	30	40		100
	GRAND TOTAL									500

SUNRISE UNIVERSITY ,ALWAR

CIVIL ENGINEERING DEPARTMENT

COURSE- M. TECH. **BRANCH- STRUCTURAL ENGINEERING**

1ST YEAR

SEMESTER – II

Code	Subject	Hrs. /Week			Exam Hrs.	Maximum Marks				
		L	T	P		MS 1	MS2	END TERM	IA	Total
Theory										
2MS E01	FEM in Structural Engg.	3	1	0	3	10	10	60	20	100
2MS E02	Design of Advanced Concrete Technology	3	1	0	3	10	10	60	20	100
2MS E03	Advanced Steel Design	3	1	0	3	10	10	60	20	100
2MS E04	Advanced Solid Mechanics	2	1	0	3	10	10	60	20	100
Practicals&Sessionals										
Code	Subject	Hrs. /Week			Exam Hrs.	IA (60%)		EA (40%)		Total
		L	T	P		MP 1* 30 %	MP2* 30%	Pr.W 40%		
2MS E05	Advanced Concrete Technology Lab	0	0	2	3	30	30	40	100	
	GRAND TOTAL								500	

SUNRISE UNIVERSITY ,ALWAR

CIVIL ENGINEERING DEPARTMENT

COURSE -M. TECH. **BRANCH- STRUCTURAL ENGINEERING**

2rd YEAR

SEMESTER - III

Code	Subject	Hrs. /Week				Exam Hrs.	Maximum Marks			
		L	T	P		MS 1	MS2	END TERM	IA	Total
Theory										
3MS E01	Design of Masonry Structures	3	1	0	3	10	10	60	20	100
3MS E02	Bridge Design and Construction Practices.	3	1	0	3	10	10	60	20	100

Practicals&Sessionals

Code	Subject	Hrs. /Week				Exam Hrs.	IA (60%)		EA (40%)	Total
		L	T	P		MP 1* 30 %	MP2* 30%		Pr.W 40%	
3MS E03	Seminar	0	0	0	0	0	0		300	100
3MS E04	Dissertation Part -I	0	0	0	0	0	0		100	100
										400

SUNRISE UNIVERSITY ,ALWAR

CIVIL ENGINEERING DEPARTMENT

COURSE M. TECH. **BRANCH- STRUCTURAL ENGINEERING**

2rd YEAR

SEMESTER - IV

Practicals&Sessionals									
Code	**Subject**	**Hrs. /Week**			**Exam Hrs.**	**IA (60%)**		**EA (40%)**	**Total**
		L	**T**	**P**		**MP1* 30 %**	**MP2* 30%**	**Pr.W 40%**	
4MSE01	**Dissertation Part-II**	**0**	**0**	**3**	**0**	**0**	**0**	**400**	**400**
	GRAND TOTAL								**400**

SUNRISE UNIVERSITY JAIPUR

Course Syllabus

M. Tech – I Year –I Sem. (Structure Engg.)

Exam Hrs:3 **1MST01: Advanced Structural Analysis**

Course Objectives:

1. To revise basic principles related to structural analysis
2. To make student understand about stiffness and flexibility methods of structural analysis
3. To study the application of matrix methods in simple beams, trusses and rigid jointed structures
4. To introduce boundary value problems and approximate approach in structural analysis

SN	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course.	1
2.	Static and kinematic indeterminacy, Principle of virtual work, Force-displacement Relationship and methods, element approach.	8
3.	**Stiffness Matrix Assembly of Structures:** Stiffness and flexibility Matrix in local and Global Coordinates, Boundary Condition Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.	9
4.	**Applications to Simple Problems:** Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.	12
5.	**Boundary Value Problems (BVP):** Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.	10
	Total	40

TEXT BOOK:

1. *Matrix Analysis of Framed Structures, Weaver and Gere. CBS Publication*

REFERENCE BOOKS:

1. *The Finite Element Method, Lewis P. E. and WardJ. P., Addison-Wesley Publication Co.*
2. *Computer Methods in Structural Analysis, MeekJ. L., E and FN, Span Publication.*
3. *The Finite Element Method, Desai and Abel, CBS Publication.*

Course outcomes:*At the end of the course, students will be able to*

1. *Understand the basic concepts and theorems in structural analysis*
2. *Analyze the skeleton structures using stiffness and flexibility analysis approach*
3. *Apply matrix methods in solution of plane trusses, beams and rigid jointed frames*
4. *Solve approximate Boundary value problems*

SUNRISE UNIVERSITY JAIPUR

Course Syllabus

M. Tech – I Year – I Sem. (Structure Engg.)

Exam Hrs:3 **1MSE02:Theory of Thin Plates and Shells** **Credits:3**

Course Objectives:

1. To introduceanalytical methods for the solution of thin plates and shells.
2. To learn methods for the solution of shells.
3. To introduce numerical techniques and tools for the complex problems in thin plates.

Sr/No.	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course.	1
2.	**Introduction:** Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, AssumptionsinShellTheory, DisplacementFieldApproximations, StressResultants,Equation of Equilibrium using Principle of Virtual Work, BoundaryConditions.	9
3	**Static Analysis of Plates**: Governing Equation for a Rectangular Plate, Navier Solution for Simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.	10
4.	**Circular Plates:** Analysis under Axis- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.	10
5.	**Static Analysis of Shells: Membrane Theory of Shells** - Cylindrical, Conical and Spherical Shells**.** **Shells of Revolution with Bending Resistance** - Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels. Thermal Stresses in Plate/ Shell.	10
	Total	40

TEXT BOOKS:

1. *Theory of Plates and Shells, Timoshenko S. and KriegerW., McGraw Hill.*
2. *Design and Construction of Concrete Shell Roofs, Ramaswamy G.S., CBS Publishers and Distributors Pvt Ltd.*

REFERENCES BOOKS:

1. *Stresses in Plates and Shells, UguralAnsel C., McGraw Hill.*
2. *Thin Elastic Shells, KrausH., John Wiley and Sons.*
3. *Theory of Plates, ChandrashekharaK., Universities Press.*

Course Outcomes:*At the end of the course, students will be able to*

1. *Use analytical methods for the solution of thin plates and shells.*
2. *Use analytical methods for the solution of shells.*
3. *Apply the numerical techniques and tools for the complex problems in thin plates.*

SUNRISE UNIVERSITY JAIPUR
Course Syllabus
M. Tech – I Year – I Sem. (Structure Engg.)

Exam Hrs:3 **1MSE03: Structural Dynamics**

Course Objectives:

1. To introduce thebasic elements of Structural Dynamics and related terminology.
2. To perform dynamic analysis for various damped and undamped systems
3. To study the vibrating systems subjected to dynamic loads and base excitation
4. To learn the applications of single degree and multi degree freedom systems to continuous systems

S. No.	Content	Contact Hours
1.	**Introduction**: Objective, scope and outcome of the course.	1
2.	**Introduction to Dynamics of Structures**: Types of Dynamic Loads, Static vs Dynamic Analysis; Basic Concept of Vibration: Mass, Stiffness and Damping, Torsional Stiffness, Equivalent Stiffness; Mathematical Modeling: Degrees of Freedom, Continuous System, Lumped Mass Idealization; Free and Forced Vibrations; Consequences of Vibration and its Control; Simple Harmonic Motion: Vector representation of S.H.M; (1hr).	4
3.	**Free Vibrations of Undamped SDOF System;** Free Body Diagram; Formulation of Differential Equation of Motion by Newton's Law of Motion, D'Alembert's Principle and Energy Approach, Natural Frequency and Time Period of Vibration;Various methods of Solution of Differential Equation of Motion. Torsional Vibration.	4
4.	**Free Vibrations of Damped SDOF System:** Types of Damping, Formulation and Solution of Differential Equation of Motion, Characteristic Equation, Critical Damping; Critically Damped, Over Damped and Under Damped System: Characteristic of their Resulting Response, Damped Natural Frequency; Logarithmic Decrement.	6
5.	**Forced vibration (under Harmonic Excitation**): Undamped and Underdamped SDOF System: Formulation and Solution of Differential Equation of Motion; Dynamic Magnification Factor, Frequency Ratios and Damping Factors, and Phase angles.	5
6.	**Base Excited Vibrations:** Underdamped SDOF System: Formulation and Solution of Differential Equation of Motion and its Solution; Transmissibility and vibration Isolation. Application to Rotary and Reciprocating Unbalance; Seismic Instrument: Basic Principle, Types of Seismic Instruments.	5
7.	**Two Degree of Freedom Systems**: Formulation of equations of motion. Undamped free vibrations and Principle Mode of Vibration and mode shapes: Analysis of Dynamic response, Normal co-ordinates, Uncoupled equations of motion, Orthogonal, properties of normal modes; Coordinate Coupling: Static and Dynamic Coupling.	6

8.	**Introduction to MDOF Systems**: Selection of the degrees of Freedom, Evaluation of structural property matrices; Undamped Free Vibrations; Formulation of the MDOF equations of motion, Solutions of Eigen value problem for natural frequencies; Approximate Methods of Determining Fundamental Frequencies: Basic Procedure of Stodola Method, Dunkerley's Method.	**5**
9.	**Introduction to Continuous Systems**: Flexural vibrations of beams: Elementary case, Derivation of governing differential equation of motion, Analysis of undamped free vibrations of beams in flexure: Natural frequencies and mode-shapes of simple beams.	**4**
	Total	**40**

TEXT BOOKS:

1. *Dynamics of Structures by Clough and Penzien, McGraw Hill, New York*
2. *Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.*
3. *Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi.*

REFERENCE BOOKS:

1. *Theory of vibrations by W.T. Thomson CBS Publishers and Distributors.*
2. *Structural Dynamics by Roy. R. Craig John willey& fours.*
3. *I.S: 1893 (Part 1) - 2016, "Code of practice for Earthquake resistant design of Structures*

Course Outcomes:*At the end of the course, students will be able to:*

1. *Understand the Objective and basic elements of Structural Dynamics and related terminology.*
2. *Perform dynamic analysis for various damped and undamped systems under free vibration.*
3. *Analyze the vibrating system subjected to dynamic loads, base excitation and its application to real problem.*
4. *Extend the concept of single degree of freedom system to multi degree freedom systems and continuous systems.*

SUNRISE UNIVERSITY JAIPUR

Course Syllabus

M. Tech – I Year – I Sem. (Structure Engg.)

Exam Hrs:3 **1MSE04: Research Methodology & IPR** **Credit:3**

Course Objectives:

1. To understand basics of the research problem formulationand analyze the research related information
2. To learn theimportance of research ethics, and appreciate the usefulness of ideas, concept and creativity in next gen.
3. To know the application of IPR in the growth of individual and nation
4. To know importance of investment in R & D in creation of new and better products for economic and social benefits

Sr/No.	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course.	1
2.	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.	7
3.	Effective literature studies approach, analysis, Plagiarism, Research ethics. Effective technical writing, how to write report, Paper. Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	8
4.	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	8
5.	**Patent Rights:** Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	8
6.	**Patent Rights:** Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR.	8
	Total	40

REFERENCE BOOKS:

1. *Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"*
2. *Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.*
3. *Mayall, "Industrial Design", McGraw Hill, 1992.*
4. *Niebel, "Product Design", McGraw Hill, 1974.*
5. *Asimov, "Introduction to Design", Prentice Hall, 1962.*
6. *Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.*
7. *Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.*

Course Outcomes: *At the end of this course, students will be able to*

1. *Understand research problem formulation and analyze research related information*
2. *Know the follow research ethics and appreciate the usefulness of ideas, concept and creativity in next gen*
3. *Understand the application of IPR in the growth of individual and nation*
4. *Know importance of investment in R & D in creation of new and better products for economic and social benefits*

SUNRISE UNIVERSITY JAIPUR

Course Syllabus
M. Tech – I Year – I Sem. (Structure Engg.)

Exam Hrs:3 1MSE03: Design of Advanced Concrete Structures

Course Objectives:

1. Structural behavior and serviceability of RCC members, relatedcodal provisions with their applications in design.
2. Limit state design method in depth of various RCC Members and to prepare accordingly detailed structural drawings.
3. To study the Yield Line theory for analysis and design of slabs.
4. To design of flat slabs, retaining walls, footings and stair caseetc

Sr/No.	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course.	1
2.	**Limit State Design:** Revision of Basic Concepts of Limit State Design of Prismatic Members in Flexure, Shear & Bond. Limit State Analysis and Design of Continuous Beams using Coefficient, Reinforcement Detailing & Curtailment provisions as per Code.	3
3	**Redistribution of Moment:** Concept of Redistribution of Moments in Fixed & Two Span Continuous Beams.	3
4	**Serviceability Requirements:** Limit State of Serviceability of Beams and Slabs in Deflection. Calculation of Deflection due to Loads, Shrinkage & Creep; Calculation of Crack Width as per IS Code.	5
5.	**Flat Slabs:** Direct design method: Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns. Shear in Flat Slabs-Check for one way and two-way shears. Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.	6
6	**Yield Line Analysis:** Yield Line Analysis for slabs: Upper bound and lower bound theorems – yield line criterion – Virtual work and equilibrium methods of analysis – For square and circular slabs with simple and continuous end conditions, special aspects, introduction to Hillerborg's strip method	6

7	**Columns and Footing:**Design of Slender Columns. Analysis and Design of (i) Isolated Footing subjected to Axial Load and Moment (ii) Combined Rectangular Footing for Two Columns subjected to Axial Loads and moments. Reinforcement Detailing	**5**
8	**Retaining walls:**Structural behavior of retaining walls, Analysis and design of Counterfort Retaining Wall, Stability of Retaining Walls, Reinforcement Detailing.	**6**
9	**Ribbed Floor and Shell Roofs:** Introduction to Structural Behavior and Construction & Design Features of Ribbed floor, Shell Roofs and Stresses in Simple Semicircular Shell. **Stair Case:** Types and Planning of Staircases, Analysis and Design of Staircase spanning longitudinally on Waist slab. Reinforcement detailing.	**5**
	Total	**40**

TEXT BOOKS:

1. *"Reinforced Concrete Design" S. Unnikrishna Pillai &Devdas Menon; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.*
2. *"Advanced Reinforced Concrete" P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.*
3. *"Limit State Theory and Design of Reinforced Concrete" Dr. S. R. Karve and V.L Shah. Standard Publishers, PUNE 2004.*

REFERENCE BOOKS:

1. *"Design of Reinforced Concrete Structures" by N.Subramanian, Oxford University Press.*
2. *Reinforced concrete structural elements – behaviour, Analysis and design by P. Purushotham, Tata Mc.Graw-Hill, 1994.*
3. *Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.*
4. *Reinforced Concrete design by KennathLeet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.*
5. *"Design Reinforced Concrete Foundations" P.C. Varghese Prentice Hall of*

INDIA Private Ltd. 6. IS 456-2000

Course Outcomes: *At the end of the course, students will be able to:*

1. *Apply the structural behavior and serviceability aspect of various RCC members along with the codal provisions in design*
2. *Design the various RCC Members using LSD and prepare accordingly detailed structural drawings.*
3. *Understand and apply the Yield Line theory for analysis and design of slabs.*
4. *Design flat slabs, retaining walls, footings and stair case etc.*

1MST1-07: Structural Design Lab

Lab: 4hrs/week

Course Objectives:

1. To study the analysis of RCC framed structures by equivalent frame method
2. To learn the method of design of structural elements of single storey RCC frame building
3. To introduce the design of the Structural Components of RCC Frame Buildings with reinforcement detailing

1. Analyse RCC framed structures by Equivalent Frame Method (EFM)
2. Analyse a typical intermediate floor of a four storeyed office multi-bay building through EFM.
3. Analyse a four storeyed multi bay (in both the directions) RCC residential /commercial framed structure for different load combinations and determination of design forces, moments etc.
4. Structural design as a RCC building for the forces and moments etcdetermined in exercise no 3 by IS Codes.
5. Reinforcement detailing of the structure designed at exercise no 4 as per IS codes.

Course Outcomes: *At the end of the course, students will be able to*

1. *Analysis of RCC framed structures by equivalent frame method*
2. *Design structural elements of single storey RCC frame building with multi bays in both the directions*
3. *Design and Detail all the Structural Components of RCC Frame Buildings.*
4. *Design and Detail steel reinforcement in a Multi-Storey RCC Frame Building upto four storeys.*

SUNRISE UNIVERSITY, ALWAR
Course Syllabus
M. Tech – I Year – II Sem. (Structure Engg.)

Exam Hrs:3 2MSE01: Finite Element Method in Structural Engineering Credit:3

Course Objectives:

1. To study the basic concepts and terms in Finite Element Analysis
2. To learn the problem formulation in FEM using approximate methods andin Solid Mechanics
3. To study the application of various types of elementsand shape functions in FEM
4. To introduce concepts of Eigen value problems and non-linear analysis

Sr/No.	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course.	1
2.	**Introduction:** Concept of FEM, Applications and advantages, Steps in finite element method, Discretization, types of elements and shape functions. Review: Matrix algebra and solution of simultaneous equations. **Finite element analysis of 1-D problems**: formulation by different approaches (direct method and potential energy); Derivation of elemental equations and their assembly, solution and its postprocessing.	7
3.	Basic Principal of Structural Mechanics, Element Properties, Finite Element formulation Introduction of Ritz method and Galerkin Method.	8
4.	1-D and 2-D problems from Structural Mechanics: Bar, Plane stress and plane strain problems, Axisymmetric problems. Bending of beams, analysis of truss and frame.	8
5.	Higher order elements, Isoperimetric formulation, Serendipity and Lagrange family elements, Numerical integration, convergence Criteria.	8
6.	1-D steady state heat conduction and fluid flow: Derivation of elemental equations, Application of boundary conditions.	8
7	Brief Introduction of Eigen –Value Problems & Nonlinear Problems: Review of iterative and incremental procedure for material and geometrical nonlinearity.	
	Total	**40**

TEXT BOOKS:

i. *CS KRISHNAMOORTHY, Finite Element Analysis,Tata McGraw Hill.*
ii. *M. Rama NarshimaReddy,K.Srinivasa Reddy, Finite Element Methods in Civil Engineering.SCITECH PUBLICATION (INDIA)PVT LTD.*

REFERENCE BOOKS:

1. *Finite Element Analysis, Seshu P., Prentice-Hall of India,2005.*
2. *Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.*
3. *Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2004.*
4. *Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.*
5. *Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier, 2000.*
6. *Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, 1991.*

Course Outcomes: *At the end of this course, students will be able to*

1. *Understand basic terms and Discretize and assemble the structure*
2. *Apply the FEM in structural mechanics and numerical approximations*
3. *Solve the problems related to bars, axisymmetric, plane stress and strain.*

4. *Analyze the problems using higher order element, isoperimetric elements and using shape functions.*
5. *Apply FEM to different boundary conditions, Eigen value problems and non-linear analysis*

SUNRISE UNIVERSITY, ALWAR

Course Syllabus
M. Tech – I Year – II Sem. (Structure Engg.)

Exam Hrs:3 **2MSE02: Design of Advanced Concrete Structures** **Credit:3**

Course Objectives:

5. Structural behavior and serviceability of RCC members, relatedcodal provisions with their applications in design.
6. Limit state design method in depth of various RCC Members and to prepare accordingly detailed structural drawings.
7. To study the Yield Line theory for analysis and design of slabs.
8. To design of flat slabs, retaining walls, footings and stair caseetc

Sr/No.	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course.	1
2.	**Limit State Design:** Revision of Basic Concepts of Limit State Design of Prismatic Members in Flexure, Shear & Bond. Limit State Analysis and Design of Continuous Beams using Coefficient, Reinforcement Detailing & Curtailment provisions as per Code.	3
3	**Redistribution of Moment:** Concept of Redistribution of Moments in Fixed & Two Span Continuous Beams.	3
4	**Serviceability Requirements:** Limit State of Serviceability of Beams and Slabs in Deflection. Calculation of Deflection due to Loads, Shrinkage & Creep; Calculation of Crack Width as per IS Code.	5
5.	**Flat Slabs:** Direct design method: Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns. Shear in Flat Slabs-Check for one way and two-way shears. Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.	6
6	**Yield Line Analysis:** Yield Line Analysis for slabs: Upper bound and lower bound theorems – yield line criterion – Virtual work and equilibrium methods of analysis – For square and circular slabs with simple and continuous end conditions, special aspects, introduction to Hillerborg's strip method	6
7	**Columns and Footing:**Design of Slender Columns. Analysis and Design of (i) Isolated Footing subjected to Axial Load and Moment (ii) Combined Rectangular Footing for Two Columns subjected to Axial Loads and moments. Reinforcement Detailing	5
8	**Retaining walls:**Structural behavior of retaining walls, Analysis and design of Counterfort Retaining Wall, Stability of Retaining Walls, Reinforcement Detailing.	6

9	**Ribbed Floor and Shell Roofs:** Introduction to Structural Behavior and Construction & Design Features of Ribbed floor, Shell Roofs and Stresses in Simple Semicircular Shell. **Stair Case:** Types and Planning of Staircases, Analysis and Design of Staircase spanning longitudinally on Waist slab. Reinforcement detailing.	**5**
	Total	**40**

TEXT BOOKS:

4. *"Reinforced Concrete Design" S. Unnikrishna Pillai &Devdas Menon; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.*
5. *"Advanced Reinforced Concrete" P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.*
6. *"Limit State Theory and Design of Reinforced Concrete" Dr. S. R. Karve and V.L Shah. Standard Publishers, PUNE 2004.*

REFERENCE BOOKS:

6. *"Design of Reinforced Concrete Structures" by N.Subramanian, Oxford University Press.*
7. *Reinforced concrete structural elements – behaviour, Analysis and design by P. Purushotham, Tata Mc.Graw-Hill, 1994.*
8. *Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.*
9. *Reinforced Concrete design by KennathLeet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.*
10. *"Design Reinforced Concrete Foundations" P.C. Varghese*

Prentice Hall of INDIA Private Ltd. 6. IS 456-2000

Course Outcomes:*At the end of the course, students will be able to:*

1. *Apply the structural behavior and serviceability aspect of various RCC members along with the codal provisions in design*
2. *Design the various RCC Members using LSD and prepare accordingly detailed structural drawings.*
3. *Understand and apply the Yield Line theory for analysis and design of slabs.*
4. *Design flat slabs, retaining walls, footings and stair case etc.*

SUNRISE UNIVERSITY, ALWAR
Course Syllabus
M. Tech – I Year – II Sem. (Structure Engg.)

Exam Hrs:3 **2MSE03: Advanced Steel Design**

1. To learn basic properties and design processes in steel structures/ components along with stability and buckling of beams
2. To understand the Analysis and design of columns for stability and strength
3. To study the method of design
3. To understand the design process of welded and bolted connections and drift criterion

Sr/No.	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course.	1
2.	**Properties of Steel:** Mechanical Properties, Hysteresis, Ductility. **Hot Rolled Sections:** compactness and non-compactness, slenderness, residual stresses.	6
3.	**Design of Steel Structures**: Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift. **Stability of Beams:** Local Buckling of Compression Flange &Web, Lateral Torsional Buckling.	7
4.	**Stability of Columns:** Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.	9
5.	**Method of Designs:** Allowable Stress Design, Plastic Design, Load and Resistance Factor Design; **Strength Criteria:** Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones**.**	7
6.	**Drift Criteria:**P-Δ Effect, Deformation Based Design.	10
7.	**Connections:** Welded, Bolted, Beam Column joint Small Moment resistant, Column Foundation, Splices.	
	Total	40

TEXT BOOKS:

1. *Limit state Design in Structural Steel by Shiyekar M.R PHI Publications.*
2. *IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.*
3. *Teaching Learning Material From Insdag .http://www.steel-insdag.orgpdf.*

REFERENCE BOOKS:

1. *Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.*
2. *Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee.*
3. *The Steel Skeleton- Vol. II, Plastic Behavior and Design - Baker J. F., Horne M. R., Heyman J., ELBS.*
4. *Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.*
5. *SP – 6 - Handbook ofStructural Steel Detailing, BIS,1987*

Course Outcomes: *At the end of the course, students will be able to*

1. *Design steel structures/ components by different design processes along with stability and buckling of beams*
2. *Analyze and design of columns for stability and strength*
3. *Design welded and bolted connections and drift criterion*

SUNRISE UNIVERSITY, ALWAR

Course Syllabus

M. Tech – I Year – II Sem. (Structure Engg.)

Exam Hrs :3 **2MSE04: Advanced Solid Mechanics**

Credit:3

Course Objectives:

1. To learn simple problems of elasticity and plasticity and understanding the basic concepts
2. To study the numerical methods to solve continuum problems
3. To introduce the concepts related to torsion
4. To introduce the analysis of advanced topics such as beams on elastic foundation, bending of bars with initial curvature

Sr/No.	Content	Contact Hours
1.	**INTRODUCTION:** Objective, scope and outcome of the course .	1
2.	**Introduction to Elasticity:** Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity. **Strain and Stress Field:** Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Hydrostatic and Deviatoric Components.	6
3.	**Equations of Elasticity:** Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems.	5
4	**Two-Dimensional Problems of Elasticity:** Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.	7
5	**Torsion of Prismatic Bars:** Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.	7
6	**Plastic Deformation:**Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, Von Mises Yield Criterion.	5
7.	**Miscellaneous Topics:** Unsymmetrical bending, beams on elastic foundation,bending of bars with initial curvature, rings hooks etc.	9
	Total	40

TEXT BOOKS:

- *Theory of Elasticity, Timoshenko S. and GoodierJ. N., McGrawHill, 1961.*
- *Advanced Mechanics of Solids, SrinathL.S., Tata McGrawHill,2000.*

REFERENCE BOOKS:

- *Elasticity, Sadd M.H., Elsevier,2005.*
- *Engineering Solid Mechanics, RagabA.R., BayoumiS.E., CRCPress,1999.*

- *Computational Elasticity, AmeenM., Narosa,2005.*
- *Solid Mechanics, KazimiS. M. A., Tata McGrawHill,1994.*
- *Theory of Plasticity by J.ChakrabartyButterworth-Heinemann Publications.*
- *THEORY OF ELASTICITY AND PLASTICITY by H. JANE HELENA PHI PUBLICATIONS.*

Course outcomes: *At the end of the course, students will be able to*

1. *Solve simple problems of elasticity*
2. *Solve simple problems of plasticity and continuum mechanics*
3. *Analyze the problems related to torsion in bars*
4. *Analyze beams on elastic foundation, hooks and rings, unsymmetrical bending in beams*

2MSE05 : Advanced Concrete Lab

Course Objectives:

1. To introduce design of high grade concrete and study the parameters affecting its performance
2. To learn and conduct Non-Destructive Tests on existing concrete structures
3. To apply engineering principles to understand behavior of structural/ elements

List of Experiments/Assignments:

1. Determination of bond strength of specimens with M25 Grade and M50 Grade concrete.
2. Preparation of M40 Grade pumpable concrete with superplasticizer and supplementary cementitious materials
3. Preparation of M60 Grade self- compacting concrete and testing it for properties in fresh and hardened states.
4. Determinestress-straincurveof highstrengthconcrete specimens (M60 or higher grade).
5. Determine correlationbetweencubestrength,cylinder strength, split tensile

strength and modulus ofrupture with normal strength concrete and high strength concrete mixes

6. Non-Destructive testing of existingconcrete members through rebound hammer, Ultrasonic pulse velocity meter, resistivity meter, carbonation test and core test.
7. Behavior of Reinforced Concrete Beam specimen- measurement of strains at various levels through LVDTs, strain Gages- determination of moment curvature relationship

TEXT BOOKS:

1. *Concrete Technology, Shetty M. S., S. Chand and Co.,2006.*

REFERENCE BOOKS:

1. *Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall,2012.*
2. *Reinforced Concrete Structures, R.Park And T.Paulay Willey &Sons , INC.*

Course Outcomes: *At the end of the course, students will be able to*

1. *Design high grade concrete and study the parameters affecting its performance.*
2. *Conduct Non-Destructive Tests on existing concrete structures.*
3. *Apply engineering principles to understand behavior of structural/ elements.*