SYLLABUS

STRUCTURAL ENGINEERING

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**I/I**	**3**	**0**	**0**	**3**
Subject Name		**Advanced Structural Analysis**				
Subject Code		**MCESE20S101**				
Paper	**English**	**English**				
	Hindi					
Max. Marks		**100**				

Course Objectives:

1. To impart the principles of elastic structural analysis and behavior of indeterminate structures.

2. To impart knowledge about various methods involved in the analysis of indeterminate Structures.

3. To apply these methods for analyzing the indeterminate structures.

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

CO1. Analyze the skeleton structures using stiffness analysis code.

CO2. Use direct stiffness method understanding its limitations.

CO3. To enable the student, get a feeling of how real-life structures behave.

CO4. To make the student familiar with latest computational techniques and software used for Structural analysis.

CO5. Evaluate the response of Structures.

Unit	Syllabus	Periods
UNIT-I	**Influence Coefficients:** Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach. Stiffness Method applied to Large Frames: Local Coordinates and Global Coordinates.	**8**
UNIT-II	**Stiffness Matrix Assembly of Structures:** Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.	**9**
UNIT-III	**Applications to Simple Problems:** Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.	**11**

UNIT-IV	**Boundary Value Problems (BVP):** Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.	**13**
UNIT-V	**Linear Element:** Shape Functions, Solution for Poisson's Equation, General One-Dimensional Equilibrium Problem.	**14**

Textbooks:

1. Computer Methods in Structural Analysis, Meek J. L., E and FN, Span Publication.
2. The Finite Element Method, Desai and Able, CBS Publication.

References books:

1. The Finite Element Method, Lewis P. E. and Ward J. P., Addison-Wesley Publication Co.

ABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Advanced Solid Mechanics				
Subject Code		MCESE20S102				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objective:

1. The course is designed to give fundamental knowledge of mechanics of deformable solids.
2. Including stress, strain, stress – strain relations, theories of failure and energy methods.
3. To study the basics of the Finite Element Technique, a numerical tool for the solution of different classes of problems.

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

CO1: Solve simple problems of elasticity and plasticity understanding the basic concepts.

CO2: Apply numerical methods to solve continuum problems.

CO3: On completion of this course, the students will know the concept of finite element analysis.

CO4: Enable to analyze framed structure, Plate and Shells.

CO5: Modify using recent software's.

Unit	Syllabus	Periods
UNIT-I	**Introduction to Elasticity:** Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.	8
UNIT-II	**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, Differential Equations of Equilibrium, Hydrostatic and Deviatory Components.	9
UNIT-III	**Equations of Elasticity:** Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axially of the Principal Directions.	11

UNIT-IV	**Two-Dimensional Problems of Elasticity:** Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.	**13**
UNIT-V	**Torsion of Prismatic Bars & Plastic Deformation:** Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes. Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.	**14**

Textbook:

1. Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.

References books:

1. Engineering Solid Mechanics, Ragab A.R., Bayoumi S.E., CRC Press, 1999.
2. Solid Mechanics, KazimiS. M. A., Tata McGraw Hill, 1994.
3. Advanced Mechanics of Solids, Srinath L.S., Tata McGraw Hill, 2000.

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Theory of Thin Plates and Shells				
Subject Code		MCESE20S103				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. To introduce the concept of plate theory.
2. To study the behaviour and analysis of thin plates.
3. To study the behaviour and analysis of rectangular plates and circular plates.
4. To present the foundations of the classical theory of shells based on the Kirchhoff Love assumptions.

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

CO1: Use analytical methods for the solution of thin plates and shells.

CO2: Use analytical methods for the solution of shells.

CO3: Apply the numerical techniques and tools for the complex problems in thin plates.

CO4: Apply the numerical techniques and tools for the complex problems in shells.

CO5: To study the classification of shell surfaces Syllabus.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.	8
UNIT-II	**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.	9
UNIT-III	**Circular Plates:** Analysis under Axi-Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.	11

UNIT-IV	**Static Analysis of Shells: Membrane Theory of Shells-** Cylindrical, Conical and Spherical Shell.	**13**
UNIT-V	**Shells of Revolution: with Bending Resistance-** Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels. Thermal Stresses in Plate/Shell.	**14**

Text books:

1. Design and Construction of Concrete Shells, Ramaswamy G.S., McGraw Hill Publication.

References:

1. Theory of Plates and Shells, Timoshenko S. and Krieger W., McGraw Hill Publication.

2. Stresses in Plates and Shells, Ugural Ansel C., McGraw Hill Publication.

3. Thin Elastic Shells, Kraus H., John Wiley and Sons.

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Theory and Applications of Cement Composites				
Subject Code		MCESE20S104				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. To introduce basic concepts related to Composite Materials such as Ferro cement, SIFCON and Fiber Reinforced Concrete.
2. To study materials as Per Orthotropic and Anisotropic Behavior.
3. To study the Strain Constants Using Theories Applicable to Composite Materials.

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

CO1: Formulate constitutive behavior of composite materials – Ferro cement, SIFCON and Fabre Reinforced Concrete - by understanding their strain- stress behavior.

CO2: Classify the materials as per orthotropic and anisotropic behavior.

CO3: Estimate strain constants using theories applicable to composite materials.

CO4: Analyze and design structural elements made of cement composites.

CO5: Learn the Design of Structural elements made of Cement Composites.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.	8
UNIT-II	**Mechanical Behavior:** Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.	9
UNIT-III	**Cement Composites:** Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete – Ferro-cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.	11

UNIT-IV	**Mechanical Properties of Cement Composites**: Behaviour of Ferro-cement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.	**13**
UNIT-V	**Application of Cement Composites:** FRC and Ferro-cement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials-Orthotropic and Anisotropic behavior, Constitutive relationship, Elastic Constants. Analysis and Design of Cement Composite Structural Elements –Ferro cement, SIFCON and Fibre Reinforced Concrete.	**14**

Text Books:

1. Fibre Reinforced Cement Composites, P. N. Balaguru and S P Shah, McGraw Hill, 1992.

Reference Books:

1. Mechanics of Composite Materials, Jones R. M, 2nd Ed., Taylor and Francis, BSP Books, 1998.
2. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.
3. New Concrete Materials, Swamy. N, 1st Edition, Blackie, Academic and Professional, Chapman & Hall, 1983.

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Theory of Structural Stability				
Subject Code		MCESE20S105				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. To impart the principles of elastic structural analysis and behaviour of indeterminate structures.
2. To impart knowledge about various methods involved in the analysis of indeterminate structures.
3. To apply these methods for analyzing the indeterminate structures to evaluate the response of structures.

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

CO1: Determine stability of columns and frames.

CO2: Determine stability of beams and plates.

CO3: Use stability criteria and concepts for analyzing discrete and continuous systems.

CO4: Enable the student get a feeling of how real-life structures behave.

CO5: Make the student familiar with latest computational techniques and software structural.

Unit	Syllabus	Periods
UNIT-I	**Criteria for Design of Structures:** Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behavior.	8
UNIT-II	**Stability of Columns:** Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.	9
UNIT-III	**Stability of Frames:** Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members. Stability of Beams laterals torsion buckling.	11
UNIT-IV	**Stability of Plates:** Axial flexural buckling, shear flexural buckling, buckling under combined loads.	13
UNIT-V	Introduction to Inelastic Buckling and Dynamic Stability.	14

Text Books: **1.** Theory of elastic stability, Timoshenko and Gere Tata McGraw Hill, 1981.
Reference Books: 1. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey. 2. Structural Stability of columns and plates, Iyengar, N. G. R., and Eastern west press Pvt. Ltd. 3. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York.

US

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Analytical and Numerical Methods for Structural Engineering				
Subject Code		MCESE20S106				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Select and use appropriate methods for finding roots of equations as well as interpolation and approximation methods.
2. Use numerical methods to solve systems of equations.
3. Understand the processes of numerical simulation, modeling, optimization, identification, and visualization of engineering systems.

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

CO1: Solve ordinary and partial differential equations in structural mechanics using numerical methods.

CO2: Write a program to solve a mathematical problem.

CO3: Use numerical methods for differentiation and integration with engineering applications.

CO4: Solve boundary value problems using the finite difference method.

CO5: Solve time-dependent problems.

Unit	Syllabus	Periods
UNIT-I	**Fundamentals of Numerical Methods:** Error Analysis, Polynomial Approximations and Interpolations, Curve Fitting Interpolation and extrapolation. Solution of Nonlinear Algebraic and Transcendental Equations.	8
UNIT-II	**Elements of Matrix Algebra**: Solution of Systems of Linear Equations, Eigen Value Problems.	9
UNIT-III	**Numerical Differentiation & Integration:** Solution of Ordinary and Partial Differential Equations.	11
UNIT-IV	**Finite Difference scheme**: Implicit &Explicit scheme.	13
UNIT-V	**Computer Algorithms:** Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.	14

Text Books: 1. Introductory Methods of Numerical Analysis Sastry S. S, Prentice Hall of India, 1998.
Reference Books: **1.** An Introduction to Numerical Analysis, Atkinson K.E., J. Wiley and Sons, 1989. **2.** Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (Shaum Series), 1988. **3.** Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India, 1998.

.

ABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Structural Health Monitoring				
Subject Code		MCESE20S107				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Implement fundamental concepts in structural health monitoring.
2. Demonstrate understanding of working principles of sensors and actuators made from smart materials.
3. Describe and classify various diagnostic methods of structural health monitoring, with their associated advantages and disadvantages.

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

CO1: Diagnose is the distress in the structure understanding the causes and factors.

CO2: Assess the health of structure using static field methods.

CO3: Assess the health of structure using dynamic field tests.

CO4: Suggest repairs and rehabilitation measures of the structure.

CO5: Describe the historical and current real-world applications of damage identification in the aerospace, civil, and mechanical engineering fields.

Unit	Syllabus	Periods
UNIT-I	**Structural Health:** Factors affecting Health of Structures, Causes of Distress, Regular Maintenance. Structural Health Monitoring Concepts, Various Measures, Structural Safety in Alteration.	8
UNIT-II	**Structural Audit:** Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.	9
UNIT-III	**Static Field Testing:** Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.	11
UNIT-IV	**Dynamic Field Testing:** Types of dynamic field test, stress history data, dynamic response methods, hardware for remote data acquisition systems, remote structural health monitoring.	13

UNIT-V	**Introduction to Repairs and Rehabilitations of Structures:** Case Studies (Site Visits), piezo-electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.	**14**

Text Books:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol 1, J. P. Ou, H. LiZ. D. Duan, Taylor and Francis Group, London, UK, 2006.

Reference Books:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	3	0	0	3
Subject Name		Structural Optimization				
Subject Code		MCESE20S108				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Understand how to formulate a structural optimization problem, including defining appropriate design variables, constraints, and objective functions.
2. Understand how structural analysis methods are integrated with optimization methods to synthesize a structural design.
3. Distinguish among sizing, shape, and topology optimization as classes of structural optimization.

Course Outcomes:

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

CO1: Use Variation principle for optimization.

CO2: Apply optimization techniques to structural steel.

CO3: Design using frequency constraint.

CO4: Comprehend how to calculate sensitivity derivatives.

CO5: Apply optimization techniques to concrete members.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Simultaneous Failure Mode and Design, Classical External Problems. Variational Principles with Constraints.	8
UNIT-II	**Linear Programming,** Integer Programming, Nonlinear Programming, Dynamic Programming.	9
UNIT-III	**Geometric** Programming and Stochastic Programming.	11
UNIT-IV	**Applications:** Structural Steel and Concrete Members, Trusses and Frames.	13
UNIT-V	**Design:** Frequency Constraint, Design of Layouts.	14

Text Books:

1. Brebbia C. A., "Earthquake Resistant Engineering Structures VIII", WIT Press, 2011.
2. Bruce A Bolt, "Earthquakes" W H Freeman and Company, New York, 2004.

Reference Books:

1. Duggal S K, "Earthquake Resistant Design of Structures", Oxford University Press, 2007.
2. Paulay,T and Priestley, M.J.N., "Seismic Design of Reinforced Concrete and Masonry buildings", John Wiley and Sons, 1992.

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	0	0	4	2
Subject Name		Structural Design Lab				
Subject Code		MCESE20S109				
Paper	English	English				
	Hindi					
Max. Marks		50				

Course Objectives:

1. To perform several laboratory experiments, including designing an experiment, in structural engineering and mechanics Assignments
2. Laboratory projects are given in steel, aluminum, wood and concrete structures.
3. To analyze data, interpret results, and write technical reports Assignments: For each experiment, a report must be submitted.

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

CO1: Design and Detail all the Structural Components of Frame Buildings.

CO2: Design and Detail complete Multi-Storey Frame Buildings.

CO3: On completion of this course, the students will know the concept of finite element analysis.

CO4: Analyze framed structure, Plate and Shells and modify using recent software's.

List of experiments	Periods
Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.	8

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	0	0	4	2
Subject Name		Advanced Concrete Lab				
Subject Code		MCESE20S110				
Paper	English	English				
	Hindi					
Max. Marks		50				

Course Objectives:

1. To test the basic properties ingredients of concrete, fresh and hardened concrete properties.
2. Describe the preparation of green concrete
3. Describe the properties of hardened concrete.

Course Outcomes:

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

CO1: Outline the importance of testing of cement and its properties

CO2: Assess the different properties of aggregate

CO3: Summaries the concept of workability and testing of concrete

List of experiments	Periods
List of Experiments/Assignments: **1.**Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture. **2.**Effect of cyclic loading on steel. **3.**Non-Destructive testing of existing concrete members. **4.**Behavior of Beams under flexure, Shear and Torsion.	**8**

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.

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	0	0	4	2
Subject Name		Research Methodology and IPR				
Subject Code		MMAT20S111				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course objectives:

1. To explain the functions of the literature review in research and writing a review.
2. To explain various research designs and their characteristics. Methods of data collections.

Course Outcomes:

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

CO1: Understand research problem formulation.

CO2: Analyze research related information.

CO3: Follow research ethics.

CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO5: Understand when IPR would take such important place in growth of individuals & Nation, it is needless to emphasis the need of information about Intellectual Property Right to be Promoted among students in general & engineering in particular.

Unit	Syllabus	Periods
UNIT-I	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	8
UNIT-II	Effective literature studies approaches, analysis plagiarism, Research ethics,	9
UNIT-III	Effective technical writing, how to write report, Paper. Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	11
UNIT-IV	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.	13

UNIT-V	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	**14**

Text books:

1. Asimov, "Introduction to Design", Prentice Hall, 1962.
2. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
3. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

References books:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.

Class		M.TECH.	L	T	P	C
Semester/Year		I/I	2	0	0	0
Subject Name		English for Research Paper Writing				
Subject Code		MCESE20S112				
Paper	English	English				
	Hindi					
Max. Marks		00				

Course objectives: Students will be able to:

1. Understand that how to improve your writing skills and level of readability.
2. Learn about what to write in each section.
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first time submission.

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

CO1: Understand that how to improve your writing skills and level of readability.
CO2: Learn about what to write in each section Understand the skills needed when writing a Title.
CO3: Ensure the good quality of paper at very first-time submission.
CO4: Being Concise and Removing Redundancy, Avoiding Ambiguity.
CO5: Discussion, skills are needed when writing the Conclusions.

Unit	Syllabus	Periods
Unit-I	Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.	8
Unit-II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism.	
Unit-III	Sections of a Paper, Abstracts. Introduction. Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.	
Unit-IV	Key skills needed when writing a Title, key skills needed when writing an Abstract, key skills needed when writing an Introduction, skills needed when writing a Review of the Literature, skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills are needed when writing the Conclusions,	
Unit-V	Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.	

Text books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

References books:

1. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book publication.
2. Adrian Wall work, English for Writing Research Papers, Dordrecht Heidelberg London, 2011.

SEMESTER - II

EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्
Estd. by Madhya Pradesh Niji Vishvavidyalaya (Sthapna Evam Sanchalana) Adhyadesh, 2020

SCHOOL OF ENGINEERING

SY
LL

ABUS

STRUCTURAL ENGINEERING

Class	M.TECH.	L	T	P	C

Semester/Year		**II/I**	**3**	**0**	**0**	**3**
Subject Name		**Finite Element Method in Structural Engineering**				
Subject Code		**MCESE20S201**				
Paper	**English**	**English**				
	Hindi					
Max. Marks		**100**				

Course Objectives:

1. To understand the fundamentals of finite element method and its applications to Civil engineering structures.

2. The objective of this course is to make students to learn principles of Structural Design.

3. To design different types of structures and to detail the structures.

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

CO1: Use Finite Element Method for structural analysis.
CO2: Execute the Finite Element Program/Software.
CO3: Solve continuum problems using finite element analysis.
CO4: Evaluate performance of the structures.
CO5: Achieve Knowledge of design and development of problem solving skills.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.	**8**
UNIT-II	**Beam Elements:** Flexure Element, Element Stiffness Matrix, Element Load Vector.	**9**
UNIT-III	**Method of Weighted Residuals**: Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications. Types Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoperimetric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.	**11**
UNIT-IV	**Application to Solid Mechanics**: Plane Stress, CST Element, Plane Strain Rectangular Element, Isoperimetric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.	**13**
UNIT-V	**Computer Implementation** of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.	**14**

Text Books:

1. Fundamentals of Finite Element Analysis, Hutton David, McGraw Hill, 2004.

2. Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall of India, 2005.

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. publication, New York, 1995.
3. Fundamentals of Finite Element Analysis, Hutton David, McGraw 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.

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		Structural Dynamics				
Subject Code		MCESE20S202				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objective:

1. The objective of this course is to make students to learn principles of Structural Dynamics.
2. To implement these principles through different methods and to apply the same for free and forced vibration of structures.
3. To evaluate the dynamic characteristics of the structures.

Course Outcomes:

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

CO1: Analyze and study dynamics response of single degree freedom system using fundamental Theory and equation of motion.

CO2: To apply the same for free and forced vibration of structures.

CO3: Use the available software for dynamic analysis.

CO4: Achieve Knowledge of design and development of problem solving skills.

CO5: Understand the principles of Structural Dynamics

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modelling of Dynamic Systems. **Single Degree of Freedom System** Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.	8
UNIT-II	**Numerical Solution** to Response using New mark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration.	9
UNIT-III	**Multiple Degree of Freedom System (Lumped parameter):** Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.	11
UNIT-IV	**Multiple Degree of Freedom System (Distributed Mass and Load):** Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.	13

UNIT-V	**Special Topics in Structural Dynamics (Concepts only):** Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.	**14**

Texts Books:

1. Dynamics of Structures, Clough R. W. and Penzien J., McGraw Hill Publication.
2. Dynamics of Structures, Humar J. L., Prentice Hall of India, 2005.

Reference Books:

1. Vibration of Structures - Application in Civil Engineering Design, Smith J. W., Chapman and Hall Publication.
2. Structural Dynamics - Theory and Computation, Paz Mario, CBS Publication.

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		Advanced Steel Design				
Subject Code		MCESE20S203				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. To gain the technical expertise in the design of complex steel structures.
2. Understand the background to the design provisions for hot-rolled.
3. Proficiency in applying the provisions for design of columns, beams, beam-columns.

Course Outcomes: At the end of the course, students will be able to:
CO1: Design steel structures/ components by different design processes.
CO2: Analyze and design beams and columns for stability and strength, and drift.
CO3: Design welded and bolted connections.
CO4: Design structural sections for adequate fire resistance.
CO5: Understand cold-formed steel structures, including the main differences between them.

Unit	Syllabus	Periods
UNIT-I	**Properties of Steel:** Mechanical Properties, Hysteresis, Ductility. **Hot Rolled Sections:** compactness and non-compactness, slenderness, residual stresses.	8
UNIT-II	**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.	9
UNIT-III	**Stability of Columns:** Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.	11
UNIT-IV	**Method of Designs:** Allowable Stress Design, Plastic Design, Load and Resistance Factor Design.	13
UNIT-V	**Strength Criteria:** Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones. **Drift Criteria** P Effect, Deformation Based Design, Welded, Bolted connection, Location Beam Column, Column Foundation, and Splices.	14

Texts 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.

Reference Books: **1.** Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.

EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्
Estd. by Madhya Pradesh Niji Vishwavidyalaya (Sthapna Evam Sanchalana) Adhyadesh, 2020

SCHOOL OF ENGINEERING

SY
LL

ABUS

STRUCTURAL ENGINEERING

Class	M.TECH.	L	T	P	C
Semester/Year	II/I	3	0	0	3

Subject Name		Design of Formwork
Subject Code		MCESE20S204
Paper	English	English
	Hindi	
Max. Marks		100

Course Objectives:

1. To study the materials associated with formwork and design aspects of Formwork under various requirements.
2. To study the planning and erection aspects of form work with few special types of forms.
3. The formwork serves as mould for concrete structural components unless such mould is provided by the soil, other structural components, etc.

Course Outcomes: At the end of the course, students will be able to:
CO1: Select proper formwork, accessories and material.
CO2: Design the form work for Beams, Slabs, columns, Walls and Foundations.
CO3: Design the form work for Special Structures.
CO4: Understand the working of flying formwork.
CO5: Judge the formwork failures through case studies.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Requirements and Selection of Formwork. **Formwork Materials**- Timber, Plywood, Steel, Aluminium, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.	8
UNIT-II	**Formwork Design:** Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.	9
UNIT-III	**Formwork Design for Special Structures**: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.	11
UNIT-IV	**Flying Formwork**: Table Form, Tunnel Form, Slip Form, and Formwork for Precast Concrete, Formwork Management Issues –Pre-and Post-Award.	13
UNIT-V	**Formwork Failures:** Causes and Case studies in Formwork Failure, Formwork Issues in Multi- Story Building Construction.	14

Texts Books:

1. Formwork for Concrete Structures, Peurify, McGraw Hill India, 2015.

Reference Books:

1. Formwork for Concrete Structures, Kumar Neeraj Jha, Tata McGraw Hill Education, 2012.

EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्
Estd. by Madhya Pradesh Niji Vishvavidyalaya (Sthapna Evam Sanchalana) Adhyadesh, 2020

SCHOOL OF ENGINEERING

SY
LL

ABUS

STRUCTURAL ENGINEERING

Class	M.TECH.	L	T	P	C
Semester/Year	II/I	3	0	0	3
Subject Name	Design of High-Rise Structures				
Subject Code	MCESE20S205				

Paper	English	English
	Hindi	
Max. Marks		**100**

Course Objectives:

1. To study the behaviour of tall structures.
2. To learn analysis and design of buildings for wind loads
3. To study design criteria for tall structures.

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

CO1: Analyze, design and detail Transmission/ TV tower, Mast and Trestles with different loading

CO2: Analyze, design and detail the RC and Steel Chimney.

CO3: Analyze, Design and detail the tall buildings subjected to different loading conditions using relevant codes.

CO4: Familiarize the students about stability analysis of tall structures.

CO5: Study behaviour of various structural systems under wind loads.

Unit	Syllabus	Periods
UNIT-I	**Design of transmission/ TV tower,** Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.	**8**
UNIT-II	**Analysis and Design of RC and Steel Chimney**, Foundation design for varied soil strata.	**9**
UNIT-III	**Tall Buildings**: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions.	**11**
UNIT-IV	Fire fighting design provisions.	**13**
UNIT-V	Application of software in analysis and design.	**14**

Texts Books:

1. High Rise Building Structures, Wolfgang Schueller, Wiley India, 1971.
2. Tall Chimneys, Manohar S. N., Tata McGraw Hill Publishing Company, New Delhi.

Reference Books:

1. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., South Asian Publishers, New Delhi, 2002.
2. Structural Analysis and Design of Tall Buildings, Taranath B. S., McGraw Hill, 1988.
3. Illustrated Design of Reinforced Concrete Buildings (GF+3storeyed), Shah V. L. & Karve S. R., Structures Publications, Pune, 2013.
4. Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.
5. Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India.1991.

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		Design of Advanced Concrete Structures				
Subject Code		MCESE20S206				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. To introduce the students to the fundamentals of reinforced concrete design with emphasis on the design of rectangular and T beams.
2. Slender columns, slabs, and footings and foundations.
3. In addition, student will learn how to analyze and design reinforced concrete structural members under bending, shear, and/or axial loads according to the ACI building code requirements (including computer applications).

Course Outcomes:

CO1: At the end of the course, students will be able to:

CO2: Analyze the special structures by understanding their behaviour.

CO3: Design and prepare detail structural drawings for execution citing relevant IS codes.

CO4: Achieve Knowledge of design and development of problem solving skills.

CO5: Understand the principles of Concrete mix design.

Unit	Syllabus	Periods
UNIT-I	**Design philosophy:** Modelling of Loads, Material Characteristics.	8
UNIT-II	**Reinforced Concrete:** P-M, M-phi Relationships, Strut-and- Tie Method, Design of Deep Beam and Corbel, Design of Shear Walls, Compression Field Theory for Shear Design, Design against Torsion; IS, ACI and Euro code.	9
UNIT-III	**Steel Structures:** Stability Design, Torsional Buckling - Pure, Flexural and Lateral, Design of Beam-Columns, Fatigue Resistant Design, IS code, AISC Standards and Euro code.	11
UNIT-IV	**Art of detailing:** earthquake resistant structures, expansion and contraction joints.	13
UNIT-V	**Design**: silos and bunkers.	14

Text Books:

1. Bhavikatti S. S. "Advance RCC Design", 3rd Edition, New Age International Private Limited, 2008.

2. Krishnam Raju, N. "Design of Reinforced Concrete Structures" 2nd Edition, CBS Publishers and Distributors, New Delhi, 2007.

References Books:

1. Reinforced Concrete Design, Pillai S. U. and Menon D., Tata McGraw Hill, 3rd Edition, 1999.
2. Design of Steel Structures, Subramaniam N., Oxford University Press, 2008.
3. Reinforced Concrete Structures, Park R. and Paulay T., John Wiley & Sons, 1995.
4. Advanced Reinforced Concrete Design, Varghese P.C., Prentice Hall of India, New Delhi.
5. Unified Theory of Concrete Structures, Hsu T. T. C. and Mo Y. L., John Wiley & Sons, 2010.

ABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		Advanced Design of Foundations				
Subject Code		MCESE20S207				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:
1.To impart the knowledge of the sub surface investigation and bore log report interpretation.
2.To developed the knowledge and skills for evaluating the bearing capacity of the soil.
3.To Analyze and evaluate the load carrying capacity of the various types of foundation.

Course Outcomes: At the end of the course, students will be able to:
CO1: Decide the suitability of soil strata for different projects.
CO2: Design shallow foundations deciding the bearing capacity of soil.
CO3: Analyze and design the pile foundation.
CO4: Understand analysis methods for well foundation.
CO5: Understand the concepts of Settlement analysis.

Unit	Syllabus	Periods
UNIT-I	**Planning of Soil Exploration** for Different Projects, Methods of Subsurface Exploration, and Methods of Borings along with Various Penetration Tests.	8
UNIT-II	**Shallow Foundations**, Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.	9
UNIT-III	**Pile Foundations**, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load-Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.	11
UNIT-IV	**Well Foundation**, IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods. **Tunnels** and Arching in Soils, Pressure Computations around Tunnels. **Open Cuts**, Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types.	13

UNIT-V	**Coffer Dams**, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction	**14**

Text Books:

1. Das, B.M., "Principles of Foundation Engineering", 4 th Edition, PWS Publishing, Singapore, 1999.
2. Bowles, J.E., "Foundation Analysis and Design", 5 th Edition, McGraw- Hill International, 2000.
3. Shamsher Prakash, "Soil Dynamics", 3 rd Edition, John Wiley publications, 2000.

Reference Books:

1. Design of foundation system, N.P. Kurian, Narosa Publishing House.
2. Foundation Analysis and Design, J. E. Bowles, Tata McGraw Hill New York.

ABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		Soil Structure Interaction				
Subject Code		MCESE20S208				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Explain the effects of soil flexibility in the response of the structure.
2. Analyze the structure with soil structure interaction effects to obtain the realistic response.
3. To evaluate the soil shear strength parameters.

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

CO1: Understand soil structure interaction concept and complexities involved.

CO2: Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.

CO3: Prepare comprehensive design-oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.

CO4: Analyze different types of frame structure founded on stratified natural deposits with linear And non-linear stress-strain characteristics.

CO5: Evaluate action of group of piles considering stress-strain characteristics of real soils.

Unit	Syllabus	Periods
UNIT-I	Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction. Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.	8
UNIT-II	Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.	9
UNIT-III	Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.	11
UNIT-IV	Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics. .	13

UNIT-V	Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pull-out Resistance	**14**

Texts Books:

1. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engineering. Vol-17, Elsevier Scientific Publishing Company.
2. Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.

Reference Books:

1. Analytical and Computer Methods in Foundation, Bowels J.E., McGraw Hill Book Co., New York, 1974.
2. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engineering. Vol-17, Elsevier Scientific Publishing Company.
3. Elastic Analysis of Soil-Foundation Interaction, Selvadurai A.P.S., Elsevier Scientific Publishing Company.

ABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		Model Testing Lab				
Subject Code		MCESE20S209				
Paper	English	English				
	Hindi					
Max. Marks		50				

Course objectives: The objectives of this course is to make students to learn:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.

Course Outcomes: At the end of the course, students will be able to:
CO1: Understand the response of structures.
CO2: Prepare the models.
CO3: Conduct model testing for static loading
CO4: Conduct model testing for free and forced vibrations
CO5: Communicate effectively the mechanical properties of materials.

Unit	Syllabus	Periods
UNIT-I	Response of structures and its elements against extreme loading events.	8
UNIT-II	Model Testing: Static - testing of plates, shells, and frames models.	9
UNIT-III	Model Testing: Free and forced vibrations, Evaluation of dynamic modulus.	11
UNIT-IV	Beam vibrations, Vibration isolation, Shear wall building model, Time and frequency-domain Study.	13
UNIT-V	Vibration Characteristics of RC Beams using Piezoelectric Sensors etc.	14

Texts Books:

1. Fenner, “Mechanical Testing of Materials”, George Newnes Ltd. London.
2. Kukreja C B, Kishore K. and Ravi Chawla “Material Testing Laboratory Manual”, Standard Publishers & Distributors 1996.

Reference Books:

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, "Building and construction materials Testing and quality control", McGraw Hill education (India) Pvt. Ltd., 2014.
3. Fenner, "Mechanical Testing of Materials", George Newnes Ltd. London.
4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd., London.
5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd., New Delhi.

ABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	3	0	0	3
Subject Name		Numerical Analysis Lab				
Subject Code		MCESE20S210				
Paper	English	English				
	Hindi					
Max. Marks		50				

Course Objectives: The objectives of the course to make the students:

1. To develop the mathematical skills of the students in the areas of numerical methods.
2. To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems, finding eigen values, eigenvectors, interpolation and applications, solving ODEs, PDEs and dealing with statistical problems like testing of hypotheses.
3. To lay foundation of computational mathematics for post-graduate courses specialized studies and research.

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

CO1: Find Roots of non-linear equations by Bisection method and Newton's method.
CO2: Do curve fitting by least square approximations
CO3: Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidel Iteration / Gauss –Jorden Method.
CO4: Integrate Numerically Using Trapezoidal and Simpson's Rules.
CO5: Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge-Kutta Method.

Unit	List of Practical's	Periods
	1. Find the Roots of Non-Linear Equation Using Bisection Method. **2.** Find the Roots of Non-Linear Equation Using Newton's Method. **3.** Curve Fitting by Least Square Approximations. **4.** Solve the System of Linear Equations Using Gauss –Elimination Method. **5.** Solve the System of Linear Equations Using Gauss –Seidel Iteration Method. **6.** Solve the System of Linear Equations Using Gauss –Jorden Method. **7.** Integrate numerically using Trapezoidal Rule. **8.** Integrate numerically using Simpson's Rules. **9.** Numerical Solution of Ordinary Differential Equations by Euler's Method. **10.** Numerical Solution of Ordinary Differential Equations by Runge- Kutta Method.	**8**

Text Books:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, 4th edition, PHI Learning Private Limited, New Delhi, 2007
2. B.S. Grewal and J.S. Grewal, Numerical Methods in Engineering and Science, 6th edition, Khanna Publishers, New Delhi.
3. Numerical Methods using MATLAB, 4th edition, PHI Learning Private Limited, New Delhi.

Reference Books:

1. A.K. Ray and K.M.Burchandi, Intel Microprocessors Architecture Programming and Interfacing, McGraw Hill International Edition, 2000
2. Kenneth J Ayala, the 8051 Microcontroller Architecture Programming and Application, 2nd Edition, Penram International Publishers (India), New Delhi, 1996.
3. M. Rafi Quazzaman, Microprocessors Theory and Applications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

ABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	0	0	4	2
Subject Name		Mini Project				
Subject Code		MCESE20S211				
Paper	English	English				
	Hindi					
Max. Marks		50				

Course Objective:

1. The aim of the mini project is that the student has to understand the structural engineering problems
2. The student should gain a thorough knowledge in the problem, he/she has selected and to analyze complex structural systems.

Course Outcomes: At the end of the Subject, the student will be able to:
CO1: Identify structural engineering problems reviewing available literature.
CO2: Study different techniques used to analyze complex structural systems.
CO3: Work on the solutions given and present solution by using his/her technique applying engineering principles.

Contents	Periods
1. Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available. 2. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals 'contribution. 3. Continuous assessment of Mini Project at Mid Sem and End-Sem will be monitored by the departmental committee.	8

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		II/I	2	0	0	0
Subject Name		Stress Management by Yoga				
Subject Code		MCESE20S212				
Paper	English	English				
	Hindi					
Max. Marks		00				

Course Objectives:
1. To achieve overall health of body and mind.
2. To overcome stress.

Course Outcomes: Students will be able to:
CO1: Develop healthy mind in a healthy body thus improving social health also.
CO2: Improve efficiency

Syllabus	Periods
1. Definitions of Eight parts of yog. (Ashtanga). 2. Yam and Niyam. Do`s and Don'ts's in life. 3. Ahinsa, satya, astheya, bramhacharya and aparigraha, Shaucha, santosh, tapa, swadhyay, ishwarpranidhan. 4. Asan and Pranayam. 5. Various yog poses and their benefits for mind &body, Regularization of breathing techniques and its effects-Types of pranayam	**8**
Suggested reading: **1.** 'Yogic Asanas for Group Training - Part I":Janardan Swami Yogabhyasi Mandal, Nagpur **2.** "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.	