Shri Shankaracharya Technical Campus,

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(An Autonomous Institute affiliated to Chhattisgarh Swami Vivekanand Technical University Bhilai)

Courses of Study and Scheme of Examination of M. Tech

SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination Theory / Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1	Civil Engg.	CE228101	Limit State Design of Steel Structures	3	1	-	100	20	20	140	4
2	Civil Engg.	CE228102	Matrix Methods of Structural Analysis	3	1	-	100	20	20	140	4
3	Civil Engg.	CE228103	Advanced Concrete Technology and Admixtures	3	1	-	100	20	20	140	4
4	Civil Engg.	CE228104	Advance Foundation Engineering	3	1	-	100	20	20	140	4
5	Refer Table –I		Elective- I	3	1	-	100	20	20	140	4
6	Civil Engg.	CE228191	Advanced Concrete Technology and Admixtures Lab	-	-	10	75		75	150	5
7	Civil Engg.	CE228192	Matrix Methods of Structural Analysis Lab	-	-	10	75		75	150	5
Total				**15**	**5**	**20**	**650**	**100**	**250**	**1000**	**30**

L-Lecture **T-Tutorial**
P-Practical, **ESE- End Semester Exam**
CT-ClassTest **TA- Teacher'sAssessment**

Table-I

ELECTIVE- I			
S.No.	**Board of Study**	**Subject Code**	**Subject**
1	Civil Engg.	CE228121	Advanced Construction Management
2	Civil Engg.	CE228122	Optimization Techniques
3	Civil Engg.	CE228123	Theory of Elastic Stability
4	Civil Engg.	CE228124	Applied Fuzzy Logic and Fuzzy sets

Note(1)– 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

Note(2)– Choice of elective course once made for an examination cannot be changed in futureexaminations.

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	**Chairman (BoS)**	**Date of Release**	**Version**	

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Limit State Design of Steel Structures	L = 3	T = 1	P = 0	Credits = 4
CE228101	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
1. To know about the merits of steel structures. 2. To know about shapes and grades of structural steel available. 3. To know about the different methods of design and the advantages of limit state design over other methods. 4. To understand the behavior of structural steel under tension, compression and flexure.	On successful completion of the course, the student will be able to: **CO1:-** To develop ability to select adequate shape and grade of structural steel. **CO2:-**To understand the basis of economical and safe design of steel structures. **CO3:-**To develop ability of choosing proper fastener for a particular joint. **CO4:-**To develop the ability to design structural steel elements by Limit State Method. **CO5:-**To develop the ability to designflexural compression structure steel elements by Limit State Method.

UNIT- I MATERIALS AND METHODS OF ANALYSIS **CO1**

Properties of Structural Steel, I. S. Specification for Rolled Sections, Elastic Analysis, Plastic Analysis for steel beams and frames - plastic hinges, Collapse mechanism, plastic modulus, shape factor. Introduction to working stress method and Limit state method of design of steel structures, Classification of rolled sections, types of loads and load combinations. **[8Hrs]**

UNIT – II FASTENERS AND TENSION MEMBERS **CO2**

Riveted, Bolted and Welded Connections, Strength, Efficiency and Design of Joints, Advantages and Disadvantages of Welded Joints, Design of Fillet and Butt Welds, Design of Eccentric Connections, High strength friction grip bolts.Net Sectional Area of Tension Members, Design of Axially Loaded Tension Member, Steel Angles under tension. **[8Hrs]**

UNIT – III COMPRESSION MEMBERS **CO3**

Modes of Failure of a Column, Buckling Failure: Euler's Theory, Effective Length, Slenderness Ratio, I.S. Code approach for design of Compression Members, Design of Built-Up Compression Members. **[8Hrs]**

UNIT – IV BEAMS **CO4**

Design Procedure, laterally supported and laterally unsupported beams, Web Crippling, Web Buckling, Design of Built-Up Beams, Curtailment of Flange Plates. [**8Hrs]**

UNIT – V BEAM COLUMNS AND CLOUMN BASES **CO5**

Design of Member Subjected to combined forces, Eccentricity of Load, Interaction Formulae. Slab and Gusseted Bases, Eccentrically Loaded Base Plates. **[8Hrs]**

SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Limit State Design of Steel Structures	L = 3	T = 1	P = 0	Credits = 4
CE228101	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Teaching Resource for Structural Steel Design	-	Volumes I- III,	Institute for Steel Development and Growth, Kolkata.
2	Design of Steel Structures	N. Subramanian	Fourth	Oxford University Press
3	Limit State Design of Steel Structures	S. K. Duggal	Second	Tata McGraw Hill

ReferenceBooks:

S. No.	Title	Authors	Edition	Publisher
1	Various Indian Standard codes of practice on steel structures.			
2	Indian Standard – General Construction in Steel –Code of Practice (3rd Revision) (IS:800 – 2007)			

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Matrix Method Of Structure Analysis	L = 3	T = 1	P = 0	Credits = 4
CE228102	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
The objective of this course is to introduce to the students, matrix-based approach for linear elastic analysis of skeletal structure and many applications in civil engineering..	On successful completion of the course, the student will be able to: **CO1:-**To understand the basic concept matrix method in structure analysis. **CO2:-** To learn about the flexibility method for beams. **CO3:-** To learn about the flexibility method for frames. **CO4:-** To learn about the stiffness method for beams. **CO5:-** To learn about the stiffness method for frames.

UNIT- I INTRODUCTION **CO1**

Review of force and displacement methods of structural analysis, Degree of Static Indeterminacy, Degree of Kinematic Indeterminacy, Basic Concepts of Matrix methods in structural analysis, Introduction to stiffness and flexibility approach, Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Determinants and Matrices. **[8Hrs]**

UNIT – II FLEXIBILITY METHOD FOR BEAMS **CO2**

Flexibility coefficients, development of flexibility matrix, Analysis of continuous beams by flexibility method. **[8Hrs]**

UNIT – III FLEXIBILITY METHOD FOR FRAMES **CO3**

Analysis of rigid jointed plane frame and pin jointed plane frame by flexibility method. **[8Hrs]**

UNIT – IV STIFFNESS METHOD FOR BEAMS **CO4**

Stiffness coefficient, development of stiffness matrix, relationship between flexibility matrix and stiffness matrix, Analysis of continuous beams by stiffness method. **[8Hrs]**

UNIT – V STIFFNESS METHOD FOR FRAMES **CO5**

Analysis of rigid jointed plane frame and pin jointed plane frame by stiffness method. **[8Hrs]**

SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Matrix Method Of Structure Analysis	L = 3	T = 1	P = 0	Credits = 4
CE228102	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Structural Analysis – A Matrix Approach	G.S. Pandit and S.P. Gupta	1st or 2nd Edition	Tata McGraw- Hill PublishingCompany Limited, New Delhi
2	Matrix Analysis of Framed Structures	William Weaver and Jr. James M. Gere	3rd Edition	CBS Publishers and Distributors, Delhi

ReferenceBooks:

S.No.	Title	Authors	Edition	Publisher
1	Finite Element Analysis – Theory and Programming	C.S. Krishanmurthy	1st	Tata McGraw- Hill Publishing Company Limited, New Delhi
2	Proceedings of recent seminars / workshops / conferences and Papers from relevant National and International Journals.	-	-	-

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Advanced Concrete Technology and Admixtures	L = 3	T = 1	P = 0	Credits = 4
CE228103	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
The objective is to make the students understand the engineering properties of cement-based materials, to understand the mixture design and engineering properties of special concretes, to bridge the gap between materials science and structural engineering so that concrete can be used properly in structural concrete projects.	On successful completion of the course, the student will be able to: **CO1:** -Outline the different properties of concrete. **CO2:** - Outline the types of admixtures its uses and properties. **CO3:** -Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy **CO4:** - Understand the different special concrete and there uses and properties. **CO5:** -Understand the application and methodology of using concrete mix in different conditions.

UNIT- I MATERIALS AND PROPERTIES **CO1**

IS specifications for materials and testing of concrete making materials, Properties, Grading, Methods of combining aggregates, Properties of fresh and hardened concrete, Variability of concrete strength, Elasticity, creep and shrinkage of concrete, Durability and factors affecting durability, behavior of concrete under aggressive environmental conditions including temperature. **[8Hrs]**

UNIT – II ADMIXTURES **CO2**

Different types of admixtures for improving properties of concrete such as strength, workability, durability etc. Suitability in different conditions. **[8Hrs]**

UNIT – III CONCRETE MIX PROPORTIONING **CO3**

Principles of concrete mix proportioning, Methods of concrete mix proportioning (with and without admixtures), Trial mixes, Testing of concrete mixes. **[8Hrs]**

UNIT – IV SPECIAL CONCRETE **CO4**

Light weight concrete, Fly ash concrete, Fibre reinforced concrete, Polymer Concrete, High performance concrete, Self compacting concrete, Concrete containing Silica Fumes, Concrete containing GGBS, No fines concrete. **[8Hrs]**

UNIT – V CONCRETING METHODS **CO5**

Process of manufacturing of concrete, Methods of transportation, placing and curing - Extreme weather concreting, special concreting methods, Vacuum dewatering - underwater concrete, special from work. **[8Hrs]**

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Advanced Concrete Technology and Admixtures	L = 3	T = 1	P = 0	Credits = 4
CE228103	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Properties of Concrete	Neville A.M.	Seventh	Pearson Education
2	Concrete Technology	Shetty M.S	Fourth	S.Chand and Company Ltd., Delhi

ReferenceBooks:

S.No.	Title	Authors	Edition	Publisher
1	Concrete Admixtures Handbook	Ramachandran V.S.	Second	Standard Publishers Distributors, Delhi
2	Handbook on Advanced Concrete Technology	A. K. Jain, N. V. Nayak	Fourth	Alpha Science

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Advance Foundation Engineering	L = 3	T = 1	P = 0	Credits = 4
CE228104	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
1. To know about the principles of foundation engineering. 2. To know about soil structure interaction. 3. To know about the beams on elastic foundation. 4. To understand about pile foundations. 5. To know about the special considerations.	On successful completion of the course, the student will be able to: **CO1: -** To develop ability to the principles of foundation engineering. **CO2: -** To understand about soil structure interaction. **CO3: -** To develop ability of the beams on elastic foundation. **CO4: -** To develop the ability about pile foundations. **CO5: -** To develop the ability the special considerations.

UNIT- I PRINCIPLES OF FOUNDATION ENGINEERING **CO1**

Functions of foundations, Types of foundations, Principal modes of failure, Estimation of allowable bearing pressures, calculation of ultimate bearing capacity by theoretical and empirical methods, settlement of foundations, Factors to be considered in foundation design. **[8Hrs]**

UNIT – II SOIL STRUCTURE INTERACTION **CO2**

Introduction to soil-foundation interaction problems – Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, Soil response models, Elastic continuum, two parameter elastic models, Elastic plastic behaviour, Time dependent behavior. **[8Hrs]**

UNIT – III BEAMS ON ELASTIC FOUNDATION **CO3**

Infinite beam, two parameters, Isotropic elastic half-space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness. **[8Hrs]**

UNIT – IV PILE FOUNDATIONS **CO4**

Purpose/Uses of pile foundations, Classification of piles, Concrete and Steel Piles, their advantages and disadvantages, behaviour of pile and pile groups under load, interaction analysis, Estimation of carrying capacity of piles and pile groups. Load deflection prediction for laterally loaded piles. **[8Hrs]**

UNIT – V SPECIAL CONSIDERATIONS **CO5**

Improvement of foundation soils - Purpose, Improvement of Granular Soils, Improvement of Cohesive soils, Grouting, Geosynthetics, Specific Applications. **[8Hrs]**

SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Advance Foundation Engineering	L = 3	T = 1	P = 0	Credits = 4
CE228104	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Foundation Analysis and Design	Bowles J.E.	-	Mc-Graw Hill International Edition
2	Foundation Engineering	Varghese P.C.	-	Printice Hall of India Private Limited

ReferenceBooks:

S.No.	Title	Authors	Edition	Publisher
1	Foundation Design and Construction	Tomlinson	-	ELBS Longman, 1996.
2	Soil Engineering in Theory and practice	A. Singh & G.R. Choudhry	-	CBS Publishers, 1990

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Advanced Construction Management	L = 3	T = 1	P = 0	Credits = 4
CE228121	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
1. To know about organizing for project management. 2. To know about design and construction process. 3. To know about the labor, material and equipment utilization. 4. To understand about cost estimation. 5. To know about the safety in construction.	On successful completion of the course, the student will be able to: **CO1: -** To develop ability to the organizing for project management. **CO2: -** To understand about design and construction process. **CO3: -** To develop ability of the labor, material and equipment utilization. **CO4: -** To develop the ability about cost estimation. **CO5: -** To develop the ability of the safety in construction.

UNIT- I ORGANIZING FOR PROJECT MANAGEMENT **CO1**

Project Management, Trends in Modern Management, Strategic Planning and Project Programming, Effectsof Project Risks on Organization, Organization of Project Participants, Traditional Designer, ConstructorSequence, Professional Construction Management, Owner-Builder Operation, Turnkey Operation,Leadership and Motivation for the Project Team, Interpersonal Behavior in Project Organizations,Perceptions of Owners and Contractors. **[8Hrs]**

UNIT – II DESIGN AND CONSTRUCTION PROCESS **CO2**

Design and Construction as an Integrated System, Innovation and Technological Feasibility, Innovation and Economic Feasibility, Design Methodology, Functional Design, Physical Structures, Geo-technical Engineering Investigation, Construction Site Environment, Value Engineering, Construction Planning, Industrialized Construction and Pre-fabrication. **[8Hrs]**

UNIT – III LABOR, MATERIAL AND EQUIPMENT UTILIZATION **CO3**

Labor Productivity, Factors Affecting Job, Site Productivity, Labor Relations in Construction, Problems in Collective Bargaining, Materials Management, Material Procurement and Delivery, Inventory Control, Tradeoffs of Costs in Materials Management, Construction Equipment, Choice of Equipment and Standard Production Rates, Construction Processes Queues and Resource Bottlenecks. **[8Hrs]**

UNIT – IV COST ESTIMATION **CO4**

Costs Associated with Constructed Facilities, Approaches to Cost Estimation, Type of Construction Cost Estimates, Effects of Scale on Construction Cost, Unit Cost Method of Estimation, Methods for Allocation of Joint Costs, Historical Cost Data, Cost Indices, Applications of Cost Indices to Estimating, Estimate Based on Engineer's List of Quantities, Allocation of Construction Costs Over Time, Estimation of Operating Costs. **[8Hrs]**

Subject Code	Advanced Construction Management	L = 3	T = 1	P = 0	Credits = 4
CE228121	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

UNIT – V SAFETY IN CONSTRUCTION **CO5**

Causes, classification, cost and measurement of an accident, safety programme for construction, protectiveequipment, accident report, safety measures for storage and handling of building materials, Construction ofelements of a building, demolition of buildings. Safety lacuna in Indian scenario.

[8Hrs]

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Construction Project Management: Planning, Scheduling and Control	Chitkara, K.K.	-	Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2	Project Management	Choudhury, S.	-	Tata McGraw-Hill Publishing Company, New Delhi, 1988

ReferenceBooks:

S.No.	Title	Authors	Edition	Publisher
1	Project Management – A Systems Approach to Planning, Scheduling and Controlling	Harold Kerzner	-	CBS Publishers & Distributors, Delhi, 1988
2	Total Project Management – The Indian Context	Joy, P.K.	-	Macmillan India Ltd., New Delhi, 1992

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1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Optimization Techniques	L = 3	T = 1	P = 0	Credits = 4
CE228122	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
The objective is to make the students understandandconceptualize thegoal is to simultaneously minimize or maximize several functions with the same objective, with one function often conflicting with another	On successful completion of the course, the student will be able to: **CO1: -** Learn to optimization techniques. **CO2: -** To study the linear programming. **CO3: -** To study the nonlinear programming. **CO4: -** Learn to geometric programming **CO5: -** Learn to special optimization techniques.

UNIT- I OPTIMIZATION TECHNIQUES **CO1**

Basic Concepts and introduction of engineering optimization, single-variable optimization, Multivariable optimization with no constraints, equality constraints and inequality constraints. **[8Hrs]**

UNIT – II LINEAR PROGRAMMING **CO2**

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. **[8Hrs]**

UNIT – III NON-LINEAR PROGRAMMING **CO3**

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. **[8Hrs]**

UNIT – IV GEOMETRIC PROGRAMMING **CO4**

Unconstrained minimization problem, constrained minimization, Applications of Geometric programming. **[8Hrs]**

UNIT – V SPECIAL OPTIMIZATION TECHNIQUES **CO5**

Separable programming, transformation of a non-linear function to separable form, multi objective optimization, calculus of variations, optimal control theory. **[8Hrs]**

Subject Code	Optimization Techniques	L = 3	T = 1	P = 0	Credits = 4
CE228122	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Engineering Optimization Theory and Practice	Rao S.S.	4	New Age Publishers, Delhi
2	Optimization for Engineering Design, Algorithms & examples	Deb K.	2	Prentice Hall of India, Delhi

ReferenceBooks:

S.No.	Title	Authors	Edition	Publisher
1	Introduction to optimum Design	Arora J.S.	4	TMH, Delhi
2	Optimization methods for Engineering Design	Fox R.L	3	Addison Wesley Publishing

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Theory of Elastic Stability	L = 3	T = 1	P = 0	Credits = 4
CE228123	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
1. To know about the stability of columns. 2. To know about the methods of analysis. 3. To know about the beam columns and frames. 4. To understand about the buckling of beams. 5. To know about the buckling of thin plates.	On successful completion of the course, the student will be able to: **CO1: -** To develop ability of the stability of columns. **CO2: -** To understand about the methods of analysis. **CO3: -** To develop ability of the beam columns and frames. **CO4: -** To develop the buckling of beams. **CO5: -** To develop the ability of the buckling of thin plates.

UNIT- I STABILITY OF COLUMNS **CO1**

Concepts of Elastic Structural stability, Analytical approaches to stability, characteristics of stability analysis, Elastic Buckling of columns, Equilibrium, Energy and Imperfection approaches, Non-prismatic columns, Built up columns, orthogonality of buckling modes, Effect of shear on buckling load, Large deflection theory. **[8Hrs]**

UNIT – II METHODS OF ANALYSIS **CO2**

Approximate methods, Rayleigh and Galerkin methods, numerical methods, Finite difference and finite Element, analysis of columns, Experimental study of column behaviour, South well plot, Column curves, Derivation of Column design formula, Effective length of Columns. **[8Hrs]**

UNIT – III BEAM COLUMNS AND FRAMES **CO3**

Beam column behaviour, standard cases, Continuous columns and beam columns, Column on elastic foundation, Buckling of frames, Single storey portal frames with and without side sway, Classical and stiffness methods, Approximate evaluation of critical loads in multistoried frames.

[8Hrs]

UNIT – IV BUCKLING OF BEAMS **CO4**

Lateral buckling of beams, Energy method, Application to Symmetric and simply symmetric I beams, simply supported and Cantilever beams, Narrow rectangular cross sections, Numerical solutions, Torsional buckling, Uniform and non uniform Torsion on open cross section, Flexural torsional buckling, Equilibrium and energy approach. **[8Hrs]**

UNIT – V BUCKLING OF THIN PLATES **CO5**

Isotropic rectangular plates, Governing Differential equations, Simply Supported on all edges, Use ofEnergy methods, Plates with stiffeners, Numerical Techniques. **[8Hrs]**

Subject Code	Theory of Elastic Stability	L = 3	T = 1	P = 0	Credits = 4
CE228123	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Stability of Structures	Ashwini kumar	-	Allied Publishers Ltd.
2	Theory of Elastic stability	Stephen P. Timoshenko and Gere	-	McGraw-Hill Company

ReferenceBooks:

S.No.	Title	Authors	Edition	Publisher
1	Elastic Stability of Structures	Smitses	-	Prentice Hall
2	Structural Stability of Columns and Plates	NGR Iyengar	-	Affiliated East- West Press Pvt. Ltd

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SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Applied Fuzzy Logic and Fuzzy sets	L = 3	T = 1	P = 0	Credits = 4
CE228124	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Course Objective	Course Outcomes
The objective is to give exposure about vague concepts using fuzzy sets and fuzzy logic and to Construct fuzzy rules and perform fuzzy reasoning on them.	On successful completion of the course, the student will be able to: **CO1: -** To Understand the basic knowledge and operationof classical set and Fuzzy set. **CO2: -** To Understand the basic knowledge of membership function and fuzzy arithmetic **CO3: -** To Understand the basic knowledge of classical logic, fuzzy logic & fuzzy rule-based systems **CO4: -** To Understand the basic knowledge of fuzzy nonlinear simulation & fuzzy optimization **CO5: -** To Understand the basic knowledge of fuzzy control system & fuzzy optimization

UNIT- I CLASSIFICATION OF SETS AND FUZZY SETS **CO1**

Basic concepts of classical set and Fuzzy set, Basic operations and properties of classical and Fuzzy sets, Basic concepts of classical relation & Fuzzy relation. **[8Hrs]**

UNIT – II MEMBERSHIP FUNCTION AND FUZZY ARITHMETIC **CO2**

Features of the Membership Function, Standard Forms land Boundaries, Fuzzification, Membership value Assignments, Extension Principle, Fuzzy Transform, Fuzzy Numbers, Approximate Methods of Extension, Fuzzy Vectors. **[8Hrs]**

UNIT – III CLASSICAL LOGIC, FUZZY LOGIC & FUZZY RULE BASED SYSTEMS **CO3**

Classical Predicate logic, Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence & Logical Proofs, Natural Language, Linguistic Hedges, Rule-based Systems. **[8Hrs]**

UNIT – IV FUZZY NON-LINEAR SIMULATION & FUZZY OPTIMIZATION **CO4**

Fuzzy Relational Equations, Partitioning, Nonlinear simulation using Fuzzy Rule-Based systems, Fuzzy Synthetic Evaluation, Fuzzy ordering, Preference & Consensus, Fuzzy Bayesian Decision method. **[8Hrs]**

UNIT – V FUZZY CONTROL SYSTEM & FUZZY OPTIMIZATION **CO5**

Simple Fuzzy logic controllers, Industrial Applications, Fuzzy Optimization, Fuzzy One-Dimensional Optimization, Fuzzy maximum & minimum. **[8Hrs]**

Subject Code	Applied Fuzzy Logic and Fuzzy sets	L = 3	T = 1	P = 0	Credits = 4
CE228124	ESE	CT	TA	Total	ESE Duration
	100	20	20	140	3 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Fuzzy set Theory and its Application	Zimmermann H.J	Second	Allied Publishers Ltd. d
2	Fuzzy Logic with Engineering Applications	Ross T. J	Third	McGraw Hill Publications

ReferenceBooks:

S.No.	Title	Authors	Edition	Publisher
1	Fuzzy sets & Fuzzy Logic, Theory & Applications	G.J. Klier, Boyuan	-	Prentice Hall of India
2	Proceedings of recent seminars / workshops / conferences and Papers from relevant National and International Journals.	-	-	-

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1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Advanced Concrete Technology and Admixtures Lab	L = 0	T = 0	P = 10	Credits = 5
CE228191	ESE	CT	TA	Total	ESE Duration
	075	-	75	150	3 Hours

Experiments to be performed (Minimum 10 experiments to be performed)

1. Tests for properties of Cement.
2. Tests for properties of Fine Aggregates.
3. Tests for properties of Coarse Aggregates.
4. Tests for properties of Admixtures.
5. Tests for strength of Concrete.
6. Tests for Flexural Strength of Concrete
7. Tests for Modulus of Elasticity of Concrete.
8. Concrete mix design (without Admixtures) and Trial Mixes.
9. Concrete mix design (with Admixtures) and Trial Mixes.
10. Non-destructive testing methods.
11. Behaviour of Concrete under different curing conditions.
12. Behaviour of Concrete under different exposure conditions.
13. Behaviour of Concrete under different placing conditions.
14. Residual Strength of existing concrete structures.
15. Comparison of properties of concrete prepared with materials from different locations.

List of Equipments / Machine Required:

1 Compression Testing Machine 100 T capacity
2 Cube Moulds 150 x 150 x 150 mm 12 nos.
3 Cube Moulds 100 x 100 x 100 mm 6 nos.
4 Cube Moulds 70 x 70 x 70 mm 12 nos.
5 Sieves of Various Sizes
6 Slump Cone Apparatus
7 Compaction Factor Apparatus
8 Moulds for Flexural Strength of Concrete
9 Cylindrical Moulds for Compressive Strength of Concrete
10 Mixing Tray, Trovels etc.

Recommended Books:

1. Neville A.M., Properties of Concrete, Pearson Education
2. SP23, Handbook on Concrete Mixes, Bureau of Indian Standards, New Delhi.

SCHEME OF EXAMINATION AND SYLLABUS

1ST Semester M-Tech. Civil Engineering (Structural Engineering)

Subject Code	Matrix Methods of Structural Analysis Lab	L = 0	T = 0	P = 10	Credits = 5
CE228192	ESE	CT	TA	Total	ESE Duration
	075	-	75	150	3 Hours

Experiments to be performed (Minimum 10 experiments to be performed)

1. Introduction to Software for Structural Analysis, such as SAP2000
2. Analysis of Continuous Beams on SAP2000 (Support Conditions and Loading type I)
3. Analysis of Continuous Beams on SAP2000 (Support Conditions and Loading type II)
4. Analysis of Continuous Beams on SAP2000 (Support Conditions and Loading type III)
5. Analysis of Plane Frames (Rigid Jointed) on SAP2000 (Support Conditions and Loading type I)
6. Analysis of Plane Frames (Rigid Jointed) on SAP2000 (Support Conditions and Loading type II)
7. Analysis of Plane Frames (Rigid Jointed) on SAP2000 (Support Conditions and Loading type III)
8. Analysis of Plane Frames (Pin Jointed) on SAP2000 (Support Conditions and Loading type I)
9. Analysis of Plane Frames (Pin Jointed) on SAP2000 (Support Conditions and Loading type II)
10. Analysis of Plane Frames (Pin Jointed) on SAP2000 (Support Conditions and Loading type III).
11. Behaviour of Frames under Dead and Live Loads.
12. Behaviour of Frames under Wind Loads.
13. Behaviour of Frames under Earthquake Loads.
14. Behaviour of Frames under combinations of Dead Load, Live Load and Wind Load.
15. Behaviour of Frames under combinations of Dead Load, Live Load and Earthquake Load.

List of Equipments / Machine Required:

1. PIV Computers with 17” Colour Monitors & UPS
2. SAP2000 Software.

Recommended Books:

1. Users Manual for SAP2000 Software Package, Computers and Structures Inc., Berkley.
2. Verification Manual for SAP2000 Software Package, Computers and Structures Inc., Berkley.