MATS UNIVERSITY

SCHOOL OF ENGINEERING AND INFORMATION TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

Syllabus

For

(Two-Years Full-Time Degree Programme)

Master of Technology (M.Tech.)

in

Civil Engineering

(Computer Aided Structural Engineering)

(2025-2027)

(Semester Based Course)

Scheme of Teaching and Evaluation starting from Session 2024-2025
(As per NEP-2020)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
M.TECH - I Semester (Civil Engineering)

S. No.	Course SubCategory	CourseName	Code	TeachingScheme				EvaluationScheme		Total Marks
				Hours			Credits			
				Theory	Tutorial	Practical		CIA	ESE	
1	DSCC-BSC	Research Methodology and IPR	MTDSCBSCCE100	3	-	-	3	30	70	**100**
2	DSCC-PCC	Advanced Concrete Technology and Admixtures	MTDSCCE140	3	-	-	3	30	70	**100**
3	DSCC-PCC	Matrix Methods of Structural Analysis	MTDSCCE141	3	1	-	4	30	70	**100**
4	DSCC-PCC	Instrumentation and Experimental Techniques	MTDSCCE142	3	-	-	3	30	70	**100**
5	DSCC-PCC	Limit State Design of Steel Structures	MTDSCCE143	3	1	-	4	30	70	**100**
6	DSCC-PCC	Matrix Methods of Structural Analysis Laboratory	MTDSCCE144	-	-	4	2	20	30	**50**
7	DSCC-PCC	Computer Aided Engineering (CAE) Laboratory -I	MTDSCCE145	-	-	4	2	20	30	**50**
	Total			**15**	**02**	**8**	**21**	**190**	**410**	**600**

L–Lecture,T–Tutorial,ESE–EndSemesterExamination,P–Practical,IM–InternalMarks(IncludeClassTest&Teacher'sAssessments)
Note: TheoryInternalMarks(CIA)=30(CT-I=05,CT-II=05,Assignment=05,MidTerm=15)
PracticalInternalMarks(CIA)=20(Attendance=05,LabViva-Voce=05,LabRecordWork=10)

Discipline Specific Core Courses(DSCC) Major		Generic Elective(C)	AEC(Ability Enhancement Course)(D)	SEC/Internship (Skill Enhancement Course) (E)	RP/SEMINAR	Value Added Course (VAC)/Indian Knowledge System(IKS)/IKS (Core) (F)
Basic Sciences (A)	Engineering Sciences (B)					
Research Methodology and IPR	Research Methodology and IPR					
	Advanced Concrete Technology and Admixtures					
	Matrix Methods of Structural Analysis					
	Instrumentation and Experimental Techniques					
	Limit State Design of Steel Structures					
	Matrix Methods of Structural Analysis Laboratory					
	Computer Aided Engineering (CAE) Laboratory -I					

CreditDefinition:

- 1-hourlecture(L) perweekpersemester=1Credit
- 1-hour tutorial(T)per week persemester=1Credit
- 2-hourPractical/Drawing(P) perweekpersemester=1Credit
- Fourcreditcoursesaretobe designedfor60 hoursof Teaching-Learning process.
- Threecredit coursesare tobedesignedfor48hoursof Teaching-Learning process.
- Two creditcoursesareto bedesignedfor28hoursofTeaching-Learningprocess.
- One creditcoursesareto bedesignedfor 15hoursofTeachingLearningprocess

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				Hours			Credits			
				Theory	Tutorial	Practical		CIA	ESE	
	DSCC-PCC	Advanced Design of Concrete Structures	MTDSCCE240	3	1	-	4	30	70	100
	DSCC-PCC	Earthquake Effects on Structures	MTDSCCE241	3	1	-	4	30	70	100
	DSCC-PCC	Finite Element Analysis of Structures	MTDSCCE242	3	1	-	4	30	70	100
	DSCC-PCC	Maintenance and Rehabilitation of Structures	MTDSCCE243	3	1	-	4	30	70	100
	DSCC-PCC	Advanced Design of Structures Laboratory	MTDSCCE244	-	-	4	2	20	30	50
	DSCC-PCC	Computer Aided Engineering (CAE) Laboratory - II	MTDSCCE245	-	-	4	2	20	30	50
	DSCC-PCC	Professional Elective - I	MTDSCCEP4XX	3	-	-	3	30	70	100
	Total			**15**	4	**8**	**23**	**190**	**410**	**600**

L–Lecture,T–Tutorial,ESE–EndSemesterExamination,P–Practical,IM–InternalMarks(IncludeClassTest&Teacher'sAssessments)
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Discipline Specific Core Courses(DSCC) Major		Generic Elective(C)	AEC(Ability Enhancement Course)(D)	SEC/Internship (Skill Enhancement Course) (E)	RP/SEMINAR	Value Added Course (VAC)/Indian Knowledge System(IKS)/IKS (Core) (F)
Basic Sciences (A)	Engineering Sciences (B)					
	Advanced Design of Concrete Structures					
	Earthquake Effects on Structures					
	Finite Element Analysis of Structures					
	Maintenance and Rehabilitation of Structures					
	Advanced Design of Structures Laboratory					
	Computer Aided Engineering (CAE) Laboratory - II					
	Professional Elective - I					

CreditDefinition:

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(Asper NEP-2020)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
M.TECH - I Semester (Civil Engineering)

S. No.	Course Sub Category	Course Name	Code	Teaching Scheme				Evaluation Scheme		Total Marks
				Hours			Credits			
				Theory	Tutorial	Practical		CIA	ESE	
	DSCC-PCC	Professional Elective – II	MTDSCCEP4XX	3	-	-	3	30	70	**100**
	DSCC-PCC	Professional Elective – III	MTDSCCEP4XX	3	1	-	4	30	70	**100**
	DSCC-PCC	Structural Dynamics Laboratory	MTDSCCE340	-	-	4	2	20	30	**50**
	RP	Project Work Phase -I	MTRP341	-	-	6	12	60	140	**200**
	Total			**6**	**1**	**10**	**21**	**140**	**310**	**450**

L–Lecture,T–Tutorial,ESE–EndSemesterExamination,P–Practical,IM–InternalMarks(IncludeClassTest&Teacher'sAssessments)
Note: TheoryInternalMarks(CIA)=30(CT-I=05,CT-II=05,Assignment=05,MidTerm=15)
PracticalInternalMarks(CIA)=20(Attendance=05,LabViva-Voce=05,LabRecordWork=10)

Discipline Specific Core Courses(DSCC) Major		Generic Elective(C)	AEC(Ability Enhancement Course)(D)	SEC/Internship (Skill Enhancement Course) (E)	RP/SEMINAR	Value Added Course (VAC)/Indian Knowledge System(IKS)/IKS (Core) (F)
Basic Sciences (A)	Engineering Sciences (B)					
	Professional Elective – II				Project Work Phase -I	
	Professional Elective – III					
	Structural Dynamics Laboratory					
	Project Work Phase -I					

CreditDefinition:

- 1-hourlecture(L) perweekpersemester=1Credit
- 1-hour tutorial(T)per week persemester=1Credit
- 2-hourPractical/Drawing(P) perweekpersemester=1Credit
- Fourcreditcoursesaretobe designedfor60 hoursof Teaching-Learning process.
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(Asper NEP-2020)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
M.TECH - I Semester (Civil Engineering)

S. No.	Course Sub Category	Course Name	Code	Teaching Scheme				Evaluation Scheme		Total Marks
				Hours			Credits			
				Theory	Tutorial	Practical		CIA	ESE	
	RP	Project Work Phase -II	MTRP440	-	-	10	18	135	315	**450**
	Total			**0**	**0**	**10**	**18**	**135**	**315**	**450**

L–Lecture,T–Tutorial,ESE–EndSemesterExamination,P–Practical,IM–InternalMarks(IncludeClassTest&Teacher'sAssessments)
Note: TheoryInternalMarks(CIA)=30(CT-I=05,CT-II=05,Assignment=05,MidTerm=15)
PracticalInternalMarks(CIA)=20(Attendance=05,LabViva-Voce=05,LabRecordWork=10)

Discipline Specific Core Courses(DSCC) Major		Generic Elective(C)	AEC(Ability Enhancement Course)(D)	SEC/Internship (Skill Enhancement Course) (E)	RP/SEMINAR	Value Added Course (VAC)/Indian Knowledge System(IKS)/IKS (Core) (F)
Basic Sciences (A)	Engineering Sciences (B)					
					Project Work Phase -II	

CreditDefinition:

- 1-hourlecture(L) perweekpersemester=1Credit
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- One creditcoursesaretobedesignedfor 15hoursofTeachingLearningprocess

Scheme of Teaching & Examination

Semester-I

S. No.	Code	Subject	Periods per Week			Scheme of Marks		Total Credit
			L	T	P	ESE	IM	
1.	MTDSCBSC100	Research Methodology and IPR	3	-	-	70	30	3
2.	MTDSCCE140	Advanced Concrete Technology and Admixtures	3	-	-	70	30	3
3.	MTDSCCE141	Matrix Methods of Structural Analysis	3	1	-	70	30	4
4.	MTDSCCE142	Instrumentation and Experimental Techniques	3	-	-	70	30	3
5.	MTDSCCE143	Limit State Design of Steel Structures	3	1	-	70	30	4
6.	MTDSCCE144	Matrix Methods of Structural Analysis Laboratory	-		4	30	20	2
7.	MTDSCCE145	Computer Aided Engineering (CAE) Laboratory-I	-		4	30	20	2
		Total	**15**	**2**	**8**	**410**	**190**	**21**

L – Lecture, T – Tutorial, ESE – End Semester Examination, P – Practical, IM – Internal Marks (Include Class Test & Teacher's Assessments)

Semester	**:**	**I**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Research Methodology and IPR**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	**MTDSCBSC100**

COURSE OBJECTIVE:

This course is designed to enable students to:

• Identify and discuss the role and importance of research in the social sciences.

• Identify and discuss the issues and concepts salient to the research process.

• Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.

UNIT-I Introduction

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

UNIT-II Literature Studies

Effective literature studies approaches, 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

UNIT-III Intellectual Property

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.

UNIT-IV Patent Rights

Scope of patent rights, Licensing and transfer of technology, Patent information and databases, Geographical indications.

UNIT-V IPR

New Developments in IPR, Administration of Patent System. New developments in IPR, IPR of Biological Systems, Computer Software etc., Traditional knowledge Case Studies, IPR and IITs.

COURSE OUTCOME:

Students who successfully complete this course will be able to:

1. Explain key research concepts and issues
2. Read, comprehend, and explain research articles in their academic discipline.
3. Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

TEXT BOOK & REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.

4. Mayall, "Industrial Design", McGraw Hill, 1992.

5. Niebel, "Product Design", McGraw Hill, 1974.

6. Asimov, "Introduction to Design", Prentice Hall, 1962.

7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

8. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Semester	**:**	**I**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Advanced Concrete Technology**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	**MTDSCCE140**

COURSE OBJECTIVE:

• The course relates to the fundamentals related to concrete and concrete material, besides dealing with masonry, reinforcement, etc.

• The course begins with an outline of what concrete is, what are the processes involved in formation of concrete, various materials that are used in concrete formation, properties of each ingredient of concrete, standard tests to be applied to concrete and concrete ingredients.

• The course then moves on to design-mix, special concretes, Nondestructive testing, etc.

UNIT-I Material and Properties

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.

UNIT-II Admixture

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

UNIT-III Concrete Mix Proportioning

Principles of concrete mix proportioning, Methods of concrete mix proportioning (with and without admixtures), Trial mixes, Testing of concrete mixes.

UNIT-IV Special Concrete

Light weight concrete, Fly ash concrete, Fiber reinforced concrete, Polymer Concrete, High performance concrete, Self-compacting concrete, Concrete containing Silica Fumes, Concrete containing GGBS, No fines concrete.

UNIT-V Concreting Methods

Process of manufacturing of concrete, Methods of transportation, placing and curing, Extreme weather concreting, special concreting methods, Vacuum dewatering - underwater concrete, Special from work.

COURSE OUTCOME:

• The knowledge of what concrete is, how it is formed, what materials are involved and properties and requirements of each concrete ingredient.

• Ability to perform various tests on concrete ingredients and also on concrete (Fresh and Hardened). Ability to analyze various special concrete and their applications.

• Basic knowledge of Nondestructive testing.

TEXT BOOK:

1. A.M. Neville, Properties of Concrete, Pearson Education.

2. M.S. Shetty, Concrete Technology, S. Chand and Company Ltd., Delhi

REFERENCE:

1. V.S. Ramachandran, Concrete Admixtures Handbook, Standard Publishers Distributors, Delhi.

2. Proceedings of recent seminars / workshops / conferences and Papers from relevant National and International Journals

Semester : I
Branch : M.Tech Civil Engineering (Computer Aided Structural Engineering)
Subject : Matrix Method of Structural Analysis
Total Theory Periods : 48
Total Tutorial Periods : 12
Total Credits : 04
Code : MTDSCCE141

COURSE OBJECTIVE:

• The main objective is to expand the student knowledge of the stiffness and flexibility methods studied in the basic structural analysis courses.

• Students will be able to implement the method developing their own computer program to analyze structures.

• Students will be able to implement their knowledge in analysis of structure.

UNIT-I Introduction

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, Determinants and Matrices.

UNIT-II Flexibility Method for Beams

Flexibility coefficients, development of flexibility matrix, Analysis of continuous beams by flexibility method.

UNIT-III Flexibility Method for Frames

Analysis of rigid jointed plane frame and pin jointed plane frame by flexibility method.

UNIT-IV Stiffness Method for Beams

Stiffness coefficient, Development of stiffness matrix, Relationship between flexibility matrix and stiffness matrix, Analysis of continuous beams by stiffness method.

UNIT-V Stiffness Method for Frames

Analysis of rigid jointed plane frame and pin jointed plane frame by stiffness method.

COURSE OUTCOME:

• Calculate deflections, reactions and internal forces for trusses, beams and frames using analytical and computer-based methods.

• Extend the study of linear elastic analysis to include non linear aspects of structure behavior

• Be able to interpret computer output and validate results using simplified models and hand calculations

TEXT BOOK:

1. Pandit G.S. and Gupta S.P., Structural Analysis – A Matrix Approach, Tata McGraw- Hill Publishing Company Limited, New Delhi

2. Weaver W. and Gere J. M., Matrix Analysis of Framed Structures, CBS Publishers and Distributors, Delhi

REFERENCE:

1. Krishnamurthy C.S., Finite Element Analysis – Theory and Programming, Tata McGraw- Hill Publishing Company Limited, New Delhi.

2. Proceedings of recent seminars / workshops / conferences and Papers from relevant National and International Journals.

Semester	**:**	**I**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Instrumentation and Experimental Techniques**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	**MTDSCCE142**

COURSE OBJECTIVE:

On successful completion of this module, students should be able to:

• Evaluate uncertainty in measurements using the ISO Guide to Uncertainty in Measurement.

• Implement a data acquisition system using lab view and the National Instruments DAQ or other data acquisition system.

• Specify and select an appropriate data acquisition system for a given application.

UNIT-I Measurement

Basic concept in measurements, Measurement of displacement, strain pressure, force, torque etc, Types of strain gauges (Mechanical, Electrical resistance, Acoustical etc.)

UNIT-II Strain Gauges

Strain gauge circuits. The potentiometer and Wheatstone bridge, use of lead wires switches etc., Use of strain gauges in structural applications.

UNIT-III Data Processing

Indicating and recording devices, Static and dynamic data recording, Data (Digital and Analogue)acquisition and processing systems, Strain analysis methods, Rosette analysis, Static and dynamic testing techniques, Equipment for loading-Moiré's techniques.

UNIT-IV Non-Destructive Technique

Non-destructive testing techniques. Photo elasticity, Optics of photo elasticity, Polar scope, Isoclinic and Isochromatic, Methods of stress separation.

UNIT-V Model Analysis

Laws of similitude, Model materials, Model testing, Testing large scale structures, Holographic techniques.

COURSE OUTCOME:

• Appreciate practical aspects of data acquisition especially signal conditioning which influence the signal to noise ratio achieved for a measurement.

• Design a basic Sound Level Meter and assess its performance.

• Understand the application areas and limitations of some commonly used sensors e.g. strain gauges, temperature and humidity sensors, microphones and sensors for measurement of electrical quantities.

TEXT BOOK:

1. Dally J W and Riley W.F, Experimental stress Analysis, McGraw-Hill Inc. New York, 1991.
2. Srinath L S et al, Experimental Stress Analysis, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1984.

REFERENCE:

1. Rangan C S et al., Instrumentation – Devices and Systems, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1983.
2. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996

Semester	**:**	**I**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Limit State Design of Steel Structures**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**12**
Total Credits	**:**	**04**
Code	**:**	**MTDSCCE143**

COURSE OBJECTIVE:

• To provide a coherent development to the students for the courses in sector of Designing of the Steel Structures.

• To present the foundations of many basic Engineering concepts related Design of Steel Structures.

• To give an experience in the implementation of engineering concepts which are applied in field of Steel Structures.

• To involve the application of scientific and technological principles of planning, analysis, design of buildings.

UNIT-I Materials and Method of Analysis

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.

UNIT-II Fasteners and Tension Member

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

UNIT-III Compression Member

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.

UNIT-IV Beams

Design Procedure, laterally supported and laterally unsupported beams, Web Crippling, Web Buckling, Design of Built-Up Beams, and Curtailment of Flange Plates

UNIT-V Beam Column and Column Bases

Design of member subjected to combined forces, Eccentricity of Load, Interaction Formulae, Slab and Gusseted Bases, Eccentrically Loaded Base Plates.

COURSE OUTCOME:

• The students will gain an experience in the implementation of Design of Steel Structures on engineering concepts which are applied in field Structural Engineering.

• The students will get a diverse knowledge of Design of Steel engineering practices applied to real life problems.

• The students will learn to understand the theoretical and practical aspects of Design of Steel Structure along with the planning and design aspects.

TEXT BOOK:

1. Teaching Resource for Structural Steel Design, Volumes I – III, Institute for Steel Development and Growth, Kolkata.

2. Various Indian Standard codes of practice on steel structures.

REFERENCE:

1. Davidson B. and Owens, G.W., Steel Designers' Manual, Blackwell Publishing, UK

2. Proceedings of recent seminars / workshops / conferences and Papers from relevant National and International Journals.

Semester : I
Branch : M.Tech Civil Engineering (Computer Aided Structural Engineering)
Subject : Matrix Method of Structural Analysis Laboratory
Total Theory Periods : 48
Total Tutorial Periods : 0
Total Credits : 02
Code : MTDSCCE144

COURSE OBJECTIVE:

• To provide required skills to apply different software skills to analyze structure.

• To provide the necessary basic concepts of a few software.

• To provide procedures for solving numerically different kinds of problems occurring in the field of Engineering and Technology.

LIST OF EXPERIMENTS

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. Behavior of Frames under Dead and Live Loads.
12. Behavior of Frames under Wind Loads.
13. Behavior of Frames under Earthquake Loads.
14. Behavior of Frames under combinations of Dead Load, Live Load and Wind Load.
15. Behavior of Frames under combinations of Dead Load, Live Load and Earthquake Load.

List of Equipment's / Machine Required:

a. PIV Computers with 17" Colour Monitors & UPS

b. SAP2000 Software.

COURSE OUTCOME:

• Calculate deflections, reactions and internal forces for trusses, beams and frames using analytical and computer-based methods.

• Extend the study of linear elastic analysis to include non linear aspects of structure behavior

• Be able to interpret computer output and validate results using simplified models and hand calculations

REFERENCE:

1. User's Manual for SAP2000 Software Package, Computers and Structures Inc., Berkley.

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

Semester	**:**	**I**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Computer Aided Engineering Laboratory-I**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**02**
Code	**:**	**MTDSCCE145**

COURSE OBJECTIVE:

At the end of the course the student will be able to:

• Estimate the crack width and deflection with regard to the serviceability.

• Analyze and design a grid floor system.

• Analyze and design a flat slab system.

LIST OF EXPERIMENTS:

1. Design of reinforced concrete beam (singly/doubly)
2. Design of reinforced concrete column subjected to biaxial bending
3. Design of reinforced concrete slab (One way/Two-way)
4. Design of reinforced concrete retaining wall (cantilever type)
5. Design of reinforced concrete shear wall
6. Lateral forces on a building due to an earthquake using equivalent static method 7. Lateral forces on a building due to wind
7. Analysis of rigid jointed plane frames
8. Analysis of simply supported/cantilever beam
9. Analysis of plane truss

COURSE OUTCOME:

After completion of this course students will be able to:

- Analyze the structure by using their skills of designing.
- Design different elements of structure.
- Implement their skills at field.

REFERENCE:

1. T.S. Sarma, Staad Pro V8i for beginners, Notion Press; 1 edition (2014).
2. Sham Tickoo, Learning Bentley Staad.Pro V8i for Structural Analysis, Dreamtech press (2015).
3. Technical Reference Manual for Staad, Bentley.

Scheme of Teaching & Examination

Semester-II

S.No.	Code	Subject	Periods per Week			Scheme of Marks		Total Credit
			L	T	P	ESE	IM	
1.	MTDSCCE240	Advanced Design of Concrete Structures	3	1	-	70	30	4
2.	MTDSCCE241	Earthquake Effects on Structures	3	-	-	70	30	3
3.	MTDSCCE242	Finite Element Analysis of Structures	3	1	-	70	30	4
4.	MTDSCCE243	Maintenance and Rehabilitation of Structures	3	-	-	70	30	3
5.	MTDSCCE244	Advanced Design of Structures Laboratory	-		4	20	30	2
6.	MTDSCCE245	Computer Aided Engineering (CAE) Laboratory-II	-		4	20	30	2
7.	MTPDSE4XX	Professional Elective –I	3	-	-	70	30	3
		Total	**15**	**2**	**8**	**410**	**190**	**21**

L – Lecture, T – Tutorial, ESE – End Semester Examination,
P – Practical, IM – Internal Marks (Include Class Test & Teacher's Assessments)

Semester	**:**	**II**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Advanced Design of Concrete Structure**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**12**
Total Credits	**:**	**04**
Code	**:**	**MTDSCCE240**

COURSE OBJECTIVE:

At the end of the course the student will be able to:

• Estimate the crack width and deflection with regard to the serviceability.

• Analyse and design a grid floor system.

• Analyse and design a flat slab system.

• Discuss fire and seismic resistance of concrete structures.

UNIT-I Design of Beams

Behavior of RCC beams under combined Shear, Torsion and Bending, Modes of Failures, Interaction effects, Analysis and design of beams circular in plan, Design calculation of deflections and crack width.

UNIT-II Design of Slender Column

Behavior of slender RCC Columns, Failure modes and Interaction curves, Additional Moment method, comparison of codal provisions, calculation of design moments for braced and unbraced columns, Principles of Moment magnification method, design of slender columns.

UNIT-III Design of Special Element

Design and detailing of Concrete walls according to IS code, Classification of shear walls, design principles, design of rectangular shear walls, Analysis of forces, Approximate analysis and design of Grid floors.

UNIT-IV Design of Flat Slab

Design of Flat slabs according to IS method, Shear in Flat Slabs.

UNIT-V Inelastic Behaviour

Inelastic behavior of concrete beams-moment-rotation curves, moment redistribution, Design of cast-in-situ joints in frames. Detailing requirements for ductility, durability and fire resistance

COURSE OUTCOME:

• Students are able to design different elements of building.

• Students are able to understand elastic behavior of structure.

• Students are able to design flat slab, slender column.

TEXT BOOK:

1. Varghese, P.C. “Advanced Reinforced Concrete Design”, Prentice Hall of India.

2. Krishna Raju, N., “Advanced Reinforced Concrete Design”, CBS Publishers and Distributers.

REFERENCE:

1. Purushothaman, P, Reinforced Concrete Structure Structural Elements: Behaviour Analysis and Design, Tata McGraw-Hill.

2. Arthur H.Nilson “Design of Concrete Structures”, Tata McGraw-Hill.

Semester	**:**	**II**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Earthquake Effect on Structure**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	**MTDSCCE241**

COURSE OBJECTIVE:

Students will be able to:

• Understand the nature of earthquakes and seismic hazard *f*

• Understand earthquake effects on buildings and types of building damage.

UNIT-I Engineering Seismology

Elements of Engineering Seismology, Characterization of ground motion, Earthquake intensity and magnitude, Recording instruments and base line correction, Predominant period and amplification through soil, Earthquake spectra for elastic and inelastic systems, Response Spectrum, Indian Standard codes on Earthquake Engineering, Seismic zoning map of India.

UNIT-II Case Study

Earthquake History, Behavior of structures in the past earthquakes, Case studies and remedial measures.

UNIT-III Design Concept

Seismic Design Concepts, Cyclic load behavior of structural elements, Design spectrum, Principles of capacity design.

UNIT-IV Codal Provision

Idealization of structural systems for low, medium and high rise buildings, Provisions of Seismic code (IS1893), Building systems frames, shear walls, Braced frames, Ductility requirements for framed structures.

UNIT-V Special Problems

Structural Configuration, Seismic performance, Irregular Buildings, Soil performance, Modern Concepts, Base Isolation, Adoptive system.

COURSE OUTCOME:

Students are able to:

• Understand the behavior of earthquake on structure.

• Understand design concept of structure.

• Understand different codal provision of earthquake.

TEXT BOOK:

1. Agrawal P. and Srikhande M., Earthquake Resistant Design of Structures, Prentice hall of India Private Limited, New Delhi.

2. Indian Standard Codes / Handbooks on Earthquake Engineering.

REFERENCE:

1. Chopra A.K., Dynamics of Structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc.

2. Proceedings of recent seminars / workshops / conferences, Papers from relevant National and International Journals and Material from NICEE, IIT Kanpur.

Semester	**:**	**II**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Finite Element of Structure**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**12**
Total Credits	**:**	**04**
Code	**:**	**MTDSCCE242**

COURSE OBJECTIVE:

• To perform finite element analysis of structural elements.

• To enable students to analyze pin jointed plane frame by finite element method.

• To enable students to analyze rigis jointed plane frame by finite element method.

UNIT I: Basic Concepts

Review of solid mechanics, Displacement model, shape functions, Lagrange and Serendipity elements. Element properties, isoperimetric elements, numerical integration technique assemblage of elements and solution technique for static analysis.

UNIT II: Analysis of Beams

Finite Element formulation and Analysis of beams by Finite Element method.

UNIT III: Analysis of Rigid Jointed Plane Frame

Finite Element formulation and Analysis of rigid jointed plane frame by Finite Element method.

UNIT IV: Analysis of Pin Jointed Plane Frame

Finite Element formulation and Analysis of pin jointed plane frame by Finite Element method.

UNIT V: Introduction of Plate and Shell Element

Analysis of plane stress / strain and ax symmetric solids-triangular, quadrilateral and isoperimetric elements, Analysis of plate bending, basic equations of thin plate theory, Reissinner-Mindlin theory, plate elements and applications. Analysis of shells, degenerated shell elements.

COURSE OUTCOME:

The students will be able to:

• Develop stiffness matrix for various elements like bar, beam, triangular and quadrilateral elements. Formulate 2d plane stress, plain strain and axis symmetric problems.

• Analyse beams and frames using FEM.

• Perform dynamic analysis using FEM.

TEXT BOOK:

1. Chandrupatla T.R., Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Private Limited, New Delhi.
2. Desai C.S., Abel J.F., Introduction to the Finite Element Method, CBS Publishers & Distributors, Delhi.

REFERENCE:

1. Krishanmurthy, C.S., Finite Element Analysis – Theory and Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Finite Element Analysis – Theory and Programming by Cook R.D. et.al., Concepts and Applications of Finite Element Analysis, John Wiley

Semester	**:**	**II**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Maintenance and Rehabilitation of Structures**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	**MTDSCCE243**

COURSE OBJECTIVE:

• To acquire the knowledge on Quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

• To enable students to learn various repairing techniques.

• To know about various repairing materials of structure.

UNIT I: Quality Assurance

Quality assurance for Concrete and Steel construction, Properties such as strength, permeability, thermal properties and cracking. Corrosion prevention.

UNIT II: Influence on Serviceability and Durability

Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III: Maintenance and Repair Strategies

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV: Material for Repair

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete.

UNIT V: Techniques for Repair

Rust eliminators and polymers coating for rebar’s during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

COURSE OUTCOME:

Upon completion of this course, the student will be able to:

• Understand the properties of fresh and hardened concrete.

• Know the strategies of maintenance and repair.

• Get an idea of repair techniques.

• Understand the properties of repair materials

• Understand the retrofitting strategies and techniques

TEXT BOOK:

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures”, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.

2. R.T.Allen and S.C.Edwards, “Repair of Concrete Structures”, Blakie and Sons, UK, 1987.

REFERENCE:

1. M.S.Shetty, "Concrete Technology - Theory and Practice", S.Chand and Company, New Delhi, 1992.

2. Raikar, R.N., "Learning from failures - Deficiencies in Design", Construction and Service - R & D Centre (SDCPL), RaikarBhavan, Bombay, 1987.

Semester	**:**	**II**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Advanced Design of Structures Laboratory**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**02**
Code	**:**	**MTDSCCE244**

COURSE OBJECTIVE:

• Students will learn software skills to analyze the structure.

• Students will be able to implement software skills in different fields.

LIST OF PRACTICALS:

a. Introduction to latest version of a Standard Structural Engineering Design Package such as STAAD Pro.

b. Modelling of RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro. (including Earthquake and Wind Loads)

c. Analysis and Interpretation of Results of Analysis on RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.

d. Design and Interpretation of Results of Design of RCC Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.

e. Modelling, of Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro. (including Earthquake and Wind Loads)

f. Analysis and Interpretation of Results of Analysis on Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.

g. Design and Interpretation of Results of Design of Steel Frame on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.

h. Case Study of design of a RCC Multistorey Building / Steel Industrial Building on latest version of a Standard Structural Engineering Design Package such as STAAD Pro.

i. Introduction to latest version of Finite Element Package such as ANSYS.

j. Modeling of an Steel Angle section on ANSYS and viewing the results.

k. Design of Multistorey Building for Dead Loads and Live Loads.

l. Design of Multistorey Building for Dead Loads, Live Loads and Wind Loads.

m. Design of Multistorey Building for Dead Loads, Live Loads and Earthquake Loads.

n. Modelling of Steel Connections in Finite Element Package ANSYS.

o. Introduction to Non-Linear Finite Element analysis of structures on ANSYS

COURSE OUTCOME:

• Students are able to analyze the structure by using STAAD.Pro.

• Students are able to understand different tools of STAAD.Pro.

LIST OF EQUIPMENTS / MACHINE REQUIRED:

a. PIV Computers with 17” Colour Monitors & UPS

b. STAAD Pro Software

c. ANSYS Software

RECOMMENDED BOOKS:

1. Users Manuals for STAAD Pro Software.

2. Users Manuals for ANSYS Software.

Semester	**:**	**II**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Computer Aided Engineering Laboratory**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**02**
Code	**:**	**MTDSCCE245**

COURSE OBJECTIVE:

• Students will learn software skills to analyze the structure.

• Students will be able to implement software skills in different fields.

LIST OF PRACTICAL:

1. Write a Python program to find deflection of a simply supported beam and draw SFD & BMD

2. Write a Python program for interactive design of reinforced concrete structure

3. Implementation of Artificial Neural Network (ANN) Structure in Python

4. Develop ANN, Fuzzy Logic and Genetic Algorithms in Python for construction project to optimize time & cost

5. Estimate earthquake-induced liquefaction potential using Artificial Intelligence (AI) 6. Determine tide level forecasting in maritime areas using AI

7. Implementation of ANN approach in Python for pavement maintenaoach in Python 9. Generate plans in all stages of construction project.

8. Bridge/tunnel planning using GIS and Expert System Appr using AI

10. Develop Neural Network System for modular construction decision making

11. Implement fuzzy controller for dynamic traffic lights

12. Population forecasting for urban planning, water supply and sewerage system using AI

13. Risk assessment and mitigation (prediction of floods/earthquakes/cyclones) using AI

COURSE OUTCOME:

• Students understand the different tools of software.

• Students are able to analyze different kind of elements of structure.

REFERENCE:

1. Introduction to Artificial Intelligence, Shinji Araya, Kyoritsu Shuppan, ISBN4-320-12116- 3.

2. New Artificial Intelligence (Fundamental), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13179.

3. New Artificial Intelligence (Advanced), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13198-X.

4. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall, ISBN0-13-080302-

Scheme of Teaching & Examination

Semester-III

S. No.	Course Sub Category	Course Name	Code	Teaching Scheme				Evaluation Scheme		Total Marks
				Hours			Credits			
				Theory	Tutorial	Practical		CIA	ESE	
	DSCC-PCC	Professional Elective – II	MTCEP4XX	3	-	-	3	30	70	**100**
	DSCC-PCC	Professional Elective – III	MTCEP4XX	3	1	-	4	30	70	**100**
	DSCC-PCC	Structural Dynamics Laboratory	MTDSCCE340	-	-	4	2	20	30	**50**
	RP	Project Work Phase -I	MTRP341	-	-	6	12	60	140	**200**
	Total			**6**	**1**	**10**	**21**	**140**	**310**	**450**

L–Lecture,T–Tutorial,ESE–End Semester Examination,P–Practical,IM–InternalMarks(Include Class Test &Teacher's Assessments)

Note: TheoryInternalMarks(CIA)=30(CT-I=05,CT-II=05,Assignment=05,MidTerm=15)
PracticalInternalMarks(CIA)=20(Attendance=05,LabViva-Voce=05,LabRecordWork=10)

Discipline Specific Core Courses(DSCC) Major		Generic Elective(C)	AEC(Ability Enhancement Course)(D)	SEC/Internship (Skill Enhancement Course) (E)	RP/SEMINAR	Value Added Course (VAC)/Indian Knowledge System(IKS) /IKS (Core) (F)
Basic Sciences (A)	**Engineering Sciences (B)**					
	Professional Elective – II				Project Work Phase -I	
	Professional Elective – III					
	Structural Dynamics Laboratory					
	Project Work Phase -I					

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Credit Definition:

- 1-hourlecture(L) per week per semester=1Credit
- 1-hour tutorial(T)per week per semester=1Credit
- 2-hourPractical/Drawing(P) per week per semester=1Credit
- Four credit courses are to be designedfor60 hours of Teaching-Learning process.
- Three credit courses are tobedesignedfor48hoursof Teaching-Learning process.
- Two credit courses are to bedesignedfor28hoursofTeaching-Learningprocess.
- One credit course is to be designed for 15 hours of the teaching-learning process.

Semester	**:**	**III**
Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	**Structural Dynamic sLaboratory**
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	**MTDSCCE340**

COURSE OBJECTIVE:

• To be able to perform the dynamic analysis of SDOF and MDOF systems.

• To be able to understand torsion response of structure.

List of Experiment (Minimum 10 numbers of experiments to be perform)

1. Simple Harmonic Oscillator
2. Free Vibration of S.D.O.F System
3. Forced Vibration of S.D.O.F System
4. Impulse Response of S.D.O.F System
5. Concept of Response Spectrum
6. Vibration of M.D.O.F System
7. Behaviour of Rigid Blocks
8. Torsional response of Building
9. Continuous Systems
10. Vibration Control

List of Equipment / Machine Required:

a. Virtual Lab

b. STAAD Pro Software

COURSE OUTCOME:

• Understand basic concepts related to dynamic analysis of structures.

• Perform analysis of SDOF and MDOF

• Perform dynamic analysis of various structures using numerical methods

TEXT BOOK:

1.T. Irvine, Partial Fractions in Shock and Vibration Analysis", Vibration data Publications, 1999.

2."Dynamics of structures" by Anil K Chopra.

3."T. Irvine, The State Space Method for Solving Shock and Vibration Problems", Vibration data Publications, 2005.

4."J.L. Merriam and L.G. Kraige, Engineering Mechanics", John Wiley, 2002.

Scheme of Teaching & Examination

Semester-IV

S. No.	Course Sub Category	Course Name	Code	Teaching Scheme				Evaluation Scheme		Total Marks
				Hours			Credits			
				Theory	Tutorial	Practical		CIA	ESE	
	RP	Project Work Phase -II	MTRP440	-	-	10	18	135	315	**450**
	Total			**0**	**0**	**10**	**18**	**135**	**315**	**450**

L–Lecture,T–Tutorial,ESE–EndSemesterExamination,P–Practical,IM–InternalMarks(IncludeClassTest&Teacher'sAssessments)

Note: TheoryInternalMarks(CIA)=30(CT-I=05,CT-II=05,Assignment=05,MidTerm=15)

PracticalInternalMarks(CIA)=20(Attendance=05,LabViva-Voce=05,LabRecordWork=10)

Discipline Specific Core Courses(DSCC) Major		Generic Elective(C)	AEC(Ability Enhancement Course)(D)	SEC/Internship (Skill Enhancement Course) (E)	RP/SEMINAR	Value Added Course (VAC)/Indian Knowledge System(IKS)/IKS (Core) (F)
Basic Sciences (A)	Engineering Sciences (B)					
					Project Work Phase -II	

Credit Definition:

- 1-hourlecture(L) per week per semester=1Credit
- 1-hour tutorial(T)per week per semester=1Credit
- 2-hourPractical/Drawing(P) per week per semester=1Credit

- ➢Four credit courses are to be designedfor60 hours of Teaching-Learning process.
- ➢Three credit courses are tobedesignedfor48hoursof Teaching-Learning process.
- ➢Two credit courses are to bedesignedfor28hoursofTeaching-Learningprocess.
- One credit courses are to be designed for 15hoursofTeachingLearningprocess

Scheme & Syllabus
Professional Elective
Master of Technology Computer Aided Structural Engineering

Professional Elective for M.Tech

S. No.	Code	Subject
1	MTPDSE400	Advanced Design of Steel Structures
2	MTPDSE401	Theory of Elastic Stability
3	MTPDSE402	Bridge Engineering
4	MTPDSE403	Advanced Construction Management
5	MTPDSE404	Advance Foundation Engineering
6	MTPDSE405	Design of Industrial Structures
7	MTPDSE406	Fabrication and Erection of Structures
8	MTPDSE407	Composite Construction using Structural Steel
9	MTPDSE408	Structural Dynamic
10	MTPDSE409	Optimization Techniques
11	MTPDSE410	Theory of Plates and Shells
12	MTPDSE411	Pre-Stressed Concrete
13	MTPDSE412	Green Building
14	MTPDSE413	Design of Formwork
15	MTPDSE414	Design of High Rise Building

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Advance Design of Steel Structure
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

• To develop in-depth understanding of advanced structural principles of stability, strength and service ability in structural design.

• To develop and extend students' analysis and design skills in hot-rolled steel and cold-formed steel structures.

• To familiarize students with computer packages commonly used in steel structural design. To explore the latest research outcomes in steel structures.

UNIT-I Plate and Gantry Girder

Design of Plate Girders, Vertical and Horizontal Stiffeners for plate girders, Connections and Splices. Forces acting on gantry girders, Cross sections for Gantry Girders, Design Considerations.

UNIT-II Industrial Building

Single storey Industrial buildings and bents, Design of Trusses, Purlins, Louver rails, Gable column etc., Analysis of Gable Frames, check for deflection.

UNIT-III High Rise Building

Design of members subjected to lateral loads and axial loads, Sway and non-sway frames, Permissible sway.

UNIT-IV Connections

Types of connections, Design of framed and seated beam connections, Unstiffened and Stiffened seat connections, Continuous beam-to-beam connections and continuous beam-to-column connection, moment resisting connections, welded and bolted connections.

UNIT-V Light Gauge Steel Structure

Types of cross sections, local bucking and lateral bucking, concepts of Effective width, Design of compression and tension members, Beams, Deflection of beams and design of beam webs. Combined stresses and connections.

COURSE OUTCOME:

Students who successfully complete this course will be able to:

• Identify and compute the design loads on a typical steel building.

• Identify the different failure modes of steel tension and compression members and beams, and compute their design strengths.

• Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria.

TEXT BOOK:

1. Teaching Resource for Structural Steel Design, Volumes I – III, Institute for Steel Development and Growth, Kolkata.

2. Various Indian Standard codes of practice on steel structures.

REFERENCE:

1. Davidson B. and Owens, G.W., Steel Designers' Manual, Blackwell Publishing, UK.

2. Proceedings of recent seminars/workshops / conferences and Papers from relevant National and International Journals.

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Advance Design of Steel Structure
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

•To define stability, instability, and buckling of structural members

•To analyze stability problems using energy and bifurcation buckling analysis approaches.

•To differentiate between column buckling for doubly symmetric, singly symmetric and asymmetric columns

UNIT-I Stability of Columns

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, orthogonally of buckling modes, Effect of shear on buckling load, Large deflection theory.

UNIT-II Methods of Analysis

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.

UNIT-III Beam, Column and Frame

Beam column behavior, 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.

UNIT-IV Buckling of Beams

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.

UNIT-V Buckling of Thin Plates

Isotropic rectangular plates, Governing Differential equations, Simply Supported on all edges, Use of Energy methods, Plates with stiffeners, Numerical Techniques.

COURSE OUTCOME:

After the completion of the course students are able to:

• Analyse the buckling of columns, beam-columns and find critical loads using energy and non-energy methods.

• Analyse the lateral buckling of beams by energy and non-energy methods.

• Analyse the buckling of rectangular plates and find critical compressive loads for various boundary conditions

TEXT BOOKS:

1. Ashwini kumar, “Stability of Structures”, Allied Publishers Ltd.

2. Stephen P. Timoshenko and Gere “Theory of Elastic stability”, McGraw-Hill Company.

REFERENCES:

1. Smitses, Elastic Stability of Structures, Prentice Hall.

2.NGR Iyengar, “Structural Stability of
Columns and Plates” Affiliated East- West Press Pvt. Ltd

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Bridge Engineering
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

• The main aim of this course is to enable students to choose the appropriate bridge type for a given project and to analyses and design the main components of the chosen bridge.

• The course also provides students with fundamental knowledge in a wide range of state-of-the-art practices, including code specifications, in bridge engineering.

UNIT-I Introduction and Investigation for Bridges

Components Of a Bridge, Classification, Standard Specifications, Need for Investigation, Selection of Bridge Site, Preliminary Data to be Collected, Preliminary Drawings, Determination of Design Discharge, Economical Span, Location of Piers And Abutments, Vertical Clearance Above HFL, Scour Depth, Choice of Bridge Type, Importance of Proper Investigation.

UNIT-II Design Consideration of RCC bridges

Various types of bridges (brief description of each type), Design of R.C.C. Culverts (Class 70R loading) and T-Beam Bridges.

UNIT-III Design Consideration of steel bridges

Various types of steel bridges (brief description of each type), Design of welded plate girder bridge. Design Principles of box girder bridges.

UNIT-IV Sub Structure for Bridges

Pier and Abutments Caps; Materials for Piers and Abutments, Design of Pier, Design of Abutment, Backfill behind Abutment, Approach Slab.

UNIT-V Bridge Bearings

General features, types of bearings, design of elastomeric pad bearing.

COURSE OUTCOME:

• Relate basic concepts for construction of bridges.

• Design of a culvert and T-beam bridge.

•Summarize design principles of different steel bridges

•Analyze and design the substructure for bridge.

TEXT BOOK:

1.D. Johnson Victor, Essentials of Bridge Engineering, 6/e, Oxford and IBH Publishing, 2007.

2.Krishna Raju N., ―Design of Bridges‖, 4th Edition, Oxford & IBH Publishing, 2010.

REFERENCE:

1.Jagadish. T.R, Jayaram. M.A, ―Design of Bridge Structures‖, 2/e, Prentice Hall of India, 2009.

2.Ponnuswamy.S, Bridge Engineering, 2/e, Tata McGraw Hill E

Branch : **M.Tech Civil Engineering (Computer Aided Structural Engineering)**

Subject : Advance Construction Management

Total Theory Periods : **48**

Total Tutorial Periods : **0**

Total Credits : **03**

Code : MTPDSE400

COURSE OBJECTIVE:

•Discuss principles of management and its functions in construction organization.

•Knowledge of organization's working procedures and organizational developments and group decision making.

•Identify quality of team leader and qualities of project leader.

UNIT-I Organizing for Project Management

Project Management, Trends in Modern Management, Strategic Planning and Project Programming, Effects of Project Risks on Organization, Organization of Project Participants, Traditional Designer, Constructor Sequence, 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.

UNIT-II Design and Construction Process

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.

UNIT-III Labour, Material and Equipment Utilization

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.

UNIT- IV Cost Estimation

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.

UNIT- V Safety in Construction

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

COURSE OUTCOME:

• Apply fundamentals of management to utilize functions of management in construction. Like Demonstrate leadership qualities by implementing construction project processes with control.

• Implement planning strategies and policies.

• Carry out organisation and execute work in group in an organization.

TEXT BOOK:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.

2. Choudhury, S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.

REFERENCE:

1. Harold Kerzner, Project Management – A Systems Approach to Planning, Scheduling and Controlling, CBS Publishers & Distributors, Delhi, 1988.

2.Joy, P.K., Total Project Management – The Indian Context, Macmillan India Ltd., New Delhi, 19

Branch : **M.Tech Civil Engineering (Computer Aided Structural Engineering)**

Subject : Advance Foundation Engineering

Total Theory Periods : **48**

Total Tutorial Periods : **0**

Total Credits : **03**

Code : MTPDSE400

COURSE OBJECTIVE:

The objective of this course is:

• To learn about types and purposes of different foundation systems and structures.

• To provide students with exposure to the systematic methods for designing foundation.

• To discuss and evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behavior.

• To build the necessary theoretical background for design and construction of foundation system.

UNIT-I Principal of Foundation Engineering

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.

UNIT- II Soil Structure Interaction

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

UNIT -III Beams of Elastic Foundation

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

UNIT- IV Pile Foundation

Purpose/Uses of pile foundations, Classification of piles, Concrete and Steel Piles, their advantages and disadvantages, behavior 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.

UNIT- V Special Consideration

Improvement of foundation soils - Purpose, Improvement of Granular Soils, Improvement of Cohesive soils, Grouting, Geosynthetics, Specific Applications.

COURSE OUTCOME:

• Identify a suitable foundation system for a structure.

• Evaluate the importance of raft foundation and principles of design for buildings and tower structures.

• Analyse and design pile foundations.

TEXT BOOK:

1. Bowles J.E., Foundation Analysis and Design, Mc-Graw Hill International Edition.

2. Varghese P.C., Foundation Engineering, Printice Hall of India Private Limited.

REFERENCE:

1. Tomlinson, Foundation Design and Construction, ELBS Longman, 1996.

2. A. Singh & G.R. Chowdhry, Soil Engineering in Theory and practice, CBS Publishers,

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Design of Industrial Structure
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

• The objective of this course is to develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard.

• Students will gain good confidence in designing major industrial structures like bridge plate girders, industrial structures like gantry girders, water tanks, support structures, high rise chimneys and pre-engineered thin walled structures..

UNIT-I Planning and Functional Requirement

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines from Factories Act.

UNIT -II Industrial Building

Roofs for Industrial Buildings, Trusses and domes, Gantry Girders, Machine Foundations.

UNIT- III Bunkers and Silos

Analysis and Design of Bunkers and Silos.

UNIT- IV Power Plant Structure

Chimneys and Cooling Towers, High Pressure boilers and piping design, Nuclear containment structures.

UNIT -V Power Transmission Structure

Cables, Transmission Line Towers, Substation Structures, Tower Foundations, Testing Towers.

COURSE OUTCOME:

At the end of the course the student will be able to:

• Discuss the planning and functional requirements of Industrial structures.

• Discover the need to learn about the design concepts, and constructional aspects of Industrial structures.

•Analyse and evaluate the importance of various construction materials for Industrial constructions.

•Design portal frames, tower cranes and bracing system in Industrial buildings.

TEXT BOOK:

1.Indian Standard Codes and Handbooks on Industrial Structures

2.Relevant Publications from Institute for Steel Development and Growth, Kolkata

REFERENCE:

1.P.Srinivasulu and C.V. Vaidyanathan, Handbook of Machine Foundations, Tata McGraw-Hill 1976.

2.S.N. Manohar, Tall Chimneys – Design and Construction, Tata McGraw-Hill, 1985.

3.A.R. Santhakumar and S.S. Murthy, Transmision Line Structures, Tata McGraw-Hill 1992.

4.Dr. K. Rajagopalan – Storage Structures – Oxford IBH Publishing Company Ltd.

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Fabrication and Erection of Structure
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

• To ensure students about various methods of fabrication and erection methods.

• Students will understand various processes involved in fabrication and erection of steel structures.

• Students will learn about various tools used in fabrication.

UNIT-I General

Various slopes, size and properties of rolled steel sections, tubes and hollow rectangular sections: Chemical composition, physical properties and weld ability of various types of structures steel, their suitability for various purposes.

Various operations like interpretation of drawings, shop-floor operations, fastenings, assembling, finishing and shipping, sub-assemblies and main assemblies**.**

UNIT-II Fabrication Drawing

Structural connections, their classification, symbols for their representation, layout of an industrial building, preparation of fabrication drawing and detailing for columns, trusses, beams and cladding, detailing of truss joints, Column bases, beam to beam and column to beam connection (Seated and framed).

UNIT-III Erection Process

Principle of erection, Erection organization, Preparation and reading of erection drawing, Assembly marks, Common types of structures to be erected, erection of tackle and false work equipment for lifting and rigging, Code provisions for erection. Methods of erection, levelling and alignment, setting out and grouting, allowable tolerances for plumbing, Levelling and alignment.

UNIT-IV Tools for Erection

Miscellaneous small tools for erection like drifts, shackles and grips, erection of shed type buildings, portal rames, multistoried buildings, prefabricated tanks, towers and chimneys.

UNIT-V Inspection, Quality Control and Safety

Code provisions for tolerances and deviations, Inspection of welds, radiographic and ultrasonic techniques, various stages of inspection, Quality control departments, methods of rectification of defects.

Accidents and their causes, various unsafe acts and precautions for their prevention, Rules for safety for cranes, winches, etc. Safety during electrical operations and while using X-ray equipment, Maintenance of erected structures, surface treatment against corrosion, etc**.**

COURSE OUTCOME:

At the end of the course the student will be able:

• To know the procedure of prefabrication.

• To design the structural prefabricated elements.

• To familiarize with joining techniques used for prefabrication

TEXT BOOK:

1. Structural Steel Fabrication and Erection – S.K. Saxena and R.B. Asthane (Somaiya Publications, 172, Mumbai Marathi Granth, Sangrahalaya Marg, Dadar, Bombay-14)

2. Guide Book for Fabrication and Erection of Steel Structures, Institute for Steel Development and Growth,Kolkata

REFERENCE:

1. Shivagunde R.B. and Asthana R.B., Structural Steel Drafting and Detailing, Somaiya Publications, New Delhi.

2. Steel Designer's Manual: Edited by Graham W. Owens & Peter R. Knowles, 5th Edition, Blackwell Scientific Publications, London.

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Composite Construction Using Structural Steel
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

•To develop an understanding of the behaviour, analysis and design of Steel concrete composite elements and structures.

• To familiarize with the design and analysis procedure of steel and concrete composite elements.

• To Learn about design of composite bridges**.**

UNIT –I Introduction

Introduction to steel - Concrete composite construction, Theory of composite structures, Seismic behavior of composite structures.

UNIT- II Design of Composite Member

Behavior of composite beams and Columns, Design of composite beams, Steel – Concrete composite columns, Design of composite trusses.

UNIT- III Design of Connection

Types of connections, Design of connections in the composite structures, Shear connections, Design of connections in composite trusses.

UNIT- IV Composite Bridgers

Introduction, Behavior of composite bridges, Design concepts.

UNIT -VCase Studies

Case studies on steel - Concrete composite construction in buildings and bridges.

COURSE OUTCOME:

At the end of the course student will be able to:

• Analyze steel concrete composite structures.

• Design composite structures and its connections.

•Conduct case studies related to steel concrete composite constructions of buildings.

TEXT BOOK:

1.Johnson R.P., Composite structures of steel and concrete, Blackwell Scientific Publications (Second Edition), UK, 1994.

2.Handbooks Published by Institute for Steel Development and Growth, Kolkata

REFERENCE:

1.Owens, G.W. and Knowels.P. Steel Designers manual (Fifth edition), Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.

2.Proceedings of recent seminars / workshops / conferences and Papers from relevant National and International Journals.

Branch : **M.Tech Civil Engineering (Computer Aided Structural Engineering)**

Subject : Structural Dynamics

Total Theory Periods : **48**

Total Tutorial Periods : **0**

Total Credits : **03**

Code : MTPDSE400

COURSE OBJECTIVE:

• To provide the fundamental understanding of the structural dynamics and the problem solving ability for dynamic response in civil engineering design, analysis and research.

• To introduce students to analytical and numerical methods in structural dynamics with emphasis on vibration and to opportunities to optimize system for desired dynamic response.

UNIT -I Basic Concept

Types and sources of dynamic loads, Methodology for dynamic analysis, Study of IS-1893, fundamentals of rigid and deformable dynamics.

UNIT –II Single Degree of Freedom System

Free and forced response, effect of damping, Analysis of undamped and viscously damped single degree of freedom. Response of single degree freedom systems to Harmonic loading, support motions and Transmissibility, Duhamel's integral.

UNIT- III Multi-Degree of Freedom System

Free vibrations of lumped mass multi degree freedom systems, analysis of undamped and viscously damped multi degree of freedom. Rayleigh's method, orthogonally criteria.

UNIT –IV Idealization of Structure

Mathematical models, Mode superposition methods, distributed mass properties**.**

UNIT –V Application to Earthquake Engineering

Introduction to vibrations due to earthquake, Response spectra. Response spectrum method for seismic design of structures.

COURSE OUTCOME:

• Classify the principles of structural dynamics.

• Summarize the solution technique for dynamics of MDOF systems.

• Design and develop analytical skills to calculate natural frequencies and mode shape.

•Analyze for lateral load on structures.

TEXT BOOK:

1.Chopra, A. K., Dynamics of Structures - Theory and Applications to Earthquake Engineering, Second Edition, Prentice Hall, 2001.

2.Rao, S. S., Mechanical Vibrations, Third Edition, Addison-Wesley Publishing Co., 1995

REFERENCE:

1.Clough, R. W., and J. Penzien, Dynamics of Structures, Second Edition, McGraw-Hill, 1993.

2.Mario Paz, Structural Dynamics – Theory and Computations, Third Edition, CBS publishers, 1990

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Optimization Technique
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

Students will learn:

• The problem formulation by using linear, dynamic programming, game theory and queuing models.

• The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.

• Formulation of mathematical models for quantitative analysis of managerial problems in industry.

UNIT- I Optimizing Technique

Basic Concepts and introduction of engineering optimization, single-variable optimization, Multivariable optimization with no constraints, equality constraints and inequality constraints.

UNIT- II Linear Programming

Basic concepts of Linear programming, Applications of Linear Programming, standard forms of a Linear programming problems, solution of a system of linear simultaneous equations, Decomposition principle, Quadratic programming.

UNIT- III Non-Linear Programming

Basic concepts of Non-linear programming, Uni-modal function, Elimination methods, Interpolation methods, classification of unconstrained minimization methods- Direct search methods, Indirect search methods, characteristics of a constrained problem-Direct methods, Indirect methods.

UNIT- IV Geometric Programming

Unconstrained minimization problem, constrained minimization, Applications of Geometric programming.

UNIT- V Special Optimizing Technique

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

COURSE OUTCOME:

• Classify optimization and various techniques.

• Solve various linear and Non-linear problems.

• Solve a problem by geometric programming and dynamic programming .

• Apply optimization to various structural elements.

TEXT BOOK:

1. Rao S.S., Engineering Optimization Theory and Practice, New Age Publishers, Delhi

2. Deb K., Optimization for Engineering Design, Algorithms & examples, Prentice Hall of India, Delhi

REFERENCE:

1. Arora J.S., Introduction to optimum Design, TMH, Delhi

2.x R.L., Optimization methods for Engineering Design, Addison Wesley Publishing.

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Theory of Plates and Shells
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

The course should enable the students to:

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

•Use analytical methods for the solution of shells.

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

•Apply the numerical techniques and tools for the complex problems in shells

UNIT- I Basic Concept

The fundamental elasticity equations. Theory of elasticity and real structures. The fundamental elasticity problems. Boundary conditions. Compatibility equations. Applications.

Calculation of displacement components. The plane stress and plane strain problem.

UNIT –II Analysis of Plates

Equation of equilibrium and deformation of plates, bending of rectangular plates and circular plates. Energy method, finite difference and finite element methods for solution of plate bending problems.

UNIT- III Folded Plates

Analysis and design of folded plates, Detailing of Reinforcement in folded plates.

UNIT- IV Analysis of Shells

Geometry of shells, Classification of Shells, membrane theory of circular and cylindrical shells, Introduction to the bending theory of shells.

UNIT- V Cylindrical Shells

Analysis and design of cylindrical shells, Detailing of Reinforcement in shells.

COURSE OUTCOME:

• Identify the concept of thin plates using various approaches.

• Analyze the thin plates subjected to different loading and boundary conditions.

• Discuss the behavior of shells and their classifications and stress-strain and force-displacement relationship.

• Analyze different types of shells subjected to different loading criterion and boundary conditions.

TEXT BOOK:

1. Timoshenko S.P. and Woinoswski-Krieger S., Theory of Plates and Shells. McGraw-Hill.

2. Gould Philipp L., Analysis of Shells and Plates. Springer Verlag New York.

REFERENCE:

1. Reddy J. N., Theory and Analysis of Elastic Plates. Taylor and Francis, London.

2. Szilard R., Theory and Analysis of Plates. Prentice-Hall, Englewood Cliffs.

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Pre-Stressed Concrete
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

• Students will know about the introduction of material properties and pre-stressing.

• Students will be able to design various types pre-stressing members of structure.

• Students will gain knowledge about advantage and disadvantages of pre-stressing.

UNIT- I Introduction- Theory and Behaviour

Basic concepts, Advantages, Materials required, Systems and methods of pre-stressing, Analysis of sections, Stress concept, Strength concept, Load balancing concept, Effect of loading on the tensile stresses in tendons, Effect of tendon profile on deflections, Factors influencing deflections, Calculation of deflections, Short term and long term deflections, Losses of pre-stress, Estimation of crack width.

UNIT- II Design for Flexure and Shear

Basic assumptions for calculating flexural stresses, Permissible stresses in steel and concrete as per I.S.1343 Code, Design of sections of Type I and Type II post-tensioned and pre-tensioned beams, Check for strength limit based on I.S. 1343 Code, Layout of cables in post-tensioned beams, Location of wires in pre-tensioned beams, Design for shear based on I.S. 1343 Code.

UNIT-III Deflection and Design for Anchorage Zone

Factors influencing deflections – Short term deflections of un-cracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT -IV Composite Beam and Continuous Beam

Analysis and design of composite beams, Methods of achieving continuity in continuous beams, Analysis for secondary moments, Concordant cable and linear transformation, Calculation of stresses, Principles of design.

UNIT- V Miscellaneous Structure

Design of tension and compression members, Tanks, Pipes and poles, Partial pre-stressing, Definition, methods of achieving partial pre-stressing, Merits and demerits of partial pre-stressing.

COURSE OUTCOME:

• Students learned about the pre stressing steel material properties.

• Students learned about the structural effect of pre stressing, and practical performance.

• Students designed the most common types of precast concrete elements and the connections between them.

TEXT BOOK:

1. Pre-stressed Concrete – Krishna Raju N. (New Age International).

2. G.S. Panditand S.P. Gupta, “Prestressed Concrete”, CBS Publishers and Distributers Pvt. Ltd, 2012.

REFERENCE:

1. N. Rajagopalan, “Pre-stressed Concrete”, Narosa Publishing House, 2002.

2. P. Dayaratnam, “Pre-stressed Concrete Structures”, Oxford and IBH, 2013

3. T.Y. Lin and Ned. H. Burns, “Design of pre-stressed Concrete Structures”, Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.

4. IS 1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012

5. IS 3370- Part 4 (2008) Indian standard Code of practice for concrete structures for the storage of liquid-Design tables, code of practice, bureau of Indian standards, New Delhi

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Green Building
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

• To imbibe basics of green design and sustainable development concept.

• To identify various area of implementing strategies for green design in projects to enhance built environment.

• To learn institutional guidelines for development and certification of green designs.

UNIT-I Introduction to Green Buildings

Concept of green building design. Need for energy and resource efficient design. Factors affecting the Energy use in Buildings – Pre-Building Stage, Construction Stage & Post Occupancy stages. Building life cycle analysis. Need for Green Building rating Systems. Brief introduction to green rating systems in India.

UNIT-II Sustainable Site Construction and Management

Selection of site, preserving and protecting landscape during construction, Top soil conservation, reducing hard paving on site, provide sanitation and safety facilities for construction workers Efficient design of services – water management: water supply and treatment methods, rain water harvesting, water recycling, reuse of water and installation of water-efficient fixtures. Waste management: reduction of waste during construction, efficient segregation of waste, resource recovery from waste.

UNIT-III Building Physics

heat transfer in buildings (conduction, convection and radiation) and importance material selection for building envelope. Specification of materials for walls and roofs in different climates. Building materials and resources: Sustainable Building Materials– Biodegradable & Non- Biodegradable Materials, resource reuse, recyclable materials, recycled content, Regional materials. Energy Efficient Construction Technology – Filler Slab, Rat trap Bond. Technologies developed by CBRI. Contemporary and future trends Nanotechnology, smart materials.

UNIT-IV Energy Conservation

Optimizing building design to reduce conventional energy demand, reducing material usage and time of construction by adopting efficient technologies, conserving energy through selection energy efficient equipment. Alternative sources of energy: Renewable energy sources, Photo Voltaic Cells, small scale hydro and wind systems, photovoltaic cells.

UNIT-VIndoor Environmental Quality

Need to improve indoor air quality-sick building syndrome, building related illness, multiple chemical sensitivity. Reducing indoor air pollutants- lowVOC paints / adhesives /sealants, Minimize ozone depleting substances, required levels of indoor ventilation. Indoor and outdoor noise levels. Case Study/Desktop Study: Case study of a live project on Green Buildings or a desktop study of a Green building.

COURSE OUTCOME:

After learning the course the students shall be able to:

• Demonstrate green concept skills and apply tools of Green building assessment.

• Select appropriate green building material and technique.

• Design sustainable and energy efficient civil engineering project.

• Carry out Green Building rating using IGBC guidelines.

TEXT BOOK:

1. Abridged Version reference guide for New Buildings (IGBC rating system)

2. ECBC reference guide.

REFERENCE:

1. New buildings reference guide

2. Heather L. Venhaus, Designing the Sustainable Site: Integrated Design Strategies for Small Scale Sites and Residential Landscapes

3. Faisal Zia, VasudevanRajaram, Solid and liquid waste management,

4. Siddiqui, Sanjeev Agrawal, Mohammed Emran Khan, Introduction to Architectural Science

5. S. V. Szokolay, The Basis of Sustainable Design

6. Sustainable Construction Techniques. From structural design to interior fit-out:

7. ebastian / John, Viola / Zeumer, Martin Assessing and improving the environmental impact of buildings by El khouli,

Branch : **M.Tech Civil Engineering (Computer Aided Structural Engineering)**

Subject : Design of Formwork

Total Theory Periods : **48**

Total Tutorial Periods : **0**

Total Credits : **03**

Code : MTPDSE400

COURSE OBJECTIVE:

• To impart knowledge on common form work and special form works, and design of form work with different materials for various structural elements.

• To impart the knowledge about designing of formwork.

• To discuss about various formwork failure.

UNIT-I Introduction and Material

Requirements and Selection of Formwork, Formwork Materials- Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

UNIT-II Formwork Design

Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab andBeams.

UNIT-III Formwork Design for Special Structures

Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

UNIT-IV Flying Formwork

Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues – Pre- and Post-Award.

UNIT-V Formwork Failures

Causes and Case studies in Formwork Failure, Formwork Issues in Multistory Building Construction.

COURSE OUTCOME:

At the end of the Course, the Student will be able to:

• Explain the various materials required for formwork.

• Analyse the loads on formwork.

• Design the formwork systems.

• Discuss the applications of special forms and their safety

TEXT BOOK:

1. Hurd, M.K., Formwork for Concrete, 7th Edition, American Concrete Institute, 2005.

2. Robert L. Peurifoy and Garold D. Oberlender, Formwork for Concrete., Structures, 4thEdition, McGraw Hill Professional, 2010

REFERENCE:

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

2. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.

3. IS 14687: 1999, Falseworkfor Concrete Structures - Guidelines, BIS.

Branch	**:**	**M.Tech Civil Engineering (Computer Aided Structural Engineering)**
Subject	**:**	Design of High Rise Building
Total Theory Periods	**:**	**48**
Total Tutorial Periods	**:**	**0**
Total Credits	**:**	**03**
Code	**:**	MTPDSE400

COURSE OBJECTIVE:

• To study the behavior of tall structures.

• To learn analysis and design of buildings for wind loads

• To study design criteria for tall structures.

• To familiarize the students about stability analysis of tall structures.

• To study behavior of various structural systems under wind loads.

UNIT-I Introduction

Introduction of high rise building, general information about high rise building, uses of high rise building, advantages and disadvantages of high rise building

UNIT-I Design of Transmission/ TV Tower, Mast and Trestles

Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

UNIT-II Analysis and Design of RC and Steel Chimney

Foundation design for varied soil strata.

UNIT-III Tall Buildings

Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.

UNIT-IV Application Based On Software

Application of software in analysis and design.

COURSE OUTCOME:

At the end of the course student will be able:

• To apply all types of loads on tall buildings according IS code.

• To analyze and Design tall buildings.

• To understand behavior of various structural systems under different loading conditions.

• To design towers, chimneys and shear walls.

• To check stability of tall structures against buckling, Torsion.

TEXT BOOK:

1. Bryan Stafford Smith and Alex Coull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 1991.

2. S.N. Manohar, “Tall Chimneys: Design and Construction”, McGraw-Hill, 1988.

REFERENCE:

1. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., SouthAsian Publishers, New Delhi,

2002.
2. Structural Analysis and Design of Tall Buildings, Taranath B. S., McGraw Hill, 1988.
3. Illustrated Design of Reinforced ConcreteBuildings(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.
6. High Rise Building Structures, Wolfgang Schueller, Wiley., 1971.
7. Tall Chimneys, Manohar S. N., Tata McGraw Hill Publishing Company, New Delhi