EXCEL ENGINEERING COLLEGE
(Autonomous)
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NBA, NAAC with "A+" and Recognised by UGC (2f &12B)
KOMARAPALAYAM – 637303

DEPARTMENT OF CIVIL ENGINEERING
M.E STRUCTURAL ENGINEERING
REGULATION 2022
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTER CURRICULUM

SEMESTER I									
Sub code	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course (s)									
22PMA101	Advanced Mathematical Methods	FC	3	2	0	4	40	60	100
22PSE101	Advanced Concrete Structures	PC	3	0	0	3	40	60	100
22PSE102	Structural Dynamics	PC	3	0	0	3	40	60	100
22PSE103	Theory of Elasticity and Plasticity	PC	3	0	0	3	40	60	100
22PSEEXX	Professional Elective I	PE	3	0	0	3	40	60	100
22PSEEXX	Professional Elective II	PE	3	0	0	3	40	60	100
		Total	**18**	**2**	**0**	**19**	**240**	**360**	**600**

SEMESTER II									
Sub code	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course (s)									
22PSE201	Advanced Steel Structures	PC	3	2	0	4	40	60	100
22PSE202	Stability of Structures	PC	3	0	0	3	40	60	100
22PSE203	Experimental Techniques and Model Analysis	PC	3	0	0	3	40	60	100
22PSE204	Finite Element Analysis	PC	3	0	0	3	40	60	100
22PSEEXX	Professional Elective III	PE	3	0	0	3	40	60	100
22PSEEXX	Professional Elective IV	PE	3	0	0	3	40	60	100
Practical Course									
22PSE205	Advanced Structural Engineering Laboratory	PC	0	0	6	3	50	50	100
Employability Enhancement Course									
22PSE206	Industrial Training – I	EEC	(2 Weeks)			1	50	50	100
		Total	**18**	**2**	**6**	**23**	**440**	**460**	**900**

SEMESTER III									
Sub code	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course (s)									
22PEE301	Research Methodology and Intellectual Property Rights	PC	3	0	0	3	40	60	100
22PSEEXX	Professional Elective V	PE	3	0	0	3	40	60	100
22PSEEXX	Professional Elective VI	PE	3	0	0	3	40	60	100
Employability Enhancement Course									
22PSE301	Project work (Phase I)	EEC	0	0	12	6	50	50	100
22PSE302	Industrial Training II	EEC	(2 Weeks)			1	100	0	100
TOTAL			**9**	**0**	**12**	**16**	**270**	**230**	**500**

SEMESTER-IV									
Sub code	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Employability Enhancement Course									
22PSE401	Project work (Phase II)	EEC	0	0	24	12	50	50	100
		TOTAL	**0**	**0**	**24**	**12**	**50**	**50**	**100**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 70

CREDIT SUMMARY

S.No	CATEGORY	CREDITS PER SEMESTER				TOTAL CREDIT	CREDITS IN %
		I	II	III	IV		
1	FC	4				4	**5.7**
2	PC	9	16	3		28	**40.0**
3	PE	6	6	6		18	**25.7**
4	EEC		1	7	12	20	**28.6**
TOTAL		19	23	16	12	70	**100.0**

FC - Foundation Course
PC - Professional Core
PE - Professional Electives
EEC - Employability Enhancement Courses
MC - Mandatory Courses (Non-Credit Courses)
CA - Continuous Assessment
FE - Final Examination

PROFESSIONAL ELECTIVE I& II									
SEMESTER I									
Sub code	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
22PSEE01	Maintenance and Rehabilitation of Structures	PE	3	0	0	3	40	60	100
22PSEE02	Prefabricated Structures	PE	3	0	0	3	40	60	100
22PSEE03	Offshore Structures	PE	3	0	0	3	40	60	100
22PSEE04	Matrix Methods for Structural Analysis	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVES III & IV									
SEMESTER II									
Sub code	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
22PSEE11	Theory of Plates	PE	3	0	0	3	40	60	100
22PSEE12	Mechanics of Composite Materials	PE	3	0	0	3	40	60	100
22PSEE13	Analysis and Design of Tall Buildings	PE	3	0	0	3	40	60	100
22PSEE14	Industrial Structures	PE	3	0	0	3	40	60	100
22PSEE15	Prestressed Concrete	PE	3	0	0	3	40	60	100
22PSEE16	Wind and Cyclone Effects on Structures	PE	3	0	0	3	40	60	100
22PSEE17	Advanced Characterisation of Construction Materials	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVES V& VI									
SEMESTER III									
Sub code	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
22PSEE21	Nonlinear Analysis of Structures	PE	3	0	0	3	40	60	100
22PSEE22	Design of Sub Structures	PE	3	0	0	3	40	60	100
22PSEE23	Optimization of Structures	PE	3	0	0	3	40	60	100
22PSEE24	Design of Steel Concrete Composite Structures	PE	3	0	0	3	40	60	100
22PSEE25	Design of Bridges	PE	3	0	0	3	40	60	100
22PSEE26	Design of Shell and Spatial Structures	PE	3	0	0	3	40	60	100
22PSEE27	Computer Aided Analysis and Design	PE	3	0	0	3	40	60	100
22PSEE28	Design of Formwork	PE	3	0	0	3	40	60	100
22PSEE29	Earthquake analysis and design of structures	PE	3	0	0	3	40	60	100

22PMA101	Advanced Mathematical Methods	L	T	P	C
		3	2	0	4
Nature of Course	Foundation Courses				
Pre requisites	Basic Mathematics				

Course Objectives:

The course is intended to

1. The main objective of this course is to provide the student with a repertoire of mathematical methods that are essential to the solution of advanced problems encountered in the fields of applied physics and engineering.
2. This course covers a broad spectrum of mathematical techniques such as Laplace Transform, Fourier Transform, Calculus of Variations, Conformal Mapping and Tensor Analysis. Application of these topics to the solution of problems in physics and engineering is stressed.
3. Find the minima or extreme of some quantity over a system that has functional degrees of freedom
4. The aim of the course is to teach the principal techniques and methods and analytic and geometric function theory
5. Expose student to mathematical applications of vector and tensor to handle diverse problems which occur in real life situation

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Blooms Level
CO1	Application of Laplace and Fourier transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.	Understand
CO2	Maximizing and minimizing the functional that occur in various branches of Engineering Disciplines	Apply
CO3	Construct conformal mappings between various domains and use of conformal mapping in studying problems in physics and engineering particularly to fluid flow and heat flow problems.	Apply
CO4	Understand tensor algebra and its applications in applied sciences and engineering and develops ability to solve mathematical problems involving tensors.	Apply
CO5	Competently use tensor analysis as a tool in the field of applied scienc related fields.	Analyze

Course Contents:

Unit – I Laplace Transform Techniques for Partial Differential Equations 12

Laplace transform: Definitions – Properties – Transform error function – Bessel's function - Dirac delta function – Unit step functions – Convolution theorem – Inverse Laplace transform: Complex inversion formula – Solutions to partial differential equations: Heat equation – Wave equation.

Unit - II Fourier Transform Techniques For Partial differential equations 12

Fourier transform: Definitions – Properties – Transform of elementary functions – Dirac delta function – Convolution theorem – Parseval's identity – Solutions to partial differential equations Heat equation – Wave equation – Laplace and Poisson's equations.

Unit- III Calculus of Variations 12

Concept of variation and its properties – Euler's equation– Functional dependant on first and higher order derivatives– Functional dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems – Direct methods – Ritz and Kantorovich methods.

Unit - IV Conformal Mapping And Applications 12

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel trans formation Transformation of boundaries in parametric form – Physical applications : Fluid flow and heat flow problems.

Unit - V Tensor Analysis 12

Summation convention – Contra variant and covariant vectors – Contraction of tensors – Inner product – Quotient law Metric tensor – Christoffel symbols – Covariant differentiation – Gradient - Divergence and curl

Total: 60 Periods

Reference Books:

1. Mathews, J. H., and Howell, R.W., “Complex Analysis for Mathematics and Engineering", 5 th Edition, Jones and Bartlett Publishers,2006.
2. Naveen Kumar, “An Elementary Course on Variational Problems in Calculus ", Narosa Publishing House, 2005.
3. Ramaniah. G. “Tensor Analysis”, S. Viswanathan Pvt. Ltd., 1990.
4. Saff, E.B and Snider, A.D, “Fundamentals of Complex Analysis with Applications in Engineering, Science and Mathematics", 3rd Edition, Pearson Education, New Delhi,2014.
5. Sankara Rao, K., “Introduction to Partial Differential Equations”, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
6. Spiegel, M.R., “Theory and Problems of Complex Variables and its Applications”, Schaum’s Outline Series, McGraw Hill Book Co.,1981
7. Andrews L.C. and Shivamoggi, B., "Integral Transforms for Engineers”, Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
8. Elsgolc, L.D., “Calculus of Variations", Dover Publications Inc., New York, 2007.
9. Kay, D. C., "Tensor Calculus”, Schaum's Outline Series, Tata McGraw Hill Edition,2014

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	3								1	3	1
CO2	3	3	2	3								1	3	1
CO3	3	3	2	3								1	3	1
CO4	3	3	2	3								1	3	1
CO5	3	3	2	3									3	1
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Assignments	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	20	20	20	40
Analyse	10	10	10	20
Evaluate	10	10	10	10
Create	0	0	0	0

22PSE101	Advanced Concrete Structures	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Analyzing and design the structural elements				

Course Objectives:

The course is intended

1. To make the students be familiar with the limit state design of RCC beams, slabs and columns
2. To design special structures such as RC walls, Deep beams, Corbels and Grid floors
3. To make the students confident to design the flats lab as per Indian standard, yield line theory and strip method.
4. To make the students to be aware on inelastic behavior of concrete beam and column
5. To design the beams based on limit analysis and detail the beams, columns and joints for ductility

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand how the constituents and mix proportions of concrete influence its early age properties, Mechanical properties, volume changes and durability, via an appreciation of their influence on concrete micro structure.	Understand
CO2	Gain the ability to design RC walls, Corbels, grid floors and proportion concrete mixtures to a specified performance	Analyse
CO3	Become familiar with design of flat slab as per IS method, yield line their and strip method	Analyse
CO4	Gains the knowledge on inelastic on inelastic behavior of concrete beams and columns	Understand
CO5	Design various concrete structures and structural elements by limit state design and detail the same for ductility as per codal requirements.	Analyse

Course Contents:

Unit – I Design Philosophy **9**

Limit state design - beams, slabs and columns according to IS Codes. Calculation of deflection and crack width according to IS Code. interaction curve generation for axial force and bending

Unit - II Design of Special RC Elements **9**

Design of slender columns - Design of RC walls. Strut and tie method of analysis for corbels and deep beams , Design of corbels, Deep-beams and grid floors.

Unit - III Flat Slabs and Yield Line Based Design **9**

Design of flat slabs and flat plates according to IS method – Check for shear - Design of spandrel beams – Yield line theory and Hillerborg's strip method of design of slabs.

Unit - IV Inelastic Behavior of Concrete Beams and Columns **9**

Inelastic behaviour of concrete beams and Baker's method, moment - rotation curves, ductility definitions, Evaluation

Unit - V Ductile Detailing **9**

Concept of Ductility – Detailing for ductility – Design of beams, columns for ductility - Design of cast-in-situ joints in frames**.**

Total: 45 periods

Reference Books:

1. Gambhir.M. L., "Design of Reinforced Concrete Structures", Prentice Hall of India,2012.
2. Purushothaman, P, "Reinforced Concrete Structural Elements: Behaviour Analysis and Design", Tata McGraw Hill,1986
3. Unnikrishna Pillai and Devdas Menon "Reinforced Concrete Design', Third Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi,2007.
4. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall ofIndia,2005.
5. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall ofIndia,2007.
6. M.S. Shetty, Concrete Technology, S. Chand & Co.,2005
7. Raft Siddique, Spacial Structural Concrete, Galgotia Publication,2000
8. Krishna Raju, Design of Concrete Mixes, C.B.S. Publication,2002
9. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi,2006.
10. J. W. Dally and W. F. Riley, Experimental Stress Analysis, McGraw-Hill, Inc. New York,1978

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
Cos	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3									2		2
CO2	3	2	3									2		2
CO3	3	2	3									2		2
CO4	3	2	3									2		2
CO5	3	2	3									2		2
	3 - High					**2 - Medium**					**1 - Low**			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Assignments	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	20	20	20	40
Analyse	10	10	10	20
Evaluate	10	10	10	10
Create	0	0	0	0

22PSE102	Structural Dynamics	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Structural Analysis				

Course Objectives:

The course is intended

1. To expose the students the principles and methods of dynamic analysis of structures
2. To make the student familiar on two degrees of freedom systems
3. To make the students confident on structural dynamic response of multi degree of freedom system
4. To make the students aware on dynamic response of continues system
5. To make the students to understand the direct integration methods for dynamic response

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Be familiar with the principles and methods of dynamic analysis of structures	Understand
CO2	Prepare them for design the structures for wind, earthquake and other dynamic loads.	Analyse
CO3	Design the structures with all kind of loads	Analyse
CO4	Prepare them design the structures and develop with the mathematical models	Analyse
CO5	Prepare them to understand the techniques of direct integration and applications in the design of structures	Analyse

Course Contents:

Unit- I Principles of Vibration Analysis 9

Mathematical models of single degree of freedom systems - Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Transmissibility applications-examples related to structural engineering

Unit II Two Degree Of Freedom Systems 9

Mathematical models of two degree of freedom systems, free and forced vibrations of two degree of freedom systems, normal modes of vibration, applications

Unit- III Dynamic Response of Multi-Degree of freedom Systems 9

Mathematical models of Multi-degree of freedom systems, orthogonality of normal modes, free and forced vibrations of multi degree of freedom systems, Mode superposition technique, response spectrum method, Applications**.**

Unit - IV Dynamic Response of Continuous Systems 9

Mathematical models of continuous systems, Free and forced vibration of continuous systems, Rayleigh – Ritz Method – Formulation using Conservation of Energy – Formulation using Virtual Work, Applications.

Unit – V Direct Integration Methods for Dynamic Response **9**

Damping in MDOF systems, Nonlinear MDOF systems, step-by-step numerical integration algorithms, substructure technique, Applications.

Total: 45 periods

Reference Books:

1. Anil K.Chopra, Dynamics of Structures, Pearson Education,5th Edition 2017.
2. Leonard Meirovitch, Elements of Vibration Analysis, McGraw Hill, 2017, IOS Press,2006.
3. Mario Paz, Structural Dynamics -Theory and Computation, Kluwer Academic Publishers,2ND Edition 2004.
4. Roy R.Craig, Jr, Andrew J. Kurdila, Fundamentals of Structural Dynamics, John Wiley & Sons,2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	3		2						1	2	1
CO2	3	3	2	3		2						1	2	1
CO3	3	3	2	3		2						1	2	1
CO4	3	3	2	3		2						1	2	1
CO5	3	3	2	3		2						1	2	1
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Class Presentation or Tutorial Class	5	15
Understand	Assignment/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	0	0	0	0
Analyse	20	20	20	40
Evaluate	10	10	10	20
Create	0	0	0	0

22PSE103	Theory of Elasticity and Plasticity	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Material Science				

Course Objectives:

The course is intended

1. To understand the concept of Elasticity
2. To familiarize the 2D stress strain problems
3. To study the torsion of non circular sections
4. To impact knowledge on the concept of elastic analysis in beams of elastic formula
5. To understand the concept of plasticity

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the concept of elastic analysis of plane stress and plane strain problems.	Understand
CO2	Gains sufficient knowledge in various theories of failure and plasticity.	Understand
CO3	Apply the concepts of elasticity and plasticity to Torsion of Non Circular section	Apply
CO4	Apply the concept of elastic analysis in Beams on elastic foundation	Apply
CO5	Be familiar to the concept of Plastic analysis of plane stress and plane strain problems.	Understand

Course Contents:

Unit – I Elasticity **9**

Analysis of stress and strain, Equilibrium Equations - Compatibility Equations - Stress Strain Relationship. Generalized Hooke's law.

Unit - II 2d Stress Strain Problems **9**

Plane stress and plane strain - Simple two dimensional problems in Cartesian and Polar Coordinates

Unit - III Torsion of Non-Circular Section **9**

St.Venant's approach - Prandtl's approach – Membrane analogy - Torsion of Thin Walled- Open and Closed sections-Design approach to open web section subjected to torsion

Unit- IV Beams on Elastic Foundations **9**

Beams on Elastic foundation – Methods of analysis – Elastic line method – Idealization of soil medium – Winkler model – Infinite beams – Semi infinite and finite beams – Rigid and flexible – Uniform Cross Section – Point load and UDL – Solution by Finite Differences.

Unit - V Plasticity **9**

Physical Assumptions – Yield Criteria – Failure Theories – Applications of Thick Cylinder – Plastic Stress Strain Relationship. Elasto-Plastic Problems in Bending and Torsion**.**

Total: 45 periods

Reference Books:

1. Chakrabarty.J, “Theory of Plasticity”, Third Edition, Elsevier Butterworth - Heinmann – UK,2007.
2. Jane Helena H, “Theory of Elasticity and Plasticity”, PHI Learning Pvt. Ltd., 2016.
3. Ansel.C.Ugural and Saul.K.Fenster, ”Advanced Strength and Applied Elasticity,” Fourth Edition, Prentice Hall Professional technical Reference, New Jersy,2003.
4. Slater R.A.C, “Engineering Plasticity”, John Wiley and Son, New York,1977.
5. Timoshenko, S. and GoodierJ.N."Theory of Elasticity", McGraw Hill Book Co., NewYork,2010.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2		3		2							2	
CO2	3	2		3		2							2	
CO3	3	2		3		2							2	
CO4	3	2		3		2							2	
CO5	3	2		3		2							2	
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Class Presentation or Tutorial Class	5	15
Understand	Assignment/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	20	20	20	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

II SEMESTER

22PSE201	Advanced Steel Structures	L	T	P	C
		3	2	0	4
Nature of Course	Professional Core				
Pre requisites	Analyzing and design the Structural Steel Elements				

Course Objectives:

The course is intended

1. To impart knowledge on the design of members subjected to combined forces
2. To understand the design of connections.
3. To gain knowledge on analysis and design of industrial structures
4. To familiarize on the plastic analysis of structures
5. To understand the analysis and design of light gauge steel structures

Course Outcomes:

On successful completion of the course, the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Design members subjected to combined forces	Create
CO2	Design the bolted and welded connections	Create
CO3	Analyse all different load acting on structure and design the industrial building	Create
CO4	Analyse the plastic analysis of structure	Analyse
CO5	Analyse the light gauge steel sections and design by effective width method	Create

Course Contents:

Unit - I General **12**

Design of members subjected to combined forces – Design of Purlins, Louver rails, Gable column and Gable wind girder – Design of simple bases, Gusseted bases and Moment Resisting Base Plates.

Unit - II Design of Connections **12**

Types of connections – Welded and Bolted – Throat and Root Stresses in Fillet Welds – Seated Connections – Unstiffened and Stiffened seated Connections – Moment Resistant Connections – Clip angle Connections – Split beam Connections – Framed Connections HSFG bolted connections.

Unit - III Analysis And Design of Industrial Buildings **12**

Analysis and design of different types of trusses – Analysis and design of industrial buildings – Sway and non sway frames – Aseismic design of steel buildings.

Unit - IV Plastic Analysis of Structures **12**

Introduction, Shape factor, Moment redistribution, Combined mechanisms, Analysis of portal frames, Effect of axial force - Effect of shear force on plastic moment, Connections – Requirement – Moment resisting connections. Design of Straight Corner Connections – Haunched Connections – Design of continuous beams.

Unit - V Design of Light Gauge Steel Structures **12**

Introduction to Direct Strength Method - Behaviour of Compression Elements - Effective width for load and deflection determination – Behaviour of Unstiffened and Stiffened Elements – Design of webs of beams – Flexural members – Lateral buckling of beams – Shear Lag – Flange Curling – Design of Compression Members – Wall Studs.

Total: 60 periods

Reference Books:

1. Lynn S. Beedle, Plastic Design of Steel Frames, John Wiley and Sons,1990.
2. Narayanan.R.etal., Teaching Resource on Structural steel Design, INSDAG, Ministry of Steel Publishing, 2000.
3. Subramanian.N, Design of Steel Structures, Oxford University Press,2014.
4. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company,1996
5. S. K. Duggal, Limit State Design of Steel Structures, McGraw Hill,2014.
6. IS 800 -2007, General Construction in Steel -Code of Practice (Third revision).
7. IS811-1987,Specification for cold formed light gauge structural steel sections
8. IS 9178 (Part 1) -1989, Design and construction of steel chimney code of practice.
9. IS 9178 (Part 2) -1979, Criteria for design of steel bins for storage of bulk materials.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3			3						2		2
CO2	3	2	3			3						2		2
CO3	3	2	3			3						2		2
CO4	3	2	3			3						2		2
CO5	3	2	3			3						2		2
	3 - High					**2 - Medium**					**1 - Low**			

Formative assessment:			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

ummative Assessment:				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSE202	Stability of Structure	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Analysis and design of Structures.				

Course Objectives:

The course is intended

1. To understand the states of equilibrium and buckling of columns
2. To impart Knowledge in phenomenon of buckling of beams, columns and frames
3. To understand the combined torsion and lateral buckling in beam / column joints
4. To gain knowledge on buckling of plates
5. To familiarize the concept of inelastic bucking of plates

Course Outcomes:

On successful completion of the course, the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Identify the type of equilibrium and failure pattern in structures.	Analyse
CO2	Calculate the critical load of columns at different end conditions by various methods.	Evaluate
CO3	Analyse the torsional and lateral buckling in beam / column joints.	Analyse
CO4	Calculate the lateral buckling of plates by differential equations.	Evaluate
CO5	Identify the inelastic buckling of plates	Analyse

Course Contents:

Unit - I Buckling of Columns **9**

States of equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem. Governing equation for columns - Analysis for various boundary conditions - using Equilibrium, Energy methods. Approximate methods - Rayleigh Ritz, Galerkins approach -Numerical Techniques - Finite difference method - Effect of shear on buckling.

Unit - II Buckling of Beam-Columns and Frames **9**

Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples Analysis of rigid jointed frames with and without sway – Use of stability function to determine the critical load.

Unit - III Torsional and Lateral Buckling **9**

Torsional buckling – Combined Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions. Lateral buckling of beams, pure bending of simply supported and cantilever beams.

Unit- IV Buckling of Plates **9**

Governing differential equation - Buckling of thin plates, various edge conditions -Analysis by equilibrium and energy approach – Finite difference method.

Unit - V Inelastic Buckling **9**

Double modulus theory - Tangent modulus theory - Shanley's model - Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behaviour of plates.

Total: 45 periods

Reference Books:

1. Ashwini Kumar, “Stability Theory of Structures”, Allied publishers Ltd., New Delhi,2003.
2. Chajes, A. “Principles of Structures Stability Theory”, Prentice Hall,1974.
3. Gambhir, “Stability Analysis and Design of Structures”, springer, New York,2004.
4. Simitser.G.J and Hodges D.H, ”Fundamentals of Structural Stability”, Elsevier Ltd.,2006.
5. Timoshenko.S.P, and Gere.J.M, “Theory of Elastic Stability”, McGraw Hill Book Company,1963.
   A. Chajes, Principles of Structural Stability Theory, Prentice Hall,2008.
6. N.G.R. Iyengar, Structural Stability of Columns and Plates, Affiliated East West press Pvt. Ltd, New Delhi -1988.
7. D.O.Brush, and B.O. Almorth, Buckling of Bars, Plates and Shells, McGraw Hill,2006
8. M.S. El Naschies, Stress, Stability and Chaos in Structural Engineering: An Energy Approach, McGraw Hill International Editions,1999

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3									2		2
CO2	3	3	3									2		2
CO3	3	3	3									2		2
CO4	3	3	3									2		2
CO5	3	3	3									2		2
	3 - High					**2 - Medium**					**1 - Low**			

Formative assessment:			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment:				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSE203	Experimental Techniques and Model Analysis	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Smart materials				

Course Objectives:

The course is intended

1. To learn the principles of measurements of forces and strain
2. To understand the structural vibration, wind blow and its measurements
3. To impart knowledge on distress measurements and control
4. To familiarize on methods of non destructive testing
5. To gain knowledge on model analysis

Course Outcomes:

On successful completion of the course, the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Know about measurement of Forces and strain	Understand
CO2	Know about measurement vibrations and wind blow.	Understand
CO3	Understand the distress measurements and control	Understand
CO4	Analyze the structure by non-destructive testing methods and model analysis.	Analyse
CO5	Gain knowledge of model analysis	Apply

Course Contents:

Unit - I Forces and Strain Measurement 9

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long-term monitoring – vibrating wire sensors– Fiber optic sensors.

Unit - II Measurement of Vibration And Wind Flow 9

Characteristics of Structural Vibrations– Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – wind tunnels – Flow meters – Venturimeter – Digital data Acquisition systems.

Unit- III Distress Measurements and Control 9

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete – Half cell, construction and use – damage assessment – controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring**.**

Unit- IV Non Destructive Testing Methods 9

Load testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission – ultrasonic testing Principles and application – Holography – use of laser for structural testing –Brittle coating, Advanced NDT methods – Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR, Ground penetrating radar (GPR).

Unit- V Model Analysis 9

Model Laws – Laws of similitude – Model materials – Necessity for Model analysis – Advantages – Applications – Types of similitude – Scale effect in models – Indirect model study – Direct model study - Limitations of models – investigations – structural problems –Usage of influence lines in model studies.

Total: 45 Periods

Reference Books:

1. Dalley .J. W and Riley. W. F, “Experimental Stress Analysis”, McGraw Hill Book Company,N.Y.1991
2. Ganesan.T.P, “Model Analysis of Structures”, University Press, India,2000.
3. Ravisankar.K. and Chellappan. A., “Advanced course on Non-Destructive Testing and
4. Evaluation of Concrete Structures”, SERC, Chennai,2007.
5. Sadhu Singh, “Experimental Stress Analysis”, Khanna Publishers, New Delhi,2006.
6. Sirohi.R.S.,Radhakrishna.H.C,“MechanicalMeasurements”,NewAgeIn ternational(P) Ltd. 1997

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3			3							3	
CO2	3	2	3			3							3	
CO3	3	2	3			3							3	
CO4	3	2	3			3							3	
CO5	3	2	3			3							3	
	3 - High					**2 - Medium**					**1 - Low**			

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Class Presentation or Tutorial Class	5	15
Understand	Assignment/Power point presentation	5	
	Attendance	5	

Summative Assessment:				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSE204	Finite Element Analysis	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Concept of Finite Element Techniques				

Course Objectives:

The course is intended

1. To understand the basics of the Finite Element Technique.
2. To understand the axial deformation of bars and spring elements
3. To impart knowledge on analysis of framed structures
4. To understand the concepts of analysis of plates and shells
5. To familiarize the students on applications of modeling and analysis using recent software's

Course Outcomes:

On successful completion of the course, the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Gain knowledge about concept of finite element	Understand
CO2	Acquire knowledge on axial deformation of bars and springs	Understand
CO3	Analyse the framed structures	Analyse
CO4	Analyse thick plates and shells	Analyse
CO5	Gain knowledge on modeling and analysis using recent softwares	Analyse

Course Contents:

Unit - I Introduction 9

Approximate solutions of boundary value problems - Methods of weighted residuals, approximate solution using variation method, Modified Galerkin method, Boundary conditions and general comments-continuity, compatibility, convergence aspects. Basic finite element concepts - Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method

Unit - II Application : Axial Deformation of Bars, Axial Spring Element 9

Natural Coordinates - Triangular Elements -Rectangular Elements - Lagrange and Serendipity Elements –Solid Elements-Isoperimetric Formulation - Stiffness Matrix of Iso parametric Elements Numerical Integration: One, Two and Three Dimensional -Examples**.**

Unit - III Analysis of Framed Structures 9

Stiffness of Truss Member - Analysis of Truss -Stiffness of Beam Member-Finite Element Analysis of Continuous Beam -Plane Frame Analysis -Analysis of Grid and Space Frame – Two Dimensional Solids - Constant Strain Triangle -Linear Strain Triangle -Rectangular Elements - Numerical Evaluation of Element Stiffness -Computation of Stresses, Geometric Nonlinearity and Static Condensation - Ax symmetric Element -Finite Element Formulation of Ax symmetric Element-Finite Element Formulation for 3 Dimensional Elements – Solution for simple frames

Unit- IV Plates and Shells 9

Introduction to Plate Bending Problems - Finite Element Analysis of Thin Plate -Finite Element Analysis of Thick Plate -Finite Element Analysis of Skew Plate - Introduction to Finite Strip Method-Finite Element Analysis of Shell.

Unit - V Applications 9

Finite Elements for Elastic Stability - Dynamic Analysis - Nonlinear, Vibration and Thermal Problems - Meshing and Solution Problems - Modeling and analysis using recent software's.

Total: 45 periods

Reference books:

1. Bhavikatti.S.S, “Finite Element Analysis”, New Age International Publishers,2007.
2. Chandrupatla, R.T. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”, Prentice Hall of India,2007.
3. Rao.S.S, “Finite Element Method in Engineering”, Butterworth – Heinmann, UK,2008
4. Logan D. L., A First Course in the Finite Element Method, Thomson Learning,2007.
5. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley&Sons.
6. David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGraw Hill Publishing Company Limited, New Delhi,2005
7.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3			3							3	
CO2	3	3	3			3							3	
CO3	3	3	3			3							3	
CO4	3	3	3			3							3	
CO5	3	3	3			3							3	
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Class Presentation or Tutorial Class	5	15
Understand	Assignment/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	20	20	20	40
Analyse	10	10	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

22PSE205	Advanced Structural Engineering Laboratory	L	T	P	C
		0	0	6	3
Nature of Course	Professional Core				
Pre requisites	Basics of Strength of Materials and Concrete Lab				

Course Objectives:

The course is intended

1. To train the students for casting and testing of RC beams
2. To impart knowledge on strength and deflection of simply supported steel beams
3. To train the students for casting and testing of RC columns
4. To gain knowledge on the dynamic response of cantilever steel beams
5. To impart training on Non Destructive Test s on of concrete

Course Outcomes:

On completion of this laboratory course students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Cast and test RC beams for strength and deformation behaviour.	Apply
CO2	Test simply supported steel beams for strength and deflection	Apply
CO3	Cast and test RC columns subjected to concentric and eccentric loading	Apply
CO4	Test the dynamic response of cantilever steel beams	Apply
CO5	Conduct non destructive test on concrete	Apply

Course Contents:

S.No	List of Exercises	CO Mapping	RBT
1	Fabrication, casting and testing of simply supported reinforced concrete beam for strength and deflection behaviour.	CO3	Understand
2	Testing of simply supported steel beam for strength and deflection behaviour.	CO3	Apply
3	Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading.	CO3	Understand
4	Dynamic Response of cantilever steel beam To determine the damping coefficients from free vibrations. To evaluate the mode shapes.	CO2	Understand

5	Static cyclic testing of single bay two storied steel frames and (i) evaluates Drift of the frame. (ii) Stiffness of the frame. (iii) Energy dissipation capacity of the frame.	CO2	Understand
6	Non-Destructive Test on concrete i)Rebound hammer and ii) Ultrasonic Pulse Velocity Tester.	CO3	Apply

Reference Books:

1. Dally J W, and Riley W F, "Experimental Stress Analysis", McGraw-Hill Inc. New York,1991**.**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	3									2		3
CO2	3	1	3									2		3
CO3	3	1	3									2		3
CO4	3	1	3									2		3
CO5	3	1	3									2		3
CO6	3	1	3									2		3
	3 - High					2 - Medium					1 - Low			

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember	10	10
Understand	10	10
Apply	30	30
Analyze	0	0
Evaluate	0	0
Create	0	0

22PSE206	Industrial Training - I	L	T	P	C
		0	0	0	1
Nature of Course	Professional Core				
Pre requisites	NA				

Course Objectives

The course is intended

1. To train the students in the construction field related to Structural Engineering
2. To develop skills in preparing project report
3. To compare the theoretical and construction field practical knowledge
4. To understand the practical difficulties and find suitable solutions
5. To get industrial exposure of various construction projects.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Train in tackling a practical field/industry orientated problem related to Structural Engineering.	Apply
CO2	Get knowledge of preparing a project report	Apply
CO3	Gain the practical knowledge in addition to the theoretical knowledge	Apply
CO4	Face the practical difficulties and able to find the solution	Apply
CO5	Gain knowledge on various construction projects.	Apply

Course Contents:

1. The students individually undertake training in reputed Industries during the summer vacation for a specified period of two weeks.
2. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester.
3. The students will be evaluated through a viva-voce examination by a team of internal staff.

Total: 2 Weeks

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						2	3	2	3	1			3	2
CO2						2	3	2	3	1			3	2
CO3						2	3	2	3	1			3	2
CO4						2	3	2	3	1			3	2
CO5						2	3	2	3	1			3	2
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Class Presentation or Tutorial Class	5	15
Understand	Assignment/Power point presentation	5	
	Attendance	5	

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Review 1 [50 marks]**	**Review 1 [50 marks]**
Remember	10	10
Understand	10	10
Apply	30	30
Analyze	0	0
Evaluate	0	0
Create	0	0

22PSEE01	Maintenance and Rehabilitation of Structures	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Repair and Maintenance				

Course Objectives:

The course is intended

1. To impart knowledge on causes of distress in concrete..
2. To gain knowledge on causes, diagnosis and remedial measures for building cracks
3. To acquire knowledge on moisture penetration in structures and remedial treatments
4. To familiarize on distresses in concrete structures and remedial measures
5. To understand the strengthening existing of structures

Course Outcomes:

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

CO. No.	Course Outcome	Bloom's Level
CO1	Study the damages, repair and rehabilitation of structures.	Understand
CO2	Demonstrate the various types of distress in concrete structures.	Understand
CO3	Identify the effects due to climate, temperature, chemicals, wear and erosion on structures	Apply
CO4	Analyze the failures in structures due to design and construction errors	Analye
CO5	Suggest methods and techniques for repairing/ strengthening concrete structures	Understand

Course Contents:

Unit- I Introduction **9**

General Consideration – Distresses monitoring – Causes of distresses – Quality assurance – Defects due to climate, chemicals, wear and erosion – Inspection – Structural appraisal – Economic appraisal**.**

Unit - II Building Cracks **9**

Causes – diagnosis – Thermal and Shrinkage cracks – unequal loading – Vegetation and trees – Chemical action – Foundation movements – Remedial measures - Techniques for repair – Epoxy injection**.**

Unit- III Moisture Penetration **9**

Sources of dampness – Moisture movement from ground – Reasons for ineffective DPC – Roof leakage – Pitched roofs – Madras Terrace roofs – Membrane treated roofs - Leakage of Concrete slabs – Dampness in solid walls – condensation – hygroscopic salts – remedial treatments – Ferro cement overlay – Chemical coatings – Flexible and rigid coatings.

Unit- IV Distresses and Remedies **9**

Concrete Structures: Introduction – Causes of deterioration – Diagnosis of causes – Flow charts for diagnosis – Materials and methods of repair – repairing, spalling and disintegration – Repairing of concrete floors and pavements.

Steel Structures : Types and causes for deterioration – preventive measures – Repair procedure – Brittle fracture – Lamellar tearing – Defects in welded joints – Mechanism of corrosion – Design of protect against corrosion – Design and fabrication errors – Distress during erection.

Masonry Structures: Discoloration and weakening of stones – Biotical treatments – Preservation – Chemical preservatives – Brick masonry structures – Distresses and remedial measures.

Unit - V Strengthening of Existing Structures 9

General principle – relieving loads – Strengthening super structures – plating – Conversation to composite construction – post stressing – Jacketing – bonded overlays – Reinforcement addition – strengthening substructures – under pinning – Enhancing the load capacity of footing – Design for rehabilitation.

Total: 45 periods

Reference Books:

1. Allen R.T and Edwards S.C, "Repair of Concrete Structures", Blakie and Sons, UK,1987
2. Dodge Woodson.R,"Concrete Structures – protection, repair and rehabilitation", Elsevier Butterworth – Heinmann, UK,2009.
3. Hand book on seismic retrofit of Building by CPWD and IITMadras,2003.
4. Peter H.Emmons, "Concrete Repair and Maintenance Illustrated", Galgotia Publications Pvt. Ltd., 2001.
5. Raikar, R.N., "Learning from failures - Deficiencies in Design, Construction and Service" – Rand D Centre (SDCPL), RaikarBhavan, Bombay,1987.
6. Dayaratnam.P and Rao.R, "Maintenance and Durability of Concrete Structures", University Press, India,1997.
7. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical, UK,1991.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3		2				1	2						3
CO2	3		2				1	2						3
CO3	3		2				1	2						3
CO4	3		2				1	2						3
CO5	3		2				1	2						3
	3 - High					**2 - Medium**					**1 - Low**			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE02	Prefabricated Structures	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Fabrication and Erection of prefabricated elements				

Course Objectives:

The course is intended

1. To learn the design principles of prefabricated structures
2. To impart Knowledge on prefabricated RC elements
3. To gain knowledge on prefabricated floors , slabs and roofs.
4. To familiarize on prefabricated wall panels
5. To know about the industrial buildings and shell roofs

Course Outcomes:

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

CO. No.	Course Outcome	Bloom's Level
CO1	Gain knowledge on principles of prefabricated structures	Understand
CO2	Design prefabricated RC elements	Create
CO3	Design prefabricated floor slabs, stairs and roofs	Create
CO4	Design prefabricated wall panels	Create
CO5	Design industrial structures and shell roofs	Create

Course Contents:

Unit- I Design Principles 9

General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, , erection, stages of loading and code provisions, safety factors material properties, Deflection control, Lateral load resistance, Location and types of shear walls**.**

Unit - II Reinforced Concrete 9

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, -Connections – Beam to column and column to column.

Unit- III Floors, Stairs And Roofs 9

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behavior and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.

Unit- IV Walls 9

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

Unit - V Industrial Buildings and Shell Roofs 9

Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing design. Cylindrical, Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, hand book based design**.**

Total: 45 Periods

Reference Books:

1. Koncz.T., Manual of Precast Concrete Construction, Vol.I II and III & IV Bauverlag, GMBH,1971.
2. Laszlo Mokk, Prefabricated Concrete for Industrial and Public Structures, AkademiaiKiado, Budapest, 2007.
3. Lewicki.B, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam/ London/New York,1998.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precase Concrete, Netherland BetorVerlag,2009.
5. Warszawski, A., Industrialization and Robotics in Building - A managerial approach, Harper and Row, 1990
6. L. Mokk, Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest,2007.
7. Promyslow.V. Design and Erection of Reinforced Concrete Structures, MIR Publishers, Moscow1980**.**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3		2									1	3	
CO2	3		2									1	3	
CO3	3		2									1	3	
CO4	3		2									1	3	
CO5	3		2									1	3	
	3 - High					2 - Medium					1 - Low			

Formative Assessment:			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	20	20	20	40
Analyse	10	10	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE03	Offshore Structures	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites					

Course Objectives:

The course is intended

1. To learn about wave theories
2. To impart knowledge on forces acting on offshore structures
3. To develop offshore soil and structural models
4. To analyse offshore structures
5. To familiarize on design of offshore structures

Course Outcomes:

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

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the principle of wave theories.	Understand
CO2	Calculate various types of forces acting on the structures.	Evaluate
CO3	Classify and model the off shore structures.	Remember
CO4	Analyze the foundation of offshore structures using static and dynamic methods.	Analyse
CO5	Design the various types of offshore structures	Create

Course Contents:

Unit - I Wave Theories **9**

Wave generation process, small, finite amplitude and nonlinear wave theories.

Unit – II Forces of Off Shore Structures **9**

Wind forces, wave forces on small bodies and large bodies - current forces - Morison equation.

Unit III Offshore Soil and Structure Modeling **9**

Different types of offshore structures, foundation modeling, fixed jacket platform structural modeling.

Unit- IV Analysis of Offshore Structures **9**

Static method of analysis, foundation analysis and dynamics of offshore structures.

Unit - V Design of Off Shore Structures **9**

Design of platforms, helipads, Jacket tower, analysis and design of mooring cables and pipelines.

Total: 45 Periods

Reference Books:

1. API RP 2A-WSD, Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design - API Publishing Services,2005
2. Chakrabarti, S.K., Handbook of Offshore Engineering by, Elsevier,2005.
3. Chakrabarti, S.K., Hydrodynamics of Offshore Structures, WIT press,2001.
4. Dawson.T.H., Offshore Structural Engineering, Prentice Hall Inc Englewood Cliffs, N.J.1983.
5. James F. Wilson, Dynamics of Offshore Structures, John Wiley & Sons, Inc,2003.
6. Reddy, D.V. and Arockiasamy, M., Offshore Structures, Vol.1 and Vol.2, Krieger Publishing Company,1991.
7. Reddy.D.V and SwamidasA.S.J.,Essential of offshore structures.CRCPress.2013
8. TurgutSarpkaya, Wave Forces on Offshore Structures, Cambridge University Press,2010.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3									2		2
CO2	3	2	3									2		2
CO3	3	2	3									2		2
CO4	3	2	3									2		2
CO5	3	2	3									2		2
	3 - High					**2 - Medium**					**1 - Low**			

Formative assessment:			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment:				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE04	Matrix Method for Structural Analysis	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Concepts of structural analysis				

Course Objectives:

The course is intended

1. To impart knowledge on the energy concept of the structure
2. To familiarize about the stiffness and flexibility of structures
3. To gain knowledge about the system forces to element forces
4. To impart knowledge about the the flexibility methods
5. The gain knowledge about the stiffness methods in structure

Course Outcomes:

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

CO. No.	Course Outcome	Bloom's Level
CO1	Understand Energy concepts in structures.	Understand
CO2	Analysis the Characteristics of Structures – Stiffness and Flexibility	Analyse
CO3	Calculate the Transformation of System Forces to Element Forces.	Evaluate
CO4	Compute the flexibility method and understand application to Pin-Jointed Plane Truss	Evaluate
CO5	Propose the Stiffness method in structural design.	Apply

Course Contents:

Unit- I Energy Concepts In Structures 9

Introduction – Strain Energy – Symmetry of The Stiffness And Flexibility Matrices – Strain Energy in Terms of Stiffness And Flexibility Matrices – Stiffness And Flexibility Coefficients in Terms of Strain Energy – Additional properties of [a] and [k] – another Interpretation of coefficients aij and kij – Bette's law – Applications of Betti's law: Forces not at the coordinates – Strain energy in systems and in Elements.

Unit- II Characteristics of Structures – Stiffness and Flexibility **9**

Introduction – Structure with Single Coordinate- Two Coordinates-Flexibility and Stiffness Matrices in Coordinates- Examples-Symmetric Nature of Matrices- Stiffness and Flexibility Matrices in Constrained Measurements- Stiffness and Flexibility of Systems and Elements-Computing Displacements and Forces form Virtual Work-Computing Stiffness and Flexibility Coefficients.

Unit - III Transformation of Information In Structures **9**

Determinate- Indeterminate Structures-Transformation of System Forces to Element Forces-Element Flexibility to System Flexibility - System Displacement to Element Displacement-Element Stiffness to System Stiffness- Transformation of Forces and Displacements in General –Stiffness and Flexibility in General –Normal Coordinates and Orthogonal Transformation-Principle of Contregradience

.

Unit- IV The Flexibility Method **9**

Statically Determinate Structures –Indeterminate Structures-Choice of Redundant Leading to Ill and Well Conditioned Matrices-Transformation to One Set of Redundant to Another-Internal Forces due to Thermal Expansion and Lack of Fit-ReducingtheSizeofFlexibilityMatrix-

ApplicationtoPin-JointedPlaneTruss-ContinuousBeams-Frames-Grids.

Unit- V The Stiffness Method **9**

Introduction-Development of Stiffness Method- Stiffness Matrix for Structures with zero Force at some Coordinates- Analogy between Flexibility and Stiffness-Lack of Fit-Stiffness Matrix with Rigid Motions-Application of Stiffness Approach to Pin Jointed Plane Trusses-Continuous Beams- Frames-Grids-Space Trusses and Frames-Introduction Only-Static Condensation Technique- Choice of Method-Stiffness or Flexibility.

Total: 45 Periods

Reference Books:

1. Moshe F. Rubinstein – Matrix Computer Analysis of Structures- PrenticeHall,1969
2. Reddy C.S., “Basic Structural Analysis”, Tata McGraw-Hill Publishing Company Limited, New Delhi,1997
3. Natarajan C and Revathi P., “Matrix Methods of Structural Analysis”, PHI Learning Private Limited, New Delhi,2014
4. Devdas Menon., “Advanced Structural Analysis”, Narosa Publishing House, New Delhi,2009
5. Pandit G.S. and Gupta S.P., “Structural Analysis-A Matrix Approach”, Tata McGraw-Hill PublishingCompany Limited, New Delhi,1997.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3									2		2
CO2	3	2	3									2		2
CO3	3	2	3									2		2
CO4	3	2	3									2		2
CO5	3	2	3									2		2
	3 - High					2 - Medium					1 - Low			

Formative assessment:			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment:				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE11	Theory of Plates	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Behavior of thin plates				

Course Objectives:

The course is intended

1. To impart knowledge on plates theory
2. To gain knowledge on analysis of simply supported rectangular plates
3. To familiarize on analysis of circular plates
4. To know about special and approximate methods of analysis of plates
5. To analyse anisotropic plates

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Illustrate the classification of plates	Understand
CO2	Gain Knowledge about the analysis of simply supported rectangular plates	Analyse
CO3	Analyse circular plates	Analyse
CO4	Gain knowledge about the energy methods	Understand
CO5	Analyse anisotropic plates	Analyse

Course Contents:

Unit - I Introduction To Plates Theory **9**

Thin plates with small deflection. Laterally loaded thin plates, governing differential equation, various boundary Conditions

Unit - II Rectangular Plates **9**

Rectangular plates Simply supported rectangular plates, Navier solution and Levy's method, Rectangular plates with various edge conditions, plates on elastic foundation. Moody's chart (for analysis of plates with various boundary conditions/loading)

Unit - III Circular Plates **9**

Symmetrical bending of circular plates.

Unit - IV Special and Approximate Methods **9**

Energy methods Finite difference and Finite element methods.

Unit - V Anisotropic Plates and Thick Plates **9**

Orthotropic plates and grids, moderately thick plates.

Total: 45 Periods

Reference Books:

1. Bulson.P.S.,"Stability Of Flat Plates.,American Elsevier Publisher.Co.,1969.
2. Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company,2006.
3. Szilard, R., "Theory and Analysis of Plates – classical and numerical methods, Prentice Hall Inc., 2004.
4. Timoshenko.S.P,andKriegerS.W."TheoryofPlatesandShells", McGrawHillBookCompany,New York,2003.
5. Ansel C.Ugural, "Stresses in plate and shells", McGraw Hill International Edition,1999.
6. Bairagi, "Plate Analysis", Khanna Publishers,1996.
7. Chandrashekahara, K. Theory of Plates, University Press (India) Ltd., Hyderabad,2001.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	2									1	3	
CO2	3	1	2									1	3	
CO3	3	1	2									1	3	
CO4	3	1	2									1	3	
CO5	3	1	2									1	3	
	3 - High					2 - Medium					1 - Low			

Formative assessment:			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment:				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE12	Mechanics of Composite Materials	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Characteristics of composite materials				

Course Objectives:

The course is intended

1. To learn about composites and its classification
2. To understand stress strain relations
3. To impart knowledge on analysis of laminated composites
4. To familiarize on failure and fracture of composites
5. To acquire knowledge on applications and design of composites

Course Outcomes:

On successful completion of the course, the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the composites and its classification	Understand
CO2	Gain knowledge on stress strain relations	Understand
CO3	Analyse the laminated composites	Analyse
CO4	Understand the failure and fracture of composites	Understand
CO5	Understand the applications and design of composites	Understand

Course Contents:

Unit –I Introduction **9**

Introduction to Composites, Classifying composite materials, commonly used fiber and matrix constituents, Composite Construction, Properties of Unidirectional Long Fiber Composites and Short Fiber Composites.

Unit - II Stress Strain Relations **9**

Concepts in solid mechanics, Hooke's law for orthotropic and anisotropic materials, Linear Elasticity for Anisotropic Materials, Rotations of Stresses, Strains, Residual Stresses

Unit – III Analysis of Laminated Composites **9**

Governing equations for anisotropic and orthotropic plates. Angle-ply and cross ply laminates – Static, Dynamic and Stability analysis for Simpler cases of composite plates, Inter laminar stresses.

Unit - IV Failure and Fracture of Composites **9**

Netting Analysis, Failure Criterion, Maximum Stress, Maximum Strain, Fracture Mechanics of Composites, Sandwich Construction.

Unit- V Applications And Design **9**

Metal and Ceramic Matrix Composites, Applications of Composites, Composite Joints, Design with Composites, Review, Environmental Issues

Total: 45 Periods

Reference Books:

1. Hyer M.W., and White S.R., “Stress Analysis of Fiber-Reinforced Composite Materials”, D.Estech Publications Inc.,2009
2. Jones R.M., “Mechanics of Composite Materials”, Taylor and Francis Group1999.
3. Mukhopadhyay.M, “Mechanics of Composite Materials and Structures”, Universities Press, India, 2005.
4. Agarwal.B.D.,Broutman.L.J., and Chandrashekara.K. “Analysis and Performance of Fiber Composites”, John-Wiley and Sons,2006.
5. Daniel.I.M., and Ishai.O, “Engineering Mechanics of Composite Materials”, Oxford University Press, 2005

apping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2							2			1	3	
CO2	3	2							2			1	3	
CO3	3	2							2			1	3	
CO4	3	2							2			1	3	
CO5	3	2							2			2	3	
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Classroom or Online Quiz	5	15
Analyze	Class Presentation/Power point presentation	5	
Evaluate	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	0	0	0	0
Understand	10	10	10	30
Apply	0	0	0	0
Analyse	10	10	10	30
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE13	Analysis and Design of Tall Buildings	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Analysis and design of structural elements.				

Course Objectives:

The course is intended

1. To learn about loading and design principles of tall building
2. To know about the behavior of various structural systems
3. To familiarize on analysis and design of tall buildings
4. To familiarize on design for differential movement , creep and shrinkage
5. To gain knowledge on stability of tall buildings

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand loading and design principles of tall buildings	Understand
CO2	Gain knowledge on behavior of various structural systems	Understand
CO3	Analyze and design tall buildings	Create
CO4	Design for differential movement, creep and shrinkage	Create
CO5	Analyze stability issues in tall buildings	Analyse

Course contents:

Unit- I Loading and Design Principles 9

Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, modal analysis - combination of loading, – Static and Dynamic approach - Analytical and wind tunnel experimental methods –Design philosophy-working stress method, limit state method and plastic design.

Unit- II Behaviour of Various Structural Systems 9

Factors affecting growth, height and structural form. High rise behaviour, Rigid frames, braced frames, In filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, outrigger - braced and hybrid mega systems.

Unit III Analysis and Design 9

Modeling for approximate analysis, accurate analysis and reduction techniques, Analysis of buildings as total structural System considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist –Computerized three dimensional analysis – Assumptions in 3D analysis – Simplified 2D analysis.

Unit-IV Structural Elements 9

Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

Unit - V Stability 9

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Total: 45 Periods

Reference Books:

1. Gupta.Y.P.,(Editor), Proceedings of National Seminar on High Rise Structures – Design and Construction Practices for Middle Level Cities, New Age International Limited, NewDelhi,1995.
2. Lin T.Y and Stotes Burry D, "Structural Concepts and systems for Architects and Engineers", John Wiley,1988.
3. Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill,1988
4. Beedle.L.S., "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi,1986.
5. Bryan Stafford Smith and Alexcoull, "Tall Building Structures - Analysis and Design", John Wiley and Sons, Inc.,2005.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3		1	3		1						2	3	
CO2	3		1	3		1						2	3	
CO3	3		1	3		1						2	3	
CO4	3		1	3		1						2	3	
CO5	3		1	3		1						2	3	
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE14	Industrial Structures	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Planning and Analysis of Industrial structures				

Course Objectives:

The course is intended

1. To learn the requirements, planning and design of Industrial structures.
2. To gain the knowledge on the design of gantry girder, corbels and nibs
3. To understand about the power plant structures
4. To impart knowledge on analysis and design of transmission line structures and chimneys
5. To familiarize on design of foundation for industrial structures

Course Outcomes:

On successful completion of the course, the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Illustrate the classification of industrial structures and its guidelines	Understand
CO2	Analyse and design gantry girder and design of corbels and nibes	Create
CO3	Understand about power plant structures like cooling towers, bunkers and silos	Understand
CO4	Analyse and design transmission line structures and chimneys	Create
CO5	Design for foundation of industrial structures	Create

Course Contents:

Unit - I Planning And Functional Requirements **9**

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

Unit – II Industrial Buildings **9**

Steel and RCC - Gantry Girder, Crane Girders - Design of Corbels and Nibs – Design of Staircase.

Unit- III Power Plant Structures **9**

Types of power plants – Containment structures - Cooling Towers - Bunkers and Silos - Pipe supporting Structures

Unit- IV Transmission Line Structures And Chimneys **9**

Analysis and design of steel monopoles, transmission line towers – Sag and Tension calculations, Methods of tower testing – Design of s elf supporting and guyed chimney, Design of Chimney bases.

Unit- V Foundation **9**

Design of foundation for Towers, Chimneys and Cooling Towers - Machine Foundation - Design of Turbo Generator Foundation.

Total: 45 Periods

Reference Books:

1. Santhakumar A.R. and Murthy S.S., Transmission Line Structures, Tata McGrawHill,1992.
2. Srinivasulu P and Vaidyanathan.C, Handbook of Machine Foundations, Tata McGraw Hill,1976.
3. JurgenAxelAdam,KatharriaHausmann,FrankJuttner,KlaussDaniel,IndustrialBuilding s:A Design Manual, Birkhauser Publishers,2004.
4. Manohar S.N, Tall Chimneys - Design and Construction, Tata McGraw Hill,1985

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3		2	3								1	3	
CO2	3		2	3								1	3	
CO3	3		2	3								1	3	
CO4	3		2	3								1	3	
CO5	3		2	3								1	3	
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Classroom or Online Quiz	5	15
Analyse	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE I (7.5)	**IAE II (7.5)**	**IAE III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

22PSEE15	Prestressed Concrete	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Basic concepts on prestressing				

Course Objectives:

The course is intended

1. To understand the principles of prestressing
2. To become familiarize with the design of flexural members
3. To gain knowledge on design of continuous and cantilever beams
4. To impart knowledge on design of tension and compression beams
5. To perform analysis and design of composite members

Course Outcomes:

On successful completion of the course

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the principles of prestressing	Understand
CO2	Analysis and design of flexural members	Create
CO3	Analysis and design of continuous and cantilever beams	Create
CO4	Analysis and design of tension and compression members	Create
CO5	Analysis and design of composite members	Create

Course Contents:

Unit- I Principles of Prestressing 9

Basic concepts of Prestressing – Types and systems of prestressing – Need for High Strength materials, Analysis methods, losses of prestress – Short and Long term deflections – Cable layouts.

Unit- II Design of Flexural Members 9

Behaviour of flexural members, determination of ultimate flexural strength – Various Codal provisions – Design of flexural members, Design for shear, bond and torsion. Transfer of prestress – Box girders.

Unit III Design of Continuous and cantilever beams 9

Analysis and design of continuous beams – Methods of achieving continuity – concept of linear transformations, concordant cable profile and gap cables – Analysis and design of cantilever beams.

Unit IV Design of Tension and Compression Members 9

Design of tension members – application in the design of prestressed pipes and prestressed concrete cylindrical water tanks – Design of compression members with and without flexure – its application in the design piles, flag masts and similar structures.

Unit -V Design of Composite Members 9

Composite beams – analysis and design, ultimate strength – their applications. Partial prestressing its advantages and applications.

Total: 45 Periods

Reference Books:

1. Lin.T.Y.,andBurns.H "Design of Prestressed Concrete Structures", John Wiley and Sons Inc, New York, 2009
2. Rajagopalan.N, "Prestressed Concrete", Narosa Publications, New Delhi,2008.
3. Sinha.N.C.and.Roy.S.K, "Fundamentals of Prestressed Concrete", S.Chand and Co.,1998.Arthur
4. H. Nilson, "Design of Prestressed Concrete", John Wiley and Sons Inc, New York,2004.
5. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill Publishing Co., New Delhi,2008.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2								2	1	3	
CO2	3	2	3								2	1	3	
CO3	3	2	3								2	1	3	
CO4	3	2	3								2	1	3	
CO5	3	2	3								2	2	3	
	3 - High					2 - Medium					1 - Low			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Classroom or Online Quiz	5	15
Analyze	Class Presentation/Power point presentation	5	
Evaluate	Attendance	5	

22PSEE16	Wind and Cyclone Effects on Structures	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Concept of wind and cyclone effects for the analysis and design of structures.				

Course Objectives:

The course is intended

1. To Be able to find wind characteristics
2. To Develop knowledge on wind tunnel analysis and aerodynamics
3. To impart knowledge on effects of wind on structures
4. To design chimneys and transmission towers for wind loads
5. To familiarize on the effects of cyclone

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Learn about the types of wind ,pressure and suctions	Understand
CO2	Gain the knowledge on types of tunnels and design of wind tunnels	Remember
CO3	Analyse the wind effects on structures like building s and chimneys	Analyse
CO4	Design tall buildings for wind load as per codal provisions	Analyse
CO5	Evaluate cyclone effects on low rise structures and sloped roof structures	Evaluate

Course Contents:

Unit - I Introduction **9**

Introduction, Types of wind – Characteristics of wind – Wind velocity, Method of measurement, variation of speed with height, shape factor, aspect ratio, drag effects - Dynamic nature of wind – Pressure and suctions - Spectral studies, Gust factor.

Unit – II Wind Tunnel Studies **9**

Wind Tunnel Studies, Types of tunnels, - Prediction of acceleration – Load combination factors – Wind tunnel data analysis – Calculation of Period and damping value for wind design - Modeling requirements, Aero dynamic and Aero-elastic models.

UNIT- III Effect of Wind on structures **9**

Classification of structures – Rigid and Flexible – Effect of wind on structures - Static and dynamic effects on Tall buildings – Chimneys.

Unit - IV Design of Special Structures **9**

Design of Structures for wind loading – as per IS, ASCE and NBC code provisions – design of Tall Buildings – Chimneys – Transmission towers and steel monopoles– Industrial sheds.

Unit - V Cyclone Effects **9**

Cyclone effect on – low rise structures – sloped roof structures - Tall buildings. Effect of cyclone on claddings – design of cladding – use of code provisions in cladding design – Analytical procedure and modeling of cladding.

Total: 45 Periods

Reference Books:

1. Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London,1980.
2. Peter Sachs, "Wind Forces in Engineering", Pergamon Press, New York,1978.
3. Cook.N.J., "The Designer's Guide to Wind Loading of Building Structures", Butterworths,1989.
4. Kolousek.V,Pirner.M,Fischer.OandNaprstek.J,"WindEffectsonCivilEngineeringStructures", Elsevier Publications,1984

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3		1	2					2				3	
CO2	3		1	2					2				3	
CO3	3		1	2					2				3	
CO4	3		1	2					2				3	
CO5	3		1	2					2				3	
	3 - High					**2 - Medium**					**1 - Low**			

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Classroom or Online Quiz	5	15
Analyze	Class Presentation/Power point presentation	5	
Evaluate	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	0	0	0	0
Analyse	30	30	30	60
Evaluate	10	10	10	20
Create	0	0	0	0

22PSEE17	Analytical Methods for Material Characterisation	L	T	P	C
		3	0	0	3
Nature of Course	Professional core				
Pre requisites	Basic concepts of Physics				

Course Objectives:

The course is intended to

1. Learn about x ray diffraction analysis
2. Impart knowledge on Electron and ion spectroscopic techniques
3. Gain knowledge on surface structure analysis
4. Acquaire knowledge on imaging techniques
5. Familiarise on scanning probe microscopy

Course Outcomes:

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Identify symmetry elements in crystal systems using X ray diffraction analysis	Understand
CO2	Illustrate special surface techniques and thin film characterisation Understand	Understand
CO3	Interpret the surface chemical composition Apply	Apply
CO4	Predict the material characterisation using imaging techniques Evaluate	Evaluate
CO5	Examine the material characterisation by adopting scanning probe microscopy	Analyse

Course Contents:

Unit I X-RAY DIFFRACTION ANALYSIS 9

Crystal systems- Symmetry elements in crystals- combination of symmetry elements- Rotationinversion axis- translation symmetry elements- space groups- Stereographic projection - Wulff net- Measurement of angle between poles - determination of Miller indices of an unknown pole. X -ray diffraction analysis

Unit II ELECTRON AND ION SPECTROSCOPIC TECHNIQUES 9

Mass spectroscopy and X-ray emission spectroscopy (Principle and limitations) - Quadrapole mass spectrometer. Special surface techniques: X ray photoelectron spectroscopy (XPS or ESCA)-photoelectron process of spectrum- elemental analysis-Instrumentation and applications, Auger electron spectroscopy (AES)-Basic principles-Information in Auger spectra-methods for surface and thin film characterization, Secondary ion mass spectrometry(SIMS) – Dynamic and static SIMS-common modes of analysis, Rutherford Backscattering Spectrometry (RBS), Field Ion Microscopy (FIM).

Unit III SURFACE STRUCTURE ANALYSIS 9

The need for surface study. Surface chemical composition: The extension of bulk techniques to surface studies - Unit meshes of five types of surface nets - diffraction from diperiodic structures. Surface

methods using electron, low energy electron diffraction (LEED), reflection high energy electron diffraction (RHEED),

Unit IV IMAGING TECHNIQUES **9**

Scanning electron microscope(SEM) – physical basis of operation – sample requirements –applications, Transmission electron Microscopy (TEM) – resolution – sensitivity- TEM operation- diffraction mode – specimen preparation, Scanning Transmission Electron Microscopy (STEM). – imaging – common analysis modes – sample requiremnets

Unit V SANNING PROBE MICROSCOPY **9**

Instrumentation, Scanning Tunnelling Microscopy,Tunneling current, probe tips and working environments, operational modes, typical applications, atomic force microscopy, near field forces, force sensors, operational modes, applications, image artifacts

TOTAL: 45 PERIODS

Text Books:

1. Richard Brundle C, Charles A. Evans Jr, Shaun Wilson, ―Encyclopedia of Materials Characterization‖ Manning Publications Co, 1992.
2. Yang leng ‖Materials Caracterization- Introduction to Microscopic and Spectroscopic Methods‖ John Wiley & Sons, 2008.

Reference Books:

1. Prutton M, "Surface Physics", Clarenden Press Oxford, 1975.
2. Cullity B D, "Elements of X-ray Diffraction", Addison Wesley Publishing Co., 1967.
3. Rodriquez F, "Principles of Polymer Systems", Tata McGraw Hill Co., 1974.

Additional References:

1. https://nptel.ac.in/courses/105/107/105107122/
2. https://nptel.ac.in/courses/105/104/105104101/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		3		3		2		2		3		3	2
CO2	3		3		3		2		2		3		3	2
CO3	3		3		3		2		2		3		3	2
CO4	3		3		3		2		2		3		3	2
CO5	3		3		3		2		2		3		3	2
	3	High				2	Medium					1	Low	

Formative assessment

Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examination**			**Final Examination (60)**
	IAE- I (7.5)	**IAE- II (7.5)**	**IAE- III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply				
Analyze	30	30	30	60
Evaluate				
Create				