

M.E. STRUCTURAL ENGINEERING
Regulations 2024
Curriculum & Syllabi

DEPARTMENT VISION

To excel by fostering excellence in technical education, pioneering impactful research, and nurturing a culture of ethical leadership and entrepreneurial spirit among engineers who passionately serve society on a global scale driving positive change.

DEPARTMENT MISSION

- To provide an exceptional technical education that equips engineers with the knowledge, skills, and practical experience to excel in their professional endeavors and make significant contributions to society.
- To conduct ground breaking research that addresses societal challenges and pushes the boundaries of innovation in civil engineering, fostering a culture of inquiry and discovery among our faculty and students.
- To cultivate ethical leadership and entrepreneurial mindset among engineers, instilling a sense of responsibility towards society
- To nurture engineers who are committed to serve society on a global scale, driving positive change through their work and embodying the values of integrity, empathy, and sustainability.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 Gain knowledge and skills in structural engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations.

PEO 2 Become consultants in Structural Engineering and solve complex real-life issues related to the analysis, design and maintenance of structures under various environmental conditions.

PEO 3 Contribute to the enhancement of knowledge in Structural Engineering by performing quality research in institutions of international repute or Research organizations or Academia.

PEO 4 Practice their profession with good communication, leadership, ethics and social responsibility and formulate solutions that are technically sound, economically feasible, and socially acceptable.

PEO 5 Graduates will function in multi-disciplinary teams and adapt to evolving technologies through life-long learning and innovation.

PROGRAMME OUTCOMES (POs)

PO 1 An ability to independently carry out research/investigation and development work to solve practical problems.

PO 2 An ability to write and present a substantial technical report/document.

PO 3 Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor's program.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1 Knowledge of Structural Engineering discipline

Acquire in-depth knowledge of the Structural Engineering discipline, with an ability to evaluate, analyze and synthesize existing and new knowledge in structural design.

PSO 2 Critical analysis of Structural Engineering issues and innovation

Critically analyze complex Structural Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.

PSO 3 Conceptualization and evaluation of Engineering solutions to Structural Design issues

Conceptualize and solve Structural Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio-cultural factors.

M.E. – STRUCTURAL ENGINEERING
CURRICULUM AND SYLLABI (Regulation 2024)
(Applicable for students admitted from the Academic year 2024-2025)
Minimum Credits to be Earned: 70

SEMESTER I										
S.No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ ES	Course Type	Category
1	24AM101	Advanced Mathematical Methods	4	0	0	4	4	40/60	T	FC
2	24ST101	Theory of Elasticity and Plasticity	3	1	0	4	4	40/60	T	PCC
3	24ST102	Structural Dynamics and Earthquake Engineering	3	1	0	4	4	40/60	T	PCC
4	24RM101	Research Methodology and IPR	2	0	0	2	2	40/60	T	RMC
5		PEC-1	3	0	0	3	3	40/60	T	PEC
6		AC-1*	2	0	0	0	2	40/60	T	AC
7	24ST111	Advanced Construction Engineering and Experimental Techniques Laboratory	0	0	4	2	4	60/40	P	PCC
8	24ST112	Technical Seminar	0	0	2	1	2	60/40	P	EEC
TOTAL							20	25		

* Audit Course is Optional

SEMESTER II										
S.No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ ES	Course Type	Category
1	24ST201	Advanced Steel Structures	3	1	0	4	4	40/60	T	PCC
2	24ST202	Advanced Concrete Structures	3	1	0	4	4	40/60	T	PCC
3	24ST203	Finite Element Analysis in Structural Engineering	3	0	0	3	3	40/60	T	PCC
4		PEC-2	3	0	0	3	3	40/60	T	PEC
5		PEC-3	3	0	0	3	3	40/60	T	PEC
6		AC-2*	2	0	0	0	2	40/60	T	AC
7	24ST211	Numerical and Finite Element Analysis Laboratory	0	0	4	2	4	60/40	P	PCC
8	24ST212	Structural Design Studio	0	0	4	2	4	60/40	P	PCC
TOTAL							21	27		

* Audit Course is Optional

SEMESTER III										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ ES	Course Type	Category
1		PEC-4	3	0	0	3	3	40/60	T	PEC
2		PEC-5	3	0	0	3	3	40/60	T	PEC
3		OEC	3	0	0	3	3	40/60	T	OEC
4	24ST311	Practical Training (4 Weeks)	0	0	0	2	0	60/40	P	EEC
5	24ST312	Project Work I	0	0	12	6	12	60/40	P	EEC
TOTAL							17	21		

SEMESTER IV										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ ES	Course Type	Category
1	24ST411	Project Work II	0	0	24	12	24	60/40	P	EEC
TOTAL							12	24		

Foundation Courses (4 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24AM101	Advanced Mathematical Methods	4	0	0	4	4	40/60	T	FC

Research Methodology and IPR Courses (2 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24RM101	Research Methodology and IPR	2	0	0	2	2	40/60	T	RMC

Professional Core Courses (25 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24ST101	Theory of Elasticity and Plasticity	3	1	0	4	4	40/60	T	PCC
2	24ST102	Structural Dynamics and Earthquake Engineering	3	1	0	4	4	40/60	T	PCC
3	24ST111	Advanced Construction Engineering and Experimental Techniques Laboratory	0	0	4	2	4	60/40	P	PCC
4	24ST201	Advanced Steel Structures	3	1	0	4	4	40/60	T	PCC
5	24ST202	Advanced Concrete Structures	3	1	0	4	4	40/60	T	PCC
6	24ST203	Finite Element Analysis in Structural Engineering	3	0	0	3	3	40/60	T	PCC
7	24ST211	Numerical and Finite Element Analysis Laboratory	0	0	4	2	4	60/40	P	PCC
8	24ST212	Structural Design Studio	0	0	4	2	4	60/40	P	PCC

Professional Elective Courses -1 (3 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24STE01	Non-linear Analysis of Structures	3	0	0	3	3	40/60	T	PEC
2	24STE02	Structural Stability	3	0	0	3	3	40/60	T	PEC
3	24STE03	Wind and Cyclone Effects on Structures	3	0	0	3	3	40/60	T	PEC
4	24STE04	Prefabricated Structures	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses - 2 (3 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24STE05	Advanced Concrete Technology	3	0	0	3	3	40/60	T	PEC
2	24STE06	Advanced Prestressed Concrete	3	0	0	3	3	40/60	T	PEC
3	24STE07	Reliability Analysis of Structures	3	0	0	3	3	40/60	T	PEC
4	24STE08	Design of Formwork	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses – 3 (3 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24STE09	Maintenance, Repair and Rehabilitation of Structures	3	0	0	3	3	40/60	T	PEC
2	24STE10	Mechanics of Fiber Reinforced Polymer Composite Materials	3	0	0	3	3	40/60	T	PEC
3	24STE11	Design of Steel-Concrete Composite Structures	3	0	0	3	3	40/60	T	PEC
4	24STE12	Design of Masonry Structures	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses - 4 (3 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24STE13	Design of Industrial Structures	3	0	0	3	3	40/60	T	PEC
2	24STE14	Advanced Design of Foundation Structures	3	0	0	3	3	40/60	T	PEC
3	24STE15	Optimization of Structures	3	0	0	3	3	40/60	T	PEC
4	24STE16	Structural Health Monitoring	3	0	0	3	3	40/60	T	PEC

Professional Elective Courses – 5 (3 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24STE17	Design of Offshore Structures	3	0	0	3	3	40/60	T	PEC
2	24STE18	Performance of Structures with Soil-Structure Interaction	3	0	0	3	3	40/60	T	PEC
3	24STE19	Design of Bridge Structures	3	0	0	3	3	40/60	T	PEC
4	24STE20	Design of Shell and Spatial Structures	3	0	0	3	3	40/60	T	PEC

Employability Enhancement Courses (21 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24ST112	Technical Seminar	0	0	2	1	2	60/40	P	EEC
2	24ST312	Practical Training (4 Weeks)	0	0	0	2	0	60/40	P	EEC
3	24ST311	Project Work I	0	0	12	6	12	60/40	P	EEC
4	24ST411	Project Work II	0	0	24	12	24	60/40	P	EEC

Open Elective Courses (3 Credits)										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24STO01	Vibration and Noise Control Strategies	3	0	0	3	3	40/60	T	OEC
2	24STO02	Energy Conservation and Management in Domestic Sectors	3	0	0	3	3	40/60	T	OEC
3	24STO03	New Product Development	3	0	0	3	3	40/60	T	OEC
4	24STO04	Sustainable Management	3	0	0	3	3	40/60	T	OEC
5	24STO05	IoT for Smart Systems	3	0	0	3	3	40/60	T	OEC
6	24STO06	Machine Learning and Deep Learning	3	0	0	3	3	40/60	T	OEC
7	24STO07	Internet of Things and Cloud	3	0	0	3	3	40/60	T	OEC
8	24STO08	Environmental Sustainability	3	0	0	3	3	40/60	T	OEC
9	24STO09	Textile Reinforced Composites	3	0	0	3	3	40/60	T	OEC
10	24STO10	Nanocomposite Materials	3	0	0	3	3	40/60	T	OEC

Audit Courses										
Registration for any of these courses is optional for students										
S. No.	Course Code	Course	L	T	P	C	Hrs. /wk.	CA/ES	Course Type	Category
1	24STA01	English for Research Paper Writing	2	0	0	0	2	40/60	T	AC
2	24STA02	Disaster Management	2	0	0	0	2	40/60	T	AC
3	24STA03	Constitution of India	2	0	0	0	2	40/60	T	AC
4	24STA04	நற்றமிழ் இலக்கியம்	2	0	0	0	2	40/60	T	AC

SEMESTERWISE CREDITS DISTRIBUTION					
Sem	I	II	III	IV	Credits
FC	4				4
PCC	10	15			25
PEC	3	6	6		15
OEC			3		3
RMC	2				2
EEC	1		8	12	21
AC	✓	✓			
Total	20	21	17	12	70

SEMESTERWISE COURSES DISTRIBUTION				
Sem	I	II	III	IV
FC	1			
PCC	3	5		
PEC	1	2	2	
OEC			1	
RMC	1			
EEC	1		2	1
AC	1*	1*		
Total	8*	8*	5	1

* Audit Course is optional

Semester-I

Course Code	24AM101	Course Name	ADVANCED MATHEMATICAL METHODS	Course Category	T	Foundation Courses	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Engineering Mathematics	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- 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. This course covers a broad spectrum of mathematical techniques such as Laplace Transform, Fourier Transform, Calculus of Variations, Conformal Mapping and Tensor Analysis. The application of these topics to the solution of problems in physics and engineering is stressed.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)											Program Specific Outcome (PSO)				
			1	2	3											1	2	3
CO-1:	Application of Laplace and Fourier transforms to the initial value, initial-boundary value and boundary value problems in Partial Differential Equations.	AP	1	-	3													
CO-2:	Maximizing and minimizing the functions that occur in various branches of Engineering Disciplines.	E	2	1	3													
CO-3:	Construct conformal mappings between various domains and use conformal mapping in studying problems in physics and engineering, particularly fluid flow and heat flow problems.	AP	2	1	3													
CO-4:	Understand tensor algebra and its applications in applied sciences and engineering and develops the ability to solve mathematical problems involving tensors.	U	2	1	3													
CO-5:	Competently use tensor analysis as a tool in the field of applied sciences and related fields.	U	2	1	3													

Unit-1 LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 12 Periods

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-2 FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 12 Periods

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-3 CALCULUS OF VARIATIONS 12 Periods

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

Unit-4 CONFORMAL MAPPING AND APPLICATIONS 12 Periods

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation – Transformation of boundaries in parametric form – Physical applications - Fluid flow and heat flow problems

Unit-5 TENSOR ANALYSIS 12 Periods

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

Total: 60 Periods

Learning Resources	Text Books	References
	<ol style="list-style-type: none"> 1. Andrews L.C. and Shivamoggi, B., "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003. 2. Elsgolc, L.D., "Calculus of Variations", Dover Publications Inc., New York, 2007. 3. Mathews, J. H., and Howell, R.W., "Complex Analysis for Mathematics and Engineering", 6th Edition, Jones and Bartlett Publishers, 2011. 4. Kay, D. C., "Tensor Calculus", Schaum's Outline Series, Tata McGraw Hill Edition, 2014. 5. Naveen Kumar, "An Elementary Course on Variational Problems in Calculus ", Narosa Publishing House, 2005. 	<ol style="list-style-type: none"> 1. 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. 2. Sankara Rao, K., "Introduction to Partial Differential Equations", 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010. 3. Spiegel, M.R., "Theory and Problems of Complex Variables and its Applications", Schaum's Outline Series, McGraw Hill Book Co., 1981. 4. Ramaniah. G. "Tensor Analysis", S. Viswanathan Pvt. Ltd., 1990.

Learning Assessment

Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	

* The expected levels for Bloom's Taxonomy should be:
 - Lower-order thinking skills: not more than 40%
 - Higher-order thinking skills: not less than 60%

Course Code	24ST101	Course Name	THEORY OF ELASTICITY AND PLASTICITY	Course Category	T	Professional Core Courses	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Structural Analysis and Strength of Materials	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To develop the ability to use the principles of theory of elasticity in engineering problems and to introduce theoretical fundamentals of theory of plasticity

		Program Outcomes (PO)												Program Specific Outcome (PSO)				
		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>																		
CO-1:	Derive and write the fundamental equations of elasticity describing the linear behaviour of elements and develop constitutive models based on material behaviour	C	3	2	2											3	2	3
CO-2:	Demonstrate the application of plane stress and plane strain in a given situation in both cartesian and polar coordinate systems	AP	3	3	3											3	3	2
CO-3:	Solve torsion problems in circular and non-circular cross-sections	AP	3	2	3											3	2	2
CO-4:	Analyse beams resting on elastic foundations	AN	3	2	2											3	2	2
CO-5:	Solve analytically the simple boundary value problems with elasto-plastic and strain hardening properties	AP	3	3	2											3	3	2

Unit-1 ELASTICITY

12 Periods

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

Unit-2 2D STRESS STRAIN PROBLEMS

12 Periods

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

Unit-3 TORSION OF NON-CIRCULAR SECTION

12 Periods

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 - Finite Difference Method

Unit-4 BEAMS ON ELASTIC FOUNDATIONS

12 Periods

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-5 PLASTICITY

12 Periods

Physical Assumptions – Yield Criteria – Failure Theories –Thick Cylinder – Plastic Stress Strain Relationship - Bending and Torsion in Elasto-Plastic Materials –Strain hardening Materials

Total: 60 Periods

Learning Resources	Text Books	References
	1. Ansel.C.Ugural and Saul.K.Fenster, "Advanced Strength and Applied Elasticity," Fourth Edition, Prentice Hall Professional Technical Reference, New Jersey, 2003. 2. Chakrabarty. J, "Theory of Plasticity", Third Edition, Elsevier Butterworth – Heinmann – UK,2007.	1. Jane Helena H, "Theory of Elasticity and Plasticity", PHI, New Delhi 2017. 2. Slater R.A.C, "Engineering Plasticity", John Wiley and Son, New York, 1977. 3. Timoshenko, S. and Goodier.J.N " Theory of Elasticity", Third Edition, McGraw Hill Book Co., New York, 2017.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24ST102	Course Name	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	Course Category	T	Professional Core Courses	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Engineering Geology	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To make the students understand the basics of structural dynamics and earthquake engineering and to develop the ability to design an earthquake resistant structure

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)											Program Specific Outcome (PSO)					
			1	2	3										1	2	3		
CO-1:	Do vibration analysis of system/structures with a single degree of freedom and can explain the method of damping the systems	AN	3	3	3												3	3	2
CO-2:	Do the dynamic analysis of system/structures with Multi degrees of freedom under free and forced vibration	AN	3	2	3												3	2	2
CO-3:	Derive a mathematical model of a continuous system and do a dynamic analysis under free and forced vibration	AP	3	2	2												3	3	2
CO-4:	Explain the causes and effects of an earthquake	U	3	1	-												3	-	1
CO-5:	Design masonry and RC structures for the earthquake forces as per their commendations of IS codes of practice	C	3	3	1												3	3	2

Unit-1 PRINCIPLES OF VIBRATION ANALYSIS

12 Periods

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, Evaluation of damping, Transmissibility, vibration control, Tuned mass damper.

Unit-2 DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS

12 Periods

Mathematical models of two-degree of freedom systems and multi-degree of freedom systems, free and forced vibrations of two-degree and multi-degree of freedom systems, normal modes of vibration, applications. orthogonality of normal modes, free and forced vibrations of multi-degree of freedom systems, Mode superposition technique, Applications.

Unit-3 DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS

12 Periods

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. Damping in MDOF systems, Nonlinear MDOF systems, and step-by-step numerical integration algorithms.

Unit-4 EARTHQUAKE GROUND MOTION AND ITS EFFECTS ON STRUCTURES

12 Periods

Engineering Seismology Seismotectonics and Seismic Zoning of India, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters, Microzonation. Effect of Earthquake on Different Types of Structures - Lessons Learnt from Past Earthquakes -Evaluation of Earthquake Forces as per codal provisions - Response Spectra, Design Spectra

Unit-5 EARTHQUAKE RESISTANT DESIGN OF MASONRY AND RC STRUCTURES

12 Periods

Structural Systems - Types of Buildings - Causes of damage - Planning Considerations – effect of material of construction on the performance of structures - Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design - Earthquake Resistant Design of Masonry Buildings and R.C.C. Buildings. Design consideration - Rigid Frames – Shear walls - Lateral load analysis of structures- Capacity based Design and detailing

Total: 60 Periods

Learning Resources	Text Books	References
	<ol style="list-style-type: none"> 1. Anil K.Chopra, Dynamics of Structures, Fifth edition, Pearson Education, 2020. 2. Leonard Meirovitch, Elements of Vibration Analysis, McGraw Hill,2014. 3. Mario Paz, Structural Dynamics -Theory and Computation, Kluwer Academic Publishers, Fifth Edition, 2006. 4. Roy R.Craig, Jr, Andrew J. Kurdila, Fundamentals of Structural Dynamics, John Wiley & Sons, 2011. 5. Brebbia C. A.,” Earthquake Resistant Engineering Structures VIII”, WIT Press, 2015 	<ol style="list-style-type: none"> 1. Mohiuddin Ali Khan “Earthquake-Resistant Structures: Design, Build and Retrofit”, Elsevier Science& Technology, 2013 2. Pankaj Agarwal and Manish Shrikhande, “Earthquake Resistant Design of Structures”, Prentice Hall of India, 2014. 3. Paulay.T and Priestley M.J.N., “Seismic Design of Reinforced Concrete and MasonryBuildings”, John Wiley and Sons, 2013. 4. Duggal S K, “Earthquake Resistant Design of Structures”, Oxford University Press, 2013. 5. Madhujit Mukhopadhyay,” Structural Dynamics: Vibrations and Systems”, Ane’s Student Edition,2017

Learning Assessment

Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	

* The expected levels for Bloom’s Taxonomy should be:
 - Lower-order thinking skills: not more than 40%
 - Higher-order thinking skills: not less than 60%

Course Code	24RM101	Course Name	RESEARCH METHODOLOGY AND IPR	Course Category	T	Research Methodology And IPR Courses	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To give an overview of the research methodology and explain the technique of defining a research problem and explain the functions of the literature review in research, carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	To explain various research designs and their characteristics.	C																
CO-2:	To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections.	AP																
CO-3:	To explain the art of interpretation and the art of writing research reports.	AN																
CO-4:	To discuss leading International Instruments concerning Intellectual Property Rights.	U																
CO-5:	To understand details of Patents	U																

Unit-1 RESEARCH DESIGN	6 Periods
Overview of the research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.	
Unit-2 DATA COLLECTION AND SOURCES	6 Periods
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.	
Unit-3 DATA ANALYSIS AND REPORTING	6 Periods
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentations	
Unit-4 INTELLECTUAL PROPERTY RIGHTS	6 Periods
Intellectual Property – The concept of IPR, Evolution and development of the concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.	
Unit-5 PATENTS	6 Periods
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.	
Total: 30 Periods	

Learning Resources	Text Books	References
	1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 12e (2018). 2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.	1. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2012. 2. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", December 2018.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STE01	Course Name	NON-LINEAR ANALYSIS OF STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To study the concept of non-linear behaviour and analysis of elements and simple structures

					Program Outcomes (PO)										Program Specific Outcome (PSO)					
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>					BL	1	2	3										1	2	3
CO-1:	Analyze the bar system considering the material and geometric nonlinearity				AN	2	3											2	2	2
CO-2:	Perform inelastic analysis of flexural members				U	2	2	3										2	3	1
CO-3:	Perform vibration analysis of flexural members				AP	2	2	3										2	2	1
CO-4:	Perform elastic and inelastic analysis of Plates				AP	2	2	3										2	2	2
CO-5:	Perform nonlinear and instability analysis of elastically supported beams				AN	2	2	3										2	2	2

Unit-1 INTRODUCTION TO NON-LINEAR ANALYSIS	9 Periods
Material non-linearity, geometric non-linearity; statically determinate and statically indeterminate bar systems of uniform and variable thickness.	
Unit-2 INELASTIC ANALYSIS OF FLEXURAL MEMBERS	9 Periods
Inelastic analysis of uniform and variable thickness members subjected to geometric and material non-linearity; inelastic analysis of bars of uniform and variable stiffness members with and without axial Restraints	
Unit-3 VIBRATION THEORY AND ANALYSIS OF FLEXURAL MEMBERS	9 Periods
Vibration theory and analysis of flexural members; hysteretic models and analysis of uniform and variable stiffness members under cyclic loading	
Unit-4 ELASTIC AND INELASTIC ANALYSIS OF PLATES	9 Periods
Elastic and inelastic analysis of uniform and variable thickness plates.	
Unit-5 NON-LINEAR VIBRATION AND INSTABILITY	9 Periods
Nonlinear vibration and Instabilities of elastically supported beams.	
Total: 45 Periods	

Learning Resources	Text Books	References
	1.Fertis, D.G, Non-linear Mechanics, CRC Press, 1999. 2. Reddy.J.N, Non-linear Finite Element Analysis, Oxford University Press, 2014	1. Sathyamoorthy.M, Nonlinear Analysis of Structures, CRC Press, 2017.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
<i>Average of Internal Test (20%)</i>	<i>Critical Thinking Assessment (20%)</i>	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE02	Course Name	STRUCTURAL STABILITY	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: The purpose of learning this course is to:

- To study the concept of buckling and analysis of structural elements

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain the phenomenon of buckling of columns and calculate the buckling load on column by various approaches	U	3	2	3												3	2	2
CO-2:	Estimate the buckling load of beam – columns and frames	U	3	2	3												2	2	2
CO-3:	Explore the concepts of torsional and lateral buckling of thin walled members	U	3		3												3	2	3
CO-4:	Explain the phenomenon of buckling of plates	U	3	2	3												3	1	2
CO-5:	Analyze the inelastic buckling of columns and plates	AN	3	2	3												2	3	2

Unit-1 BUCKLING OF COLUMNS	9 Periods
States of equilibrium - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis. Governing equation for column buckling - critical load using Equilibrium, Energy methods - Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method.	
Unit-2 BUCKLING OF BEAM-COLUMNS AND FRAMES	9 Periods
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-3 TORSIONAL AND LATERAL BUCKLING	9 Periods
Torsional buckling – Combined Torsional and flexural buckling - Local buckling - Buckling of Open Sections - Lateral buckling of beams - simply supported and cantilever beams.	
Unit-4 BUCKLING OF PLATES	9 Periods
Governing differential equation - Buckling of thin plates with various edge conditions - Analysis by equilibrium and energy approach – Finite difference method.	
Unit-5 INELASTIC BUCKLING	9 Periods
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	

Learning Resources	Text Books	References
	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.M.L, "Stability Analysis and Design of Structures", springer, New York, 2013.	1. Simitser.G.J and Hodges D.H, "Fundamentals of Structural Stability", Elsevier Ltd., 2006. 2. Timoshenko.S.P, and Gere.J.M, "Theory of Elastic Stability", Dover Publication, 2012.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE03	Course Name	WIND AND CYCLONE EFFECTS ON STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To study the concept of wind and cyclone effects for the analysis and design of structures.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain the characteristics of wind	U	3	1													2	1	2
CO-2:	Evaluate the intensity of wind on structures	E	3		3												2	1	2
CO-3:	Design some special structures subjected to wind loading	C	3	2	3												2	2	3
CO-4:	Design of structures for cyclone	C	3	2	3												2	2	2
CO-5:	Model and analyse a structure in a wind tunnel	AN	3	2	3												2	3	2

Unit-1 INTRODUCTION

9 Periods

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

Unit-2 EFFECT OF WIND ON STRUCTURES

9 Periods

Classification of structures – Rigid and Flexible – Effect of wind on structures –Vortex shedding,translational vibration of structures - Static and dynamic effects on Tall buildings – Chimneys

Unit-3 DESIGN OF SPECIAL STRUCTURES

9 Periods

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

Unit-4 CYCLONE EFFECTS

9 Periods

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

Unit-5 WIND TUNNEL STUDIES

9 Periods

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

Total: 45 Periods

Learning Resources	Text Books	References
		1. Cook.N.J., “The Designer’s Guide to Wind Loading of Building Structures”, Butterworths, 1990. 2. Kolousek.V, Pirner.M, Fischer.O and Naprstek.J, “Wind Effects on Civil Engineering Structures”, Elsevier Publications, 1984

	3. Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London, 1980.	
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Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE04	Course Name	PREFABRICATED STRUCTURES	Course Category	T	Professional Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To study the design principles, analysis and design of Prefabricated structures

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Explain the design principles involved in prefabrication	C	3	1	2										2	2	2
CO-2:	Detail the different types of connection	U	3	2	2										3	2	3
CO-3:	Design for stripping forces during manufacture	C	3	2	3										3	3	3
CO-4:	Determine the forces in shear walls	C	2	1	3										3	3	3
CO-5:	Identify the different roof trusses used in industrial buildings	E	2	2	3										3	3	2

Unit-1 DESIGN PRINCIPLES

9 Periods

General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control.

Unit-2 REINFORCED CONCRETE

9 Periods

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-3 FLOORS, STAIRS AND ROOFS

9 Periods

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

Unit-4 WALLS

9 Periods

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, Hoisting and placing, 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, Lateral load resistance, Location and types of shear walls, approximate design of shear walls.

Unit-5 INDUSTRIAL BUILDINGS AND SHELL ROOFS

9 Periods

Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing. Cylindrical, Folded plate and paraboloid shells, Erection and jointing of components in industrial buildings.

Total: 45 Periods

Learning Resources	Text Books	References
	1. Hubert Bachmann and Alfred Steinle, Precast Concrete Structures, 2012. 2. Koncz.T. Manual of Precast Concrete Construction, Vol.I II and III & IV Bauverlag, GMBH, 1971. 3. Laszlo Mokka, Prefabricated Concrete for Industrial and Public Structures, Akademiai Kiado, Budapest, 2007.	1. Lewicki.B, Building with Large Prefabricates, Elsevier Publishing Company, 1988. 2. Structural Design manual, Precast concrete connection details, Society for studies in the use of Precast concrete, Netherland BetonVerlag, 2009.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24ST111	Course Name	ADVANCED CONSTRUCTION ENGINEERING AND EXPERIMENTAL TECHNIQUES LABORATORY	Course Category	TP	Professional Core Courses	L	T	P	C
							0	0	4	2

Pre-requisite Courses	Concrete Technology	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To provide a thorough knowledge of material selection through the material testing based on specification
- To provide a detailed account of modern experimental techniques in construction Engineering research.
- To introduce the basic working principles, the operational know-how, and the strength and limitations of the techniques.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)											Program Specific Outcome (PSO)				
			1	2	3										1	2	3	
CO-1:	Do the mix proportion using IS and ACI codal provisions. Then, Test the concrete in a non-destructive manner using rebound hammer.	AP	3	2	2											3	3	3
CO-2:	Know the permeability characteristics of concrete and Observe the effect of mineral and chemical admixture in concrete.	U	3	1												2	1	1
CO-3:	Study the flow characteristics of self-compact Gain practical knowledge by applying the experimental methods to correlate with the theorizing concrete and	AP	2		2											3	2	3
CO-4:	Learn the usage of electrical and optical systems for various measurements and Apply the analytical techniques and graphical analysis to interpret the experimental data.	AN	3	1	2											3	2	2
CO-5:	Gain practical knowledge of non-destructive testing and Learn to calibrate and use proving rings and LVDTs	AP	3		1											2	1	1

List of Experiments

Total Practical: 60 Periods

1. Mix design of concrete as per IS, ACI & BS methods for high performance concrete
2. Flow Characteristics of Self Compacting concrete.
3. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
4. NDT on hardened concrete - UPV, Rebound hammer and core test
5. Permeability test on hardened concrete (RCPT) – Demonstration
6. Determination of elastic constants – Hyperbolic fringes and Elliptical fringes
7. Strain gauge meter – Determination of Young's modulus of a metallic wire
8. Ultrasonic interferometer – ultrasonic velocity in liquids
9. Electrical conductivity of metals and alloys with temperature-four probe method
10. Resistivity measurements
11. NDT – Ultrasonic flaw detector
12. Calibration of Proving Ring and LVDT

Learning Assessment				
Continuous Learning Assessment (CLA) (50% weightage)				End Semester Examination (50% weightage)
Theory (25% weightage)		Practical (25% weightage)		
Average of Internal Test (15%)	Critical Thinking Assessment (10%)	Evaluation of Laboratory Observation, Record (15%)	Model Lab Exam (10%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 				

Course Code	24ST112	Course Name	TECHNICAL SEMINAR	Course Category	P	Employability Enhancement Courses	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Mini Project, Main Project	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To work on a specific technical topic in Structural Engineering in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

Course Outcomes (CO): At the end of this course, learners will be able to:		BL	Program Outcomes (PO)											Program Specific Outcome (PSO)					
			1	2	3										1	2	3		
CO-1:	Identify the latest developments in the field of Structural Engineering	U	3	2	2												3	1	1
CO-2:	Acquire technical writing abilities for seminars, conferences and journal publications	U	3	1	-												3	-	3
CO-3:	Use modern tools to present the technical details	AP	2	-	2												2	1	2
CO-4:	Conduct brainstorming sessions on technical concepts	AP	2	1	3												3	3	3
CO-5:	Gain insight on upcoming trends in Structural Engineering	AP	3	2	2												3	1	2

List of Experiments

30 Periods

The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to Structural Engineering and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as the audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

Learning Assessment

Continuous Learning Assessment (CLA) (60% weightage)

Evaluation of Laboratory Observation, Record (45%)

Model Lab Exam (15%)

End Semester Examination (40% weightage)

* The expected levels for Bloom's Taxonomy should be:

- Lower-order thinking skills: not more than 40%
- Higher-order thinking skills: not less than 60%

Semester-II

Course Code	24ST201	Course Name	ADVANCED STEEL STRUCTURES	Course Category	T	Professional Core Courses				L	T	P	C
										3	1	0	4

Pre-requisite Courses	Design of Steel Structural Elements	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	IS800:2007, IS875 Part-1,2,3	

Course Objective: *The purpose of learning this course is to:*

- To study the behaviour of members, connections and industrial buildings.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Design the steel members such as purlins, gable wind girders subjected to combined forces	C	3	2	3												3	3	3
CO-2:	Explain and design different types of steel connections such as welded and bolted flexible as well as moment resisting connections	AN	3	2	3												3	3	2
CO-3:	Analyze and design industrial structures such as trusses and portal frames subjected to wind and seismic forces	AN	3	3	2												3	3	2
CO-4:	Explain the effect of axial force and shear force on steel structures and analyse continuous beams and frames using plastic theory	AN	3	2	2												3	2	3
CO-5:	Evaluate the behaviour and design of compression and flexural Cold-formed Steel members	E	3	2	2												3	2	3

Unit-1 GENERAL	12 Periods
Design Philosophies and Design Codes (IS, EC, AISC) – Stability Criteria –Beam- Columns and Frames (Sway and Non-Sway) – Design of members subjected to combined forces – Design of Purlins, Louver rails, Gable column and Gable wind girder.	
Unit-2 DESIGN OF CONNECTIONS	12 Periods
Types of connections – Welded and Bolted – Design of simple base, Gusseted base and Moment Resisting Base – Flexible Connections - Seated Connections – Unstiffened and Stiffened Seated Connections – Moment Resistant Connections– Clip angle Connections – Split beam Connections.	
Unit-3 ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS	12 Periods
Structural Configurations - Functional and Serviceability Requirements- Analysis and design of different types of trusses – Analysis and design of industrial buildings – Sway and non-sway frames–Gantry Girders –Earthquake resistant design of steel buildings	
Unit-4 PLASTIC ANALYSIS OF STRUCTURES	12 Periods
Introduction, Shape factor - Moment redistribution - Beam, Sway, Joint and Gable mechanisms -Combined mechanisms– Analysis of portal frames, Effect of axial force and shear force on plastic moment capacity, Connection Requirements– Moment resisting connections - Design of Straight Corner Connections –Design of continuous beams.	
Unit-5 DESIGN OF LIGHT GAUGE STEEL STRUCTURES	12 Periods
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	

Learning Resources	Text Books	References
	1. Lynn S. Beedle, Plastic Design of Steel Frames, John Wiley and Sons, 1997. 2. Narayanan.R.et.al., Teaching Resource on Structural steel Design, INSDAG, Ministry of Steel Publishing, 2000. 3. Subramanian. N, Design of Steel Structures, Oxford University Press, 2016.	1. Wie Wen Yu, Design of Cold-Formed Steel Structures, McGraw Hill Book Company, 2019 2. S.K. Duggal, Limit State Design of Steel Structures, McGraw Hill Book Company, 2017

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24ST202	Course Name	ADVANCED CONCRETE STRUCTURES	Course Category	T	Professional Core Courses				L	T	P	C
										3	1	0	4

Pre-requisite Courses	Design of Reinforced concrete structures	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To make the students familiar with the behaviour of RCC beams and columns and to design special structural members with proper detailing

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)										Program Specific Outcome (PSO)					
			1	2	3									1	2	3		
CO-1:	Explain the structural behaviour of flexural members and columns	C	3													3	2	2
CO-2:	Design the compression members and construct interaction diagrams	C	3	2	2											3	2	2
CO-3:	Design the special elements like corbels, deep beams and grid floors	C	3	2	2											3	2	2
CO-4:	Design flat slab and spandrel beams	C	3	2	2											2	3	2
CO-5:	Predict the moment curvature behavior and design and detail concrete elements based on ductility	C	3	2	2											2	3	2

Unit-1 BEHAVIOUR AND DESIGN OF R.C. BEAMS

12 Periods

Properties and behaviour of concrete and steel – Behaviour and design of R.C. beams in flexure, shear and torsion - modes of failure - calculations of deflections and crack width as per IS 456.

Unit-2 BEHAVIOUR AND DESIGN OF R.C. COLUMNS

12 Periods

Behaviour of short and long columns - behaviour of short column under axial load with uniaxial and bi-axial moments - construction of Pu - Mu interaction curves - Design of slender columns -

Unit-3 DESIGN OF SPECIAL R.C. ELEMENTS

12 Periods

Design of RC walls - design of corbels - strut and tie method - design of simply supported and continuous deep beams - analysis and design of grid floors

Unit-4 FLAT SLABS AND YIELD LINE BASED DESIGN

12 Periods

Design of flat slabs according to IS method – Check for shear - Design of spandrel beams - Yield line theory and design of slabs - virtual work method - equilibrium method.

Unit-5 INELASTIC BEHAVIOUR OF CONCRETE STRUCTURES

12 Periods

Inelastic behaviour of concrete beams - Moment-curvature curves - moment redistribution - Concept of Ductility – Detailing for ductility – Design of beams, columns for ductility - Design of cast-in-situ joints in frames.

Total: 60 Periods

Learning Resources	Text Books	References
	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	1. Varghese, P.C, “Advanced Reinforced Concrete Design”, Prentice Hall of India, 2020. 2. Sinha.S.N., Reinforced Concrete Design”, Tata McGraw Hill publishing company Ltd.2017

Edition, Tata
McGraw Hill Publishers Company Ltd., New Delhi, 2017.

Learning Assessment

Continuous Learning Assessment (CLA) (40% weightage)

***Average of Internal Test
(20%)***

***Critical Thinking Assessment
(20%)***

**End Semester Examination
(60% weightage)**

* The expected levels for Bloom's Taxonomy should be:
- Lower-order thinking skills: not more than 40%
- Higher-order thinking skills: not less than 60%

Course Code	24ST203	Course Name	FINITE ELEMENT ANALYSIS IN STRUCTURAL ENGINEERING	Course Category	T	Professional Core Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Structural Analysis	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To make the students understand the basics of the Finite Element Technique, and to cover the analysis methodologies for 1-D, 2-D and 3-D Structural Engineering problems.

		Program Outcomes (PO)											Program Specific Outcome (PSO)				
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3										1	2	3
CO-1:	Formulate a finite element problem using basic mathematical principles	C	3	2	3										2	2	2
CO-2:	Explain the various types of elements and select the appropriate element for modelling	C	3	3											2	2	2
CO-3:	Analyse a frame using truss element	AN	3	2	3										2	3	2
CO-4:	Formulate and analyse the two- and three-dimensional solid finite element problems	C	3	2	3										2	3	2
CO-5:	Analyse shells, thick and thin plates and explain the dynamic analysis using FEM	C	3	3	2										2	3	2

Unit-1 INTRODUCTION

9 Periods

Introduction - Basic Concepts of Finite Element Analysis - Introduction to Elasticity- Steps in Finite Element Analysis - Finite Element Formulation Techniques - Virtual Work and Variational Principle - Galerkin Method - Finite Element Method: Displacement Approach - Stiffness Matrix and Boundary Conditions

Unit-2 ELEMENT PROPERTIES

9 Periods

Natural Coordinates - Triangular Elements-Rectangular Elements - Lagrange and Serendipity Elements - Solid Elements - Isoparametric Formulation - Stiffness Matrix of Isoparametric Elements Numerical Integration: One, Two and Three Dimensional - Problems

Unit-3 ANALYSIS OF FRAME STRUCTURES

9 Periods

Stiffness of Truss Members-Analysis of Truss-Stiffness of Beam Members-Finite Element Analysis of Continuous Beam-Plane Frame Analysis-Analysis of Grid and Space Frame

Unit-4 TWO AND THREE DIMENSIONAL SOLIDS

9 Periods

Constant Strain Triangle - Linear Strain Triangle - Rectangular Elements- Numerical Evaluation of Element Stiffness - Computation of Stresses, Geometric Nonlinearity and Static Condensation - Axisymmetric Element - Finite Element Formulation of Axisymmetric Element - Finite Element Formulation for 3 Dimensional Elements- Problems

Unit-5 APPLICATIONS OF FEM

9 Periods

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 -Finite Elements for Elastic Stability - Dynamic Analysis

Total: 45 Periods

Learning Resources	Text Books	References
	1. David Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017. 2. Logan D. L, A First Course in the Finite Element Method, Thomson-Engineering, 3rd edition, 2010. 3. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", Seventh Edition, McGraw – Hill, 2013	1. Chandrupatla, R.T. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", Fourth Edition, Prentice Hall of India, 2015. 2. Moaveni, S., "Finite Element Analysis Theory and Application with ANSYS", Prentice Hall Inc., 2020.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STE05	Course Name	ADVANCED CONCRETE TECHNOLOGY	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Concrete Technology	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	IS10262:2019		

Course Objective: The purpose of learning this course is to:

- To study the properties of concrete making materials, tests, mix design, special concretes, and various methods for making concrete.

Course Outcomes (CO): At the end of this course, learners will be able to:		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Develop knowledge on various materials needed for concrete manufacture	C	2	1	2												2	1	1
CO-2:	Apply the rules to do mix designs for concrete by various methods	AP	2	2	2												2	2	2
CO-3:	Develop the methods of manufacturing of concrete	AN	3	2	3												3	1	2
CO-4:	Explain about various special concrete	U	3	2	3												2	2	1
CO-5:	Explain various tests on fresh and hardened concrete	U	2	2	2												2	2	2

Unit-1 CONCRETE MAKING MATERIALS

9 Periods

Aggregates classification IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates - Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements - Water - Chemical admixtures, Mineral admixture.

Unit-2 MIX DESIGN

9 Periods

Principles of concrete mix design, Methods of concrete mix design, IS Method, ACI Method, DOE Method – Mix design for special concretes- changes in Mix design for special materials.

Unit-3 CONCRETING METHODS

9 Periods

Process of manufacturing of concrete, methods of transportation, placing and curing, cracking, plastic shrinkage, Extreme weather concreting, special concreting methods. Vacuum dewatering –Underwater Concrete

Unit-4 SPECIAL CONCRETES

9 Periods

Light weight concrete Fly ash concrete, Fiber reinforced concrete, Sulphur impregnated concrete, Polymer Concrete – High performance concrete. High performance fiber reinforced concrete, Self Compacting Concrete, Geo Polymer Concrete, Waste material-based concrete – Ready mixed concrete.

Unit-5 TESTS ON CONCRETE

9 Periods

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage-Durability of concrete. Non-destructive Testing Techniques - microstructure of concrete

Total: 45 Periods

Learning Resources	Text Books	References
	1. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2017. 2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2019. 3. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2006.	1. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London. 2. Job Thomas., Concrete Technology, Cengage learning India Private Ltd, New Delhi, 2015.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
<i>Average of Internal Test (20%)</i>	<i>Critical Thinking Assessment (20%)</i>	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE06	Course Name	ADVANCED PRESTRESSED CONCRETE	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To develop an understanding of the philosophy of design of prestressed concrete
- To be able to design indeterminate prestressed concrete structure
- To design the prestressed concrete bridge and composite sections.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Identify the various methods of prestressing and estimate the loss	U	1	1	1												2	2	3
CO-2:	Design the beams for flexure, shear, bond and torsion	C	2	2	2												2	1	2
CO-3:	Design the continuous beams and composite beams	C	3	2	3												2	3	1
CO-4:	Design the water tank, piles and masts	C	3	2	3												1	1	2
CO-5:	Analyze and design the prestressed concrete bridge	AN	3	2	3												2	3	1

Unit-1 INTRODUCTION	9 Periods
Concepts of Prestressing – Materials and methods of prestressing – Design philosophy- Analysis methods, Time-dependent deformation of concrete and losses of prestress.	
Unit-2 DESIGN FOR FLEXURE, SHEAR AND TORSION	9 Periods
Behaviour of flexural members, determination of ultimate flexural strength using various Codal provisions - Design for Flexure, Shear, torsion and bond of pre-stressed concrete elements –Transfer of prestress – Box girders - Camber, deflection and crack control.	
Unit-3 DESIGN OF CONTINUOUS AND COMPOSITE BEAMS	9 Periods
Statically indeterminate structures - Analysis and design of continuous beams and frames– Choice of cable profile - Methods of achieving continuity – concept of linear transformations, concordant cable profile and gap cables – Composite sections of prestressed concrete beam and cast in situ RC slab - Design of composite sections - Partial prestressing - Limit State design of partially prestressed concrete beams	
Unit-4 DESIGN OF TENSION AND COMPRESSION MEMBERS	9 Periods
Pre-stressed concrete compression and 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 of piles, flag masts and similar structures –Two way pre-stressed concrete floor systems – Connections for pre-stressed concrete elements	
Unit-5 DESIGN OF PRESTRESSED CONCRETE BRIDGES	9 Periods
Review of IRC and IRS loadings. Effect of concentrated loads on deck slabs, load distribution methods for concrete bridges. Analysis and Design of superstructures - Design of pre-stressed concrete bridges incorporating long-term effects like creep, shrinkage, relaxation, and temperature effects, Dynamic response of bridge decks.	
Total: 45 Periods	

Learning Resources	Text Books	References
	1. Arthur H. Nilson, "Design of Prestressed Concrete", John Wiley and Sons Inc, New York, 2004. 2. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill Publishing Co., New Delhi, 6 th Edition, 2018. 3. Lin.T.Y.andBurns.H "Design of Prestressed Concrete Structures", John Wiley and Sons Inc, 3rd Edition, 2010.	1. Rajagopalan.N, "Prestressed Concrete", Narosa Publications, New Delhi, 2014. 2. Sinha.N.C.and.Roy.S.K, "Fundamentals of Prestressed Concrete", S.Chand and Co., 1998. 3. Johnson Victor, D., Essentials of Bridge Engineering, Oxford and IBH Publishing Co., New Delhi 2019

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STE07	Course Name	RELIABILITY ANALYSIS OF STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: The purpose of learning this course is to:

- To develop knowledge to solve structural analysis problems using reliability concepts.

Course Outcomes (CO): At the end of this course, learners will be able to:		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Achieve the Knowledge of design and development of problem-solving skills.	C	3	2	3												2	2	2
CO-2:	Understand the principles of reliability.	U	2	1													2	3	2
CO-3:	Design and develop analytical skills.	C	3	2	2												2	2	2
CO-4:	Summarize the Probability distributions	E	2		1												1	2	2
CO-5:	Understands the concept of System reliability.	U	2	2	1												1	2	3

Unit-1 DATA ANALYSIS	9 Periods
Graphical representation Histogram, frequency polygon, Measures of central tendency- grouped and ungrouped data, measures of dispersion, measures of asymmetry. Curve fitting and Correlation: Fitting a straight line, curve of the form $y = abx$, and parabola, Coefficient of correlation	
Unit-2 PROBABILITY CONCEPTS	9 Periods
Random events-Sample space and events, Venn diagram and event space, Measures of probability interpretation, probability axioms, addition rule, multiplication rule, conditional probability, probability tree diagram, statistical independence, total probability theorem and Baye's theorem	
Unit-3 RANDOM VARIABLES	9 Periods
Probability mass function, probability density function, Mathematical expectation, Chebyshev's theorem. Probability distributions: Discrete distributions- Binomial and poison distributions, Continuous distributions, Normal, Log normal distributions	
Unit-4 RELIABILITY ANALYSIS	9 Periods
Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second Moment Method (Hasofer-Lind's method).	
Unit-5 SYSTEM RELIABILITY	9 Periods
Influence of correlation coefficient, redundant and non-redundant systems series, parallel and combined systems, Uncertainty in reliability assessments- Confidence limits, Bayesian revision of reliability. Simulation Techniques: Monte Carlo simulation- Statistical experiments, sample size and accuracy, Generation of random numbers, random numbers with standard uniform distribution, continuous random variables, discrete random variables	
Total: 45 Periods	

Text Books	References
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Learning Resources	1. A Papoulis, Probability, Random Variables and Stochastic Processes, McGraw-Hill, New York, 2017. 2. R E Melchers, Structural Reliability Analysis and Prediction, Third Edition, John Wiley & Sons Ltd, Chichester, England,2018. 3. O. Ditlevsen, H. O. Madsen, Structural Reliability Methods, Wiley, 1st Edition, 1996.	1. Srinivasan Chandrasekaran, Offshore Structural Engineering: Reliability and Risk Assessment, CRC Press, Florida, 2016. 2. Jack R Benjamin, C. Allin Cornell, Probability, Statistics, and Decision for Civil Engineers, Dover Publications, New York, 2014.
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Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STE08	Course Name	DESIGN OF FORMWORK	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.		

Course Objective: *The purpose of learning this course is to:*

- To study and understand the detailed planning of formwork, Design of forms for various elements such as foundation, slabs, beams, columns and walls.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Select proper formwork, accessories and material	C	3												2	2	1
CO-2:	Design the form work for Beams, Slabs, columns, Walls and Foundations	C	3	1	2										2	2	2
CO-3:	Design the form work for Special Structures	C	3	2	3										2	2	3
CO-4:	Describe the working of flying formwork.	U	3												2	3	2
CO-5:	Judge the formwork failures through case studies	E	2	2	2										2	3	2

Unit-1 INTRODUCTION	9 Periods
General objectives of formwork building - Development of a Basic System - Key Areas of cost reduction - Requirements and Selection of Formwork.	
Unit-2 FORMWORK MATERIALS AND TYPES	9 Periods
Timber, Plywood, Steel, Aluminium, Plastic, and Accessories. Horizontal and Vertical Formwork Supports. Flying Formwork, Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete,	
Unit-3 FORMWORK DESIGN	9 Periods
Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.	
Unit-4 FORMWORK DESIGN FOR SPECIAL STRUCTURES	9 Periods
Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.	
Unit-5 FORMWORK FAILURES	9 Periods
Formwork Management Issues – Pre- and Post-Award. Formwork Failures: Causes and Case studies in Formwork Failure, Formwork Issues in Multi story Building Construction.	
Total: 45 Periods	

Learning Resources	Text Books	References
	1. Formwork for Concrete Structures, R.L.Peurifoy, McGraw Hill India, 2010. 2. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012. 3. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.	1. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996 2. Michael P. Hurst, Construction Press, London and New York, 2003.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
<i>Average of Internal Test (20%)</i>	<i>Critical Thinking Assessment (20%)</i>	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE09	Course Name	MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	ME Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To study the damages, repair and rehabilitation of structures

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain the importance of maintenance assessment and repair strategies	U	3		2												3	2	2
CO-2:	Acquire knowledge of strength and durability properties and their effects due to climate and temperature.	U	3	1													2	2	1
CO-3:	Gain knowledge of recent developments in repair	U	3		2												2	3	1
CO-4:	Explain the techniques for repair and protection methods	U	3	1													3	2	2
CO-5:	Explain the repair, rehabilitation and retrofitting of structures and demolition methods.	U	3	2	1												2	2	1

Unit-1 MAINTENANCE AND REPAIR STRATEGIES

9 Periods

Maintenance, Repair and Rehabilitation, retrofit and strengthening, need for rehabilitation of structures- Service life behaviour - importance of Maintenance, causes and effects of deterioration. Non-destructive Testing Techniques

Unit-2 STRENGTH AND DURABILITY OF CONCRETE

9 Periods

Quality assurance for concrete based on Strength, Durability and Microstructure of concrete - NDT techniques- Cracks- different types, causes – Effects due to Environment, Fire, Earthquake, Corrosion of steel in concrete, Mechanism, quantification of corrosion damage

Unit-3 REPAIR MATERIALS AND SPECIAL CONCRETES

9 Periods

Repair materials-Variou repair materials, Criteria for material selection, Methodology of selection, Special mortars and concretes- Polymer Concrete and Grouting materials- Bonding agents-Latex emulsions, Epoxy bonding agents, Protective coatings-Protective coatings for Concrete and Steel, FRP sheets

Unit-4 PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING

9 Periods

Concrete protection methods – reinforcement protection methods- cathodic protection - Sacrificialanode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings-Corrosion resistant steels, Coatings to reinforcement, Structural health monitoring.

Unit-5 REPAIR, RETROFITTING AND DEMOLITION OF STRUCTURES

9 Periods

Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Repair to active cracks, Repair to dormant cracks. Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing Techniques, Strengthening Methods for Structural Elements. Engineered Demolition - Case studies

Total: 45 Periods

Learning Resources	Text Books	References
	1. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012 2. DovKominetzky.M.S., - Design and Construction Failures, Galgotia Publications Pvt. Ltd., 2001 3. Ravishankar.K., Krishnamoorthy. T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.	1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008. 2. Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD, Govt of India, New Delhi – 2002 3. BS EN 1504 - Products and systems for the protection and repair of concrete structures -Definitions, requirements, quality control and evaluation of conformity

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom’s Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STE10	Course Name	MECHANICS OF FIBER REINFORCED POLYMER COMPOSITE MATERIALS	Course Category	T	Professional Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To study the behaviour of composite materials and to investigate the failure and fracture characteristics.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain the various types of composites and their constituents	U	3														3	1	1
CO-2:	Derive the constitutive relationship and determine the stresses and strains in a composite material	U	3	2	2												2	2	2
CO-3:	Analyze a laminated plate	AN	2	3	2												2	3	2
CO-4:	Explain the various failure criteria and fracture mechanics of composites	U	3		1												2	2	2
CO-5:	Design simple composite elements	C	3	2	2												2	3	2

Unit-1 INTRODUCTION

9 Periods

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-2 STRESS STRAIN RELATIONS

9 Periods

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

Unit-3 ANALYSIS OF LAMINATED COMPOSITES

9 Periods

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-4 FAILURE AND FRACTURE OF COMPOSITES

9 Periods

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

Unit-5 APPLICATIONS AND DESIGN

9 Periods

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

Total: 45 Periods

Learning Resources	Text Books	References
	1. Agarwal. B.D. Broutman. L.J. and Chandrashekara. K. "Analysis and Performance of Fiber Composites", Fourth Edition, John-Wiley and Sons, 2017 2. Daniel. I.M, and Ishai. O, "Engineering Mechanics of Composite Materials", Second Edition, Oxford University Press, 2005.	1. Jones R.M., "Mechanics of Composite Materials", Taylor and Francis Group 1999. 2. Mukhopadhyay.M, "Mechanics of Composite Materials and Structures", Universities Press, India, 2005.

	3. Hyer M.W., and White S.R., "Stress Analysis of Fiber-Reinforced Composite Materials", D. Estech Publications Inc., 2009	
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Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE11	Course Name	DESIGN OF STEEL-CONCRETE COMPOSITE STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Design of Steel Structural Elements	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To develop an understanding of the behaviour and design concrete composite elements and structures.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain composite action	U	3														3	2	1
CO-2:	Design composite elements	C	3	2	2												2	2	1
CO-3:	Design connections	C	2	2	1												2	2	1
CO-4:	Explain the concept of design of composite box girder bridges	U	2	2	2												2	2	2
CO-5:	Study and evaluate case studies	E	3														3	2	2

Unit-1 INTRODUCTION

9 Periods

Introduction to steel – concrete composite construction – Codes – Composite action –Serviceability and Construction issues in design.

Unit-2 DESIGN OF COMPOSITE MEMBERS

9 Periods

Design of composite beams, slabs, columns, beam – columns – Design of composite trusses.

Unit-3 DESIGN OF CONNECTIONS

Periods

Shear connectors – Types – Design of connections in composite structures – Design of shear connectors – Partial shear interaction.

Unit-4 COMPOSITE BOX GIRDER BRIDGES

9 Periods

Introduction –Design concepts of box girder bridges and corrugated web girder bridges

Unit-5 CASE STUDIES

9 Periods

Case studies on steel – concrete composite construction in buildings – seismic behaviour of composite structures.

Total: 45 Periods

Learning Resources	Text Books	References
	1. Johnson R.P., "Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings", Vol. I, Fourth Edition, Blackwell Scientific Publications, 2018 2. Oehlers D.J. and Bradford M.A., "Composite Steel and Concrete Structural Members, Fundamental behaviour", Revised Edition, Pergamon press, Oxford, 2013. 3. Owens. G.W and Knowles. P, "Steel Designers Manual", Seventh Edition, Steel Concrete Institute(UK), Oxford Blackwell Scientific Publications, 2011.	1. Narayanan R, "Composite steel structures – Advances, design and construction", Elsevier, Applied science, UK, 1987 2. Teaching resource for, "Structural Steel Design," Volume 2 of 3, Institute for Steel Development and Growth (INSDAG), 2002.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
<i>Average of Internal Test (20%)</i>	<i>Critical Thinking Assessment (20%)</i>	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE12	Course Name	DESIGN OF MASONRY STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	ME Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To design, detail and retrofit a masonry structure

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain the properties of a masonry unit and the various components	U	3														3	2	2
CO-2:	Design a masonry structure for compression	C	3	2	2												2	2	3
CO-3:	Design a masonry structure for lateral loads	C	3	2	2												3	2	2
CO-4:	Design an earthquake-resistant masonry wall	C	3	2	2												2	2	3
CO-5:	Suggest retrofitting techniques for existing masonry walls	U	3														3	2	2

Unit-1 INTRODUCTION	9 Periods
Introduction – Masonry construction – National and International perspective – Historical development, Modern masonry, Material Properties – Masonry units: clay and concrete blocks, Mortar, grout and reinforcement, Bonding patterns, Shrinkage and differential movements.	
Unit-2 DESIGN OF COMPRESSION MEMBER	9 Periods
Principles of masonry design, Masonry standards: IS 1905 and others - Masonry in Compression –Prism strength, Eccentric loading -Kern distance. Structural Wall, Columns and Plasters, Retaining Wall, Pier and Foundation – Prestressed masonry	
Unit-3 DESIGN OF MASONRY UNDER LATERAL LOADS	9 Periods
Masonry under Lateral loads – In-plane and out-of-plane loads, Ductility of Reinforced Masonry Members Analysis of perforated shear walls, Lateral force distribution -flexible and rigid diaphragms. Behaviour of Masonry – Shear and flexure – Combined bending and axial loads – Reinforced and unreinforced masonry – Infill masonry	
Unit-4 EARTHQUAKE RESISTANT DESIGN OF MASONRY STRUCTURES	9 Periods
Structural design of Masonry – Consideration of seismic loads –concepts of confined masonry –Cyclic loading and ductility of shear walls for seismic design -Code provisions- Working and Ultimate strength design – In-plane and out-of-plane design criteria for load-bearing and infills, connecting elements and ties. Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra – use of Software.	
Unit-5 RETROFITTING OF MASONRY	9 Periods
Seismic evaluation and Retrofit of Masonry – In-situ and non-destructive tests for masonry –properties – Repair and strengthening of techniques.	
Total: 45 Periods	

Learning Resources	Text Books	References
		1. Drysdale, R. G. Hamid, A. H. and Baker, L. R, “Masonry Structures: Behaviour & Design”, Prentice Hall Hendry, 1994. 2. A.W. Hendry, B.P. Sinha and Davis, S. R, “Design of Masonry Structures”, E &

	FN Spon, UK, 2017. 3. R.S. Schneider and W.L. Dickey, "Reinforced Masonry Design", Prentice Hall, 3rd edition, 1994.	2. A.W. Hendry, "Structural Masonry", 2nd Edition, Palgrave McMillan Press, 1998.
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Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STA01	Course Name	ENGLISH FOR RESEARCH PAPER WRITING	Course Category	T	Audit Courses				L	T	P	C
										2	0	0	0

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

					Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>					BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand that how to improve your writing skills and level of readability				U															
CO-2:	Learn about what to write in each section				U															
CO-3:	Understand the skills needed when writing a Title				U															
CO-4:	Understand the skills needed when writing the Conclusion				U															
CO-5:	Ensure the good quality of paper at very first-time submission				U															

Unit-1 INTRODUCTION TO RESEARCH PAPER WRITING

6 Periods

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit-2 PRESENTATION SKILLS

6 Periods

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

Unit-3 TITLE WRITING SKILLS

9 Periods

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

Unit-4 RESULT WRITING SKILLS

6 Periods

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit-5 VERIFICATION SKILLS

6 Periods

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the firsttime submission

Total: 30 Periods

	Text Books	References
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Learning Resources	1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011 2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006	1. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006 2. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.
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Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STA02	Course Name	DISASTER MANAGEMENT	Course Category	T	Audit Courses				L	T	P	C
										2	0	0	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Ability to summarize basics of disaster	E															
CO-2:	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	U															
CO-3:	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	AP															
CO-4:	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	U															
CO-5:	Ability to develop the strengths and weaknesses of disaster management approaches	U															

Unit-1 INTRODUCTION

6 Periods

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit-2 REPERCUSSIONS OF DISASTERS AND HAZARDS

6 Periods

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit-3 DISASTER PRONE AREAS IN INDIA

6 Periods

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

Unit-4 DISASTER PREPAREDNESS AND MANAGEMENT

6 Periods

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

Unit-5 RISK ASSESSMENT

6 Periods

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

Total: 30 Periods

Learning Resources	Text Books	References
	1. Goel S. L., Disaster Administration and Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009. 2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company,2007. 3. Sahni, Pardeep et.al.," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi,2001.	

Learning Assessment

Continuous Learning Assessment (CLA) (40% weightage)			End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)		
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%			

Course Code	24STA03	Course Name	CONSTITUTION OF INDIA	Course Category	T	Audit Courses	L	T	P	C
							2	0	0	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics	U																
CO-2:	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	U																
CO-3:	Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	U																
CO-4:	Discuss the passage of the Hindu Code Bill of 1956	U																

Unit-1 HISTORY OF MAKING OF THE INDIAN CONSTITUTION	6 Periods
History, Drafting Committee, (Composition & Working)	
Unit-2 PHILOSOPHY OF THE INDIAN CONSTITUTION	6 Periods
Preamble, Salient Features	
Unit-3 CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	6 Periods
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	
Unit-4 ORGANS OF GOVERNANCE	6 Periods
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges,Qualifications, Powers and Functions.	
Unit-5 LOCAL ADMINISTRATION	6 Periods
District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level:Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	
Total: 30 Periods	

Learning Resources	Text Books	References
	1.The Constitution of India,1950(Bare Act),Government Publication. 2.Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015. 3.M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014. 4.D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.	

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STA04	Course Name	நற்றமிழ் இலக்கியம்	Course Category	T	Audit Courses	L	T	P	C
							2	0	0	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Unit-1 சங்க இலக்கியம்	6 Periods
1. தமிழின் துவக்க நூல் தொல்கொப்பியம் - எழுத்து, சொல், பொருள் 2. அகநானூறு (82) - இயற்கை இன்னிசை அரங்கம் 3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி 4. புறநானூறு (95,195) - போரை நிறுத்திய ஓளவையார்	
Unit-2 அறநெறித்தமிழ்	6 Periods
1. அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ் 2. பிற அறநூல்கள் - இலக்கிய மருந்து - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும்நூல்)	
Unit-3 இரட்டைக் காப்பியங்கள்	6 Periods
1. கண்ணகியின் புரட்சி - சிலப்பதிகார வழக்குரை காதை சமூக சேவை இலக்கியம் மணிமேகலை - சிறைக்கோட்டம் அறக்கோட்டமாகிய. காதை	
Unit-4 அருள்நெறித்தமிழ்	6 Periods
1. சிறுபாணாற்றுப்படை - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஓளவைக்கு நல்லிக்கனி கொடுத்தது, அரசர் பண்புகள் 2. நற்றிணை - அன்னைக்குறிய புன்னை சிறப்பு 3. திருமந்திரம் (617, 618) - இயமம் நியமம் விதிகள் 4. தர்மச்சாலையை நிறுவிய வள்ளலார் 5. புறநானூறு - சிறுவனே வள்ளலானான் 6. அகநானூறு (4) - வண்டு நற்றிணை(11) - நண்டு	

கலித்தொகை (11) - யானை, புறா ஐந்திணை 50 (27) - மான் ஆகியவை பற்றிய செய்திகள்	
Unit-5 நவீன தமிழ் இலக்கியம்	6 Periods
1. உரைநடைத்தமிழ், - தமிழின் முதல் புதினம், - தமிழின் முதல் சிறுகதைகள், - கட்டுரை இலக்கியம், - பயண இலக்கியம், - நாடகம். 2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும், 3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும், 4. பெண் விடுதலையும் விளிம்பு நிலையினர் மேம்பாட்டில் தமிழ் இலக்கியமும், 5. அறிவியல் தமிழ், 6. இணையத்தில் தமிழ், 7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.	
Total: 30 Periods	

	Text Books	References
Learning Resources	1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org 2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) - https://ta.wikipedia.org 3. தர்மபுர ஆதீன வெளியீடு 4. வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர் 5. தமிழ்கலைக்களஞ்சியம் - தமிழ் வளர்ச்சித்துறை (thamilvalarchithurai.com) 6. அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்	

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

SEMESTER III

Course Code	24STE13	Course Name	DESIGN OF INDUSTRIAL STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Advanced Steel Structures, Advanced Concrete Structures	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	IS 456, IS 800, IS 6533(Part 1 & 2), IS 875(Part 2)		

Course Objective: *The purpose of learning this course is to:*

- To disseminate knowledge about planning and design of RCC and Steel Industrial structures.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Develop the concept of planning & functional requirements of industrial standards.	U	3												3	2	2
CO-2:	Analyse and design Steel Gantry girders & Crane girders and RCC design of corbels, nibs and staircase.	AN	3	2	2										3	3	2
CO-3:	Analyse & design cooling towers, bunkers, silos and pipe supporting structures.	AN	3	2	2										2	3	3
CO-4:	Analyse and design Steel transmission line towers and chimneys.	AN	3	2	2										3	2	3
CO-5:	Design foundations for cooling tower, chimneys and turbo generator.	AP	3	2	2										2	3	3

Unit-1 PLANNING AND FUNCTIONAL REQUIREMENTS

9 Periods

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-2 INDUSTRIAL BUILDINGS

9 Periods

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

Unit-3 POWER PLANT STRUCTURES

9 Periods

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

Unit-4 TRANSMISSION LINE STRUCTURES AND CHIMNEYS

9 Periods

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

Unit-5 FOUNDATION

9 Periods

Foundation for Towers, Chimneys and Cooling Towers –Design of Block foundations for machines - Design of Turbo Generator Foundation.

Total: 45 Periods

Learning Resources	Text Books	References
	1. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004. 2. Santhakumar A.R. and Murthy S.S., Transmission Line Structures, Tata McGraw Hill, 1992.	1. Swami saran, Analysis & Design of substructures, Limit state Design second Edition. 2018. 2. N. Subramaniyan, Design of Steel Structures, United Press, 2018. 3. N. Krishna Raju, Advanced Reinforced concrete Design, 3rd edition 2016.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
<i>Average of Internal Test (20%)</i>	<i>Critical Thinking Assessment (20%)</i>	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE14	Course Name	ADVANCED DESIGN OF FOUNDATION STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Advanced Concrete Structures	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- To design various types of foundations to fulfill the required criteria.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Design shallow and deep foundations for various types of structures.	AP	3	2	2												3	2	2
CO-2:	Design piles and pile caps.	AP	3	3	2												2	3	2
CO-3:	Design well foundation for bridge piers and related structures.	AP	3	2	2												3	3	3
CO-4:	Apply the principles of design and construction techniques to develop suitable machine foundations for various load conditions.	AP	3	2	2												3	2	2
CO-5:	Design foundations for bridges, towers and chimneys.	AP	3	2	2												2	3	2

Unit-1 SHALLOW FOUNDATIONS

9 Periods

soil investigation – Types of foundations and their specific applications – depth of foundation – bearing capacity and settlement estimates – structural design of isolated, strip, rectangular and trapezoidal and combined footings – strap – raft foundation.

Unit-2 PILE FOUNDATIONS

9 Periods

Types of Pile foundations and their applications – Load Carrying capacity – pile load test – Settlements – Group action – pile cap – structural design of piles and pile caps – undreamed pile foundation.

Unit-3 WELL FOUNDATION

9 Periods

Types of well foundations – grip length – load carrying capacity – construction of wells – failure and remedies – structural design of well foundation – lateral stability.

Unit-4 MACHINE FOUNDATIONS

9 Periods

Types – General requirements and design criteria – General analysis of machine foundations-soil system – Stiffness and damping parameters – Tests for design parameters – design of foundation for reciprocating engines, impact type machines and rotary type machines.

Unit-5 SPECIAL FOUNDATIONS

9 Periods

General requirements and design criteria – Foundations for towers, Chimneys and Silos – design of anchors

Total: 45 Periods

Learning Resources	Text Books	References
	1. Tomlinson, M.J. and Boorman. R., Foundation Design and Construction, ELBS Longman, Seventh Edition, 2001. 2. Nayak, N.V., Foundation Design manual for Practicing Engineers, Dhanpat Rai and Sons, 2018.	1. Brain J. Bell and M.J. Smith, Reinforced Concrete Foundations, George Godwin Ltd., 1981. 2. Braja M. Das, Principles of Foundations Engineering, Eighth Edition, Thomson Asia (P) Ltd., 2017. 3. Bowels J.E., Foundation Analysis and Design, Fifth Edition, McGraw-Hill International Book Co., 2017.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
<i>Average of Internal Test (20%)</i>	<i>Critical Thinking Assessment (20%)</i>	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE15	Course Name	OPTIMIZATION OF STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: The purpose of learning this course is to:

- To study the optimization methodologies applied to structural engineering.

Course Outcomes (CO): At the end of this course, learners will be able to:		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Apply the knowledge of engineering fundamentals to formulate and solve engineering problems by classical optimization techniques.	AP	3	2	2												3	2	2
CO-2:	Identify, formulate and solve engineering problems by linear and non-linear programming.	AP	3	3	3												2	3	3
CO-3:	Analyse the problem and reduce G.P.P to a set of simultaneous equations.	AN	3	3	3												2	3	2
CO-4:	Apply the Engineering knowledge to understand the concept of dynamic programming.	AP	3		1												3	2	2
CO-5:	Design various structural elements with minimum weight.	AP	3	2	2												2	2	2

Unit-1 BASIC PRINCIPLES AND CLASSICAL OPTIMIZATION TECHNIQUES 9 Periods

Definition – Objective Function; Constraints – Equality and inequality – Linear and non-linear Side, Non-negativity, Behaviour and other constraints – Design space – Feasible and infeasible- Convex and Concave – Active constraint – Local and global optima. Differential calculus – Optimality criteria – Single variable optimization – Multivariable optimization with no constraints- - (Lagrange Multiplier method) – with inequality constraints (Kuhn – Tucker Criteria).

Unit-2 LINEAR AND NON-LINEAR PROGRAMMING 9 Periods

LINEAR PROGRAMMING: Formulation of problems -Graphical solution – Analytical methods- Standard form - Slack, surplus and artificial variables – Canonical form – Basic feasible solution - simplex method – Two phase method – Penalty method- Duality theory – Primal – Dual algorithm, Dual Simplex method. Non-linear programming: One Dimensional minimization methods: Unidimensional - Unimodal function – Exhaustive and unrestricted search – Dichotomous search - Fibonacci Method – Golden section method -Interpolation methods. Unconstrained optimization Techniques.

Unit-3 GEOMETRIC PROGRAMMING 9 Periods

Polynomial – degree of difficulty – reducing G.P.P to a set of simultaneous equations – Unconstrained and constrained problems with zero difficulty – Concept of solving problems with one degree of difficulty.

Unit-4 DYNAMIC PROGRAMMING 9 Periods

Bellman's principle of optimality – Representation of a multistage decision problem- concept of sub-optimization problems using classical and tabular methods.

Unit-5 STRUCTURAL APPLICATIONS 9 Periods

Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory -Minimum weight design for truss members - Fully stressed design –Optimization principles to design of R.C. structures such as multistory buildings, water tanks and bridges.

Total: 45 Periods

Learning Resources	Text Books	References
	1. Iyengar. N.G.R and Gupta. S.K, "Structural Design Optimization", Affiliated East West Press Ltd, New Delhi, 1997. 2. Rao, S.S. "Engineering Optimization: Theory and Practice", Fourth Edition, Wiley Eastern (P) Ltd., 2013.	1. Spunt, "Optimization in Structural Design", Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey 1971. 2. Uri Kirsch, "Optimum Structural Design", McGraw Hill Book Co. 1981. 3. Haftka, R. T. and Gurdal, Z., Elements of Structural Optimization, Springer, 3 rd Edition, 1992.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STE16	Course Name	STRUCTURAL HEALTH MONITORING	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To make the students familiar with various structural health monitoring tools and techniques.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand the need, advantages and challenges of SHM.	U	2												2	2	2
CO-2:	Understand the various types of sensors and the techniques used for instrumentation.	U	2	1	3										2	2	2
CO-3:	Comprehend the static and dynamic measurement techniques.	U	2												3	2	2
CO-4:	Compare the various damage detection techniques.	U	3	2	3										2	2	2
CO-5:	Identify the various data processing methods through case studies.	U	3	3											3	2	2

Unit-1 INTRODUCTION TO STRUCTURAL HEALTH MONITORING

9 Periods

Need for SHM, Structural Health Monitoring versus Non-Destructive Evaluation, Methods of SHM Local & Global Techniques for SHM, Short & Long-Term Monitoring, Active & Passive Monitoring, Remote Structural Health Monitoring- Advantages of SHM - Challenges in SHM

Unit-2 SENSORS AND INSTRUMENTATION FOR SHM

9 Periods

Sensors for measurements: Electrical Resistance Strain Gages, Vibrating Wire Strain Gauges, Fiber Optic Sensors, Temperature Sensors, Accelerometers, Displacement Transducers, Load Cells, Humidity Sensors, Crack Propagation Measuring Sensors, Corrosion Monitoring Sensors, Pressure Sensors, Data Acquisition – Data Transmission - Data Processing – Storage of processed data - Knowledgeable information processing

Unit-3 STATIC AND DYNAMIC MEASUREMENT TECHNIQUES FOR SHM

9 Periods

Static measurement - Load test, Concrete core trepanning, Flat jack techniques, Static response measurement, Dynamic measurement -Vibration based testing- Ambient Excitation methods, Measured forced Vibration-Impact excitation, step relaxation test, shaker excitation method.

Unit-4 DAMAGE DETECTION

9 Periods

Damage Diagnostic methods based on vibrational response- Method based on modal frequency/shape/damping, Curvature and flexibility method, Modal strain energy method, Sensitivity method, Baseline-free method, Cross-correlation method, Damage Diagnostic methods based on wave propagation Methods-Bulk waves/Lamb waves, Reflection and transmission, Wave tuning/mode selectivity, Migration imaging, Phased array imaging, Focusing array/SAFT imaging

Unit-5 DATA PROCESSING AND CASE STUDIES

9 Periods

Advanced signal processing methods -Wavelet, Hilbert-Huang transform, Neural networks, Support Vector Machine Principal component analysis, Outlier analysis. Applications of SHM on bridges and buildings, case studies of SHM in Civil/ Structural engineering.

Total: 45 Periods

Learning Resources	Text Books	References
	1. Daniel Balageas, Peter Fritzen, Alfredo Guemes, Structural Health Monitoring, John Wiley & Sons, 2006. 2. Douglas E Adams, Health Monitoring of Structural Materials and Components Methods with Applications, Wiley Publishers, 2007	1. Hua-Peng Chen, Structural Health Monitoring of Large Civil Engineering Structures, Wiley Publishers, 2018 2. Ansari, F Karbhari, Structural health monitoring of civil infrastructure systems, V.M, Woodhead Publishing, 2009 3. J. P. Ou, H. Li and Z. D, "Duan Structural Health Monitoring and Intelligent Infrastructure", Vol1, Taylor and Francis Group, London, UK, 2006. 4. Victor Giurgluti, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc, 2007.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STE17	Course Name	DESIGN OF OFFSHORE STRUCTURES	Course Category	T	Professional Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To impart knowledge about the concept of wave theories, forces, offshore foundation, analysis and design of jacket towers, pipes and cables.

														Program Outcomes (PO)			Program Specific Outcome (PSO)														
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Develop the concept of wave theories													AP	3													3	1	2	
CO-2:	Apply the knowledge of wave forces and offshore structures													AP	3	2													3	2	1
CO-3:	Explain the modeling for offshore structure and its foundation													U	3	2	2												2	1	1
CO-4:	Analyse offshore structures by means of static and dynamic methods													AN	3	1	2												2	2	2
CO-5:	Design of jacket towers, mooring cables and pipelines													AP	3	2	2												3	2	2

Unit-1 WAVE THEORIES

9 Periods

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

Unit-2 FORCES OF OFFSHORE STRUCTURES

9 Periods

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

Unit-3 OFFSHORE SOIL AND STRUCTURE MODELLING

9 Periods

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

Unit-4 ANALYSIS OF OFFSHORE STRUCTURES

9 Periods

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

Unit-5 DESIGN OF OFFSHORE STRUCTURES

9 Periods

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

Total: 45 Periods

Learning Resources	Text Books	References
	1. Chakrabarti, S.K., Handbook of Offshore Engineering by, Elsevier, 2005. 2. Chakrabarti, S.K., Hydrodynamics of Offshore Structures, Springer – Verlag, 2003. 3. Chakrabarti, S.K. 1994, Offshore Structure Modelling: World Scientific	1. Chandrasekaran, S. 2017. Dynamic analysis and design of ocean structures. 2. B. Gou, S.Song, J Chacko and A. Ghalambar, offshore pipelines, GPP publishers, 2006.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination
<i>Average of Internal Test</i> <i>(20%)</i>	<i>Critical Thinking Assessment</i> <i>(20%)</i>	<i>(60% weightage)</i>
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE18	Course Name	PERFORMANCE OF STRUCTURES WITH SOIL STRUCTURE INTERACTION	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: The purpose of learning this course is to:

- To study the concept of soil-structure – interaction in the analysis and design of structures.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain the concept of soil structure interaction.	U	3														3	2	2
CO-2:	Do a static analysis of infinite and finite beams resting on elastic foundation	AN	3	2	2												2	3	3
CO-3:	Analyse finite thin and thick plates	AN	3	2	2												2	3	3
CO-4:	Do a static and dynamic analysis of soil structure interaction problems	AN	3	2	3												3	2	2
CO-5:	Analyse ground foundation and structure interaction problems	AN	3	2	3												3	2	2

Unit-1 SOIL-FOUNDATION INTERACTION

9 Periods

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

Unit-2 BEAM ON ELASTIC FOUNDATION- SOIL MODEL

9 Periods

Infinite beam – Two-parameters models – Isotropic elastic half space model – Analysis of beams of finite length – combined footings.

Unit-3 PLATES ON ELASTIC CONTINUUM

9 Periods

Thin and thick rafts – Analysis of finite plates - Numerical analysis of finite plates.

Unit-4 ANALYSIS OF AXIALLY AND LATERALLY LOADED PILES AND PILE GROUPS

9 Periods

Elastic analysis of single pile – Theoretical solutions for settlement and load distributions – Analysis of pile group – Interaction analysis – Load distribution in groups with rigid cap – Load deflection prediction for laterally loaded piles – Subgrade reaction and elastic analysis – Interaction analysis – Pile-raft system.

Unit-5 GROUND-FOUNDATION-STRUCTURE INTERACTION

9 Periods

Effect of structure on ground-foundation interaction – Static and dynamic loads- Contact pressure and its estimation – Estimation of the settlement from the constitutive laws – Free-field response – Kinetic interaction – Inertial interaction

Total: 45 Periods

Learning Resources	Text Books	References
	1. John P. Wolf, (1985) Soil-structure interaction, Prentice Hall, 1987. Bowels, J.E., “Analytical and Computer methods in Foundation” McGraw Hill Book Co., New York., 1974 2. Desai C.S. and Christian J.T., “Numerical Methods in Geotechnical Engineering” McGraw Hill Book Co. New York,1977.	1. A.P.S. Selvadurai, Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg.vol-17, Elsevier Scientific Publishing Co., 1979. 2. Prakash, S., and Sharma, H. D., “Pile Foundations in Engineering Practice.”John Wiley & Sons, New York, 1990.

	3. Soil Structure Interaction, the real behaviour of structures, Institution of Structural Engineers, 1989.	3. Rolando P. Orense, Nawawi Chouw & Michael J. Pender Soil-Foundation -Structure Interaction, CRC Press, Taylor & Francis Group, London, UK, 2010.
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Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE19	Course Name	DESIGN OF BRIDGE STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Advanced Concrete Structures	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	IRC 6-2000, IRC 112-2011, IS456		

Course Objective: The purpose of learning this course is to:

- To study the loads, forces on bridges and design principles of several types of bridges.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Explain the different types of bridges and design philosophies	U	3														3	1	2
CO-2:	Design an RC solid slab culvert bridge	AP	3	2	2												2	3	3
CO-3:	Design an RC Tee Beam and Slab bridge	AP	3	2	2												2	3	2
CO-4:	Design the bridge bearings and substructure	AP	3	2	2												2	3	3
CO-5:	Explain the design principles of PSC bridges, box girder bridges, truss bridges	U	3	2	2												2	3	3

Unit-1 INTRODUCTION	9 Periods
Introduction-Selection of Site and Initial Decision Process - Classification of Bridges- General Features of Design- Standard Loading for Bridge Design as per different codes - Road Bridges – Railway Bridges - Design Codes - Working Stress Method- Limit State Method of Design	
Unit-2 SUPERSTRUCTURES	9 Periods
Selection of main bridge parameters, design methodologies -Choices of superstructure types - Orthotropic plate theory, load distribution techniques - Grillage analysis - Finite element analysis Different types of superstructure (RCC and PSC); Longitudinal Analysis of Bridge - Transverse Analysis of Bridge	
Unit-3 BRIDGE DESIGN PRINCIPLES	9 Periods
Analysis and Design of RCC solid slab culverts -Design of RCC Tee beam and slab bridges - Design principles of continuous girder bridges, box girder bridges, balanced cantilever bridges – Arch bridges – Box culverts – Segmental bridges–Design principles only	
Unit-4 SUBSTRUCTURE, BEARINGS AND DECK JOINTS	9 Periods
Design of bridge bearings and substructure	
Unit-5 PRESTRESSED CONCRETE BRIDGES & STEEL BRIDGES	9 Periods
Design principles of PSC bridges – PSC girders –Design principles of steel bridges - Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.	
Total: 45 Periods	

Learning Resources	Text Books	References
	1. Jagadeesh. T.R. and Jayaram. M.A., “Design of Bridge Structures”, Second Edition, Prentice Hall of India Pvt. Ltd. 2009. 2. Johnson Victor, D. “Essentials of Bridge Engineering”, Sixth Edition, Oxford and IBH Publishing Co. New Delhi, 2019. 3. Ponnuswamy, S., “Bridge Engineering”, Third Edition, Tata McGraw Hill, 2017.	1. Raina V.K.” Concrete Bridge Practice” Tata McGraw Hill Publishing Company, New Delhi, 2014. 2. Design of Highway Bridges, Richard M. Barker & Jay A. Puckett, John Wiley & Sons, Inc., 2021

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STE20	Course Name	DESIGN OF SHELL AND SPATIAL STRUCTURES	Course Category	T	Professional Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Advanced Concrete Structures	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- To study the behaviour and design of shells, folded plates, space frames and application of FORMIAN software.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Explain the different forms of shells and design the domes and shells	U	3	2	2										3	3	2
CO-2:	Evaluate the structural behaviour and design of folded plate structures	AN	3	2											3	2	2
CO-3:	Explain the various functional configurations of space frames	U	2												2	2	2
CO-4:	Design of space frames and apply the knowledge of CAD for the analysis of space structures	AP	3	2	2										2	2	2
CO-5:	Analyse the configurations of space structures using FORMIAN software	AN	3	3	3										2	2	2

Unit-1 CLASSIFICATION OF SHELLS

9 Periods

Classification of shells, types of shells, structural action, - Design of circular domes, conical roofs, circular cylindrical shells by ASCE Manual No.31.

Unit-2 FOLDED PLATES

9 Periods

Folded Plate structures, structural behaviour, types, design by ACI - ASCE Task Committee method – pyramidal roof- Prismatic roof.

Unit-3 INTRODUCTION TO SPACE FRAME

9 Periods

Space frames - configuration - types of nodes - Design Philosophy - Behaviour.

Unit-4 ANALYSIS AND DESIGN

9 Periods

Analysis of space frames – Design of Nodes – Pipes - Space frames – Introduction to Computer Aided Design.

Unit-5 SPECIAL METHODS

9 Periods

Application of Formex Algebra, FORMIAN for generation of configuration.

Total: 45 Periods

Learning Resources	Text Books	References
	1. Billington. D.P, "Thin Shell Concrete Structures", McGraw Hill Book Co., New York, ASCE Manual No.31, Design of Cylindrical Shells,1982. 2. Varghese. P.C., Design of Reinforced Concrete Shells and Folded Plates, PHI Learning Pvt. Ltd., 2010. 3. Subramanian. N," Space Structures: Principles and Practice", Multi-Science Publishing Co. Ltd. 2008.	1. Ramasamy, G.S., "Analysis, Design and Construction of Steel Space Frames", Thomas Telford Publishing, 2002. 2. Wilby. C "Concrete Folded Plate Roofs", Elsevier, 1998.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24ST001	Course Name	VIBRATION AND NOISE CONTROL STRATEGIES	Course Category	T	Open Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	NIL	

Course Objective: The purpose of learning this course is to:

- To appreciate the basic concepts of vibration in damped and undamped systems
- To appreciate the basic concepts of noise, its effect on hearing and related terminology
- To use the instruments for measuring and analyzing the vibration levels in a body
- To use the instruments for measuring and analyzing the noise levels in a system
- To learn the standards of vibration and noise levels and their control techniques

					Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:					BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Apply the basic concepts of vibration in damped and undamped systems				U	1		2										2	1	1
CO-2:	Apply the basic concepts of noise and to understand its effects on systems				U			2										1	1	1
CO-3:	Select the instruments required for vibration measurement and its analysis				U	1		2										1	1	1
CO-4:	Select the instruments required for noise measurement and its analysis				U	1		1										1	1	1
CO-5:	Recognize the noise sources and to control the vibration levels in a body and to control noise under different strategies.				U			1										1	1	1

Unit-1 BASICS OF VIBRATION

9 Periods

Introduction – Sources and causes of Vibration-Mathematical Models - Displacement, velocity and Acceleration - Classification of vibration: free and forced vibration, undamped and damped vibration, linear and non-linear vibration - Single Degree Freedom Systems - Vibration isolation - Determination of natural frequencies

Unit-2 BASICS OF NOISE

09 Periods

Introduction - Anatomy of human ear - Mechanism of hearing - Amplitude, frequency, wavelength and sound pressure level - Relationship between sound power, sound intensity and sound pressure level - Addition, subtraction and averaging decibel levels - sound spectra -Types of sound fields -Octave band analysis - Loudness.

Unit-3 INSTRUMENTATION FOR VIBRATION MEASUREMENT

9 Periods

Experimental Methods in Vibration Analysis.- Vibration Measuring Instruments - Selection of Sensors - Accelerometer Mountings - Vibration Exciters - Mechanical, Hydraulic, Electromagnetic and Electrodynamics – Frequency Measuring Instruments -. System Identification from Frequency Response -Testing for resonance and mode shapes

Unit-4 INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS

9 Periods

Microphones - Weighting networks - Sound Level meters, its classes and calibration - Noise measurements using sound level meters - Data Loggers - Sound exposure meters - Recording of noise - Spectrum analyser - Intensity meters - Energy density sensors - Sound source localization.

Unit-5 METHODS OF VIBRATION CONTROL, SOURCES OF NOISE AND ITS CONTROL

9 Periods

Specification of Vibration Limits – Vibration severity standards - Vibration as condition Monitoring Tool – Case Studies - Vibration Isolation methods - Dynamic Vibration Absorber – Need for Balancing - Static and Dynamic Balancing machines – Field balancing - Major sources of noise - Noise survey techniques – Measurement technique for vehicular noise - Road vehicles Noise standard – Noise due to construction equipment and domestic appliances – Industrial noise sources and its strategies – Noise control at

the source – Noise control along the path – Acoustic Barriers –Noise control at the receiver -- Sound transmission through barriers – Noise reduction Vs Transmission loss - Enclosures

Total: 45 Periods

Learning Resources	Text Books	References
	<ol style="list-style-type: none"> 1. Singiresu S. Rao, "Mechanical Vibrations", Pearson Education Incorporated, 2017. 2. Graham Kelly. Sand Shashidhar K. Kudari, "Mechanical Vibrations", Tata McGraw –Hill Publishing Com. Ltd., 2007. 3. Ramamurti. V, "Mechanical Vibration Practice with Basic Theory", Narosa Publishing House, 2000. 	<ol style="list-style-type: none"> 1. William T. Thomson, "Theory of Vibration with Applications", Taylor & Francis, 2003. 2. G.K. Grover, "Mechanical Vibrations", Nem Chand and Bros.,Roorkee, 2014. 3. A.G. Ambekar, "Mechanical Vibrations and Noise Engineering", PHI Learning Pvt. Ltd., 2014. 4. David A. Bies and Colin H. Hansen, "Engineering Noise Control – Theory and Practice", Spon Press, London and New York, 2009.

Learning Assessment

Continuous Learning Assessment (CLA) (40% weightage)

*Average of Internal Test
(20%)*

*Critical Thinking Assessment
(20%)*

**End Semester Examination
(60% weightage)**

* The expected levels for Bloom's Taxonomy should be:
 - Lower-order thinking skills: not more than 40%
 - Higher-order thinking skills: not less than 60%

Course Code	24STO02	Course Name	ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	NIL	

Course Objective: *The purpose of learning this course is to:*

- To learn the present energy scenario and the need for energy conservation.
- To understand the different measures for energy conservation in utilities.
- Acquaint students with principle theories, materials, and construction techniques to create energy efficient buildings.
- To identify the energy demand and bridge the gap with suitable technology for sustainable habitat.
- To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand technical aspects of energy conservation scenario.	U	1														
CO-2:	Energy audit in any type for domestic buildings and suggest the conservation measures.	U	2	2													
CO-3:	Perform building load estimates and design the energy efficient landscape system.	U	2	2													
CO-4:	Gain knowledge to utilize an appliance/device sustainably.	U															
CO-5:	Understand the status and current technological advancement in energy storage field.	U	2														

Unit-1 ENERGY SCENARIO	9 Periods
Primary energy resources - Sectorial energy consumption (domestic, industrial and other sectors), Energy pricing, Energy conservation and its importance, Energy Conservation Act-2001 and its features – Energy star rating.	
Unit-2 HEATING, VENTILLATION & AIR CONDITIONING	9 Periods
Basics of Refrigeration and Air Conditioning – COP / EER / SEC Evaluation – SPV system design & optimization for Solar Refrigeration.	
Unit-3 LIGHTING, COMPUTER, TV	9 Periods
Specification of Luminaries – Types – Efficacy – Selection & Application – Time Sensors – Occupancy Sensors – Energy conservation measures in computer – Television – Electronic devices.	
Unit-4 ENERGY EFFICIENT BUILDINGS	9 Periods
Conventional versus Energy efficient buildings – Landscape design – Envelope heat loss and heat gain – Passive cooling and heating – Renewable sources integration.	
Unit-5 ENERGY STORAGE TECHNOLOGIES	9 Periods
Necessity & types of energy storage – Thermal energy storage – Battery energy storage, charging and discharging– Hydrogen energy storage & Super capacitors – energy density and safety issues – Applications.	
Total: 45 Periods	

Learning Resources	Text Books	References
	1. Yogi Goswami, Frank Kreith, Energy Efficiency and Renewable energy Handbook, CRC Press, 2016 2. ASHRAE Handbook 2020 – HVAC Systems & Equipment 3. Paolo Bertoldi, Andrea Ricci, Anibal de Almeida, Energy Efficiency in Household Appliances and Lighting, Conference proceedings, Springer, 2001 4. David A. Bainbridge, Ken Haggard, Kenneth L. Haggard, Passive Solar Architecture: Heating, Cooling, Ventilation, Daylighting, and More Using Natural Flows, Chelsea Green Publishing, 2011.	1. Guide book for National Certification Examination for Energy Managers and Energy Auditors(Could be downloaded from www.energymanagertraining.com) 2. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002. 3. Robert Huggins, Energy Storage: Fundamentals, Materials and Applications, 2nd edition, Springer, 2015 4. Ru-shiliu, Leizhang, Xueliang sun, Electrochemical technologies for energy storage and conversion, Wiley publications, 2012.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STO03	Course Name	NEW PRODUCT DEVELOPMENT	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	NIL	

Course Objective: *The purpose of learning this course is to:*

- Applying the principles of generic development process; and understanding the organization structure for new product design and development.
- Identifying opportunity and planning for new product design and development.
- Conducting customer need analysis; and setting product specification for new product design and development.
- Generating, selecting, and testing the concepts for new product design and development
- Applying the principles of Industrial design and prototype for new product design and development.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Apply the principles of generic development process; and understand the organization structure for new product design and development	AP	3	1	3										1	1	1
CO-2:	Identify opportunity and plan for new product design and development.	AP	3	1	3										1	1	1
CO-3:	Conduct customer need analysis; and set product specification for new product design and development.	AN	3	1	3										1	1	1
CO-4:	Generate, select, and test the concepts for new product design and development	U	3	1	3										1	1	1
CO-5:	Apply the principles of Industrial design and prototype for design and develop new products	AP	3	1	3										1	1	1

Unit-1 INTRODUCTION TO PRODUCT DESIGN & DEVELOPMENT

9 Periods

Introduction – Characteristics of Successful Product Development – People involved in Product Design and Development – Duration and Cost of Product Development – The Challenges of Product Development – The Product Development Process – Concept Development: The FrontEnd Process – Adapting the Generic Product Development Process – Product Development Process Flows – Product Development Organizations.

Unit-2 OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING

9 Periods

Opportunity Identification: Definition – Types of Opportunities – Tournament Structure of Opportunity Identification – Effective Opportunity Tournaments – Opportunity Identification Process – Product Planning: Four types of Product Development Projects – The Process of Product Planning.

Unit-3 IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS

9 Periods

Identifying Customer Needs: The Importance of Latent Needs – The Process of Identifying Customer Needs. Product Specifications: Definition – Time of Specifications Establishment – Establishing Target Specifications – Setting the Final Specifications

Unit-4 CONCEPT GENERATION, SELECTION & TESTING

9 Periods

Concept Generation: Activity of Concept Generation – Structured Approach – Five step method of Concept Generation. Concept Selection: Methodology – Concept Screening and Concepts Scoring. Concept testing: Seven Step activities of concept testing.

Unit-5 INDUSTRIAL DESIGN & PROTOTYPING

9 Periods

Industrial Design: Need and Impact–Industrial Design Process. Prototyping – Principles of Prototyping – Prototyping Technologies – Planning for Prototype

Total: 45 Periods

Learning Resources	Text Books	References
	1. Ulrich K.T., Eppinger S. D. and Anita Goyal, "Product Design and Development" McGraw-Hill Education; 7 edition, 2020.	<ol style="list-style-type: none"> 1. Belz A., 36-Hour Course: "Product Development" McGraw-Hill, 2010. 2. Rosenthal S., "Effective Product Design and Development", Business One Orwin, Homewood, 1992, ISBN1-55623-603-4. 3. Pugh.S, "Total Design Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, 1991, ISBN0-202-41639-5. 4. Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013. 5. Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press, 2018.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom's Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STO04	Course Name	SUSTAINABLE MANAGEMENT	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To provide students with fundamental knowledge of the notion of corporate sustainability
- To determine how organizations impacts on the environment and socio-technical systems, the relationship between social and environmental performance and competitiveness, the approaches and methods.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.	U	1														
CO-2:	An understanding of corporate sustainability and responsible Business Practices	U		1													
CO-3:	Knowledge and skills to understand, to measure and interpret sustainability performances	U	1														
CO-4:	Knowledge of innovative practices in sustainable business and community management	U	2														
CO-5:	Deep understanding of sustainable management of resources and commodities	U															

Unit-1	MANAGEMENT OF SUSTAINABILITY	9 Periods
Management of sustainability -rationale and political trends: An introduction to sustainability management, International and European policies on sustainable development, theoretical pillars in sustainability management studies		
Unit-2	CORPORATE SUSTAINABILITY AND RESPONSIBILITY	9 Periods
Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.		
Unit-3	SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES	9 Periods
Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.		
Unit-4	SUSTAINABILITY AND INNOVATION	9 Periods
Socio-technical transitions and sustainability, Sustainable entrepreneurship, Sustainable pioneers in green market niches, Smart communities and smart specializations.		
Unit-5	SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS	9 Periods
Energy management, Water management, Waste management, Wild Life Conservation, Emerging trends in sustainable management, Case Studies		
Total:		45 Periods

Learning Resources	Text Books	References
	1. Daddi, T., Iraldo, F., Testa, Environmental Certification for Organizations and Products: Management, 2015 2. Christian N. Madu, Handbook of Sustainability Management 2012 3. Petra Molthan-Hill, The Business Student's Guide to Sustainable Management: Principles and Practice, 2014	1. Margaret Robertson, Sustainability Principles and Practice, 2014 2. Peter Rogers, An Introduction to Sustainable Development, 2006

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STO05	Course Name	IOT FOR SMART SYSTEMS	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- To study about Internet of Things technologies and its role in real time applications.
- To introduce the infrastructure required for IoT.
- To familiarize the accessories and communication techniques for IoT.
- To provide insight about the embedded processor and sensors required for IoT.
- To familiarize the different platforms and Attributes for IoT.

					Program Outcomes (PO)												Program Specific Outcome (PSO)				
Course Outcomes (CO): At the end of this course, learners will be able to:					BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Analyze the concepts of IoT and its present developments				AN	1		1													
CO-2:	Compare and contrast different platforms and infrastructures available for IoT				AP																
CO-3:	Explain different protocols and communication technologies used in IoT				AP																
CO-4:	Analyze the big data analytic and programming of IoT				AN	1															
CO-5:	Implement IoT solutions for smart applications				AP	2															

Unit-1 INTRODUCTION TO INTERNET OF THINGS	9 Periods
Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.	
Unit-2 IOT ARCHITECTURE	9 Periods
IoT reference model and architecture -Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture, IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy beacons.	
Unit-3 PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT	9 Periods
PROTOCOLS:NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell. Wireless technologies for IoT: WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.	
Unit-4 OT PROCESSORS	9 Periods
Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability. Embedded processors for IOT :Introduction to Python programming - Building IOT with RASPERRY PI and Arduino	
Unit-5 CASE STUDIES	9 Periods
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense	
Total: 45 Periods	

Learning Resources	Text Books	References
	<ol style="list-style-type: none"> 1. ArshdeepBahga and VijaiMadiseti : A Hands-on Approach “Internet ofThings”, Universities Press 2015. 2. Oliver Hersent , David Boswarthick and Omar Elloumi “ The Internet of Things”, Wiley,2016. 3. Samuel Greengard, “ The Internet of Things”, The MIT press, 2015. 4. Adrian McEwen and Hakim Cassimally“Designing the Internet of Things “Wiley,2014. 5. Jean- Philippe Vasseur, Adam Dunkels, “Interconnecting Smart Objects with IP: The Next Internet” Morgan Kuffmann Publishers, 2010. 	<ol style="list-style-type: none"> 1. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley and sons, 2014. 2. Lingyang Song/DusitNiyato/ Zhu Han/ Ekram Hossain,” Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015. 3. OvidiuVermesan and Peter Friess (Editors), “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication, 2013. 4. Vijay Madiseti , ArshdeepBahga, “Internet of Things (A Hands on- Approach)”, 2014. 5. Zach Shelby, Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet”, John Wiley and sons, 2009.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
<p>* The expected levels for Bloom’s Taxonomy should be:</p> <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STO06	Course Name	MACHINE LEARNING AND DEEP LEARNING	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- Understanding about the learning problem and algorithms
- Providing insight about neural networks
- Introducing the machine learning fundamentals and significance
- Enabling the students to acquire knowledge about pattern recognition
- Motivating the students to apply deep learning algorithms for solving real life problems

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Illustrate the categorization of machine learning algorithms	U	1														
CO-2:	Compare and contrast the types of neural network architectures, activation functions	AP			1												
CO-3:	Acquaint with the pattern association using neural networks	U															
CO-4:	Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks	AP	1														
CO-5:	Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs	AP	2	1	1												

Unit-1 LEARNING PROBLEMS AND ALGORITHMS

9 Periods

Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

Unit-2 NEURAL NETWORKS

9 Periods

Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning

Unit-3 MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS

9 Periods

Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

Unit-4 DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS

9 Periods

Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs

Unit-5 DEEP LEARNING: RNNs, AUTOENCODERS AND GANS

9 Periods

State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

Total: 45 Periods

Learning Resources	Text Books	References
	1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence, 2012, PHI learning 2. Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN: 9780262035613, 2016.	1. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009. 2. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006. 3. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STO07	Course Name	INTERNET OF THINGS AND CLOUD	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols.
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT.
- To develop IoT infrastructure for popular applications.

					Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:					BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Understand the various concept of the IoT and their technologies.				U															
CO-2:	Develop IoT application using different hardware platforms				AP	2		1												
CO-3:	Implement the various IoT Protocols				AP	1														
CO-4:	Understand the basic principles of cloud computing				U															
CO-5:	Develop and deploy the IoT application into cloud environment				AP	1														

Unit-1 FUNDAMENTALS OF IoT	9 Periods
Introduction to IoT – IoT definition – Characteristics – IoT Complete Architectural Stack – IoT enabling Technologies – IoT Challenges. Sensors and Hardware for IoT – Hardware Platforms –Arduino, Raspberry Pi, Node MCU. A Case study with any one of the boards and data acquisition from sensors.	
Unit-2 PROTOCOLS FOR IoT	9 Periods
Infrastructure protocol (IPv4/V6/RPL), Identification (URIs), Transport (Wifi, Lifi, BLE), Discovery, Data Protocols, Device Management Protocols. – A Case Study with MQTT/CoAP usage-IoT privacy, security and vulnerability solutions	
Unit-3 CASE STUDIES/INDUSTRIAL APPLICATIONS	9 Periods
Case studies with architectural analysis: IoT applications – Smart City – Smart Water – Smart Agriculture – Smart Energy – Smart Healthcare – Smart Transportation – Smart Retail – Smart waste management.	
Unit-4 CLOUD COMPUTING INTRODUCTION	9 Periods
Introduction to Cloud Computing - Service Model – Deployment Model- Virtualization Concepts –Cloud Platforms – Amazon AWS – Microsoft Azure – Google APIs	
Unit-5 IoT AND CLOUD	9 Periods
IoT and the Cloud - Role of Cloud Computing in IoT - AWS Components - S3 – Lambda - AWS IoT Core -Connecting a web application to AWS IoT using MQTT- AWS IoT Examples. Security Concerns, Risk Issues, and Legal Aspects of Cloud Computing- Cloud Data Security	
Total: 45 Periods	

	Text Books	References
Learning Resources	1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman ,CRC Press, 2017 2. Adrian McEwen, Designing the Internet of Things, Wiley,2013.	1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015. 2. Simon Walkowiak, "Big Data Analytics with R" PackT Publishers, 2016 3. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STO08	Course Name	ENVIRONMENTAL SUSTAINABILITY	Course Category	T	Open Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- Analyze environmental valuation, property rights, and externalities.
- Define sustainable development and examine resource challenges.
- Evaluate the significance of biodiversity and its threats.
- Examine pollution types and their environmental impacts.
- Apply environmental economics to address development and sustainability.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Assess the valuation of environmental goods and the role of property rights and externalities in shaping environmental policies.	U															
CO-2:	Apply the concept of sustainable development to analyze the challenges in resource management, especially in energy, water, and agriculture.	U															
CO-3:	Identify and assess the threats to biodiversity caused by pollution and human activity.	U															
CO-4:	Evaluate the impacts of water pollution, solid waste, hazardous substances, and global warming on ecosystems and human health.	U	1														
CO-5:	Evaluate and apply environmental economic theories to propose solutions for sustainable development.	U	1														

Unit-1 INTRODUCTION	9 Periods
Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems	
Unit-2 CONCEPT OF SUSTAINABILITY	9 Periods
Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture	
Unit-3 SIGNIFICANCE OF BIODIVERSITY	9 Periods
Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air Pollution, Acid Rain and Atmospheric Modification, Transportation	
Unit-4 POLLUTION IMPACTS	9 Periods
Water Pollution, Solid Waste and Recycling, Toxic Substances and Hazardous Wastes, Global Warming.	
Unit-5 ENVIRONMENTAL ECONOMICS	9 Periods
Development, Poverty, and the Environment, Visions of the Future, Environmental economics and policy by Tom Tietenberg, Environmental Economics	
Total:	45 Periods

Learning Resources	Text Books	References
	1. Andrew Hoffman, Competitive Environmental Strategy - A Guide for the Changing Business Landscape, Island Press. 2. Stephen Doven, Environment and Sustainability Policy: Creation, Implementation, Evaluation, the Federation Press, 2005.	1. Robert Brinkmann., Introduction to Sustainability, Wiley-Blackwell., 2016. 2. Niko Roorda., Fundamentals of Sustainable Development, 3rd Edn, Routledge, 2020. 3. Bhavik R Bakshi., Sustainable Engineering: Principles and Practice, Cambridge University Press, 2019

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: <ul style="list-style-type: none"> - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60% 		

Course Code	24STO09	Course Name	TEXTILE REINFORCED COMPOSITES	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- Analyze the properties, classification, and applications of composites and reinforcements.
- Define and examine the preparation, chemistry, and optimization of matrices in composite materials.
- Investigate various composite manufacturing methods and design requirements.
- Evaluate testing methods for mechanical properties of composites, including tensile, flexural, and impact tests.
- Apply micromechanics and macromechanics theories to predict and analyze composite material behaviours.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): At the end of this course, learners will be able to:		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Assess the classification, properties, and applications of composites and reinforcements.	U	1												1		
CO-2:	Analyze the preparation, chemistry, and optimization of matrices in composite materials.	U	1													1	
CO-3:	Investigate and compare composite manufacturing methods for thermoplastics and thermosets.	U		1												1	1
CO-4:	Evaluate mechanical properties of composites through specific testing methods and techniques.	U	1													1	1
CO-5:	Apply micromechanics and macromechanics theories to predict composite material behaviors and interlaminar stresses.	U			1												

Unit-1 REINFORCEMENTS	9 Periods
Introduction – composites –classification and application; reinforcements- fibres and its properties; preparation of reinforced materials and quality evaluation; preforms for various composites	
Unit-2 MATRICES	9 Periods
Preparation, chemistry, properties and applications of thermoplastic and thermoset resins; mechanism of interaction of matrices and reinforcements; optimization of matrices.	
Unit-3 COMPOSITE MANUFACTURING	9 Periods
Classification; methods of composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament Winding, Resin transfer moulding, prepregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and composite design requirements	
Unit-4 TESTING	9 Periods
Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, inter laminar shear stress and fatigue properties of thermoset and thermoplastic composites.	
Unit-5 MECHANICS	9 Periods
Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminar stresses using at ware	
Total: 45 Periods	

Learning Resources	Text Books	References
	1. BorZ.Jang, "Advanced Polymer composites", ASM International, USA, 1994. 2. Carlsson L.A. and Pipes R.B., "Experimental Characterization of advanced composite Materials", Second Edition, CRC Press, New Jersey, 1996. 3. George Lubin and Stanley T. Peters, "Handbook of Composites", Springer Publications, 1998.	1. Mel. M. Schwartz, "Composite Materials", Vol. 1 & 2, Prentice Hall PTR, New Jersey, 1997. 2. Richard M. Christensen, "Mechanics of composite materials", Dover Publications, 2005. 3. Sanjay K. Mazumdar, "Composites Manufacturing: Materials, Product, and Process Engineering", CRC Press, 2001

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24STO10	Course Name	NANOCOMPOSITE MATERIALS	Course Category	T	Open Elective Courses				L	T	P	C
										3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil	
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil		

Course Objective: The purpose of learning this course is to:

- Analyze properties, processing, and applications of nanocomposites, including their preparation and characterization.
- Examine preparation techniques and properties of metal-based nanocomposites and their functionalities.
- Investigate the preparation and mechanical properties of polymer-based nanocomposites, especially carbon nanotube composites.
- Explore biomaterial-based nanocomposites and their applications in synthetic and natural systems.
- Understand the preparation and applications of nanocomposites in textiles, cosmetics, and food technology.

														Program Outcomes (PO)				Program Specific Outcome (PSO)												
Course Outcomes (CO): At the end of this course, learners will be able to:														BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO-1:	Assess the properties, processing, and applications of nanocomposites.													U	1		1											1	2	1
CO-2:	Analyze metal-based nanocomposites, their preparation, and functionality.													U	1		1											1	1	1
CO-3:	Evaluate polymer-based nanocomposites and their mechanical properties.													U	1		1											1	2	1
CO-4:	Identify the potential of biomaterial-based nanocomposites in applications.													U	1		1											1	2	1
CO-5:	Examine nanocomposite technologies in textiles, cosmetics, and food packaging.													U	1		1											1	1	1

Unit-1	BASICS OF NANOCOMPOSITES	9 Periods
Nomenclature, Properties, features and processing of nanocomposites. Sample Preparation and Characterization of Structure and Physical properties. Designing, stability and mechanical properties and applications of super hard nanocomposites.		
Unit-2	METAL BASED NANOCOMPOSITES	9 Periods
Metal-metal nanocomposites, some simple preparation techniques and their properties. Metal Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Core-Shell structured nanocomposites		
Unit-3	POLYMER BASED NANOCOMPOSITES	9 Periods
Preparation and characterization of diblock Copolymer based nanocomposites; Polymer Carbon nanotubes based composites, their mechanical properties, and industrial possibilities.		
Unit-4	NANOCOMPOSITE FROM BIOMATERIALS	9 Periods
Natural nanocomposite systems - spider silk, bones, shells; organic-inorganic nanocomposite formation through self-assembly. Biomimetic synthesis of nanocomposites material; Use of synthetic nanocomposites for bone, teeth replacement.		
Unit-5	NANOCOMPOSITE TECHNOLOGY	9 Periods
Nanocomposite membrane structures- Preparation and applications. Nanotechnology in Textiles and Cosmetics-Nano-fillers embedded polypropylene fibers – Soil repellence, Lotus effect - Nano finishing in textiles (UV resistant, anti-bacterial, hydrophilic, self-cleaning, flame retardant finishes), Sun-screen dispersions for UV protection using titanium oxide – Colour cosmetics. Nanotechnology in Food Technology - Nanopackaging for enhanced shelf life - Smart/Intelligent packaging.		
Total:		45 Periods

Learning Resources	Text Books	References
	1. Introduction to Nanocomposite Materials. Properties, Processing, Characterization- ThomasE. Twardowski. 2007. DEStech Publications. USA.80. 2. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V.Braun 2006. 3. Physical Properties of Carbon Nanotubes- R. Saito 1998. 4. Carbon Nanotubes (Carbon , Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus 1997.	1. The search for novel, superhard materials- Stan Veprjek (Review Article) JVST A, 1999. 2. Nanometer versus micrometer-sized particles-Christian Brosseau, Jamal BeN Youssef, Philippe Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003. 3. Diblock Copolymer, - Aviram (Review Article), Nature, 2002. 4. Bikramjit Basu, Kantesh Balani Advanced Structural Ceramics, A John Wiley & Sons, Inc.. 5. P. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead publication, London, 2006.

Learning Assessment		
Continuous Learning Assessment (CLA) (40% weightage)		End Semester Examination (60% weightage)
Average of Internal Test (20%)	Critical Thinking Assessment (20%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		

Course Code	24ST311	Course Name	PRACTICAL TRAINING (4 WEEKS)	Course Category	P	Employability Enhancement Courses	L	T	P	C
							0	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To train the students in the field work so as to have firsthand knowledge of practical problems related to Structural Engineering in carrying out engineering tasks.

Course Outcomes (CO): At the end of this course, learners will be able to:		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Describe the Structural Engineering organization	E	3	2	1												3	3	3
CO-2:	Realize the various functions of construction activities	AN	3														2	1	2
CO-3:	Gain an understanding of groups and group dynamics	U	2	1	2												2	1	1
CO-4:	Participate in real-life construction projects	E	3	1	3												3	3	3
CO-5:	Put to use the theoretical knowledge gained so far	AP	3	2	3												2	3	3

List of Experiments

28 Periods

- The students individually undertake training in reputed engineering companies doing Structural Engineering during the summer vacation for a specified duration of four weeks. At the end of the training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

Learning Assessment

Continuous Learning Assessment (CLA) (60% weightage)

Evaluation of Laboratory Observation, Record (45%)

Model Lab Exam (15%)

End Semester Examination (40% weightage)

- * The expected levels for Bloom's Taxonomy should be:
- Lower-order thinking skills: not more than 40%
 - Higher-order thinking skills: not less than 60%

Course Code	24ST312	Course Name	PROJECT WORK I	Course Category	P	Employability Enhancement Courses	L	T	P	C
							0	0	12	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Project Work II
Course Offering Department	Structural Engineering		Data Book / Codes / Standards	Nil	

Course Objective: *The purpose of learning this course is to:*

- To identify a specific problem for the current need of the society and collect information related to the same through a detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examinations.

		Program Outcomes (PO)												Program Specific Outcome (PSO)			
Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO-1:	Apply the knowledge gained from theoretical and practical courses in solving problems.	AP	3	2	3										3	1	2
CO-2:	Recognize the importance of literature review.	U	3												2	1	2
CO-3:	Develop a clear outline and methodology for the project.	AP	2	1	2										2	3	2
CO-4:	Identify the potential research gap and list parameters to work with.	AN	2		2										2	2	2
CO-5:	Report and present the findings of the work conducted.	E	2	3	3										2	2	1

Syllabus

180 Periods

The student individually works on a specific topic approved by the faculty member who is familiar with this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains a clear definition of the identified problem, detailed literature review related to the area of work and a methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

Learning Assessment

Continuous Learning Assessment (CLA) (60% weightage)		End Semester Examination (40% weightage)
Evaluation of Laboratory Observation, Record (45%)	Model Lab Exam (15%)	

* The expected levels for Bloom's Taxonomy should be:

- Lower-order thinking skills: not more than 40%
- Higher-order thinking skills: not less than 60%

SEMESTER IV

Course Code	24ST411	Course Name	PROJECT WORK II	Course Category	P	Employability Enhancement Courses	L	T	P	C
							0	0	24	12

Pre-requisite Courses	Project Work I	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Structural Engineering	Data Book / Codes / Standards	Nil		

Course Objective: *The purpose of learning this course is to:*

- To solve the identified problem based on the formulated methodology
- To develop skills to analyze and discuss the test results, and make conclusions.

Course Outcomes (CO): <i>At the end of this course, learners will be able to:</i>		BL	Program Outcomes (PO)												Program Specific Outcome (PSO)				
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO-1:	Discover potential research areas in the field of Structural Engineering.	E	2	3	3												3	3	2
CO-2:	Apply the knowledge gained from theoretical and practical courses to be creative, well-planned, organized and coordinated	AP	2	1	3												3	2	1
CO-3:	Represent data acquired in graphical and reader-friendly formats	AN	1	3	1												1	2	1
CO-4:	Derive detailed conclusions from work carried out	AN	2	3	2												1	2	2
CO-5:	Report and present the findings of the work conducted	E	3	3	3												2	1	2

List of Experiments

360 Periods

1. The student should continue the phase I work on the selected topic as per the formulated methodology / Undergo internship. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Learning Assessment

Continuous Learning Assessment (CLA) (60% weightage)		End Semester Examination (40% weightage)
Evaluation of Laboratory Observation, Record (45%)	Model Lab Exam (15%)	
* The expected levels for Bloom's Taxonomy should be: - Lower-order thinking skills: not more than 40% - Higher-order thinking skills: not less than 60%		