KUMARAGURU COLLEGE OF TECHNOLOGY,

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049.

M.E STRUCTURAL ENGINEERING

REGULATION 2024

I to IV Semesters

Department of Civil Engineering

VISION

Department of Civil Engineering is striving to become as a world class Academic Centre for quality education and research in diverse areas of Civil Engineering, with a strong social commitment

MISSION

- Producing highly competent and technologically capable professionals and motivatedyoung academicians
- Providing quality education in undergraduate and post graduate levels, with strong emphasis on professional ethics and social commitment.
- Developing a scholastic environment for the state of art research, resulting in practical applications.
- Undertaking professional consultancy services in diverse areas of Civil Engineering.

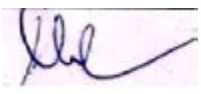
PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of Environmental Engineering Postgraduate Program are to prepare the graduates:

PEO1: To produce students with excellent academic qualities and inculcate the required skills to contribute for the academic and research requirements.

PEO2: To develop the students as experts in laboratory and experimental work as per recommended standards.

PEO3: To prepare the students to meet the industrial needs by encouraging them to involve in real time projects.



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PROGRAM OUTCOMES (POs)

Graduates of the Structural Engineering Postgraduate Program should have the ability to:

PO1: Independently carry out research /investigation and work to solve practical problems.

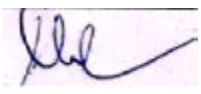
PO2: Write and present a substantial technical report/document.

PO3: 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 program.

PO4: Analyze and solve complex structural engineering problems using the knowledge of mathematics and engineering

PO5: Use modern/advanced techniques, tools and skills for structural engineering problems and practices.

PO6: Communicate with larger community, the importance of appropriate standards to .design and document complex problems.



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KUMARAGURU COLLEGE OF TECHNOLOGY

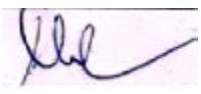
DEPARTMENT OF CIVIL ENGINEERING
REGULATION 2024
M.E. Structural Engineering - Curriculum

Semester I

S.No.	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24MAI502	Applied Numerical Methods and Statistics for Structural Engineering	Embedded	BS	3	0	2	0	4
2	24INT501	Research Methodology and IPR	Theory	ES	3	0	0	0	3
3	24STP501	Structural Design Studio	Laboratory	ES	0	0	4	0	2
4	24STT502	Theory of Elasticity and Plasticity	Theory	PC	3	0	0	0	3
5	24STT503	Design of Advanced Concrete Structures	Theory	PC	3	1	0	0	4
6	24STI504	Advanced Concrete Technology	Embedded	ES	3	0	2	0	4
								Total Credits	**20**
								Total Contact Hours/week	**24**

Semester II

S.No.	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24STI505	Structural Dynamics & Earthquake Engineering	Embedded	PC	3	0	2	0	4
2	24STI506	Advanced Design of Steel Structures	Embedded	PC	3	0	2	0	4
3	24STI507	Finite Element Analysis	Embedded	PC	3	0	2	0	4
4	24STE0YY	Professional Elective I	Theory	PE	3	0	0	0	3
5	24STE0YY	Professional Elective II	Theory	PE	3	0	0	0	3
6	24STC0YY	Professional Elective III – Industry Driven	Embedded	PE	2	0	0	2	3
								Total Credits	**21**
								Total Contact Hours/week	**25**



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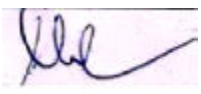
Semester III									
S.No.	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24STE0YY	Professional Elective IV	Theory	PE	2	0	0	2	3
2	24STE0YY	Professional Elective V	Theory	PE	3	0	0	0	3
3	24STE0YY	Professional Elective VI	Theory	PE	3	0	0	0	3
4	24STJ601	Industrial Training*	Project	PW	0	0	0	0	2
5	24STJ602	Project Phase – I#	Project	PW	0	0	0	20	10
*Mandatory for a minimum period of one month during II semester vacation #Student can opt Project Phase – I as Internship in Industrial or Research Labs or inhouse									
								Total Credits	**21**
								Total Contact Hours/week	**30**
Semester IV									
S.No.	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
1	24STJ603	Project Phase - II#	Project	PW	0	0	0	40	20
#Student can opt Project Phase – II as Internship in Industrial or Research Labs or inhouse									
								Total Credits	**20**
								Total Contact Hours/week	**40**

LIST OF ELECTIVES									
S.No.	**Course code**	**Course Title**	**Course Mode**	**Course Type**	**L**	**T**	**P**	**J**	**C**
PROFESSIONAL ELECTIVES									
1	24STE001	Design of Bridges	Theory	PE	3	0	0	0	3
2	24STE002	Smart Materials for Construction	Theory	PE	3	0	0	0	3
3	24STE003	Industrial Structures	Theory	PE	3	0	0	0	3
4	24STC004	Design of Tall buildings	Theory	PE	2	0	0	2	3
5	24STC005	Experimental Methods and Model Analysis	Theory	PE	2	0	0	2	3
6	24STE006	Stability of Structures	Theory	PE	3	0	0	0	3
7	24STE007	Design of Plates, Shells and Spatial Structures	Theory	PE	3	0	0	0	3
8	24STE008	Maintenance and Rehabilitation of Structures	Theory	PE	3	0	0	0	3



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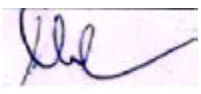
9	24STC009	Fluid Structure Interaction	Theory	PE	2	0	2	0	3
10	24STE010	Design of Pre-Stressed Concrete Elements	Theory	PE	3	0	0	0	3
11	24STE011	Steel Concrete Composite Structures	Theory	PE	3	0	0	0	3
12	24STE012	Design of Structures for Dynamic Loads	Theory	PE	3	0	0	0	3
13	24STE013	Structural Optimization	Theory	PE	3	0	0	0	3
14	24STE014	Design of Offshore Structures	Theory	PE	3	0	0	0	3
INDUSTRY DRIVEN ELECTIVES									
15	24STC015	Energy Efficient Buildings	Embedded	PE	2	0	0	2	3
16	24CNC016	Construction Site Administration and Control	Theory	PE	2	0	0	2	3
17	24STC017	Structural Health Monitoring	Embedded	PE	2	0	0	2	3
18	24STC018	Prefabricated Structures	Embedded	PE	2	0	0	2	3
19	24STC019	Design of Formwork	Embedded	PE	2	0	0	2	3
20	24STC020	Pre-Engineered Buildings	Embedded	PE	2	0	0	2	3

Semester-wise Credits	
Semester – I	20
Semester – II	21
Semester – III	21
Semester – IV	20
Total Credits	**82**

Course types	**Credits**
Basic Science	4
Engineering Science	9
Professional Core	19
Professional Electives	18
Project/Internship	32
Seminar	Nil
Total Credits	**82**



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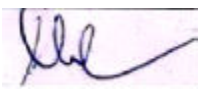
SEMESTER I



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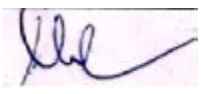
24MAI502	APPLIED NUMERICAL METHODS AND STATISTICS FOR STRUCTURAL ENGINEERING	L	T	P	J	C
		3	0	2	0	4
BS		SDG	4, 8, 9			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Statistical Table

Course Objectives :	
The purpose of taking this course is to:	
1	Understand the efficiency and accuracy of different numerical methods for solving single nonlinear equations and non-linear systems.
2	Equip students with the knowledge and skills required to use the method of least squares for fitting various types of curves to data
3	Develop a deep understanding of spline curves, including their mathematical foundations learn to construct and use different types of splines, such as linear and quadratic splines, to model and interpolate data, ensuring smooth transitions between data points.
4	Provide the effectiveness of finite difference methods, shooting methods, and various numerical schemes for solving boundary value problems involving parabolic and hyperbolic equations.
5	Provide a comprehensive understanding of multiple and partial correlation techniques, plane of regression, properties of residuals, and the relationships between various correlation coefficients and regression models
6	Afford students with a comprehensive understanding and practical skills in ANOVA and experimental design, enabling them to use these techniques effectively in various research and practical scenarios.

Course Outcomes :		
After successful completion of this course, the students shall be able to:		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply techniques for solving both single and multi-dimensional nonlinear equations to real-world numerical analysis and computational problems, developing practical problem-solving skills.	Ap
CO 2	Apply least squares fitting techniques to different types of data and models, demonstrating a broad understanding of how to use these methods effectively.	Ap
CO 3	Apply spline curves and their techniques to model and interpolate data, demonstrating an understanding of their practical applications.	Ap
CO 4	Apply the finite difference method for solving shooting methods, and in solving boundary value problems for parabolic and hyperbolic equations.	Ap
CO 5	Apply multiple and partial correlation, regression analysis, and residual diagnostics to perform and interpret complex statistical analyses, demonstrating a deep understanding of these methods	Ap
CO 6	Apply theoretical and practical knowledge of ANOVA and experimental design techniques to analyze and interpret data effectively.	Ap



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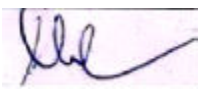
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	2	1	1	1	1	2
2	2	1	2	2	1	2
3	2				1	
4	2		1		1	
5	2	1	1	2	2	2
6	2	2	1	2	2	2

Course Content	
NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS Solution of nonlinear equations – Newton's method, Bisection method, Secant method, Golden section search and Muller method for a single equation. Numerical evaluation of multiple roots: Brent's algorithm. Solution of non -linear system of equations by Newton's method **Practical Component** • Introduction to MATLAB and R • Solving a non- linear equation using Newton's method, Secant method	**10 Hours** **6 Hours**
CURVE FITTING AND INTERPOLATION Method of least squares – Fitting a linear curve, second-degree parabolic curve and non-linear curves of the form $y = ae^{bx}$, $y = ab^{x}$, $y = ax^{b}$- Spline curves – B-Spline curves- Bezier curves – Cubic spline interpolation **Practical Component** • Fitting of curves by Method of least squares • Fitting of Bezier curves and Spline curves	**8 Hours** **8 Hours**
NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS Boundary value problems (ODE)–Finite difference methods – Shooting Methods - Parabolic equations: explicit and implicit finite difference methods, First order hyperbolic equations– method of characteristics, different explicit and implicit methods. **Practical Component** • Solution of ODE using Shooting Methods	**8 Hours**



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• Solution of PDE using Explicit and Implicit Methods	**6 Hours**
CORRELATION AND REGRESSION Multiple and partial correlation - Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order co-efficient. **Practical Component** • Applications of Correlation and Regression	**10 Hours** **2 Hours**
DESIGN OF EXPERIMENTS Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design. **Practical Component** • ANOVA – one-way classification • ANOVA – two-way classification • ANOVA – Latin square design	**9 Hours** **8 Hours**

Theory	Tutorial	Practical	Project	Total
Hours: 45	Hours: 0	Hours: 30	Hours: 0	Hours: 75

Learning Resources

Textbooks

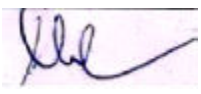
1. Steven C. Chapra and Raymond P. Canale., Numerical Methods for Engineers with Programming and Software Applications., McGraw-Hill ,7th Edition (2010).
2. Johnson R.A., Miller I and Freund J., Miller and Freund's Probability and Statistics for Engineers., PearsonEducation, Asia 8th Edition (2015).

References

1. Kendall E. Atkinson., An Introduction to numerical analysis., John Wiley & Sons, 2nd Edition (2008).
2. Conte S.D and Carl de Boor., Elementary Numerical Analysis - An Algorithmic Approach, McGraw-Hill (2018)
3. John H. Mathews and Kurtis D. Fink., Numerical Methods using Matlab, Prentice Hall of India,4th Edition (2021).
4. Gerald C. F. and Wheatley P.O., Applied Numerical Analysis., Pearson Education Asia, New Delhi (2007).
5. Gupta S.C and Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 11thEdition (2020).
6. Johnson R.A. and Wichern D. W., Applied Multivariate Statistical Analysis., Pearson Education, Asia, 6thEdition(2015).

Online Educational Resources:

NIL



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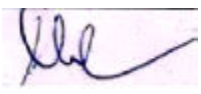
Assessment (Embedded course)
CAT, Activity and Learning Strategy - Think-pair-share, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, Viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
1. Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore. 2. Mr.Jayakumar Venkatesan, Valles Marineris International Private Limited- Chennai. 3. Mr. Imran Khan, GE Transportation Company, Bangalore.	1. Dr.T.Govindan, Government College of Engineering, Srirangam, Trichy. 2. Dr.C.Porkodi, PSG College of Technology, Coimbatore. 3. Dr.P.Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.	1. Dr.S.Meenapriyadarshini, Mathematics. 2. Dr.D.Arivuoli, Mathematics.	
Recommended by BoS on	16/08/2024		
Academic Council Approval	No. 27	**Date**	24/08/2024



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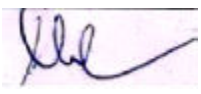
24INT501	RESEARCH METHODOLOGY AND IPR (Common to CN, EN, MB, ST)	L	T	P	J	C
		3	0	0	0	3
ES		SDG	9,12,13			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Equip students with the knowledge and skills necessary to design, conduct and critically evaluate research
2	Draft research reports and present effective research findings
3	foster an understanding of intellectual property rights and ethical considerations essential for successful research and innovation

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the scientific method and research planning steps to formulate research problems and objectives	Ap
CO 2	Analyze different research designs and ethical considerations to classify research types and ensure ethical integrity	An
CO 3	Evaluate the structure and components of research reports to organize and present research findings effectively	E
CO 4	Interpret data collection tools and statistical methods to visualize and analyze biological research data	An
CO 5	Create a research proposal incorporating IPR principles to develop innovative and ethically sound research plans	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3	3		3	3	
2	3	3		3		
3	3			3		3



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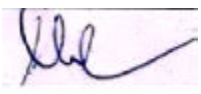
4	3	3		3		3
5	3	3		3		

Course Content	
INTRODUCTION TO RESEARCH METHODS Definition and Objectives of Research, Scientific Method, Various Steps in Scientific Research, Research Planning, Selection of a Problem for Research, Formulation of Selected Problems, Purpose of the Research, Formulation of Research Objectives, Formulation of Research Questions, Hypotheses Generation and Evaluation, Literature Search and Review Process.	**9 Hours**
RESEARCH DESIGN AND ETHICS Types and Methods of Research, Classification of Research, Research Ethics: Informed Consent, Confidentiality, Data Protection, Sampling Techniques, Methods of Collecting Primary Data, Use of Secondary Data, Experimentation, Design of Experiments, Survey Research, Construction of Questionnaires, Pilot Studies, and Pre-tests, Data Collection Methods, Processing, Editing, Classification, and Coding Validity, Reliability, Ethical Dilemmas and Solutions.	**9 Hours**
RESEARCH REPORTS Components of Research Articles, Manuscripts, Thesis, and Review Papers, Preparation of Thesis Documents: Referencing, In-text Citations, Tools like Endnote, Mendeley, Writing Techniques: CARS Model, Organizing Literature Review, Materials, and Methods Critical Thinking for Writing the Discussion Section. **Case Study:** Comparison of Research Articles with and without Referencing Tools	**9 Hours**
DATA COLLECTION AND ANALYSIS FOR RESEARCH Tools for Data Collection: Clinical Trials, Surveys, Questionnaires, Observational Methods, Data Management and Preparation, Overview of Statistical Concepts, Descriptive Statistics: Mean, Median, Mode, Variance, Standard Deviation, Data Visualization Techniques. **Case Study:** Journal Club on Research Papers Published in Tier 1 Journals	**9 Hours**
INTELLECTUAL PROPERTY RIGHTS (IPR) AND RESEARCH GRANTS Introduction to Intellectual Property Rights: Patents, Trademarks, Copyrights, Trade Secrets, Importance of IPR in Research and Innovation, developing a Research Proposal: Components, Do's and Don'ts, Writing Winning Research Proposals, Peer Review, and Feedback, Finalizing Research Plans. **Case Study:** Evaluating Successful Research Proposals and Understanding the Role of IPR	**9 Hours**



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Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 45

Learning Resources:

Textbooks:

1. Cooper, D. R., Schindler, P. S., & Sharma, J. K.. Business research methods (11th ed.). Tata McGraw Hill Education. (2012)
2. Hazari, A.. Research Methodology for Allied Health Professionals. Springer Nature Singapore. (2023)
3. Goh, K. M. Research Methodology in Bioscience and Biotechnology. Springer. (2023)
4. Ganguli, P. Intellectual property rights: Unleashing the knowledge economy. McGraw Hill Education. (2017)

References:

1. AJIET. (n.d.). Lecture Notes on Research Methodology & Intellectual Property Rights. Retrieved from https://www.ajiet.edu.in/img/basic-science/21RMI56%20notes.pdf
2. Oxford University Press. (n.d.). Handbook of Intellectual Property Research: Lenses, Methods, and Perspectives. Retrieved from https://academic.oup.com/book/41122
3. Goddard, W., & Melville, S.. Research Methodology: An Introduction for Science & Engineering Students. Juta and Company Ltd. (2004)
4. Kumar, R. Research Methodology: A Step by Step Guide for Beginners (4th ed.). SAGE Publications. (2014)

Online Educational Resources:

1. https://hrdc.ugc.ac.in/Web/Home/ViewCourseDetails/842/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview

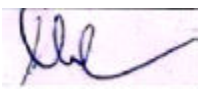
Assessment (Theory course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr.K.Ram, Biotechnology

Recommended by BoS on	13/08/2024		
Academic Council Approval	27	**Date**	24/08/2024



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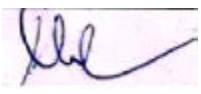
24STP501	STRUCTURAL DESIGN STUDIO	L	T	P	J	C
		0	0	4	0	2
ES		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 456: 2000

Course Objectives:	
The purpose of taking this course is to:	
1	Analyze and design various structural components such as beams, reinforced concrete framed buildings, industrial sheds, T-beam bridges, and foot-over bridges using STAAD. Pro.
2	Design simple reinforced concrete (RC) structural elements, including beams, columns, slabs, and isolated footings, using Excel spreadsheets for effective manual calculation and verification.
3	Gain knowledge to Autodesk Revit Structure and use it for structural modeling, detailing, and report generation, applying BIM principles to enhance project visualization and collaboration.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze and design various structures, including framed buildings, industrial sheds, and bridges.	An
CO 2	Design Reinforced Concrete (RC) structural elements using Excel spreadsheets.	An
CO 3	Model and detail the structures using Revit by applying Building Information Modeling (BIM) concepts.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	2	2		2	3	2
2		2		2	3	2
3		2			3	2



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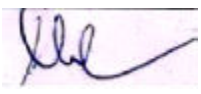
Course Content	
STAAD.Pro **Practical Component:** • Analysis and Design of Beams. • Analysis and Design of a reinforced concrete framed building. • Analysis and Design of an industrial shed. • Analysis and Design of T-beam bridge. • Analysis and Design of Foot-over bridge.	**30 Hours**
EXCEL **Practical Component:** • Design of simple structural elements of RC structures using Excel spread sheets - (Beam, Column, Slab, Isolated Footing).	**15 Hours**
BIM **Practical Component:** • Introduction to Revit structure. • Structural modelling, detailing, and report generation using Autodesk Revit Structure.	**15 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**60**	**Project Hours:**	**0**	**Total Hours:**	**60**

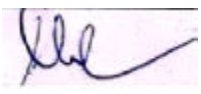
Learning Resources
Textbooks:
1. Krishna Raju N, "Structural Design and Drawing", Universities Press, (2009). 2. Sham Tickoo, "Exploring Bentley STAAD. Pro CONNECT Edition", CADCIM Technologies, (2022). 3. Autodesk, Revit 2021 Structure Fundamentals, © 2020, ASCENT - Center for Technical Knowledge®.(2021)
References:
1. Sarma T S, "Staad Pro v8i for beginners" Notion Press, (2014). 2. Gurmeet Kaur and Simon Gibson , Spreadsheet Solutions for Structural Engineering (2022) 3. "Autodesk Revit for Architecture Certified User Exam Preparation" by Daniel John Stine (2021)
Online Educational Resources:
1. https://www.udemy.com/topic/staad-pro/ 2. https://caddcentre.com/courses/staad-pro-certification-and-training-course/ 3. https://www.autodesk.com/certification/all-certifications/revit-structural-design-professional?msockid=0fb52fb46fab697f0ab73cc36e4d685d 4. https://www.udemy.com/course/bim-revit-family-creation-expert-level-level-2/



Signature of the BOS Chairman

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. V. Govindaraj Head R&D, L&T Construction, Chennai.	Dr. R.Thenmozhi Professor, Government College of Technology, Coimbatore.		Dr.R.Manju Civil Engineering
Recommended by BoS on	13/08/2024		
Academic Council Approval	No. 27	**Date**	24/08/2024



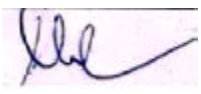
Signature of the BOS Chairman

24STT502	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	J	C
		3	0	0	0	3
PC		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	To introduce the mathematical formulation of elasticity problems, including equilibrium and compatibility equations for 3D systems.
2	To equip students with the skills to formulate and solve boundary value problems in linearized elasticity using Airy's stress functions for 2D cases.
3	To provide knowledge on solving boundary value problems related to the torsional behavior of prismatic beams.
4	To familiarize students with plasticity theories and their application in analysing material behavior beyond elastic limits.
5	To introduce the principles of fracture mechanics for analysing failure mechanisms in materials and structures.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Mathematical formulation of elasticity problems in equilibrium and compatibility equations for 3D problems	An
CO 2	Formulating Boundary Value Problems in Linearized Elasticity and Solving 2D Problems with Airy's Stress Functions	E
CO 3	Solution to boundary value problems corresponding to end torsion of prismatic beams	An
CO 4	Analyse with Plasticity Theories	An
CO 5	Analyse with fracture mechanics	U



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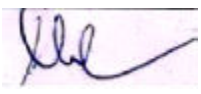
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1			2		
2	2			3		
3	1			3		
4	1		2	3		
5	2		2	3	2	

Course Content	
INTRODUCTION TO ELASTICITY Elasticity Theory - Understanding stress and strain - Notation, and components - Generalized Hooke's law - Transformation and invariance of stress and strain – Principal stresses and strains in 3D Elements - Equilibrium and compatibility equations in cartesian and cylindrical Coordinates. **Practical Component: Nil**	**12 Hours**
BOUNDARY VALUE PROBLEMS: FORMULATION Airy's stress functions for plane stress and strain analysis - Bending of cantilever and simply supported beams with narrow rectangular cross-sections under various loads - Asymmetric challenges: Thick and thin cylinders under internal pressure - Stress concentrations around circular holes in plates - non-axisymmetric problems using the Flamant's approach. **Practical Component: Nil**	**12 Hours**
END TORSION OF PRISMATIC BEAMS Formulation of boundary value problems for torsion of solid cross-section beams - Warping function and Prandtl stress function methods - Torsion of circular, elliptic, rectangular, and triangular cross-sections - Membrane analogy - Torsion analysis of thin-walled tubes, Thin rectangular sections, rolled sections. **Practical Component: Nil**	**8 Hours**



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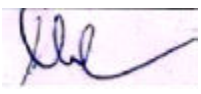
PLASTIC DEFORMATION Introduction to plastic deformation: Concepts and definitions- Strain hardening and idealized stress-strain Curves - Yield criteria - Plasticity theories, von mises, Tresca, and Mohr-coulomb - Plastic deformation in engineering applications - Isotropic hardening. **Practical Component: Nil**	**9 Hours**
INTRODUCTION TO FRACTURE MECHANICS Fracture mechanics - History and importance - Types of fracture- Linear elastic fracture mechanics (LEFM)- Failure criteria - Stress concentration- Stress intensity factor for complex geometries- Crack propagation, and Energy release rate - Case studies in fracture of engineering structures. **Practical Component: Nil**	**4 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

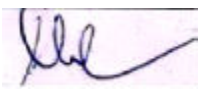
Learning Resources
Textbooks:
1. Timoshenko's and Goodier, , Theory of Elasticity, McGraw Hill, Singapore. (2010) 2. Chakrabarty, Theory of Plasticity, Tata McGraw Hill Book Co., New Delhi, (2012) 3. Sadhu Singh, Theory of Elasticity, Khanna Publishers, New Delhi, Fourth Edition, (2012). 4. Advanced Mechanics of Solids, Srinath, L.S, Second Edition, Tata McGraw Hill, India, (2003).
References:
1. Richard. G. Budynas, Advanced Strength and Applied Stress Analysis, McGraw-Hill, New Delhi, Second Edition, (2011) 2. L.S. Srinath, Advanced Mechanics of Solids, Tata McGraw Hill, (2007). 3. M.H. Sadd, Elasticity: Theory, Applications and Numeric, Academic Press, (2006). 4. A.R. Ragab and S.E. Bayoumi, Engineering Solid Mechanics: Fundamentals and Applications, CRC Press, (1999).
Online Educational Resources:
1. https://onlinecourses.nptel.ac.in/noc21_ce45/preview 2. https://onlinecourses.nptel.ac.in/noc22_mm15/preview 3. https://www.udemy.com/course/theory-of-elasticityadvanced-solid-mechanics/?couponCode=IND21PM 4. https://www.amrita.edu/course/theory-elasticity-and-plasticity/

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, MCQ, End Semester Examination (ESE)



Signature of the BOS Chairman

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. V. Govindaraj Head R&D, L&T Construction, Chennai.	Dr.R.Thenmozhi Professor & Head Government College of Technology, Coimbatore		Mr.A.Vishnu Civil Engineering
Recommended by BoS on	13/08/2024		
Academic Council Approval	No.27	**Date**	24/08/2024



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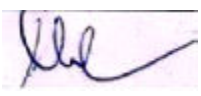
24STT503	DESIGN OF ADVANCED CONCRETE STRUCTURES	L	T	P	J	C
		3	1	0	0	4
PC		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 456, IS 13920

Course Objectives:	
The purpose of taking this course is to:	
1	make the students familiar with the serviceability behaviour of RCC beams and slabs
2	familiarise the students about the moment-rotation characteristics and moment redistribution of concrete beams
3	introduce the ductility concept and to design and detailing for ductility as per relevant IS codes
4	design special structural members with proper detailing

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Calculate short term and long-term deflections and crack width for structural elements	An
CO 2	Understand inelastic behaviour of concrete beams	U
CO 3	Design beam column joints for ductility as per relevant IS code	Ap
CO 4	Design and detail the ribbed slab, deep beams, grid floor and flat slabs in accordance with relevant IS code and standards	Ap
CO 5	Design corbels, slender columns, shear walls, edge (spandrel beams), pile cap, bunkers and silos	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1			2	3	2	
2		2	3	3		
3		2	3	3	2	
4		2	3	3	2	
5		2	3	3	2	



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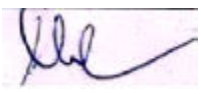
Course Content	
SERVICEABILITY CRITERIA FOR RC BEAMS AND SLABS **Deflection:** Calculation of deflection of RC beams and slabs - as per IS code, comparative study with Eurocode and ACI code. **Crack width:** Introduction - Factors affecting Crack width in Beams–Mechanism of Flexural Cracking–Estimation of Crack width in Beams by IS456 and BS8110 – Shrinkage, Creep and Thermal Cracking. **Practical Component: Nil**	**8 Hours**
INELASTIC BEHAVIOUR OF CONCRETE BEAMS Momen-rotation characteristics, moment redistribution, Baker's method of limit state analysis of continuous beam **Practical Component: Nil**	**6 Hours**
DUCTILE DETAILING Concept of ductility, design of beam column joints for ductility, design of cast in-situ joints in frames, detailing for ductility. **Practical Component: Nil**	**3 Hours**
DESIGN OF RIBBED (Voided) SLABS Introduction – Specification regarding the slabs – Analysis of the Slabs for Moment and Shears – Ultimate Moment of Resistance – Design of Shear – Deflection– Arrangement of Reinforcements . **Tutorial:** • Design of Ribbed slab using software **Practical Component: Nil**	**6 Hours** **3 Hours**
DESIGN OF FLAT SLABS AND GRID FLOORS Design of flat slabs according to IS and ACI method- design of grid floors – yield line theory of slabs. **Tutorial:** • Design of Flat slab using software • Design of Grid floor using software	**7 Hours** **6 Hours**
DESIGN OF SPECIAL STRUCTURES Design of deep beams , corbels , slender columns, shear walls, edge (spandrel) beams and design of pile cap. **Tutorial:** • Design of Deep beam using software • Design of Shear wall using software • Design of Pile cap using software	**9 Hours** **12 Hours**



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DESIGN OF RC CHIMNEYS, BUNKERS AND SILOS Design of chimneys for combined effect of self load, wind load and temperature - design of bunkers and silos- Janssen's theory , Airy's theory. **Tutorial:** • Design of Bunker using software • Design of Silo using software	**6 Hours** **9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**15**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**60**

Learning Resources

Textbooks:

1. Krishnaraju, N. Advanced Reinforced Concrete Design, CBS Publishers and Distributors, Delhi, (2013)
2. S. Unnikrishna Pillai and Devdas Menon, 'Reinforced Concrete Design', TATA McGraw-Hill Education Pvt. Ltd., New Delhi, (2017).

References:

1. P.C. Vargheese, Advanced Concrete Design, Prentice Hall of India Pvt. Ltd., (2010).
2. Jain, A.K. Reinforced Concrete-Limit State Design, Nem Chand and Bros., Roorkee, (2012).
3. Park. R. and Paulay T., Reinforced Concrete Structures, John Wiley and Sons, New Delhi, (2009).
4. Sinha, N.C. and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand and Company, New Delhi, (2007).
5. B.C. Punmia, A.K.Jain , Limit State Design of Reinforced Concrete, Firewall media, (2007).

Online Educational Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ce109/preview
2. https://www.researchgate.net/publication/311440191

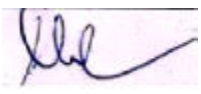
Assessment (Theory course)

CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
Dr. V. Govindaraj Head R&D, L&T Construction, Chennai.	Dr.R.Thenmozhi Professor & Head Government College of Technology, Coimbatore	Dr.J.Premalatha Civil Engineering

Recommended by BoS on	13/08/2024		
Academic Council Approval	No.27	**Date**	24/08/2024



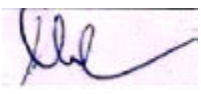
Signature of the BOS Chairman

24STI504	ADVANCED CONCRETE TECHNOLOGY	L	T	P	J	C
		3	0	2	0	4
ES		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 456, IS 10262

Course Objectives:	
The purpose of taking this course is to:	
1	Acquire knowledge on the properties of admixtures, fresh concrete properties, mix design, for special concretes and durability properties.
2	Understand microstructural behaviour of concrete and various modern trends in making of concrete.
3	Perform advanced laboratory experiments that emphasizes the use of admixtures, SCC and NDT tests
4	Study the structural behaviour of reinforced concrete beam and column elements.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the role of constituent materials and admixtures in concrete composition and Performance.	Ap
CO 2	Analyze the flow properties, setting, and hardening characteristics of fresh concrete and SCC.	An
CO 3	Design mix proportions for special concrete and suggest advanced methods of concrete manufacture and placement.	An
CO 4	Evaluate the durability and resistance properties of concrete and demonstrate NDT tests.	U
CO 5	Recommend appropriate concreting methods and equipment for specialized applications and future trends in concrete technology.	E
CO 6	Demonstrate the use of laboratory tests to assess the mechanical properties, durability and strength of concrete specimen.	E



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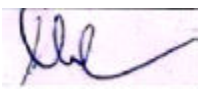
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3		3		3	
2	3		3		3	
3	3		3		3	2
4	3		3		3	
5	3		3		3	
6	3		3		3	2

Course Content	
CONSTITUENT MATERIALS OF CONCRETE Constituent materials of structural concrete, Types of cement, chemical composition, Hydration of Cement, Structure of hydrated Cement, mineral and chemical admixtures, Effects of Admixtures on properties of concrete. **Practical Component:** • Effect of admixtures in workability of concrete	**6 Hours** **2 Hours**
CONCRETE PROPERTIES Fresh concrete properties and Flow properties of SCC - Concrete properties - setting and hardening - transition zone in concrete - Elastic behaviour in concrete - creep, shrinkage and thermal properties of concrete. Strength-porosity relationship - Permeability of concrete, Non-destructive testing of concrete. **Practical Component:** • Ultrasonic Pulse Velocity Test • Rebound hammer Test • Rebar locator test • Study of stress - strain characteristics and determination of Youngs modulus	**9 Hours** **8 Hours**
CONCRETE PRODUCTION, PROCESSES, AND APPLICATIONS Mix design for special concrete - High Strength Concrete, High performance concrete and SCC - Advanced methods of concrete manufacture and placement - Ready mix concrete, Pumpable Concrete, Sprayed concrete; mass concrete. **Practical Component:** • Testing Flow Characteristics of Self Compacting concrete	**9 Hours** **8 Hours**



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TESTING AND QUALITY ASSURANCE OF CONCRETE Durability tests - Rapid Chloride permeability test- water absorption test- Resistance against sulphate attack, Carbonation, Classification and causes of concrete deterioration - Alkali aggregate reactivity, Effect of elevated temperature, Failure modes in concrete - plastic and thermal cracking. Microstructural analysis – SEM, EDX and XRD analysis. **Practical Component:** • Rapid Chloride Penetration Test • Accelerated corrosion test on concrete • Testing of RC beam to study the moment rotation behaviour under flexure • Testing of RC column under axial compression	**12 Hours** **12 Hours**
MODERN TRENDS IN CONCRETE MANUFACTURE AND PLACEMENT Concreting machinery and equipment, Special concreting methods - Under water concreting, Vacuum dewatering of concrete, extreme weather concreting. Methods of Transportation, Placing and curing. Future trends in concrete technology - Concrete for prefabricated elements, 3D printing concrete. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

Learning Resources

Textbooks:

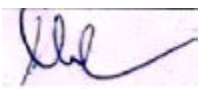
1. A.R.Santhakumar, Concrete Technology , Oxford University Press, (2018).
2. Shetty.M.S and A.K.Jain, Concrete Technology Theory and Practice, S Chand and Company Ltd, New Delhi, (2019).

References:

1. P. Kumar Metha and Paulo J.M.Monteiro, Concrete : Microstructure, Properties and Materials, Mc Graw Hill, Fourth Edition, (2014).
2. John Newman and B.S.Choo, Advanced Concrete Technology Part 1 to 4, Butterworth - Heinemann, First Edition, (2003).
3. Adam M., Neville, Properties of Concrete, Wiley Publications, Fourth and Final edition, (2010).
4. Piere Cloud Aitcin and Robert J Flatt, Science and Technology of Concrete Admixtures, (2016).

Online Educational Resources:

1. https://onlinecourses.nptel.ac.in/noc18_ce21/preview
2. https://swayam.gov.in/courses/4709-july-2018-concrete-technology
3. https://cs-iitd.vlabs.ac.in/List%20of%20experiments.html
4. https://www.teksure.in/self-compacting_concrete_virtual_lab.php



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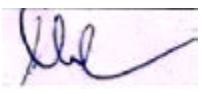
Assessment (Embedded course)
CAT, Activity and Learning Strategy - Think-pair-share, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, Viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. V. Govindaraj Head R&D, L&T Construction, Chennai.	Dr.R.Thenmozhi Professor & Head Government College of Technology, Coimbatore		Dr.K.Ramadevi Civil Engineering
Recommended by BoS on	13/08/2024		
Academic Council Approval	No.27	**Date**	24/08/2024



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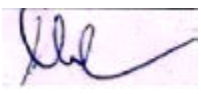
SEMESTER II



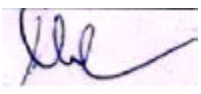
Signature of the BOS Chairman

24STI505	STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 4326, IS 1893, IS 13920, IS 13827 & IS 13828

Course Objectives:	
The purpose of taking this course is to:	
1	To develop the ability to design earthquake resistant structural elements
2	To understand dynamic response of SDOF and MDOF systems
3	To understand and introduce ductility into RC structural elements as per IS code provisions
4	To demonstrate the dynamic response of structural elements through experiments

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the basics of engineering seismology and theory of vibration or earthquake analysis	Ap
CO 2	Analyze the response of SDOF systems to various types of dynamic loading	An
CO 3	Analyze the behaviour of MDOF systems and decoupling of equations of motion	An
CO 4	Examine IS code provisions for seismic design and analyze structures using various methods of seismic analysis	U
CO 5	Design structural elements like RC beams, columns, and shear walls according to IS codes	E
CO 6	Demonstrate the dynamic response of structural elements through laboratory tests.	E



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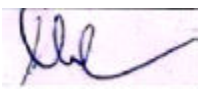
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1		1		1	
2	1			3		
3	1			3		
4	1		2	2		
5	1		2	3	3	1
6	2	2	2	2		1

Course Content	
INTRODUCTION Engineering Seismology, Objectives and Importance of Vibration Analysis, Nature of Exciting Forces, Degrees of freedom, Mathematical Modelling of Dynamic Systems, Equation of motion, Transmissibility, Vibration control, Tuned mass damper. **Practical Component:** • Demonstration on Horizontal Shake table • Demonstration on Vertical Shake table	**6 Hours** **2 Hours**
SINGLE DEGREE OF FREEDOM SYSTEM Single Degree of Freedom System: Free and Forced Vibration with and without Damping, Logarithmic decrement, Response to Harmonic Loading, Response to Dynamic Loading using Duhamel's Integral. **Practical Component:** • Vibration of SDOF system • Impact test on slab specimen	**9 Hours** **8 Hours**
MULTIPLE DEGREE OF FREEDOM SYSTEM Two Degree of Freedom System, Multiple Degree of Freedom System - Response to free and forced vibration of damped and undamped systems, Orthogonality principle, Evaluation of natural frequencies and mode shapes, Approximate methods - Mode superposition method. **Practical Component:**	**9 Hours** **8 Hours**



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• Vibration of MDOF system • Lateral Load testing of G+1 storied steel frame	
IS CODE PROVISIONS & SPECIAL TOPICS Design Criteria - Strength, Deflection, Ductility and Energy Absorption – Cyclic Behaviour of PCC, RCC, Steel and PSC Elements- Code provisions of Design of Buildings As Per IS 1893 And IS 4326. Ductile Detailing of Structures as Per IS 13920. Behaviour and Design of Masonry Structures as Per IS 13827 and IS13828. Methods of Seismic Analysis: Equivalent static analysis – Response Spectrum method – Time history method – Pushover Analysis. Active and passive control devices, Soil liquefaction. **Practical Component:** • Cyclic load test on RC beam • Evaluation of dynamic modulus of concrete • Study of Vibration Characteristics using FFT analyzer	**12 Hours** **12 Hours**
DESIGN OF RC STRUCTURAL ELEMENTS Design of RC beams, columns and shear walls as per IS code provisions. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

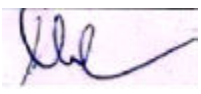
Learning Resources

Textbooks:

1. S.K.Duggal, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi (2022).
2. Paz Mario., Structural Dynamics – Theory and Computation, CBS Publication., 5th edition (2018).
3. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi (2016).

References:

1. Clough R. W. and Penzien J., Dynamics of Structures, McGraw Hill Inc., US (2015).
2. A.K. Chopra, Dynamics of Structures – Theory and Applications of Earthquake Engineering, Pearson Education (2020).
3. Damodarasamy and Kavitha, Basics of Dynamics and Aseismic Design, PHI Learning Pvt Ltd (2009).
4. Hector Estrada & Luke S. Lee , Introduction to Earthquake Engineering, CRC Press, Florida (2017).
5. Motoki Akazawa et al, "Test and sensitivity analysis of base-isolated steel frame with low-friction spherical sliding bearings", Earthquake Engineering and Structural Dynamics, Vol. 1 No. 1 (2024), pp1-19, DOI: 10.1002/eqe.4249, https://onlinelibrary.wiley.com/doi/epdf/10.1002/eqe.4249.



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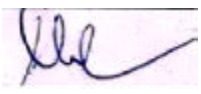
Online Educational Resources:
1. https://archive.nptel.ac.in/courses/105/101/105101006/ 2. https://www.youtube.com/watch?v=MCRX1KXQZBU 3. https://ssdl.iitd.ac.in/vssdl/about.html 4. https://sd-iiith.vlabs.ac.in/List%20of%20experiments.html

Assessment (Embedded course)
CAT, Activity and Learning Strategy - Think-pair-share, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, Viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.K.Ramadevi Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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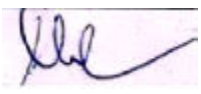
24STI506	ADVANCED DESIGN OF STEEL STRUCTURES	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 800, IS 801, Design Data book

Course Objectives:	
The purpose of taking this course is to:	
1	To learn advanced design concepts for steel buildings
2	To understand design concepts of steel connections used for steel structures
3	To understand various components of industrial buildings and their design using standard IS codes.
4	To learn plastic analysis of steel beams and frames, Light gauge steel structures

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the various design philosophies used for steel structures and design the steel members such as purlins, gable wind girders subjected to combined forces	Ap
CO 2	Explain and design different types of steel connections such as welded and bolted flexible as well as moment resisting connections	Ap
CO 3	Analyze and design industrial structures such as trusses and portal frames subjected to wind and seismic forces	Ap
CO 4	Explain the effect of axial force and shear force on steel structures and analyse continuous beams and frames using plastic theory	Ap
CO 5	Use cold formed sections in steel buildings	Ap
CO 6	Design the steel structural elements using software.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems



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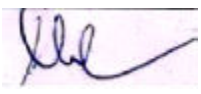
1	1	1	3	2	3	
2	1	1	3	2	3	
3	1	1	3	2	3	
4	1	1	3	2	3	
5	1	1	3	2	3	
6	1	2	3	2	3	3

Course Content	
GENERAL 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. **Practical Component:** • Design of Gable column and Purlin using software	**9 Hours** **3 Hours**
DESIGN OF CONNECTIONS 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 **Practical Component:** • Design of Moment Resistant connections using software	**9 Hours** **3 Hours**
ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS Design of Industrial buildings: Design of members subjected to lateral loads and axial loads- Sway and non-sway frames, bracings and bents, rigid frame joints, knees for rectangular frames and pitched roofs- Rigid joints in multistorey buildings – Design of steel chimneys- analysis and design of steel towers **Practical Component:** • Design of steel chimney using software	**9 Hours** **3 Hours**
PLASTIC ANALYSIS OF STRUCTURES Introduction, Plastic methods of analysis and design- plastic behaviour under static and cyclic loading- 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 - Design of Straight Corner Connections – Design of continuous beams. **Practical Component:** • Plastic Analysis of Portal frames using software	**9 Hours** **3 Hours**



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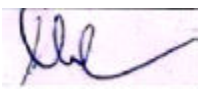
DESIGN OF LIGHT GAUGE STEEL STRUCTURES Introduction to Direct Strength Method - behaviour of Compression Elements - Effective width for load and deflection determination – behaviour of Unstiffened and Stiffened Elements – Design of webs of beams – Flexural members – Lateral buckling of beams – Shear Lag – Flange Curling – Design of Compression Members – Wall Studs. **Practical Component:** • Design of cold formed steel beams using software	**9 Hours** **3 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

Learning Resources
Textbooks:
1. Subramanian. N, Design of Steel Structures, Oxford University Press, 2016Chakrabarty, Theory of Plasticity, Tata McGraw Hill Book Co., New Delhi (2019) 2. S.K. Duggal, Limit State Design of Steel Structures, McGraw Hill Book Company(2017)
References:
1. Chandrasekaran.S, Advanced Steel Design of Structures, CRC Press, Taylor and Francis group, (2020) 2. Narayanan.R.et.al., Teaching Resource on Structural steel Design, INSDAG, Ministry of Steel Publishing, (2002) 3. Wie Wen Yu, Design of Cold-Formed Steel Structures, McGraw Hill Book Company, (2019) 4. Gaylord., Design of steel structures, McGraw Hill, New York(2010) 5. IS 800-2007 Indian Standard code of practice for use of structural steel in general building construction, BIS New Delhi (2007)
Online Educational Resources:
1. https://onlinecourses.nptel.ac.in/noc22_oe02/preview

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, MCQ, End Semester Examination (ESE)

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Dr.J.Premalatha Civil Engineering
Recommended by BoS on		
Academic Council Approval		**Date**



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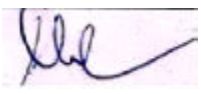
24STI507	FINITE ELEMENT ANALYSIS	L	T	P	J	C
		3	0	2	0	4
PC		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the fundamental principles of finite element analysis, including formulation techniques such as Virtual Work, Variational Principle, and Galerkin's Method.
2	Gain proficiency in analysing continuous beams, plane frames, grids, and space frames.
3	Learn concepts like constant strain triangle, linear strain triangle, and rectangular elements, and compute stresses considering geometric nonlinearity and static condensation.
4	Apply finite element methods to practical engineering problems demonstrating a comprehensive understanding and practical application of FEA techniques.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the basic concepts of Finite Element Analysis to solve simple structural problems using the displacement approach.	Ap
CO 2	Analyse the properties of various elements like triangular, rectangular, and Isoparametric elements to determine their applications in structural analysis.	An
CO 3	Evaluate the stiffness of members to perform finite element analysis of continuous beams and frames.	E
CO 4	Create finite element models using constant and linear strain triangles to compute stresses and handle geometric nonlinearity.	C
CO 5	Develop finite element solutions for plate bending problems and dynamic analysis to assess the stability and behaviour of structures.	C
CO 6	Demonstrate the use of FEM software to model, simulate, and analyse real-world structural engineering problems, including trusses, frames, and plates.	Ap



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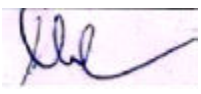
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1		3			
2	1		3	3		
3	1		3	3		
4	1		3	3		
5	1		2	2		
6	3	3	3	3	3	2

Course Content	
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's Method Finite Element Method: Displacement Approach - Stiffness Matrix and Boundary Conditions **Practical Component:** • Introduction to MATLAB/Python • Analysis of a 2D truss using matrix stiffness method	**9 Hours** **6 Hours**
ELEMENT PROPERTIES 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 **Practical Component:** • Introduction to ANSYS/ADINA • Study on types of elements, mesh patterns and refinement	**9 Hours** **6 Hours**
ANALYSIS OF FRAMED STRUCTURES 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 **Practical Component:** • Analysis of a simply supported beam subjected to two-point load	**9 Hours** **6 Hours**



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• Analysis of a space frame	
TWO- AND THREE-DIMENSIONAL SOLIDS 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 **Practical Component:** • Analysis of a thin cylinder with internal pressure • Analysis of a thick cylinder with internal pressure	**9 Hours** **6 Hours**
APPLICATIONS OF FEM 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 **Practical Component:** • Analysis of a plate with a hole • Dynamic Analysis of a space frame	**9 Hours** **6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**75**

Learning Resources

Textbooks:

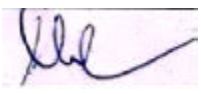
1. Chandrupatla, R.T. and Belegundu, A.D., Introduction to Finite Elements in Engineering, Fourth Edition, Prentice Hall of India (2015)
2. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi.(2017)

References:

1. Mohamed Gadala, Finite Elements for Engineers with Ansys Applications, Cambridge University Press, ISBN: 978-1-107-19408-3.(2020)
2. Erdogan Madenci, Ibrahim Guven, The Finite Element Method and Applications in Engineering using ANSYS, Springer, ISBN 978-1-4899-7549-2.(2015)
3. Moaveni, Saeed, Finite Element Analysis: Theory and Application with ANSYS, Pearson Prentice Hall, ISBN 978-0-13-189080-0.(2011)
4. Logan D. L,A First Course in the Finite Element Method, Thomson- Engineering(2007)
5. Zienkiewicz, O.C. and Taylor, R.L., The Finite Element Method, McGraw – Hill.(2013)

Online Educational Resources:

1. https://ocw.mit.edu/courses/2-092-finite-element-analysis-of-solids-and-fluids-i-fall-2009/
2. https://ocw.mit.edu/courses/2-094-finite-element-analysis-of-solids-and-fluids-ii-spring-2011/
3. https://ocw.mit.edu/courses/4-500-introduction-to-design-computing-fall-2008/



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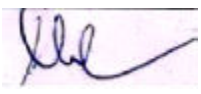
Assessment (Embedded course)
CAT, Quizzes, Think-pair-share, Open-ended questions, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Mr. Satheesh Kumar KRP Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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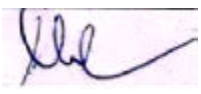
SEMESTER III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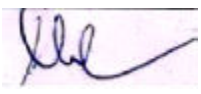
24STJ601	INDUSTRIAL TRAINING	L	T	P	J	C
		0	0	0	0	2
PC		SDG	4, 9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To train students with hands-on fieldwork experience, enabling them to understand and address practical challenges while performing engineering tasks

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify and describe the organizational framework of a Structural Engineering entity, as well as comprehend the various roles and functions within construction operations	An
CO 2	Participate in real-world construction projects to acquire hands-on, practical experience	Ap
CO 3	Prepare detailed technical reports and deliver clear, impactful presentationss	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	2	2	1	2	3	3
2	2	2	1	2	3	3
3	2	2	1	2	3	3



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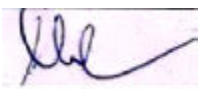
Course Content	
INDUSTRY TRAINING The students individually undertake training in reputed engineering companies or in Research Labs doing Structural Engineering during the summer vacation for a specified duration of one month. At the end of the training, a detailed report on the work done should be submitted 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.	**1 month duration**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	0

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Mr.Satheesh Kumar KRP Civil Engineering	
Recommended by BoS on	13/08/2024		
Academic Council Approval	No. 27	**Date**	24/08/2024



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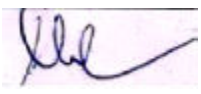
24STJ602	PROJECT PHASE – I	L	T	P	J	C
		0	0	0	20	10
Professional Core		SDG	4, 9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	All relevant codes

Course Objectives:	
The purpose of taking this course is to:	
1	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.
2	To develop the methodology to solve the identified problem
3	To train the students in preparing project reports and to face reviews and viva-voce examinations

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the knowledge gained from theoretical and practical courses in solving problems and recognize the importance of literature review.	An
CO 2	To develop the methodology to solve the identified problem and perform investigation	Ap
CO 3	Prepare project reports and present findings of the work	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3	3	3	2	3	2
2	2	3	2	2	3	2
3	3	3	3	2	3	2



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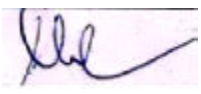
Course Content	
The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of structural engineering. The topic may be experimental / analytical / industry problem. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and 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.	**300 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**300**	**Total Hours:**	**300**

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.R.Manju Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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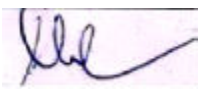
SEMESTER IV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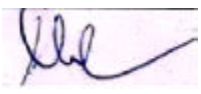
24STJ603	PROJECT PHASE – II	L	T	P	J	C
		0	0	0	40	20
PC		SDG	4, 9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	All relevant codes

Course Objectives:	
The purpose of taking this course is to:	
1	To solve the identified problem based on the formulated methodology.
2	To develop skills to analyze and discuss the test results, and make conclusions

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	To solve the identified problem based on the formulated methodology.	An
CO 2	To develop skills to analyse and discuss the test results, and make conclusions	An
CO 3	Demonstrate the research findings and present the solutions of the thesis work.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	2	2	2	2	3	2
2	1	2	2	2	3	2
3	1	2	2	3	3	2



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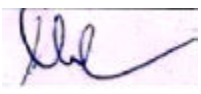
Course Content	
The student should continue the Phase I work on the selected topic as per the formulated methodology under the same supervisor / undergo internship. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should 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.	**600 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**600**	**Total Hours:**	**600**

Assessment (Practical course)
Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.K.Ramadevi Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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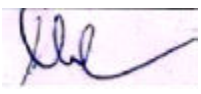
PROFESSIONAL ELECTIVES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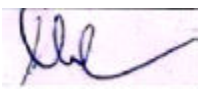
24STE001	DESIGN OF BRIDGES	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 456:2000, IRC 21:2022, IRC 6:2017, IRC 18:2022

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the components and classification of bridges, and learn the principles of bridge planning, including the history and design specifications as per IRC, with a focus on loading and load distribution theories.
2	Analyze and design short-span bridges, such as slab bridges, box culverts, and tee beam bridges, using appropriate design methodologies for structural efficiency and safety.
3	Design long-span girder bridges, including balanced cantilever, continuous, and box girder bridges, while considering the challenges associated with longer spans.
4	Explore the advantages of prestressed concrete bridges and design post-tensioned prestressed concrete bridge decks, including slab, tee beam, and continuous two-span bridges.
5	Design bearings, substructures, and footings for bridges, including the analysis of loads on substructures and the design of piers, pier caps, abutments, and various foundation types such as pile, well, and caisson foundations.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the basic concepts of bridge components and planning principles to choose the appropriate type of bridge based on IRC specifications.	Ap
CO 2	Analyse and Design short span bridges such as slab bridges, box culverts, and tee beam bridges.	An
CO 3	Analyse and Design long span bridges including balanced cantilever bridges, continuous bridges, and box girder bridges.	An
CO 4	Design post-tensioned prestressed concrete slab bridge decks.	An
CO 5	Design the bearings, substructures, and footings for bridges to meet specific safety and stability requirements.	An



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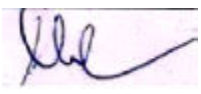
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1			2		1
2	1			3	1	1
3	1			3	1	1
4	1			3	1	1
5	1			3	1	1

Course Content	
INTRODUCTION Components of bridges, Classification of bridges, History of bridges, Planning of bridges, Loading and Design Specifications: Indian Roads Congress (IRC) on live loads for road bridges, Various forces acting on bridges, Load distribution theories: Courbon's Method, Hendry Jaeger Method, Grillage analogy, Pigeaud's curves. **Practical Component: Nil**	**9 Hours**
DESIGN OF SHORT SPAN BRIDGES Analysis and design of slab bridge, box culverts and tee beam bridges. **Practical Component: Nil**	**9 Hours**
DESIGN OF LONG SPAN GIRDER BRIDGES Design of balanced cantilever bridges, continuous bridges, box girder bridges. **Practical Component: Nil**	**9 Hours**
DESIGN OF PRESTRESSED CONCRETE BRIDGES Advantages of prestressed concrete bridges, Design of post tensioned prestressed concrete slab bridge deck, Design of post tensioned prestressed concrete tee beam and slab bridge deck, Design of post tensioned prestressed concrete continuous two span beam and slab bridge deck. **Practical Component: Nil**	**9 Hours**
BEARINGS, SUB-STRUCTURES AND FOOTINGS FOR BRIDGES Types of bearings, Design of bearings, Various parts of substructures, Loads acting on	**9 Hours**



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substructures, Design of pier and pier cap, Design of abutments, Design of different types of foundation – Pile, well & caisson. **Practical Component: Nil**	

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks:

1. Krishnaraju, N., 'Design of Bridges', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, (2019)
2. Ponnuswamy, S., 'Bridge Engineering', Tata McGraw-Hill Education, (2017).
3. N. Rajagopalan, 'Bridge Superstructure', Alpha Science International Ltd, (2016).
4. Jagadeesh T,R., Jayaram M.A., 'Design Of Bridge Structures' PHI Learning, (2021).

References:

1. Raina V.K. 'Concrete Bridge Practice Analysis, Design and Economics, Shroff Publishers & Distributors Pvt. Limited, (2014).
2. D. Johnson Victor, 'Essentials of Bridge Engineering', Oxford and IBH Publishing, (2010)
3. Victor, D.J., Essentials of Bridge Engineering, 6th Ed., Oxford & IBH Publishing Co. Pvt. Ltd., (2019)

Online Educational Resources:

1. https://www.wileyindia.com/design-of-concrete-bridges-as-per-latest-irc-codes.html
2. https://archive.nptel.ac.in/courses/105/105/105105216/
3. https://www.udemy.com/course/fundamentals-of-bridge-designyour-way-to-be-bridge-designer/

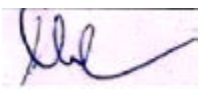
Assessment (Theory course)

CAT, Activity and learning strategy, Think-pair-share, MCQ, End Semester Examination (ESE).

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr.R.Manju Civil Engineering

Recommended by BoS on			
Academic Council Approval		**Date**	



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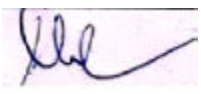
24STE002	SMART MATERIALS FOR CONSTRUCTION	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the composition, properties, and advancements special concretes.
2	Analyze the materials, properties, and applications of geo-polymer bricks and concrete in construction.
3	Learn the principles, design, and applications of steel-concrete composite structures.
4	Explore the types, characteristics, and uses of smart materials in construction.
5	Investigate recent developments, sustainability, and future trends in smart materials for construction.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply concrete technology principles to explore the composition and properties of high-performance and ultra-high-performance concrete, and assess their applications in modern construction	Ap
CO 2	Examine the composition, characteristics, and engineering properties of geo-polymer materials, and evaluate their performance and potential through case study analysis	An
CO 3	Assess the design principles and performance attributes of steel-concrete composite structures, and propose design enhancements based on case study findings	E
CO 4	Analyze the mechanisms and applications of smart materials such as shape memory alloys and piezoelectric materials; evaluate their integration into structural systems.	An
CO 5	Evaluate recent advancements and future trends in smart materials; assess their impact on sustainability and career opportunities in the construction industry.	E



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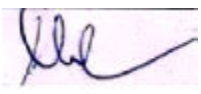
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3	3	3	3	2	3
2	3	3	3	3	2	3
3	2	3	2	2	2	2
4	2	2	3	2	3	2
5	2	2	3	2	3	2

Course Content	
ADVANCEMENTS IN CONCRETE MAKING MATERIALS Introduction to Concrete Technology- Basics of concrete composition and properties, Historical perspective and evolution - High-Performance Concrete - Characteristics and benefits, Applications in modern construction - Ultra-High-Performance Concrete (UHPC) - Composition, properties, and applications, Case studies and recent developments - Self-Healing Concrete - Mechanisms and types of self-healing, Practical applications and case studies. **Practical Component: Nil**	**9 Hours**
GEO-POLYMER BRICKS AND CONCRETE Materials - Characterization – activating solution – structure of geopolymers – accelerated curing – durability – design - Engineering properties – applications – case study. **Practical Component: Nil**	**9 Hours**
STEEL-CONCRETE COMPOSITE STRUCTURES Introduction to Composite Materials - Definitions and principles, Benefits and limitations - Steel-Concrete Composite Beams - Design principles and methodologies, Load distribution and performance characteristics - Composite Slabs and Columns - Design considerations and construction practices, Case studies and applications in high-rise buildings - Innovative Composite Systems - Recent advancements and research trends, Real-world applications and case studies. **Practical Component: Nil**	**9 Hours**
SMART MATERIALS AND THEIR CHARACTERISTICS	**9 Hours**



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Overview of Smart Materials - Definition and types of smart materials, Applications in various industries – Shape Memory Alloys (SMAs) - Properties, mechanisms, and applications in construction – Piezoelectric Materials - Principles, uses, and integration into structural systems - Electrochromic and Thermochromic Materials - Functional characteristics and potential applications in buildings. **Practical Component: Nil**	
RECENT DEVELOPMENTS AND FUTURE TRENDS Emerging Trends in Smart Materials - Current research and development areas, Future possibilities and Innovations - Case Studies of Modern Applications - Analysis of recent projects utilizing smart materials, Lessons learned and best practices - Sustainability and Environmental Impact - Evaluation of the environmental benefits of smart materials, Strategies for sustainable material selection and use – Industry Perspectives and Career Opportunities - Insights from industry professionals, Emerging career paths and opportunities in smart materials and construction. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks:

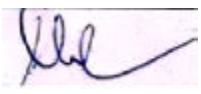
1. G. Rajesh, M. Suresh, Smart Materials and Structures, Pearson India, (2020).
2. N. Gopalakrishnan, Advances in Construction Materials and Sustainable Environment, Springer India, (2021).
3. B. Bhattacharjee, S. Krishnamoorthy, Smart Materials in Structural Engineering, Narosa Publishing House, (2015).

References:

1. Mehta, P. Kumar and Monteiro, Paulo J. M., Concrete: Microstructure, Properties, and Materials, McGraw-Hill Education, New York, (3rd Edition) (2014)
2. K. S. Jagadish, B. V. Venkatarama Reddy, K. S. Nanjunda Rao, Alternative Building Materials and Technologies, New Age International Publishers, (2017).
3. S. K. Duggal, Design of Steel Structures, Tata McGraw-Hill Education, (2014).
4. V. L. Shah, S. R. Karve, Limit State Design of Steel Structures, Structures Publications, (2016).

Online Educational Resources:

1. Coursera – Concrete Technology by National Taiwan University
2. Geo-Polymer Concrete Basics
3. ScienceDirect – Smart Materials in Construction
4. Elsevier – Recent Advances in Smart Materials for Construction



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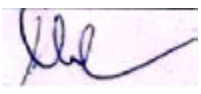
Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		G.Karthikeyan Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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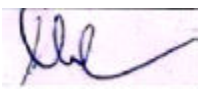
24STE003	INDUSTRIAL STRUCTURES	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS: 456, IS: 800, IS: 2974

Course Objectives:	
The purpose of taking this course is to:	
1	Prepare the layout for industrial buildings along with lighting requirements
2	Assess effective functional requirements for industrial structures
3	Design machine foundations and expansion joints as per IS guidelines.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze and classify industrial site layouts and equipment requirements across various industries.	Ap
CO 2	Assess effective lighting, electrical, and ventilation systems with a focus on safety and efficiency.	U
CO 3	Develop planning and structural design skills for single and multi-story industrial buildings using RCC and steel. Design and silos as per IS code	E
CO 4	Design RC structures like steel girder, bunker chimneys, silos and RC ducts	E
CO 5	Design machine foundations and other foundations as per IS codes and understand waterproofing as per industry standards.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3		2	3	2	
2	2	2	3	3	2	
3	2		2	3	3	
4	2		2	3	3	
5	2		3	3	3	



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Course Content	
INTRODUCTION Specific equipment for industries like Engineering. Textile, Chemical etc., - Site layout and external facilities classification of industries minimum standards internal calculation – Materials – Works. **Practical Component: Nil**	**9 Hours**
FUNCTIONAL REQUIREMENTS Lighting – Natural and artificial – protection from the sun – skylight. Services, Layout, wiring fixtures, cable and pipe bridges – Electrical installations – lighting - Substations - effluent. Ventilation and fire protection, ventilation & air – conditioning, fire escapes and, chutes, fire alarms, extinguishers and hydrants. **Practical Component: Nil**	**9 Hours**
PLANNING & DESIGN Layout stages. Loading Design of single bay and design of multi bay multi storied frames in RCC and steel – Analysis of industrial structures. **Practical Component: Nil**	**9 Hours**
DESIGN OF ADVANCED STRUCTURES Cranes - Different types - principles - design of girder – open web and solid web bunkers – silos – R.C. ducts. **Practical Component: Nil**	**9 Hours**
CONSTRUCTION TECHNIQUES Expansion joints- design of machine foundations and other foundations as per I.S Code - Water proofing – roof drainage – joints – sound, shockproof mountings. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**Total Hours:**	**45**

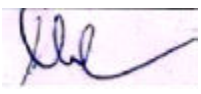
Learning Resources

Textbooks:

1. Ezra Bawden, Reinforced Concrete Structures: Analysis, Drawing and Design, Willford Press, (2023)
2. Pasala Dayaratnam,"Design of Steel Structure", Wheeler publishers Allahabad , (2018)

References:

1. Planning industrial structures Dunham, Industrial Structures McGraw-Hill Book Co; 1st edition (2021)
2. Henn W. Buildings for Industry, vols.I and II, London Hill Books, (2007).



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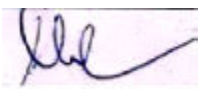
3. Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi (2013)
4. Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, (2017).

Online Educational Resources:

1. Design of steel structures - Course (nptel.ac.in)
2. Design of an Industrial Building| Structural Design-1 | Prof. Sajjan Wagh (youtube.com)
3. https://www.iith.ac.in/~prestressed/index.htm

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Mr. P. Nandhakumar Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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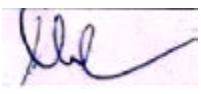
24STC004	DESIGN OF TALL BUILDINGS	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11			

Pre-requisite courses	24STT503 Advanced Design of Concrete Structures	Code book	IS: 456, 875, 1893, 13920

Course Objectives:	
The purpose of taking this course is to:	
1	Acquire knowledge of modern design materials, various loading types, and the behaviour of different structural systems.
2	Gain skills in modelling, analysing, and designing structures using both approximate and computerized 3D methods.
3	Develop competency in conducting comprehensive stability analysis and designing resilient structures that consider differential movement, temperature, and fire resistance.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyse modern concrete materials and design philosophies to evaluate their suitability for tall structures	An
CO 2	Apply diverse loading conditions and methods to solve design challenges in tall buildings.	Ap
CO 3	Compare different structural systems to justify their use in high-rise buildings.	U
CO 4	Evaluate analysis techniques and design methods to recommend effective solutions for structural integrity.	E
CO 5	Design stability analysis models to develop safe and resilient tall structures.	C
CO 6	Develop structural design for Tall buildings incorporating design principles like Response Spectrum Method, Combination of loads, Wall – Frames, Tubular, Outrigger braced, Hybrid systems	Ap



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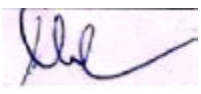
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1	1	3	3	1	
2	1	1	3	3	1	
3	1	1	3	3	1	
4		1	3	3	1	
5	3	1	3	3	1	1
6	3	3	3	2	2	3

Course Content	
DESIGN CRITERIA Design Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete. **Practical Component: Nil**	**6 Hours**
LOADING Gravity Loading – Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral load analysis. **Practical Component: Nil**	**6 Hours**
BEHAVIOUR OF STRUCTURAL SYSTEMS Factors affecting the growth, height and structural form, Behaviour of braced frames, Rigid frames, Infilled frames, Shear walls, Coupled shear walls. **Practical Component: Nil**	**6 Hours**
ANALYSIS AND DESIGN Modelling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance. **Practical Component: Nil**	**6 Hours**



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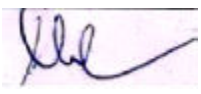
STABILITY ANALYSIS Overall buckling analysis of frames, wall – frames, Approximate methods, Second order effect of gravity loading, P – Delta Effects, Simultaneous first order and P-Delta analysis, Translational instability, Torsional Instability, Out-of-plumb effects. **Practical Component: Nil**	**6 Hours**
PROJECT COMPONENT Design of Tall buildings - Response Spectrum Method, Combination of loads, Wall – Frames, Tubular, Outrigger braced, Hybrid systems. Stability of structures. Students shall undergo field visits and demonstrate various real-world case studies on various pre-engineered structures.	**30 Hours**

Theory Hours:	30	**Tutorial Hours:**	0	**Practical Hours:**	0	**Project Hours:**	30	**Total Hours:**	60

Learning Resources
Textbooks:
1. Taranath B.S, 'Structural Analysis and Design of Tall Buildings', McGraw-Hill, (2011). 2. Lynn S.Beedle, 'Advances in Tall Buildings', CBS Publishers and Distributors, Delhi, (202).
References:
1. Bryan Stafford Smith and Alex Coull, 'Tall Building Structures', Analysis and Design, John Wiley and Sons, Inc., (2011). 2. Coull, A. and Smith, Stafford, B. 'Tall Buildings', Pergamon Press, London, (2011). 3. LinT.Y. and Burry D.Stotes, 'Structural Concepts and Systems for Architects and Engineers', John Wiley, 1994.
Online Educational Resources:
1. https://ocw.mit.edu/courses/4-440-basic-structural-design-spring-2009/ 2. https://ocw.mit.edu/courses/1-051-structural-engineering-design-fall-2003/

Assessment (Embedded course)
SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Mr. Satheesh Kumar KRP Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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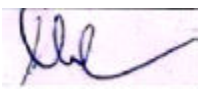
24STC005	EXPERIMENTAL METHODS AND MODEL ANALYSIS	L	T	P	J	C
		2	0	2	0	3
PC		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	To demonstrate various force and strain measuring equipment and data indicating and recording instruments
2	To understand strain rosettes and NDT techniques of structures.
3	To perform model testing and understand photo-elastic techniques and holographic techniques

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Use measuring equipment to determine forces and strain in structures	Ap
CO 2	Demonstrate various data indicating and recording instruments	An
CO 3	Illustrate the use of strain rosettes and various techniques for vibration measurement	An
CO 4	Recognize and perform various non-destructive testing techniques of structures	An
CO 5	Understand the significance of model analysis, materials used and demonstrate testing of models	U
CO 6	Present research findings from experimental methods conducted in the lab and propose solutions based on the research outcomes	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	2	1	2		3	
2	2	1	2		3	
3	2	1	2	1	3	



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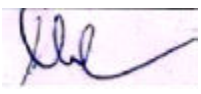
5	2	1	2		3	
6	3	3	3	2	2	2

Course Content	
FORCE AND STRAIN MEASUREMENTS Basic Concept in Measurements – Types of strain gauges – Hydraulic jacks – pressure gauges – proving rings – electronic load cells – Calibration of Testing Machines **Project component:** • Load measurement using Hydraulic jacks & Load cells, Strain measurement	**6 Hours** **6 Hours**
DATA RECORDING Strain gauge circuits – Potentiometer and Wheatstone bridge, Use of electrical resistance strain gauges in transducer applications. LVDT - Indicating and recording devices - Static and dynamic data recording –Data (Digital and Analogue) acquisition and processing systems **Project component:** • Data acquisition during testing of RC specimen.	**6 Hours** **6 Hours**
VIBRATION MEASUREMENT Strain analysis methods – Rosette analysis. Static and dynamic testing techniques. - Equipment for loading - Moire's techniques - Transducers for velocity and acceleration measurements - vibration meter - Seismographs - vibration analyzer - Cathode Ray Oscilloscope, FFT Analyzer. **Project component:** • Testing of concrete specimen for vibration measurement	**6 Hours** **6 Hours**
NON-DESTRUCTIVE TESTING TECHNIQUES (NDT) Non-destructive testing techniques - Load testing of structures, Buildings, bridges and towers -Acoustic emission - holography - use of laser for structural testing. **Project component:** • Rebound hammer test and Ultrasonic test on concrete elements	**6 Hours** **6 Hours**
MODEL ANALYSIS Laws of similitude - model materials – model testing – testing large scale structures – holographic techniques – Photoelasticity – optics of photoelasticity – Polariscope – Isoclinics and Isochromatics - methods of stress separation – wind tunnel and its use in structural analysis. **Project component:** • Testing of RC beams, Columns and Slabs	**6 Hours** **6 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**60**



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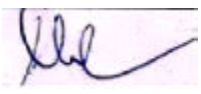
Learning Resources
Textbooks:
1. Dr.Sadhu Singh, 'Experimental Stress Analysis', Khanna Publishers, New Delhi, 2017. 2. Rangan C S et al., 'Instrumentation – Devices and Systems', Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 2017.
References:
1. Srinath L S et al, 'Experimental Stress Analysis', Tata McGraw-Hill Publishing Co., Ltd., New Delhi,1984. 2. D.E.Bray and R.K.Stanley, "Non-Destructive Evaluation", McGraw Hill Publishing Co., New York, 1997. 3. C.B.Kukreja and V.V.Sasty, Experimental Methods in Structural Mechanics, Standard Publishers Distributors, New Delhi, Dally J W and Riley W.F, 'Experimental stress Analysis', McGraw-Hill Inc. New York, 2014.
Online Educational Resources:
1. https://onlinecourses.nptel.ac.in/noc21_me02/preview 2. https://www.hbkworld.com/en/knowledge/resource-center/articles/strain-measurement-basics/strain-gauge-fundamentals/experimental-stress-analysis-using-strain-gauges

Assessment (Embedded course)
SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.K.Ramadevi Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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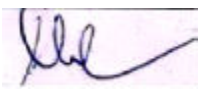
24STE006	STABILITY OF STRUCTURES	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the fundamental concepts of structural stability
2	Analyze the stability of beam-columns and rigid jointed frames under various loading conditions.
3	Evaluate torsional and lateral buckling in structural elements, focusing on open sections and beams, using numerical methods
4	Analyze buckling behaviour of thin plates with various edge conditions using energy and equilibrium approaches.
5	Analyze inelastic buckling problems in columns and plates considering post-buckling behaviour.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply equilibrium and energy methods to analyze buckling problems of columns under different boundary conditions.	Ap
CO 2	Analyze stability of beam-columns and frames under various loading and boundary conditions using stability functions and applying these concepts to real-world engineering problems.	An
CO 3	Evaluate torsional and lateral buckling of open sections and beams under different conditions using numerical methods.	An
CO 4	Apply equilibrium and energy methods to analyze buckling in thin plates, considering various edge conditions, and develop skills in numerical techniques such as the finite difference method.	An
CO 5	Examine inelastic buckling and post-buckling behavior in columns and plates, using double modulus theory and tangent modulus theory, and explore the effects of material imperfections and eccentric loading.	An



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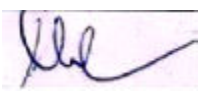
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3			3	2	
2	3			3	2	
3	3			3	2	
4	3			3	2	
5	3			3	2	

Course Content	
BUCKLING OF COLUMNS States of equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem. Governing equation for columns - Analysis for various boundary conditions - using Equilibrium, Energy methods. Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method - Effect of shear on buckling. **Practical Component: Nil**	**9 Hours**
BUCKLING OF BEAM-COLUMNS AND FRAMES 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. **Practical Component: Nil**	**9 Hours**
TORSIONAL AND LATERAL BUCKLING Torsional buckling – Combined Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions. Lateral buckling of beams, pure bending of simply supported and cantilever beams. **Practical Component: Nil**	**9 Hours**
BUCKLING OF PLATES Advantages of prestressed concrete bridges, Design of post tensioned prestressed concrete slab bridge deck, Design of post tensioned prestressed concrete tee beam and	**9 Hours**



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slab bridge deck, Design of post tensioned prestressed concrete continuous two span beam and slab bridge deck. **Practical Component: Nil**	
INELASTIC BUCKLING Double modulus theory - Tangent modulus theory - Shanley's model - Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behaviour of plates. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks:

1. Gambhir, "Stability Analysis and Design of Structures", springer, New York, (2013).
2. Simitser.G.J and Hodges D.H, "Fundamentals of Structural Stability", Elsevier Ltd., (2006).
3. Timoshenko.S.P, and Gere.J.M, "Theory of Elastic Stability", McGraw Hill Book Company, (2012).

References:

1. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall, (1974).
2. Ashwini Kumar, "Stability Theory of Structures", Allied publishers Ltd., New Delhi, (2003).

Online Educational Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105217/
2. https://ocw.mit.edu/courses/2-080j-structural-mechanics-fall-2013/resources/mit2_080jf13_lecture9/
3. https://mycourses.aalto.fi/pluginfile.php/1260824/course/section/158918/art_BAZANT__Structural %20stability.pdf

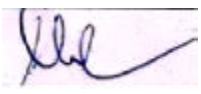
Assessment (Theory course)

CAT, Activity and learning strategy, Think-pair-share, MCQ, End Semester Examination (ESE).

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr.R.Manju Civil Engineering

Recommended by BoS on			
Academic Council Approval		**Date**	



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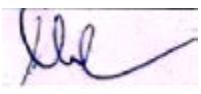
24STE007	DESIGN OF PLATES, SHELLS AND SPATIAL STRUCTURES	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Design rectangular and circular plates.
2	Analyse folded plates using numerical methods
3	Analyse, Design and detailing of reinforcement in shells
4	Study the behaviour of space frames.
5	Analyse the space frames by algebraic methods

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	To design rectangular and circular plates based on structural principles.	Ap
CO 2	To analyse folded plates using numerical methods for structural performance.	Ap
CO 3	To analyse, design, and detail the reinforcement in shell structures.	Ap
CO 4	To study the structural behavior and characteristics of space frames.	U
CO 5	To analyse space frames using algebraic methods for structural analysis.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1			2	3	
2	1			3		
3				2	2	
4	1		2	2	2	
5	1		2	3	3	



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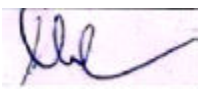
Course Content	
SYMMETRICAL BENDING OF PLATES Equation of equilibrium and deformation of plates – Bending of rectangular plates and circular plates – Post buckling behaviour. **Practical Component: Nil**	**8 Hours**
NUMERICAL METHODS Energy method, finite difference and finite element methods for solution of plate bending problems. Principles of design of folded plates. **Practical Component: Nil**	**10 Hours**
SHELLS Geometry of shells – Classification of Shells – membrane theory of circular and cylindrical shells – Detailed Analysis and design of cylindrical shells – Detailing of Reinforcement in shells, edge beams and transfer beams. **Practical Component: Nil**	**9 Hours**
INTRODUCTION TO SPACE FRAMES Space frames – configuration – types of nodes – general principles of design Philosophy – Behaviour. **Practical Component: Nil**	**10 Hours**
ANALYSIS OF SPACE FRAMES Analysis Of Space Frames – Formex Algebra, Formian – Detailed Design of Space Frames. **Practical Component: Nil**	**8 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources
Textbooks:
1. Ramasamy, G.S. 'Design and Construction of Concrete shells roofs', CBS Publishers, (2005). 2. Timoshenko, S. 'Theory of plates and Shells', McGraw-Hill, (2017). 3. Principles of space structures by Dr.N. Subramanian, Wheeler Publishing Co., (1999)
References:
1. Proceedings of International Conference on Space structures, Anna University, November (2009). 2. Szllard, R. Theory of Analysis of Plates, Prentice Hall Inc, (2004).
Online Educational Resources:
1. https://onlinecourses.nptel.ac.in/noc22_ce80/preview 2. https://onderwijsaanbod.kuleuven.be/syllabi/e/H05L8AE.htm#activetab=doelstellingen_idp29184 3. https://mycourses.aalto.fi/course/view.php?id=35442



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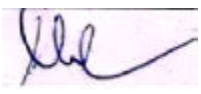
4. https://www.novatr.com/blog/shell-structures

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Mr.A.Vishnu Civil Engineering
Recommended by BoS on		
Academic Council Approval		**Date**



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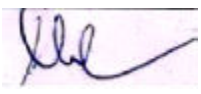
24STE008	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	To explain the principles of quality assurance in concrete construction and assess the impacts of distress on concrete structures.
2	To highlight the importance of maintenance and develop effective repair strategies for concrete structures.
3	To identify and analyse various materials used in structural repairs, focusing on their properties and applications.
4	To recommend and evaluate recent advancements in the repair techniques for concrete structures.
5	To explain the processes involved in the repair, rehabilitation, retrofitting, and demolition of concrete structures.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Describe quality assurance practices in concrete construction and analyze the causes and effects of distress in concrete structures	U
CO 2	Demonstrate the importance of maintenance and repair strategies.	U
CO 3	Identify materials used for structural repairs and evaluate their properties	An
CO 4	Recommend recent developments in repair of concrete structures	An
CO 5	Explain the processes of repair, rehabilitation, retrofitting, and demolition methods for structures	U



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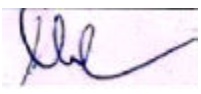
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1					
2	1		1	3	2	
3	1			2		
4	2		2	2		
5	1		2	2	3	

Course Content	
GENERAL Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection. **Practical Component: Nil**	**9 Hours**
MAINTENANCE AND REPAIR STRATEGIES Definitions: Maintenance, repair and rehabilitation, Facts of Maintenance - importance of Maintenance - Preventive measures on various aspects - Inspection, Assessment procedure for evaluating a damaged structure - causes of deterioration - testing techniques. **Practical Component: Nil**	**9 Hours**
MATERIALS FOR REPAIR Repair materials-Various repair materials, Criteria for material selection, Methodology of selection, Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Protective Coatings- Protective coatings for Concrete and Steel, FRP sheets. **Practical Component: Nil**	**9 Hours**



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TECHNIQUES FOR REPAIR Rust eliminators and polymers coating for rebars during repair foamed concrete, Corrosion inhibitors, Coatings to reinforcement, mortar and dry pack, vacuum concrete, Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. **Practical Component: Nil**	**9 Hours**
REPAIR, RETROFITTING AND DEMOLITION OF STRUCTURES 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. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks:

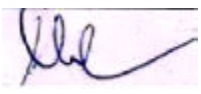
1. Varghese, P. C., Maintenance, Repair & Rehabilitation and Minor Works of Buildings, PHI Learning Pvt Ltd, New Delhi, (2014).
2. Bhattacharjee. J, Concrete Structures Repair, Rehabilitation and Retrofitting, CBS Publishers, New Delhi (2019).
3. Dr.S. Arunachalam, Maintenance, Repair and Rehabilitation of Structures, Lakshmi Publications, Chennai, (2017).

References:

1. M.S. Shetty, 'Concrete Technology - Theory and Practice', S.Chand and Company, New Delhi, (2021).
2. Santhakumar, A.R., 'Training Course notes on Damage Assessment and repair in Low-Cost Housing', "RHDC-NBO", Anna University, July (1992).
3. Raikar, R.N., 'Learning from failures - Deficiencies in Design', Construction and Service - R & D Centre (SDCPL), RaikarBhavan, Bombay, (2002).
4. Lakshmipathy, Metal Lecture notes of Workshop on 'Repairs and Rehabilitation of Structures', 29 - 30th October (1999).
5. Denison Campbell, Allen and Harold Roper, 'Concrete Structures, Materials, Maintenance and Repair', Longman Scientific and Technical UK, (2019).

Online Educational Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ce06/preview
2. https://online.vtu.ac.in/course-details/maintenance-and-repair-of-concrete-structures
3. https://www.udemy.com/course/reinforced-concrete-structure-assessment-and-repair/
4. https://onlinecourses.swayam2.ac.in/nou21_ce04/preview
5. https://www.lpcentre.com/online/construction-civil-engineering/damage-assessment-and-rehabilitation-of-concrete-structures



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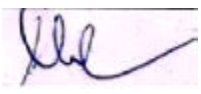
Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Mr.A.Vishnu Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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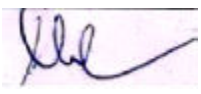
24STC009	FLUID STRUCTURE INTERACTION	L	T	P	J	C
		2	0	2	0	3
PE		SDG	9, 11			

Pre-requisite courses	24STI507, 24STI505	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Understand Basic Concepts: Learn the fundamental principles and equations of fluid-structure interaction and apply them to solve related engineering problems.
2	Analyze and Simulate: Develop the ability to use software tools like MATLAB and ANSYS to model and simulate the effects of wind and earthquake forces on structures.
3	Evaluate Structural Stability: Assess the stability and behaviour of different types of foundations and structures under various loading conditions using modern analysis techniques.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply governing equations and boundary conditions to solve fluid-structure interaction problems using various methods.	Ap
CO 2	Analyze wind loads and induced vibrations on structures by performing wind tunnel testing and simulations.	An
CO 3	Compare the effects of liquid sloshing and liquid dampers in earthquake engineering to enhance structural resilience.	An
CO 4	Evaluate different foundation models and the Finite Difference Method for analysing soil-structure interaction problems.	E
CO 5	Design efficient mesh adaptations for complex fluid-structure interaction scenarios in structural engineering.	C
CO 6	Demonstrate the ability to use MATLAB and ANSYS/ADINA for solving and simulating FSI problems practically.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	2	1	2	3	2	2



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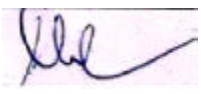
2	2	1	3	3	3	2
3	2	2	3	3	3	2
4	3	2	3	3	3	3
5	3	2	3	3	3	2
6	3	2	2	3	3	2

Course Content	
INTRODUCTION TO FSI Governing Equations – Boundary Conditions - Types of PDE – Various methods of solving PDEs – Coupled Equations – Decoupling – Mesh adaptation for FSI problems **Practical Component:** • Solving PDEs in MATLAB • Introduction to Multiphysics model simulation using ANSYS / ADINA	**6 Hours** **6 Hours**
FSI IN BUILT ENVIRONMENT Wind Engineering: Wind loads on structures – Wind tunnel testing (types of wind tunnels, types of models, similitudes) – Wind induced Vibrations Earthquake Engineering: Liquid Sloshing – Liquid Dampers – Tuned Liquid Dampers **Practical Component:** • Simulation of Flow around a Building using ANSYS-CFX or OpenFOAM • Simulation of liquid sloshing using ANSYS / ADINA • Demo on performance of TLD using a lab scale mode	**8 Hours** **16 Hours**
SOIL STRUCTURE INTERACTION Shallow Foundations – Different Foundation Models – Beams on Elastic Foundation – Finite Difference Method for Soil Structure Interaction **Practical Component:** • FDM for SSI using MATLAB • Simulating SSI in ANSYS / ADINA	**16 Hours** **8 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**60**



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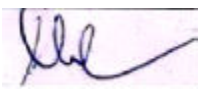
Learning Resources
Textbooks:
1. Panneer Selvam, R., Computational Fluid Dynamics for Wind Engineering., Wiley (2022). 2. Desai, C. S., Zaman, M., Advanced Geotechnical Engineering: Soil-Structure Interaction Using Computer and Material Models., CRC Press, United States (2013).
References:
1. Bull, J.W., Soil-Structure Interaction: Numerical Analysis and Modelling., CRC Press (2022). 2. Bret Lizundia, S.E., "A Practical Guide to Soil-Structure Interaction.", Structure, December, pp.8, ISSN 1536 4283, https://www.structuremag.org/article/a-practical-guide-to-soil-structure-interaction/, (2020),: 3. Holmes, J.D., Wind Loading of Structures., Taylor & Francis (2007). 4. ASCE/SEI 49-2021, Wind Tunnel Testing for Buildings and Other Structures., American Society of Civil Engineers (2021).
Online Educational Resources:
1. https://archive.nptel.ac.in/courses/105/105/105105200/ 2. https://www.coursera.org/learn/fluid-solid-interaction

Assessment (Embedded course)
CAT, Activity and Learning Tasks: Think-pair-share, MCQ, End Semester Examination (ESE) Lab Workbook

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Mr. Satheesh Kumar KRP Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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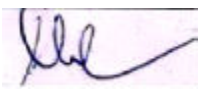
24STE010	DESIGN OF PRE-STRESSED CONCRETE ELEMENTS	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9			

Pre-requisite courses	24STT503 Design of Advanced Concrete Structures	Data Book / Codes / Standards (If any)	IS1343-2012, IS3370-Part 3

Course Objectives:	
The purpose of taking this course is to:	
1	Learn about the types of prestress technology, their advantages and disadvantages, their uses
2	Understand the Prestressed concrete behavior under different limit states
3	Study the essential principles of designing prestressed concrete with advanced construction material
4	Acquire knowledge on different prestressing methods and the principles of partial prestressing
5	Design structures such as beams, pipes, water tanks, posts, and similar elements.

Course Outcomes:		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Analyze the principles of pre-stressing systems to evaluate the behavior of various pre-stressed concrete elements.	An
CO2	Evaluate limit state design concepts to justify design choices based on serviceability and collapse resistance.	E
CO3	Design solutions for shear, torsion, and anchorage zones by applying appropriate analytical techniques.	Ap
CO4	Analyze statically indeterminate structures to select optimal cable profiles and predict deflection behavior.	An
CO5	Evaluate special structures' design approaches to assess their suitability for partial pre-stressing and composite construction.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1	2			2	1
2	1	3	2	3	2	2
3	1			3		



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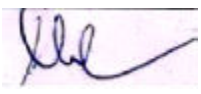
4	1		2	2		2
5	1	2	2	3	1	

Course Content	
PRINCIPLES AND ANALYSIS FOR FLEXURE Principles of Pre-stressing – Types of pre-stressing systems – Materials – Systems and devices– Analysis and design for flexure – Components of tendons – Behaviour of pre-stressed concrete elements – General concept of pre-stress – Force transmitted by pre-tensioned and post-tensioned systems – deflection – crack width - losses in prestress – analysis for Ultimate strength – Comparison of codal provisions. **Practical Component: Nil**	**9 Hours**
DESIGN FOR FLEXURE Concept of Limit State design – Limit state of Collapse and serviceability – Design using allowable stresses – Stress range approach-Lin's approach – Magnel's approach – Analysis of Ultimate Strength **Practical Component: Nil**	**8 Hours**
DESIGN FOR SHEAR, TORSION AND ANCHORAGE ZONE Principal stresses – Shear resistance in beams – Design for shear in rectangular and flanged beams – Behaviour under torsion – Modes of failure - Design for torsion, shear and bending Anchorage Zone – analysis and design of pre-tensioned and post tensioned end blocks. **Practical Component: Nil**	**8 Hours**
STATICALLY INDETERMINATE STRUCTURES Analysis of indeterminate structures – Continuous beams – linear transformations - Concept of concordance – Choice of cable profiles – deflection of pre-stressed members. **Practical Component: Nil**	**8 Hours**
SPECIAL STRUCTURES Partial pre-stressing – Principles, analysis and design concepts - Concept of circular prestressing – Design of pre-stressed concrete pipes and cylindrical water tanks - Composite construction- types, behaviour, flexural stresses, longitudinal shear transfer, transverse shear–Compression members–Design of poles, piles. **Practical Component: Nil**	**7 Hours**
DESIGN FOR TENSION Design of Tension Members **Practical Component: Nil**	**5 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**



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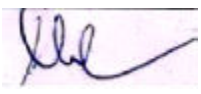
Learning Resources*
Textbooks:
1. N. Krishnaraju, 'Prestressed Concrete', Tata McGraw-Hill Publishing Company,4th Ed (2012) 2. N. Rajagobalan, 'Prestressed Concrete', Norosa Publishing House, (2014) 3. N.C. Sinha & S.K. Roy, 'Fundamentals of Prestressed Concrete' S. Chand & Co, New Delhi, (2011)
References:
1. Praveen Nagarajan, "Advanced Concrete Design", Person Publishers (2022) 2. P. Dayaratnam, "Pre stressed Concrete Structures", Scientific International Pvt. Ltd .(2022) 3. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York 4. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi (2012) 5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi. 6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.
Online Educational Resources:
1. https://archive.nptel.ac.in/courses/105/106/105106118/ 2. https://archive.nptel.ac.in/courses/105/106/105106118/ 3. https://archive.nptel.ac.in/courses/105/106/105106118/ 4. https://archive.nptel.ac.in/courses/105/106/105106118/

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Dr.A.Vennila Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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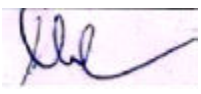
24STE011	STEEL CONCRETE COMPOSITE STRUCTURES	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	24STT506 Advanced Design of Steel Structures	Data Book / Codes / Standards (If any)	IS 800, IS 456, IS 11384

Course Objectives:	
The purpose of taking this course is to:	
1	Gain a comprehensive understanding of the principles of steel-concrete composite structures.
2	Explore the Properties, Behaviour, and Advantages Composite Structure
3	Examine the interactions between Steel And Concrete, including Bond Mechanisms,
4	Understand the shear transfer, and overall system performance With Case Studies

Course Outcomes:		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the knowledge in design concrete composite elements and structures	R
CO 2	Design of composite elements and structures like beams, columns, slabs and trusses as per IS code	U
CO 3	Design the connections in Composite Structures for shear and columns	Ap
CO 4	Design of composite beams, columns, trusses and box girder bridges as per IS codes	An
CO 5	Review various case studies on steel-concrete composite structures and seismic behaviour of composite structures	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1				2	1
2	1	3	2	3	2	
3	1			3		
4	1		2	2		2
5	1		2	3	3	



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Course Content	
INTRODUCTION Introduction to steel - concrete composite construction – Codes – Composite action – Serviceability and Construction issues in design, theory of composite structures. **Practical Component: Nil**	**9 Hours**
DESIGN OF COMPOSITE MEMBERS Design of composite beams, slabs, columns, beam – columns - Design of composite trusses. **Practical Component: Nil**	**9 Hours**
DESIGN OF CONNECTIONS Shear connectors – Types – Design of connections in composite structures – Design of shear connectors – Partial shear interaction. Deck slab – encased columns – in filled columns subjected to Uni-axial & Bi-axial. **Practical Component: Nil**	**9 Hours**
COMPOSITE BOX GIRDER BRIDGES Introduction - behaviour of box girder bridges and its types - design procedure & concepts. **Practical Component: Nil**	**9 Hours**
CASE STUDIES Case studies on steel - concrete composite construction in buildings - seismic behaviour of composite structures. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

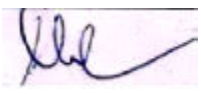
Learning Resources

Textbooks:

1. Johnson R.P., "Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings", Vol.I, Blackwell Scientific Publications, (2019).
2. Oehlers D.J. and Bradford M.A., "Composite Steel and Concrete Structural Members, Fundamental behaviour", Pergamon press, Oxford, (2013).

References:

1. Owens.G.W and Knowles.P, "Steel Designers Manual", Steel Concrete Institute(UK), Oxford Blackwell Scientific Publications, (2003).
2. HarshadBhandari," Analysis and Design of Steel and Composite Structures" Scitus Academics LLC (Publisher), (2016).



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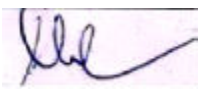
3. Teaching resource for, "Structural Steel Design," Volume 2 of 3, Institute for Steel Development and Growth (INSDAG), (2011).
Online Educational Resources:
1. https://www.youtube.com/watch?v=fRqxXkxApSY 2. https://www.classcentral.com/course/engineering-purdue-university-design-of-steel-con-22576

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Dr.A.Vennila Civil Engineering
Recommended by BoS on		
Academic Council Approval		**Date**



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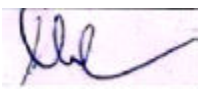
24STE012	DESIGN OF STRUCTURES FOR DYNAMIC LOADS	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 1893, IS 4326, IS 4991, IS 13920

Course Objectives:	
The purpose of taking this course is to:	
1	Explain behaviour of concrete structures subjected to various dynamic loads
2	Design the structures for dynamic loads like blast loads, Impact loads, earthquake and wind loads.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the behavior of structures under dynamic loads, importance of ductility	U
CO 2	Design framed structures and shear walls for earthquake with ductility concept	Ap
CO 3	Design structures subjected to blast and impact loads	Ap
CO 4	Design structures for wind loads including tall structures and chimneys.	Ap
CO 5	Perform ductile detailing and understand energy absorption capacity	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1					
2	1		1	3	2	
3	1			2		
4	2		2	2		
5	1		2	2	3	



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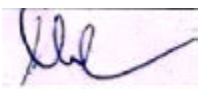
Course Content	
GENERAL Factors affecting design against dynamic loads - Behaviour of concrete, steel, masonry and soil under impact and cyclic loads - Recap of Structural dynamics with reference to SDOF, MDOF and continuum systems - Ductility and its importance. **Practical Component: Nil**	**9 Hours**
DESIGN AGAINST EARTHQUAKES Earthquake characterisation - Response spectra - seismic coefficient and response spectra methods of estimating loads - Response of framed, braced frames and shear wall buildings - Design as per BIS codes of practice - Ductility based design. **Practical Component: Nil**	**9 Hours**
DESIGN AGAINST BLAST AND IMPACT Characteristics of internal and external blast - Impact and impulse loads - Pressure distribution on buildings above ground due to external blast - underground explosion - Design of buildings for blast and impact as per BIS codes of practice. **Practical Component: Nil**	**9 Hours**
DESIGN AGAINST WIND Characteristics of wind - Basic and Design wind speeds - Effect of permeability of the structure – pressure coefficient - Aeroelastic and Aerodynamic effects - Design as per BIS code of practice including Gust Factor approach - tall buildings, stacks and chimneys. **Practical Component: Nil**	**9 Hours**
SPECIAL CONSIDERATIONS Energy absorption capacity – Ductility of the material and the structure – Detailing for ductility – Passive and active control of vibrations – New and favourable materials - Case studies. **Practical Component: Nil**	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources
Textbooks:
1. S.K.Duggal, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi (2015). 2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi (2016).
References:



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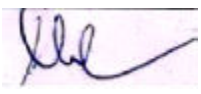
1. Clough R. W. and Penzien J., Dynamics of Structures, McGraw Hill Inc., US (2015).
2. A.K. Chopra, Dynamics of Structures – Theory and Applications of Earthquake Engineering, Pearson Education (2020).
3. Damodarasamy and Kavitha, Basics of Dynamics and Aseismic Design, PHI Learning Pvt Ltd (2009).
4. Andreas Kappos, Dynamic Loading and Design of Structures, CRC Press, Taylor & Francis Group, (2020)

Online Educational Resources:

1. https://www.researchgate.net/publication/382062770_Design_of_Structures_Subjected_to_Blast_Loads_Analysis_and_Design_Review
2. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nicee.org/iaee/E_Chapter3.pdf

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Dr.K.Ramadevi Civil Engineering
Recommended by BoS on		
Academic Council Approval		**Date**



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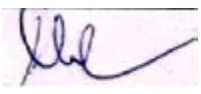
24STE013	STRUCTURAL OPTIMIZATION	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Study the optimization methodologies applied to structural engineering
2	Apply optimization principles to achieve optimum design

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply knowledge on the recent advances in optimization and differential calculation	U
CO 2	Create cost effective designs by linear programming and simplex method	Ap
CO 3	Create cost effective designs by non-linear programming using Interpolation methods. Unconstrained optimization techniques	Ap
CO 4	Explain algorithm for geometric and dynamic programming using computer Algorithm for geometric and dynamic Programming	An
CO 5	Design various structural elements with minimum weight and software packages for optimization	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1					
2	1		1	2	2	
3	1			2		
4	1			2		
5	2		2	3		



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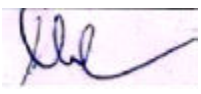
Course Content	
BASIC PRINCIPLES Definition - Objective Function; Constraints - Equality and inequality - Linear and nonlinear, Side, Non-negativity, Behaviour and other constraints - Design space - Feasible and infeasible - Convex and Concave - Active constraint - Local and global optima. Differential calculus - Optimality criteria - Single variable optimization - Multivariable optimization with no constraints - (Lagrange Multiplier method) - with inequality constraints (Khun - Tucker Criteria). **Practical Component: Nil**	**9 Hours**
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. Computer Algorithm for Linear Programming. **Practical Component: Nil**	**9 Hours**
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 (Multivariables): Unconstrained multivariable functions - Univariate method - Cauchy's steepest descent method - Conjugate gradient method (Fletcher Reeves) - Variable metric methods - (Davidon - Fletcher Powell). Constrained optimization techniques: Direct and indirect methods - Cutting plane method - Methods of feasible direction - Interior penalty function - Exterior penalty function method. **Practical Component: Nil**	**9 Hours**
GEOMETRIC AND DYNAMIC PROGRAMMING Hours Posynomial - 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. Computer Algorithm for Geometric Programming Hours Bellman's principle of optimality - Representation of a multistage decision problem - concept of sub-optimization problems using classical and tabular methods. Computer Algorithm for Dynamic Programming **Practical Component: Nil**	**9 Hours**
STRUCTURAL APPLICATIONS Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory - Minimum weight design for truss members -	**9 Hours**



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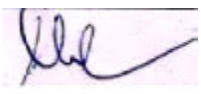
Fully stressed design - Optimization principles to design of R.C. structures such as multistorey buildings, water tanks, bridges, shell roofs. Use of Software packages for optimization **Practical Component: Nil**	

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources
Textbooks:
1. Rao, S.S. "Engineering Optimization: Theory and Practice", Fourth Edition, Wiley Eastern (P) Ltd., (2013) 2. Iyengar. N.G.R and Gupta. S.K, "Structural Design Optimization", Affiliated East West Press Ltd, New Delhi, (1997).
References:
1. Spunt, "Optimization in Structural Design", Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey (2016). 2. Uri Kirsch, "Optimum Structural Design", McGraw Hill Book Co. (2020). 3. Haftka, R. T. and Gurdal, Z., Elements of Structural Optimization, Springer, 3rd Edition, (2018)
Online Educational Resources:
1. https://archive.nptel.ac.in/courses/105/103/105103210/ 2. https://archive.nptel.ac.in/courses/105/108/105108127/

Assessment (Theory course)
CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Dr.K.Ramadevi Civil Engineering
Recommended by BoS on		
Academic Council Approval		**Date**



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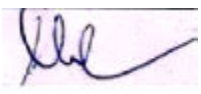
24STE014	DESIGN OF OFFSHORE STRUCTURES	L	T	P	J	C
		3	0	0	0	3
PE		SDG	9,12,13,14			

Pre-requisite courses	Nil	Data Book / Code book (If any)	IS 456, IS 4651, API, DNV

Course Objectives:	
The purpose of taking this course is to:	
1	To learn the types and functions of offshore structure
2	To study the behaviour of structures subjected to waves
3	To study the effect of the different load considerations in the analysis procedures for offshore structures.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Interpret the fundamentals of wave mechanics and offshore structures	U
CO 2	Understand and apply principles of wave and structural analysis for offshore platforms	An
CO 3	Analyze the design specifications and standards for offshore structures	Ap
CO 4	Design offshore structural elements as per standards	C
CO 5	Recognize the principles of material selection and corrosion protection methods for offshore structures	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3	2	1	1	1	1
2	3	3	3	2	2	1
3	2	2	2	1	3	1
4	3	2	1	1	1	1
5	3	2	3	2	3	2



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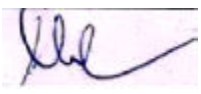
Course Content	
INTRODUCTION TO WAVE MECHANICS Wind generated waves– Small and finite Amplitude Wave Theory; Formulation and solution, Wave Celerity, Length and Period, Classification of waves based on relative depth, Orbital motions and Pressure – Standing waves – Wave trains and Wave energy – Wave reflection, refraction and diffraction – Breaking of waves. Types of wave theories and its applications. **Practical Component: Nil**	**7 Hours**
OFFSHORE STRUCTURES Offshore engineering- Types of Offshore Structures and platforms – Fixed (Gravity and jacket), floating and subsea (hybrid) - Functions of offshore structures, Components of a Typical Offshore Structure, Structural Systems for shallow, medium and deep water, offshore pipelines and risers; Steel, concrete, and hybrid platforms. **Practical Component: Nil**	**8 Hours**
ANALYSIS OF OFFSHORE STRUCTURES Site-specific data collection for meteorological, oceanographic, and geotechnical factors - Gravity Loads, Wind Load, Offshore Loads, Fatigue Load, Seismic Loads, Wave load, Current loads - Wave and Structural Analysis – Return Waves: Concept and impact on offshore structures. Static & Dynamic Analyses: Principles and use of approximate methods for fixed platforms- Loads and stability during handling and towing, Fatigue analysis of fixed and floating offshore structure, stress concentration, S-N curves - Palmgren-Miner Cumulative Damage Rule - SDOF and MDOF models, Dynamic response of different platforms. **Practical Component: Nil**	**8 Hours**
DESIGN OF OFFSHORE STRUCTURAL ELEMENTS Design Specifications & Standards for offshore structure design: API, DNV, IS 4651, API RP 2A, ISO 19900 series, Lloyd's Register, and other classification societies - Offshore Platform Construction – Overview of design and construction methods for Jacket and Gravity Platforms; Design of Structural Elements of offshore structures - General principles for platform components - Introduction, failure modes, and design considerations as per API codes - Fatigue of Tubular Joints - Practical applications of codes in offshore projects through real-world case studies. **Practical Component: Nil**	**15 Hours**
MATERIALS AND CORROSION PROTECTION Materials for offshore structures - Steel, concrete, and composite materials –Corrosion mechanism – Types of corrosion - Offshore structure corrosion zones - Preventive measures of Corrosion – Principles of cathode protection systems and coatings– Sacrificial anode method and impressed current method – Online corrosion monitoring – Corrosion fatigue. Case studies on fixed platform construction and its erection. **Practical Component: Nil**	**7 Hours**



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Theory Hours:	45	Tutorial Hours:	0	Practical Hours:	0	Project Hours:	0	Total Hours:	45

Learning Resources:

Textbooks:

1. Srinivasan Chandrasekaran, Dynamic Analysis and Design of Offshore Structures, Springer Nature Publicaions, (2018)
2. Mohamed A. El-Reedy, Offshore Structures: Design, Construction and Maintenance, Gulf Professional Publishing, (2019).

References:

1. McClelland, B., and Reifel, M.D. Planning and Design of Fixed Offshore Platforms. Van Nostrand Reinhold, (1986).
2. API Recommended Practice 2A-WSD, Recommended Practice for Planning, Designing, and Constructing Fixed Offshore Platforms - Working Stress Design, 22nd Edition. (2020)
3. Indian Standards: IS 4651 (various parts), Code of Practice for Planning and Design of Ports and Harbours. Chakrabarti, S.K. Handbook of Offshore Engineering, Volumes 1 & 2. Elsevier, (2005).
4. Clauss, G.F., Lehmann, E., and Östergaard, C. Offshore Structures: Volume 1: Conceptual Design and Hydromechanics. Springer, (2012).
5. B.C Gerwick, Jr., Construction of Marine and Offshore Structures, CRC Press, Florida, (2007).
6. Planning, Designing and Constructing Fixed Offshore Platforms, API RP 2 A., API., (2009).

Online Educational Resources:

1. https://archive.nptel.ac.in/courses/114/106/114106011/#
2. https://onlinecourses.nptel.ac.in/noc24_oe05/preview
3. https://onlinecourses.nptel.ac.in/noc24_oe04/preview

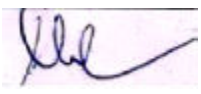
Assessment (Theory course)

CAT, Activity and Learning Task(s)*, Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Ms. S.Rajalakshmi Civil Engineering

Recommended by BoS on			
Academic Council Approval		Date	



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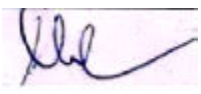
INDUSTRY DRIVEN ELECTIVES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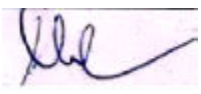
24STC015	ENERGY EFFICIENT BUILDINGS	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11, 12, 13			

Pre-requisite courses	Nil	Data Book / Code book (If any)	(ECBC) 2007, ISO 50002:2014

Course Objectives:	
The purpose of taking this course is to:	
1	Provide an understanding of the concept of reduction in energy consumption through low or net zero energy building design
2	Introduce strategies to integrate daylighting and low energy heating/cooling in buildings

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the concepts of energy efficiency	U
CO 2	Understand the principles of passive solar heating and cooling	U
CO 3	Analyze the components and techniques used in day lighting and electrical lighting	An
CO 4	Analyze the various systems involved in heat control and ventilation	An
CO 5	Design various energy efficient buildings	E
CO 6	Design and a project that applies energy-efficient design principles to a specific building type and execute Case study/Field visits.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1	1	2	2	1	
2	1	1	2	2		
3	1		1	3		
4	3		1	3	1	2
5	3	1	3	3	2	2
6	3	3	3	2	2	2



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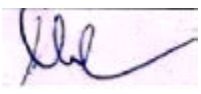
Course Content	
INTRODUCTION Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams **Practical Component: Nil**	**6 Hours**
PASSIVE SOLAR HEATING AND COOLING General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies. **Practical Component: Nil**	**6 Hours**
DAYLIGHTING AND ELECTRICAL LIGHTING Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts – Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design.. **Practical Component: Nil**	**6 Hours**
HEAT CONTROL AND VENTILATION Hourly Solar radiation – Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Design for Natural Ventilation – Calculation of probable indoor wind speed. **Practical Component: Nil**	**6 Hours**
DESIGN FOR CLIMATIC ZONES Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials - Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification **Practical Component: Nil**	**6 Hours**
PROJECT COMPONENT Design an energy-efficient building for a Residential / Commercial /Institutional building. Integrate principles of passive solar heating, daylighting, heat control, and	**30 Hours**



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ventilation. Assess energy savings, environmental impact, and potential improvements using software.	

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**30**	**Total Hours:**	**60**

Learning Resources

Textbooks:

1. Zhiqiang John Zhai, Energy Efficient Buildings: Fundamentals of Building Science and Thermal Systems, Wiley Publications, New Jersey, (2022).
2. Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non Conventional Energy Sources, (2002)

References:

1. Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley ad Sons Inc, (2013)
2. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, (2017).
3. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) (1995)
4. Moore, F., Environmental Control System, McGraw Hill Inc. (2002).
5. Tyagi, A.K. (Ed). Handbook on Energy Audits and Management Tata Energy Research Institute, (2010)

Online Educational Resources:

1. http://www.wbdg.org/resources/daylighting.php
2. https://www.kaarwan.com/blogs/architecture/key-initiatives-for-energy-efficient-buildings-in-india?id=416
3. https://www.energy.gov/eere/energy-efficiency-buildings-and-industry

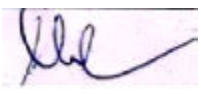
Assessment (Embedded course)

SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		-

Recommended by BoS on			
Academic Council Approval		**Date**	



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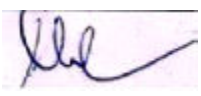
24CNC016	CONSTRUCTION SITE ADMINISTRATION AND CONTROL (Common for M.E Structural Engineering and M.E Construction Management)	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11			

Pre-requisite courses	Nil	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Equip students with the skills to analyze project delays and develop effective mitigation strategies.
2	Enable students to evaluate the effectiveness of different project delivery systems.
3	Provide students with site management techniques focused on safety and layout planning.
4	Develop an understanding of the Field Procedure Manual for labour and wast e management.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyse project delays and suggest mitigation strategies.	An
CO 2	Evaluate project delivery systems' effectiveness.	An
CO 3	Apply site management techniques for layout and safety.	Ap
CO 4	Analyse the Field Procedure Manual for labour and waste management.	An
CO 5	Create a communication plan using digital tools and ERP.	An
CO 6	Design and execute a project plan focusing on site management and control using modern digital tools.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Mastering Sustainable Practices	Applying advanced techniques and innovative technology	DEvaluate solution considering public health and environmental factors	adopting advanced design tools for project management & research	technological advancement for complex engineering solutions	Community involvement through appropriate design standards
1	3		2	3	2	3
2	3		2	3	2	3
3	3		2	3	2	3
4	3		2	3	2	3
5	3		2	3	2	3
6	3	3	3	3	3	3



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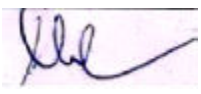
Course Content	
INDIAN CONSTRUCTION INDUSTRY AND PROJECT ECONOMICS Overview - Sectors - Project Delays: Causes & Mitigation - GDP Contribution - Construction as a Business - Risk Management - Economic Indicators - Sustainable Practices - Technology Integration - Industry Case Studies	**6 Hours**
PROJECT LIFE CYCLE AND DELIVERY SYSTEMS Life Cycle Phases: Concept to Completion - Stakeholder Roles - Delivery Systems: Design-Bid-Build, Design-Build, EPC, PPP - Merits & Demerits - Integrated Project Delivery (IPD) - Technology in Delivery - Agile Management - Stakeholder Communication - Case Studies	**6 Hours**
CONSTRUCTION SITE MANAGEMENT Site Layout Planning - Site Facilities Setup - Safety Management - Accident Prevention - Digital Documentation - Contract Administration - Lean Construction - AI in Site Management - Case Studies	**6 Hours**
FIELD PROCEDURE MANUAL AND RESOURCE MANAGEMENT Field Procedure Manual (FPM) - Labor & Subcontractor Management - Site Waste Management - Measurement & Billing - Project Control Estimate - Escalation Management - ERP Systems - Case Studies	**6 Hours**
PROJECT COMMUNICATION AND CASE STUDIES Project Communication Tools - Meetings & Reviews - Organizational Relationships - ERP in Construction - Digital Collaboration - Real-World Case Studies - Lessons Learned - Future Trends.	**6 Hours**
PROJECT COMPONENT Develop a detailed project plan that includes site layout, safety management, digital documentation practices, and communication strategies using ERP tools. Present their plans and showcase their implementation of modern site management techniques.	**30 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**30**	**Total Hours:**	**60**

Learning Resources

Textbooks:

1. Mincks, W., & Johnston, H. Construction Jobsite Management. Delmar Cengage Learning, New York. (2011).
2. Ritz, G. Total Construction Project Management. McGraw-Hill, Singapore. (1994).



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3. Jha, N. Construction Project Management: Theory and Practice. Pearson Education, 2nd Edition, India. (2015).

Reference books & Weblinks:

1. Joy, P. (2007). Handbook of Construction Management. Macmillan India Limited, New Delhi.
2. Moore, D.Project Management – Designing Effective Organizational Structures in Construction. Blackwell Publishing, London. (2001).
3. Gould, F. E., & Joyce, N. E. Construction Project Management. Pearson, USA. (2011)

Online Resources:

1. https://www.leanconstruction.org
2. https://www.autodesk.com/solutions/construction-site-management
3. https://www.procore.com

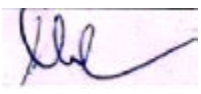
Assessment (Embedded course)

SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		1. Dr. P.A.Prabakaran AP/Civil 2. Ms.U.Sindhu Vaardini AP/Civil 3. Mr.P.Aswin Bharath AP/Civil

Recommended by BoS on			
Academic Council Approval		**Date**	



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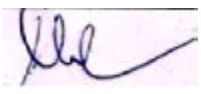
24STC017	STRUCTURAL HEALTH MONITORING	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11, 12, 13			

Pre-requisite courses	Nil	Data Book / Code book (If any)	(ECBC) 2007, ISO 50002:2014

Course Objectives:	
The purpose of taking this course is to:	
1	Make the students familiar with various structural health monitoring tools and techniques
2	Impart practical skills in structural health monitoring to the students

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Comprehend the necessity, benefits, and challenges of Structural Health Monitoring (SHM).	U
CO 2	Recognize the various types of sensors and instrumentation methods used in SHM	U
CO 3	Acquire knowledge of both static and dynamic measurement techniques	An
CO 4	Evaluate and contrast different damage detection techniques	An
CO 5	Outline the various data processing approaches using case studies	An
CO 6	Present research findings on structural health monitoring through lab demonstrations and propose solutions based on the research outcomes	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	1	1	2	2	1	
2	1	1	2	2	1	
3	1	1	1	3	2	2
4	1	1	1	3	2	1
5	1	1	2	3	1	3
6	3	3	3	2	2	2



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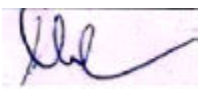
Course Content	
INTRODUCTION Need for Structural Health Monitoring (SHM), SHM versus Non-Destructive Evaluation, Methods of SHM- Local & Global Techniques for SHM, Short & Long-Term Monitoring, Active & Passive Monitoring, Remote Structural Health Monitoring- Advantages of SHM - Challenges in SHM. **Practical Component: Nil**	**6 Hours**
SENSORS AND INSTRUMENTATION FOR SHM 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. **Practical Component: Nil**	**6 Hours**
STATIC AND DYNAMIC MEASUREMENT TECHNIQUES FOR SHM 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. **Practical Component: Nil**	**6 Hours**
DAMAGE DETECTION 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. **Practical Component: Nil**	**6 Hours**
CASE STUDIES Case studies of SHM in Civil/ Structural engineering structures like Bridges, Piers, Dams, Framed structures etc., in India and abroad. **Practical Component: Nil**	**6 Hours**
PROJECT COMPONENT To assess the health of a structural component applying Non-destructive testing. To test RC elements like beams/columns using load cells. To demonstrate seismic behaviour of models using Vertical Shake Table and Horizontal Shake Table tests & measure acceleration, frequency, amplitude etc., using software. Perform flexure test on RC beam and determine Curvature & assess the damage using wave propagation method like UPV method for a building.	**30 Hours**



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Theory Hours:	30	Tutorial Hours:	0	Practical Hours:	0	Project Hours:	30	Total Hours:	60

Learning Resources

Textbooks:

1. Hua-Peng Chen, Structural Health Monitoring of Large Civil Engineering Structures, Wiley Publishers, (2018).
2. Douglas E Adams, Health Monitoring of Structural Materials and Components Methods with Applications, Wiley Publishers, (2007)

References:

1. Daniel Balageas, Peter Fritzen, Alfredo Guemes, Structural Health Monitoring, John Wiley & Sons, (2015).
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 Giurglutiu, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc, (2007)

Online Educational Resources:

1. https://archive.nptel.ac.in/courses/114/106/114106046/

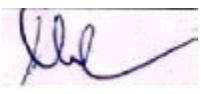
Assessment (Embedded course)

SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr.K.Ramadevi Civil Engineering

Recommended by BoS on			
Academic Council Approval		Date	



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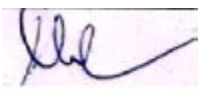
24STC018	PREFABRICATED STRUCTURES	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11			

Pre-requisite courses	Course code(s)	Data Book / Code book (If any)	IS 15916-2010

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the Design Principles of Prefabrication
2	Apply Reinforced Concrete Concepts to Prefabricated Structures
3	Design Floors, Stairs, Roofs, Wall Systems and Industrial Building for Prefabricated Structures
4	Design prefabricated elements applying the techniques and demonstrate various case studies

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply design principles and IS Code specifications to plan and layout a prefabrication plant.	Ap
CO 2	Analyze the structural behavior of prefabricated reinforced concrete components to optimize connections between beams and columns.	An
CO 3	Evaluate different types of floor slabs and roof systems to assess their suitability for prefabrication and construction methods.	E
CO 4	Examine wall panel systems and joints to recommend solutions for load transfer and stability in prefabricated structures.	E
CO 5	Evaluate the design and erection processes of industrial buildings and shell roofs to ensure compliance with prefabrication standards.	E
CO 6	Develop structural design for various prefabricated buildings incorporating design principles and work on real-world case studies and field visits.	Ap



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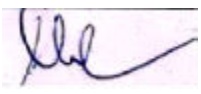
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3		3	3	3	
2	2		3	3	3	
3	3		3	3	3	
4	2		3	3	3	
5	3		3	3	3	
6	3	3	3	2	2	2

Course Content	
DESIGN PRINCIPLES 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. **Practical Component: Nil**	**6 Hours**
PRECAST ELEMENTS AND CONNECTIONS 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. **Practical Component: Nil**	**6 Hours**
FLOORS, STAIRS AND ROOFS 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. **Practical Component: Nil**	**6 Hours**
PRECAST WALLS Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall	**6 Hours**



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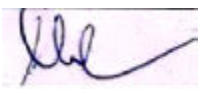
panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, Lateral load resistance, Location and types of shear walls, approximate design of shear walls. **Practical Component: Nil**	
INDUSTRIAL BUILDINGS AND SHELL ROOF Components of 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. **Practical Component: Nil**	**6 Hours**
PROJECT • Students shall undergo field visits and demonstrate various real-world case studies on various prefabricated structures. • The project work includes applying the prefabricated design principles to design various building elements.	**30 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**30**	**Total Hours:**	**60**

Learning Resources
Textbooks:
1. L. Mokk, Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian, Academy of Sciences, Budapest, (2007). 2. Koncz T., Manual of precast concrete construction, Vol..I, II and III, Bauverlag, GMBH, (2023).
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, (2023). 3. Laszlo Mokk, Prefabricated Concrete for Industrial and Public Structures, Akademiai Kiado, Budapest, (2023). 4. Lewicki.B, Building with Large Prefabricates, Elsevier Publishing Company, (2006). 5. Structural Design manual, Precast concrete connection details, Society for studies in the use of Precast concrete, Netherland Betor Verlag, (2009).
Online Educational Resources:
1. https://nptel.ac.in/courses/105/106/105106117/ 2. https://www.youtube.com/watch?v=b9WQhnYq81s 3. https://www.iith.ac.in/~prestressed/index.htm

Assessment (Embedded course)
SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce



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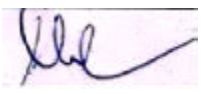
Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
			Mr.P.Nandhakumar Civil Engineering
Recommended by BoS on			
Academic Council Approval		**Date**	



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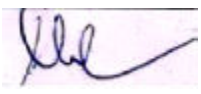
24STC019	DESIGN OF FORMWORK	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11			

Pre-requisite courses	Course code(s)	Data Book / Code book (If any)	IRC 87, IS 456, IS 14687

Course Objectives:	
The purpose of taking this course is to:	
1	Provide an exposure on the significance of formwork, materials and design procedures
2	Design special formwork, decks and falseworks & assess formwork failures

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify proper formwork and select accessories & material required.	U
CO 2	Design the form work for conventional structural elements	Ap
CO 3	Design the form work for special structures and identify formwork management issues	Ap
CO 4	Assess the formwork failures through case studies	An
CO 5	Design decks and falseworks	C
CO 6	Design formwork for various structural elements incorporating design principles and work on real-world case studies and field visits.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3	1	2	2	2	
2	2	1	3	3	3	
3	3	1	3	3	3	
4	2	1	2	2	2	
5	3	1	2	2	2	2
6	3	3	3	2	2	2



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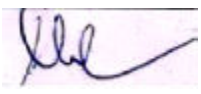
Course Content	
INTRODUCTION Formwork and Falsework, Requirements and Selection of Formwork. Formwork Materials- Timber, Plywood, Steel, Aluminium, Plastic, and Accessories. Horizontal and Vertical Formwork Supports. **Practical Component: Nil**	**6 Hours**
FORMWORK DESIGN Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beam. **Practical Component: Nil**	**6 Hours**
FLYING FORMWORK Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre and Post Award. **Practical Component: Nil**	**6 Hours**
FORMWORK FAILURES Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Storey Building Construction. **Practical Component: Nil**	**6 Hours**
DESIGN OF DECKS AND FALSE WORKS Types of beam, decking and column formwork, Design of decking, False work design, Effects of wind load, Foundation and soil on false work design. **Practical Component: Nil**	**6 Hours**
PROJECT • Students shall undergo field visits and demonstrate various real-world case studies on various formworks. • The project work includes applying the design principles of formwork to design various formworks, special formworks, decks, falseworks etc.,	**30 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**30**	**Total Hours:**	**60**

Learning Resources
Textbooks:
1. Robert L. Peurifoy and Garold D.Oberlender, Formwork for Concrete Structures, McGraw Hill Professional, New York, (2011). 2. K. P. Raghavan, S. Natarajan and V. Thamilarasu, Formwork management In Construction, Khanna Publishing House, New Delhi, (2024).
References:



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1. Michael P. Hurst, Construction Press, London and New York, (2003).
2. Austin, C.K., "Formwork for Concrete", Cleaver -Hume Press Ltd., London, (2008).
3. Hurd, M.K., "Formwork for Concrete", Special Publication No.4, American Concrete Institute, Detroit, (1996)
4. Robert L. Peurifoy and Garold D. Oberlender, "Formwork For Concrete Structures", McGraw - Hill , (1996).

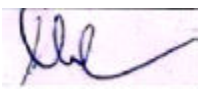
Online Educational Resources:

1. https://www.researchgate.net/publication/261411286

Assessment (Embedded course)
SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		- Dr.K.Ramadevi Civil Engineering

Recommended by BoS on			
Academic Council Approval		**Date**	



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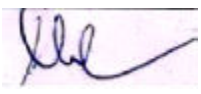
24STC020	PRE-ENGINEERED BUILDINGS	L	T	P	J	C
		2	0	0	2	3
PE		SDG	9, 11			

Pre-requisite courses	Course code(s)	Data Book / Code book (If any)	IRC 800, IS 15916

Course Objectives:	
The purpose of taking this course is to:	
1	Introduce pre-engineered buildings, materials used and design methodology.
2	Evaluate design loads on PEB structures, design framed structures and study the equipment used for transportation of PEB components

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Classify different materials used for pre-engineered buildings & pre-engineered building components.	U
CO 2	Classify different building components of pre-engineered buildings	An
CO 3	Evaluate various types of loads on pre-engineered buildings	An
CO 4	To design the pre-engineered rigid frames and shear connections for PEB systems as per IS codes	C
CO 5	Understand the equipment used for transportation of various types of vertical and horizontal of PEB elements	U
CO 6	Design PEB structure applying pre-engineered building design methodology and work on real-world case studies and field visits.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research /investigation and work	Write and present a substantial technical report/document	Demonstrate a degree of mastery over the area	Analyze and solve complex structural engineering problems	Use modern/advanced techniques, tools and skills	Communicate with larger community, to design and document complex problems
1	3	1	2	2	2	
2	2	1	3	3	3	
3	3	1	3	3	3	
4	2	1	2	2	2	
5	3	1	2	2	2	2
6	3	3	3	2	2	2



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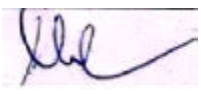
Course Content	
INTRODUCTION TO PRE-ENGINEERED BUILDINGS Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre-Engineered buildings. **Practical Component: Nil**	**6 Hours**
PRE-ENGINEERED BUILDING COMPONENTS **Primary System:** Main frames, Gable End Frame - Secondary frame system: Sizes and Properties of Purlins & Girts – **Bracing System:** Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Staircases. **Practical Component: Nil**	**6 Hours**
DESIGN LOADS ON PRE-ENGINEERED BUILDINGS. Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and other applicable Loads. Serviceability Limits as per code. **Practical Component: Nil**	**6 Hours**
PEB DESIGN METHODOLOGY Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/tw, bf/tf ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations. Analysis and Design of Rigid Frames. Rigid Frame Moment Connection, Shear Connection- Anchor bolt and base plate design (Pinned and Fixed). **Practical Component: Nil**	**6 Hours**
EQUIPMENT FOR TRANSPORTATION Equipment for horizontal and vertical transportation of PEB elements. **Practical Component: Nil**	**6 Hours**
PROJECT COMPONENT Design a pre-engineered building applying principles of PEB and as per IS guidelines. Students shall undergo field visits and demonstrate various real-world case studies on various pre-engineered structures.	**30 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**30**	**Total Hours:**	**60**



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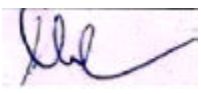
Learning Resources
Textbooks:
1. Aswin palaniappan Subramanian, Hariharan Subbiah Subramanian, Pre Engineered Building(PEB) AND Rules of Thumb For Steel Design (PEB), Kindle Edition, (2021) 2. K.S.Vivek&P.Vaishavi – Pre Engineered Steel Buildings, Lambert Academic Publishing, (2017).
References:
1. Alexander Newman, Metal Building Systems, Design and Specifications, Mc Graw Hill, 2nd Edition. (2015).
Online Educational Resources:
1. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ofbcipher.s3.amazonaws.com/tendersDataFiles/iocletenders.nic.in/2018_NRO_76642_1/SpecificationofPreEngineered.pdf 2. https://archive.nptel.ac.in/courses/105/106/105106113/

Assessment (Embedded course)
SA, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		- Dr.K.Ramadevi Civil Engineering	
Recommended by BoS on			
Academic Council Approval		**Date**	



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