Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Affiliated to Anna University, Chennai; Approved by AICTE ; Accredited by NAAC with Grade 'A++'
Accredited by NBA - Tier1 (Mech, Auto, Civil, EEE, ECE, E&I and CSE)
Udumalai Road, Pollachi - 642 003 Tel: 04259-236030/40/50 Fax: 04259-236070 www.mcet.in

Curriculum and Syllabi
M.E., Structural Engineering

Semesters I to IV

Regulations 2019

M.E., STRUCTURAL ENGINEERING

Curriculum for Semester I to IV

Dr.Mahalingam College ofEngineering and Technology

Office of Controller of Examinations

2019 Regulations -Course Code Generation Procedure for PG Courses

1	2	3	4	5	6	7	8	9	10
1	9	A	E						

Regulations

Board /Departments	
Character Type-Alphabet	
AE	Applied Electronics
CC	CAD / CAM
CO	Communication Systems
CP	Computer Science
ST	Structural Engineering
CA	Computer Applications
SH	Science and Humanities

Semester Number	
Character Type-Number	
1to4	Semester
0	Floating Semester

Course Type	
Character Type – Alphabet	
F	Foundation Courses
C	Professional Core
E	Professional Elective
O	Open Elective
A	Audit Courses
P	Employability Enhancement Courses

Mode of Assessment	
Character type-Number	
1	Theory
2	Practical
3	Miniproject
4	Seminar
5	Project
6	Professional Skills
7	OCC

Common to any board /Departments	
Character Type-Alphabet	
G	Generic (common to all branches–ex. Communication skills)
N	Non Common Course(Individual)
C	Common Course(Ex Common to AE,CO,CS)

Sequence Number
Character type-Number
01,02,03….99

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Programme: M.E., STRUCTURAL ENGINEERING

2019 REGULATIONS

Curriculum for Semester I to IV

SEMESTER I

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STFN1101	Analytical and Numerical Methods	3	0	0	3	100	-
19STCN1101	Theory of Elasticity and Plasticity	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - I	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - II	3	0	0	3	100	-
19COFG1101	Research Methodologies and IPR	3	0	0	3	100	All
19STCN2101	Advanced Concrete Laboratory	0	0	4	2	100	-
19STCN2102	Structural Engineering Laboratory	0	0	4	2	100	-
19SHAG1101	English for Research Paper Writing	2	0	0	0	-	All
TOTAL		**17**	**0**	**8**	**19**	**700**	

Passed in BOS meeting

BOS Convener

Approved in AC meeting

BOS Chairperson

SEMESTER II

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STCN1201	Finite Element Methods	3	0	0	3	100	-
19STCN1202	Structural Dynamics	3	0	0	3	100	-
19STCN1203	Design of Sub Structures	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - III	3	0	0	3	100	-
XXXXXXXXXX	Professional Elective - IV	3	0	0	3	100	-
19STCN2201	Structural Design Laboratory	0	0	4	2	100	-
19STPN3201	Mini Project with Seminar	0	0	4	2	100	-
19SHAG1201	Teaching and Learning in Engineering	2	0	0	0	-	All
TOTAL		**17**	**0**	**8**	**19**	**700**	

SEMESTER III

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
XXXXXXXXXX	Professional Elective - V	3	0	0	3	100	-
XXXXXXXXXX	Open Elective	3	0	0	3	100	-
19STPN5301	Project - I	0	0	20	10	200	-
TOTAL		**6**	**0**	**20**	**16**	**400**	

SEMESTER IV

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STPN5401	Project - II	0	0	32	16	**400**	-
TOTAL		**0**	**0**	**32**	**16**	**400**	

Total Credits: 70

Passed in BOS meeting

BOS Convener

Approved in AC meeting

BOS Chairperson

PROFESSIONAL ELECTIVES – I

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STEN1101	Structural Stability	3	0	0	3	100	-
19STEN1102	Theory of Plates and Shells	3	0	0	3	100	-
19STEN1103	Structural Analysis by Matrix Methods	3	0	0	3	100	-

PROFESSIONAL ELECTIVES – II

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STEN1104	Experimental Methods and Model Analysis	3	0	0	3	100	-
19STEN1105	Advanced repair and rehabilitation techniques for concrete structures	3	0	0	3	100	-
19STEN1106	Structural Optimization	3	0	0	3	100	-

PROFESSIONAL ELECTIVES – III

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STEN1201	Advanced Steel Design	3	0	0	3	100	-
19STEN1202	Design of Bridges	3	0	0	3	100	-
19STEN1203	Design of High-Rise Buildings	3	0	0	3	100	-

Passed in BOS meeting

BOS Convener

Approved in AC meeting

BOS Chairperson

PROFESSIONAL ELECTIVES – IV

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STEN1204	Design of Advanced Concrete Structures	3	0	0	3	100	-
19STEN1205	Design of Industrial Structures	3	0	0	3	100	-
19STEN1206	Construction Facilities using Composite Materials	3	0	0	3	100	-

PROFESSIONAL ELECTIVES – V

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programme
		L	T	P			
19STEN1301	Design of Prestressed Concrete Structures	3	0	0	3	100	-
19STEN1302	Construction Techniques and Management	3	0	0	3	100	-
19STEN1303	Prefabricated of Structures	3	0	0	3	100	-
19STEN1304	Geoenvironmental Engineering	3	0	0	3	100	-

OPEN ELECTIVES

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
19STOC1301	Safety Engineering	3	0	0	3	100
19STOC1302	Waste to Energy	3	0	0	3	100
19CCOC1301	Automation Systems	3	0	0	3	100
19CCOC1302	Enterprise Resource Planning	3	0	0	3	100
19COOC1301	Cryptography and Network security	3	0	0	3	100
19COOC1302	Advanced Embedded systems	3	0	0	3	100
19CPOC1301	Business Analytics	3	0	0	3	100
19CPOC1302	Cyber Security and Computer Forensics	3	0	0	3	100

Passed in BOS meeting

BOS Convener

Approved in AC meeting

BOS Chairperson

Regulations 2019

Detailed Syllabi for Semesters I to IV

SEMESTER I

Course Code: 19STFN1101	Course Title: ANALYTICAL AND NUMERICAL METHODS		
Course Category: Core		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Utilize curve-fitting techniques for data representations and computation in engineering analysis
2. Solve linear system of equations and calculate the dominant eigen value.
3. Solve nonlinear equations and determine the integrals from the given data using numerical techniques
4. Solve initial and boundary value problems
5. Solve the Partial Differential Equations using numerical techniques

Unit I EMPIRICAL LAWS AND CURVE FITTING **9 Hours**

Laws reducible to the linear law- Least square curve fitting procedure-Fitting a straight line-Nonlinear curve fitting- Weighted least squares approximation- Linear Weighted least squares approximation.

Unit II MATRICES AND LINEAR SYSTEM OF EQUATIONS **9 Hours**

Solution of linear systems- Direct Methods – Gaussian Elimination method- Cholesky method-Iterative methods- Relaxation method – Iterative method for Eigen values- Power Method- Jacobi method.

Unit III SOLUTION OF NONLINEAR EQUATIONS AND INTERPOLATION **9 Hours**

Solution of nonlinear equations- Method of False position –Newton Raphson Method- Numerical Integration-Trapezoidal rule- Simpson's rule – Gaussian Quadrature- Numerical Double integration –Trapezoidal rule – Adaptive Integration.

Unit IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9 Hours**

Initial value problems-Taylor's series- Euler method- Runge-Kutta method- Predictor-Corrector method- Milne's method-Boundary value problem- Shooting method.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS **9 Hours**

Classification of second order equations- Finite Difference approximation to Derivatives- Solution of Laplace equation- Poisson equation- Solution of one-dimensional heat equation.

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Utilize curve-fitting techniques for data representations and computation in engineering analysis	Understand
CO.2. Solve linear system of equations and calculate the dominant eigen value.	Analyze
CO.3. Solve nonlinear equations and determine the integrals from the given data using numerical techniques	Analyze
CO.4. Solve initial and boundary value problems	Analyze
CO.5. Solve the Partial Differential Equations using numerical techniques	Analyze

Reference Book(s):

R1. Venkataraman M.K., Higher Mathematics for Engineering and Science, National publishing company, 2000.

R2. Grewal B.S, Higher Engineering Mathematics, 40th Edition, Khanna publishers, Delhi, 2007.

R3. Introductory Methods of Numerical Analysis, Sastry S.S, Prentice Hall of India, 1998.

R4. An Introduction to Numerical Analysis, Atkinson K.E., J. Wiley and Sons, 1989.

R5. Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (Shaum Series), 1988

Web References:

1. https://nptel.ac.in/courses/103/101/103101111/
2. https://swayam.gov.in/nd1_noc19_ma21/preview

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STCN1101	Course Title: THEORY OF PLASTICITY AND ELASTICITY		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the stress and strain behavior
2. Solve 2D problems in Cartesian and Polar coordinates
3. Solve problems on torsional behavior of the member
4. Solve problems on energy theorem to elastic problems
5. Explain the physical behavior of yield criteria of material

Unit I ANALYSIS OF STRESS AND STRAIN **9 Hours**

Analysis of stress and strain (two and three dimension)- Stress-strain relationship Generalized Hooke's Law- Lame's constants -Compatibility equations- 2D and 3D problems in Cartesian and Polar coordinates-Mohr Circle Theory

Unit II 2D PROBLEMS IN CARTESIAN AND POLAR COORDINATES **9 Hours**

Plane stress and plane strain - Airy's stress function- Bending of beam by uniform load - Thick cylinder under uniform pressure - Shrink and force fits - Stress concentration - Flat plate subjected to in plane traction and shear with circular hole - Boussinesque's equation-Wedge problem subjected to inclined loading

Unit III TORSION OF PRISMATIC BARS **9 Hours**

Torsion on prismatic bars- St. Venant's approach - Prandtl's approach - Membrane analogy - Torsion of thin walled- Open and closed sections-Design approach to open web section subjected to torsion

Unit IV ENERGY THEOREM ANALYSIS **9 Hours**

Strain energy for 2D and 3D -Principle of Complementary energy - Principle of virtual work - Reciprocal theorem -Engesser Theorems - Raleigh Ritz method

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V PLASTICITY **9 Hours**

Physical Assumptions -Plastic stress-strain relations-Strain hardening -Application to simple problems intension, compression, bending and torsion

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Explain the stress and strain behavior	Understand
CO.2. Solve 2D problems in Cartesian and Polar coordinates	Apply
CO.3. Solve problems on torsional behavior of the member	Analyze
CO.4. Solve problems on energy theorem to elastic problems	Apply
CO.5. Explain the physical behavior of yield criteria of material	Understand

Reference Book(s):

R1. Timoshenko, S. and Goodier J. N., Theory of Elasticity, McGraw Hill Book Co., New York, 2010.

R2. Jane Helena H, Theory of Elasticity and Plasticity, PHI Learning Pvt. Ltd., 2016

Web References:

1. https://nptel.ac.in/syllabus/112104042/
2. https://nptel.ac.in/courses/105108070/
3. https://nptel.ac.in/courses/105105177/

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19COFG1101	Course Title: RESEARCH METHODOLOGIES AND IPR (common to all PG Programme)		
Course Category: Foundation Courses		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Describe the overview of research methodology.
2. Explain the attitude measurements, scales and sampling methods
3. Apply hypotheses testing in research problem
4. Elucidate the research report writing and presentation effectively.
5. Apply patent and copyright for their innovative works.

Unit I Overview of Research Methodology **9 Hours**

Research methodology – definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

Unit II Attitude measurements, Scales and Sampling methods **9Hours**

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple ran dom sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non- probability sampling method – convenience sampling, judgment sampling, quota sampling.

Unit III Hypotheses testing **10Hours**

Hypotheses testing – Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests)

Unit IV Report Writing and Presentation **8Hours**

Report writing- Types of report, guidelines to review report, typing instructions, oral presentation

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V Patenting **9Hours**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO 1. Describe the overview of research methodology.	Understand
CO 2. Explain the attitude measurements, scales and sampling methods	Understand
CO 3. Apply hypotheses testing in research problem.	Apply
CO 4. Elucidate the research report writing and presentation effectively.	Understand
CO 5: Apply patent and copyright for their innovative works	Apply

Reference Book(s):

R1. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.
R2. Kumar, Ranjit, "Research Methodology: A Step by Step Guide for beginners", London Sage: Publications, 2005.
R3. Halbert, "Resisting Intellectual Property", Taylor & Francis Publications ,2007.
R4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Clause 8 Publishing, 2016.
R5. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand Publications, 2008.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STCN2101	Course Title: ADVANCED CONCRETE LABORATORY		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Course Objectives

The course is intended to:

1. Design a concrete mix based on IS methods of mix proportioning.
2. Determine the flow characteristics of self-compacting concrete.
3. Determine the effects of admixtures in fresh and hardened state of concrete.
4. Determine the various strength parameters on hardened concrete.
5. Determine the permeability tests on hardened concrete.

AREA OF EXPERIMENTS:

1. Mix Design of High strength concrete as per IS Method.
2. Determination of flow characteristics on self-compacting concrete.
3. Determine the effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
4. Determination of flow ability of cement paste.
5. Determination of compressive strength and split tensile strength of concrete.
6. Determination of Elastic modulus of concrete.
7. Determination of Water permeability test on concrete.
8. Determination of Rapid Chloride permeability test of concrete.

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO 1: Design a concrete mix based on IS methods of mix proportioning.	Apply
CO 2: Determine the flow characteristics of self-compacting concrete.	Apply
CO 3: Determine the effects of admixtures in fresh and hardened state of concrete.	Apply
CO 4: Determine the various strength parameters on hardened concrete.	Apply
CO 5: Determine the permeability tests on hardened concrete.	Apply

Reference (s):

R1. Neville A. M., and Brooks J. J., Concrete Technology, 2nd revised edition, Pearson publications, 2016

R2. Advanced Concrete Technology Laboratory Manual of Civil Engineering Department. MCET, 2019

R3. http://theconcreteportal.com

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STCN2102	Course Title: STRUCTURAL ENGINEERING LABORATORY		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Course Objectives

The course is intended to:

1. Explain the instrumentation used for load, strain measurement
2. Determine properties of the concrete specimens for NDT
3. Determine the behavior of structural members
4. Determine the effect of concrete and steel beam for flexure and for shear.
5. Determine the concrete column for buckling

AREA OF EXPERIMENTS:

1. Introduction and demonstrations to instrumentation (LVDT, Load cell, Hydraulic jack, Strain gauges)
2. Non-destructive testing of concrete (a) Rebound hammer (b) Impact-Echo method and (c) Ultrasonic pulse velocity.
3. Testing of constitutive behavior of steel, aluminum and wood specimens
4. Testing of Simply Supported Steel beams for Flexure and Shear
5. Casting and Testing of Simply Supported Reinforced Concrete beams for Flexure and Shear
6. Casting and Testing of Reinforced Concrete Columns for Buckling Behavior

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Explain the instrumentation used for load, strain measurement	Apply
CO.2. Determine properties of the concrete specimens for NDT	Apply
CO.3. Determine the behavior of structural members	Apply
CO.4. Determine the effect of concrete and steel beam for flexure and for shear.	Apply
CO.5. Determine the concrete column for buckling	Apply

Reference (s):

R1. A.R. Santhakumar, Concrete Technology, Oxford University Press,2007, New Delhi

R2. Relevant BIS Codes of practice for mix design, rebar testing, concrete design etc.

R3. Structural Engineering Laboratory Manual of Civil Engineering Department,MCET,2019.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19SHAG1101	Course Title: ENGLISH FOR RESEARCH PAPER WRITING (common to all PG Programme)		
Course Category: Audit Courses		Course Level: Introductory	
L:T:P(Hours/Week) 2:0:0	Credits: -	Total Contact Hours: 30	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Describe how to improve the writing skills and level of readability
2. Apply research writing skills in each section
3. Explain the skills needed when writing titles

Unit I Research Plan and preparatory tools **10 Hours**

Plan - Word Order - Break up long sentences - Paragraph and Sentence Structures - Concise and Remove Redundancy - Avoid Ambiguity and Vagueness - Preparation

Unit II Grammar for research **10 Hours**

Expand the vocabulary & phrases – Grammar & punctuation - Ensure the content - Review of the Literature - Conclusions

Unit III Key skills for preparation **10 Hours**

Clarify Who Did What – Highlight the Findings - Hedge and Criticise - Paraphrase - Check Plagiarism - Sections of a Paper - Abstracts –Introduction - Key skills needed when writing - a Title, an Abstract, an Introduction, a Review of the Literature, Methods, Results, Discussion, Conclusions

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO 1: Describe how to improve the writing skills and level of readability	Understand
CO 2: Apply research writing skills in each section	Apply
CO 3: Use the skills needed when writing titles	Apply

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Reference Book(s):

R1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

R2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006

R3. Kumar, Ranjit, "Research Methodology: A Step by Step Guide for beginners", London Sage: Publications, 2005.

Web References:

1. https://writing.wisc.edu/handbook/assignments/planresearchpaper/
2. https://libguides.usc.edu/writingguide/grammar
3. https://grammar.yourdictionary.com/writing/how-to-write-a-research-paper.html
4. https://wordvice.com/seminar-how-to-write-an-effective-research-paper/

Assessment pattern:

	Assessment Component	CO.No.	Marks	Total
Continuous Comprehensive Evaluation (Internal)	Assignment 1	1	20	100
	Assignment 2	2	20	
	Assignment 3	3	20	
	MCQ	1,2,3	20	
	Descriptive Pattern Test	1,2,3	20	

- **Student will be finally awarded with three levels based on the score as follows:**

Marks Scored	Levels
70% & above	Good
30- 69%	Average
< 30%	Fair

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

SEMESTER I–ELECTIVES

Course Code: 19STEN1101	Course Title: STRUCTURAL STABILITY		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the basic nature of elastic and inelastic stability in structures.
2. Solve problems of buckling of beam, column and frames.
3. Solve problems for torsional buckling.
4. Solve problems for buckling in plates.
5. Solve problems for inelastic buckling of members.

Unit I STABILITY OF COLUMNS **9 Hours**

Concepts of Elastic Structural stability- Characteristics and analytical approaches to stability- Elastic buckling of columns- Equilibrium, energy and imperfection approaches on non-prismatic and built up columns- Effect of shear on buckling load -Analysis of various boundary conditions- Timoshenko's Imperfect and kinetic methods

Unit II BUCKLING OF BEAM, COLUMNS AND FRAMES **9 Hours**

Stability analysis of beam - columns with single and several concentrated loads, distributed load and end moments - Analysis of rigid jointed frames -Use of stability function to determine the critical load - Moment distribution – Slope, deflection and stiffness methods.

Unit III TORSIONAL AND LATERAL BUCKLING **9 Hours**

Torsional buckling - Torsional and flexural buckling - Local Buckling-Numerical Solutions-Lateral buckling of beams - Pure bending of simply supported and cantilever beams.

Unit IV BUCKLING OF PLATES **9 Hours**

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

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V INELASTIC BUCKLING **9 Hours**

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

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Explain the basic nature of elastic and inelastic stability in structures.	Understand
CO.2. Solve problems of buckling of beam, column and frames.	Apply
CO.3. Solve problems for torsional buckling.	Apply
CO.4. Solve problems for buckling in plates.	Apply
CO.5. Solve problems for inelastic buckling of members.	Apply

Reference Book(s):

R1. Timoshenko, S.P., Gere G.M., Theory of Elastic Stability, 2nd Edition, Dover publications, 2009.

R2. Gambhir M. L., Stability Analysis and Design of Structures, Springer Publishing Company, New York, 2009.

R3. Simitser.G. J and Hodges D. H., Fundamentals of Structural Stability, Elsevier Ltd., 2006

Web References:

1. https://nptel.ac.in/syllabus/105999912/

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code:19STEN1102	Course Title: THEORY OF PLATES AND SHELLS		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Derive differential equation for bending of thin plate.
2. Solve rectangular and circular thin plates.
3. Solve the problems for folded plates
4. Solve the behaviour of anisotropic plates.
5. Describe membrane and bending theory for cylindrical shells

Unit I PLATE THEORY **9 Hours**

Thin and thick plates - Small and large deflection - Small deflection theory of thin plate- Moment-curvature relation - Differential equation of laterally loaded thin plates

Unit II RECTANGULAR AND CIRCULAR PLATES **9 Hours**

Navier solution and Levy's method for rectangular plates -Differential equation of thin circular plates.

Unit III FOLDED PLATES **9 Hours**

Structural behavior - Assumptions - Analysis of folded plates - Design principles of prismatic folded plate roofs as per ACI recommendations –Reinforcement detailing.

Unit IV ANISOTROPIC PLATES **9 Hours**

Bending of anisotropic plates - Bending of rectangular, circular and elliptic plates

Unit V INTRODUCTION TO SHELLS **9 Hours**

Geometry and classification - Analysis and design of cylindrical shells - Membrane theory of circular and cylindrical shells-Reinforcement detailing.

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Derive differential equation for bending of thin plate.	Apply
CO.2. Solve rectangular and circular thin plates.	Apply
CO.3. Solve the problems for folded plates	Apply
CO.4. Solve the behaviour of anisotropic plates.	Apply

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

CO.5. Describe membrane and bending theory for cylindrical shells	Understand

Reference Book(s):

R1. Chandrashekahara, K. Theory of Plates, University Press (India) Ltd., Hyderabad, 2001.

R2. Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company, 2006

R3. Timoshenko. S. P, and Krieger S.W. Theory of Plates and Shells, McGraw Hill Book Company, New York, 2003.

Web References:

1. https://nptel.ac.in/courses/112101095/34

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1103	Course Title: STRUCTURAL ANALYSIS BY MATRIX METHODS		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the concept of structural analysis using matrix method
2. Analyze transformation of force and displacement from element to system
3. Analyze members by stiffness method
4. Analyze members by flexibility method
5. Analyze members by direct stiffness method

Unit I INTRODUCTION **9 Hours**

Determination of static and Kinematic Indeterminacies –Principle of superposition – Methods of structural analysis – Equilibrium, compatibility and force displacement relations – Betti's Law – Stiffness and Flexibility matrices of the Elements.

Unit II TRANSFORMATION OF SYSTEMS **9 Hours**

Transformation of system force to element forces – Element flexibility to System flexibility – system displacement to element displacement – Transformation of forces and displacement in general – Normal and orthogonal transformation

Unit III STIFFNESS METHOD OF ANALYSIS **9 Hours**

Development of stiffness method – analogy between flexibility and stiffness – Analysis due to thermal expansion, lack of fit – Application to pin-jointed plane and spacetrusses – Continuous beams – frames and grids – problem solving

Unit IV FLEXIBILITY METHOD OF ANALYSIS **9 Hours**

Choice of redundant – ill and well-conditioned equations – Automatic choice of redundant – Rank technique – Transformation of one set of redundant to another set – Thermal expansion – Lack of fit – Application to pin jointed plane truss – continuous beams - frames and grids

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V ADVANCED TOPIC IN MATRIX METHOD **9 Hours**

Static condensation Technique – Substructure Technique - Transfer Matrix method – Symmetry & Anti symmetry of structures – Reanalysis Technique

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Explain the concept of structural analysis using matrix method	Understand
CO.2. Analyze transformation of force and displacement from element to system	Analyze
CO.3. Analyze members by stiffness method	Analyze
CO.4. Analyze members by flexibility method	Analyze
CO.5. Analyze members by direct stiffness method	Analyze

Reference Book(s):

R1. Chandrashekahara, K. Theory of Plates, University Press (India) Ltd., Hyderabad, 2001.

R2. Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company, 2006

R3. Timoshenko. S. P, and Krieger S.W. Theory of Plates and Shells, McGraw Hill Book Company, New York, 2003.

Web References:

1. https://nptel.ac.in/courses/112101095/34

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1104	Course Title: EXPERIMENTAL METHODS AND MODEL ANALYSIS		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the principles of force and strain measuring instruments.
2. Explain the principles, applications of vibration measuring instruments.
3. Explain the methods of distress measurement and remedial measures.
4. Explain the principles, applications of Non-Destructive Testing methods.
5. Explain the procedure for investigation by model analysis

Unit I FORCE AND STRAIN MEASUREMENTS **9 Hours**

Choice of experimental stress analysis methods, errors in measurements – strain measurements – strain gauges – Wheatstone bridge – strain rosette – hydraulic jacks and pressure gauges – electronic load cells – proving rings – calibration and calibration testing machines.

Unit II VIBRATION MEASUREMENTS **9 Hours**

Characteristics of structural vibrations – Linear Variable Differential Transformer (LVDT) – transducers for velocity and acceleration measurements. Vibration measuring instruments – Seismographs – Vibration Analyzer –Cathode Ray Oscilloscope – Digital Data Acquisition Systems.

Unit III DISTRESS MEASUREMENTS AND REMEDIAL MEASURES **9 Hours**

Diagnosis of distress in structures – crack observations and measurements – corrosion of reinforcement in concrete – Half cell, construction and uses – damage assessment – remedial measures for distressed concrete – controlled blasting for demolition – techniques for residual stress measurements.

Unit IV NON-DESTRUCTIVE TESTING METHODS **9 Hours**

Load testing on structures – Rebound hammer, Acoustic emission technique – Ultrasonic pulse velocity technique – Impact Echo testing – Ground penetrating radar technique – Brittle coating– principle and application.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V MODEL ANALYSIS **9 Hours**

Necessity, advantages and applications of Model analysis – Model laws – Laws and types of similitude – model materials – scale effects in models – Variables in structural behaviour– dimensional analysis – Buckingham π theorem – Direct and indirect model study – Investigations and structural problems.

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Explain the principles of force and strain measuring instruments.	Understand
CO.2. Explain the principles, applications of vibration measuring instruments.	Understand
CO.3. Explain the methods of distress measurement and remedial measures.	Understand
CO.4. Explain the principles, applications of Non-Destructive Testing methods.	Understand
CO.5. Explain the procedure for investigation by model analysis	Understand

Reference Book(s):

R1. Dalley. J. W. and Riley. W. F, Experimental Stress Analysis, McGraw Hill Book Co, New York, 1991.

R2. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 2009

R3. Ganesan T. P, Model Analysis of Structures, University Press, Hyderabad, 2000

Web References:

1. https://nptel.ac.in/courses/112106198/

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1105	Course Title: ADVANCED REPAIR AND REHABILITATION TECHNIQUES FOR CONCRETE STRUCTURES		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the knowledge on the need of repair and rehabilitation
2. Explain the strengthening concept for structural members
3. Explain the concept of specialized repair techniques
4. Explain the concept of retrofitting by modern composite materials
5. Explain the concept of repair and restoration of heritage buildings

Unit I INTRODUCTION **9 Hours**

Need for strengthening due to various reasons such as ageing - natural calamities, increase of load - change of function and design, construction errors

Unit II STRUCTURAL STRENGTHENING **9 Hours**

Strengthening and retrofitting of columns, beams, walls, footings and slabs, piers of concrete structures by jacketing, external posttensioning, replacing or adding reinforcement, plate bonding, textile reinforced concrete.

Unit III SPECIALIZED REPAIRS TECHNIQUES **9 Hours**

Electrochemical repair using re-alkalization and chloride extraction techniques – Specialized repairs for chemical disruption, fire, marine exposure – Repair of damaged structures of water retaining and hydraulic structures, Pavements, Runways, Tunnels, Piers, Flyovers and Parking Garages – Underwater repair – Masonry Repair

Unit IV RETROFITTING BY COMPOSITE MATERIALS **9 Hours**

Fiber reinforced concrete – Ultra-high-performance fibre reinforced concrete (UHPFRC) – Fiber reinforced composites – Carbon fibre reinforced polymer (CFRP) – Fibre wrapping (Carbon, Aramide, Glass)

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V REPAIR AND RESTORATION OF HERITAGE STRUCTURES **9 Hours**

The existing information on the building- detailed assessment- monitoring of the building- elaboration of the diagnosis- quality of the intervention work

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Explain the knowledge on the need of repair and rehabilitation	Understand
CO.2. Explain the strengthening concept for structural members	Understand
CO.3. Explain the concept of specialized repair techniques	Understand
CO.4. Explain the concept of retrofitting by modern composite materials	Understand
CO.5. Explain the concept of repair and restoration of heritage buildings	Understand

Reference Book(s):

R1. Denison Campbell, Allen and Harold Roper, 'Concrete Structures, Materials, Maintenance and Repair', Longman Scientific and Technical UK, 1991.

R2. Santhakumar, A.R., 'Training Course notes on Damage Assessment and repair in Low Cost Housing', "RHDC-NBO", Anna University, July, 1992.

Web References:

1. https://cpwd.gov.in/Publication/ConservationHertBuildings.pdf
2. http://site.cibworld.nl/dl/publications/pub335.pdf

Course Code: 19STEN1106	Course Title: STRUCTURAL OPTIMIZATION		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Solve the concept of optimization techniques.
2. Solve theory of linear programming.
3. Explain theory of nonlinear programming.
4. Solve problems of conversion of a final value problem into an initial value problem and dynamic programming in optimization
5. Solve the problems on practical structures subjected to dynamic loading as well.

Unit I INTRODUCTION **9 Hours**

Introduction - Engineering applications of optimization - statement of an optimization problem - classification of optimization problems - optimization techniques

Unit II LINEAR PROGRAMMING **9 Hours**

Standard form of a linear programming - Geometry of linear programming -simplex method - basic solution - computation maximization and minimization - Dual relations - Dual simplex method - revised simplex method.

Unit III SPECIALIZED REPAIRS TECHNIQUES **9 Hours**

One Dimensional minimization methods - Dichotomous search - Fibonacci Method - Golden section method - Unconstrained optimization - cauchy's steepest descent method - davidon Fletcher powell method - Constrained function of single variable.

Unit IV DYNAMIC PROGRAMMING **9 Hours**

Multistage decision processes - representation and types - concept of sub-optimization problems and the principle of optimality - conversion of a final value problem into an initial - linear programming as a case of dynamic programming.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V STRUCTURAL APPLICATIONS **9 Hours**

Methods for optimal design of structural elements - Minimum weight design for truss members - Fully stressed design - Optimization principles to design of R.C members.

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Solve the concept of optimization techniques.	Apply
CO.2. Solve theory of linear programming.	Apply
CO.3. Apply the concept of theory of nonlinear programming.	Apply
CO.4. Solve problems of conversion of a final value problem into an initial value problem and dynamic programming in optimization	Apply
CO.5. Solve the problems on practical structures subjected to dynamic loading as well.	Apply

Reference Book(s):

R1. Rao S. S., Engineering Optimization: Theory and Practice, 3rd Edition, New Age International, New Delhi, 2010.

R2. Belegundu A. D., Chandrupatla T. R., Optimization Concepts and Applications in Engineering, 2nd Edition, Cambridge University Press, Delhi, 2011.

Web References:

1. https://nptel.ac.in/courses/112108211/25

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

SEMESTER II

Course Code: 19STCN1201	Course Title: FINITE ELEMENT METHODS		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain various methods of finite element formulation.
2. Derive one dimensional element properties.
3. Derive two and three-dimensional element properties.
4. Solve the plate shell elements using static analysis.
5. Solve the dynamic problems using finite element method.

Unit I INTRODUCTION **9 Hours**

Historical Background - Basic Concept of FEM - Engineering problems and governing differential equations – Finite element modeling – Discretization - Node, Element - different types of element – Approximate Solutions – Principal of minimum potential energy, Rayleigh-Ritz method and Galerkins methods.

Unit II ANALYSIS OF ONE-DIMENSIONAL PROBLEMS **9 Hours**

One dimensional problem - Coordinate systems – global, local and natural coordinate systems, shape functions – Bar, beam and truss element - Generation of Stiffness Matrix and Load Vector – Application to trusses, beams and plane frames – Convergence requirements, P and H methods.

Unit III ANALYSIS OF TWO DIMENSIONAL IN PLANE PROBLEMS **9 Hours**

Two Dimensional problems – Plane Stress, Plane Strain Problems – Triangular and Quadrilateral Elements – Isoparametric Formulation - Natural Coordinates, Shape function, stiffness matrix - Axisymmetric Problems - Higher Order Elements - Numerical Integration – Application to solve in plane problems – Convergence – Ill conditioned elements.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit IV PLATES AND SHELLS **9 Hours**

Kirchoff plate theory, Mindlin plate theory, Assumptions and Limitations, Triangular and rectangular plate elements – Isoparametric formulation strain – Displacement relation – Stiffness matrix, Shell elements – Application to solve plate problems.

Unit V STRUCTURAL DYNAMICS APPLICATIONS **9 Hours**

Dynamic equations – Mass and damping matrices – Natural frequencies and modes – Reduction of number of DOF-Formulation for point mass and distributed masses, Consistent element mass matrix of one-dimensional bar element, beam element and quadri latateral element. Lumped mass matrix, Evaluation of eigen values and eigen vectors, Applications to bars and beams.

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Explain various methods of finite element formulation.	Understand
CO.2. Derive one dimensional element properties.	Apply
CO.3. Derive two and three-dimensional element properties.	Apply
CO.4. Solve the plate shell elements using static analysis.	Apply
CO.5. Solve the dynamic problems using finite element method.	Apply

Reference Book(s):

R1. Reddy J.N., An Introduction to the Finite Element Method, 3rd Edition, Tata Mcgraw Hill Education Private Ltd, New Delhi, 2005.

R2. Krishnamoorthy C.S, Finite Element Analysis: Theory and Programming, 2nd Edition, Tata Mc graw Hill Education Pvt Ltd, New Delhi, 2017.

R3. Rao S.S., The Finite Element Method in Engineering, 5thEdition, Butterworth-heinemann, Oxford, 2010.

Web References:

1. https://nptel.ac.in/courses/105105041/

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STCN1202	Course Title: STRUCTURAL DYNAMICS		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Solve problems on vibration in Single Degree of Freedom systems
2. Solve problems on vibration in Two Degree of Freedom systems.
3. Solve problems on vibration in Multi Degree of Freedom systems.
4. Solve problems on vibration in continuous systems
5. Solve problems on vibration to sub structure

Unit I INTRODUCTION TO STRUCTURAL DYNAMICS **9 Hours**

Overview - Degree of freedom -Simple harmonic motion - Newton's second law of motion - D'Alembert's principle -Energy method – Single degree of freedom systems - Damped and un-damped free and forced vibration.

Unit II TWO DEGREE OF FREEDOM SYSTEM **9 Hours**

Principle modes of vibration and equation of motion for two degree of freedom – Two degrees of freedom for torsional system – Vibrations of undamped two degrees of freedom – Forced vibrations – Undamped forced vibration for two degrees of freedom – Orthogonality principle.

Unit III MULTIPLE DEGREE OF FREEDOM SYSTEMS **9 Hours**

Inverse iteration – Method for determination of natural frequencies and mode shapes – Dynamic Response by modal superposition – Direct integration of equation of motion – Multiple degree of freedom system (Distributed mass and load) – Free and forced vibration – Generalized Single Degree of freedom system

Unit IV DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS **9 Hours**

Vibration of springs – Free longitudinal vibration of a bar – Free flexural vibration of simply supported beams and beams with other end conditions – Vibration analysis using finite element method for beams and frames.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V INTRODUCTION TO VIBRATION STUDY IN SUB STRUCTURE **9 Hours**

Design of bearings and base Isolation – Design criteria – MSD and EHS method of analysis – Tschebotarioff's reduced frequency method – Design problems

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Solve problems on vibration in Single Degree of Freedom systems	Apply
CO.2. Solve problems on vibration in Two Degree of Freedom systems.	Apply
CO.3. Solve problems on vibration in Multi Degree of Freedom systems.	Apply
CO.4. Solve problems on vibration in continuous systems	Apply
CO.5. Solve problems on vibration to sub structure	Apply

Reference Book(s):

R1. Anil K. Chropra, Dynamics of Structures: Theory and Applications to Earthquake Engineering, 3rd Edition, Dorling Kindersley Pub Inc., New Delhi, 2007.

R2. Mario Paz, Structural Dynamics: Theory and Computation, 2nd Edition, CBS publishers, New Delhi, 2004.

Web References:

1. https://nptel.ac.in/courses/105101006/

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STCN1203	Course Title: DESIGN OF SUB STRUCTURES		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

CO.1. Explain the appropriate soil investigation techniques and Design of shallow foundations.

CO.2. Design pile foundations and pile caps.

CO.3. Design well foundations and foundations in expansive soils.

CO.4. Design machine foundations.

CO.5. Design special foundation on different structures and soil conditions.

Unit I SHALLOW FOUNDATIONS **9 Hours**

Soil Investigation – Types of foundation – Selection of foundation – Requirements of foundation - Significant Depth - Modes of Shear failures - Computation of loads - Bearing Capacity of soil – Shallow foundation – Design of strip, isolated, combined and strap footings – Raft foundation.

Unit II PILE FOUNDATIONS **9 Hours**

Introduction, Types of pile foundation– Load carrying capacity of different types of piles and pile groups according to IS 29111 - Settlement of piles - Negative skin friction - Lateral load resistance of individual piles and pile groups – Structural design of straight piles – Different shapes of pile caps – Structural design of pile cap.

Unit III WELL FOUNDATIONS **9 Hours**

Introduction - Types of well foundation – Grip length – Construction of wells – Failures and remedies – Design of well foundation – Lateral stability

Unit IV MACHINE FOUNDATIONS **9 Hours**

Introduction - Types of machine foundation – Basic principles of design of machine foundation - Dynamic properties of soil - Vibration analysis of machine foundation - Natural frequency - Design of foundation for Reciprocating machines and Impact machines - Reinforcement and construction details – Vibration isolation.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V SPECIAL FOUNDATIONS **9 Hours**

Foundation on expansive soils – choice of foundation – under reamed pile foundation – Foundation for concrete towers – chimneys – Design of anchors – Reinforced earth retaining wall.

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Explain the appropriate soil investigation techniques and Design of shallow foundations.	Understand
CO.2. Design pile foundations and pile caps.	Apply
CO.3. Design well foundations and foundations in expansive soils.	Apply
CO.4. Design machine foundations.	Apply
CO.5. Design of special foundation on different structures and soil conditions.	Apply

Reference Book(s):

R1. Joseph Bowles, "Foundation Analysis and Design", McGraw-Hill Book Company.
R2. Braja M. Das, "Principles of Foundation engineering", PWS Publishing Company.
R3. Braja M. Das, Principles of Soils Dynamics, McGraw Hill, 1992.
R4. Kaniraj, Design Aids in Soil Mech. and Found. Engg., Tata McGraw, 1995.
R5. Tomlinson, Found. Design and Const., 6th Edition, Longman Pub., 1995.

Web References:

1. https://nptel.ac.in/courses/105108069/advancedfoundationengineering
2. https://freevideolectures.com/advancedfoundationengineering

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STCN2201	Course Title: STRUCTURAL DESIGN LABORATORY		
Course Category: Lab/Practical		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Solve the truss and frame.
2. Solve the problems on elasticity and finite element analysis concepts for analyzing the plate problems.
3. Design different concrete structures.
4. Design different steel structures.

AREA OF EXPERIMENTS:

ANALYSIS OF STRUCTURES USING SOFTWARE

1. Analysis of pin jointed plane trusses
2. Analysis of rigid jointed plane frames
3. Plane stress analysis of using CST and four noded isoparametric elements
4. Plate bending analysis using isoparametric plate and shell element

DESIGN OF REINFORCED CONCRETE STRUCTURES USING SOFTWARE

5. Design and Detailing of Slabs and Beams
6. Design and Detailing of short and slender Columns including biaxial bending
7. Design and Detailing of reinforced concrete retaining wall (cantilever type)
8. Design and Detailing of different types of foundations

DESIGN OF STEEL STRUCTURES USING SOFTWARE

9. Design of steel structural elements (Beams and Columns)
10. Design of purlins and elements of truss.
11. Design of steel Towers

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Solve the truss and frame.	Apply
CO.2. Solve the problems on elasticity and finite element analysis concepts for analyzing the plate problems.	Apply
CO.3. Design different concrete structures.	Apply

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

CO.4. Design different steel structures.	Apply

Reference (s):

R1. Structural Design Laboratory Manual of Civil Engineering department, MCET, Pollachi.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STPN3201	Course Title: MINI PROJECT WITH SEMINAR		
Course Category: Lab/Practical		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Trained for oral presentation and ability of writing on a specific technical area to acquire the skills.

OUTLINE

During the course of the programme each student is expected to do a mini project. The student can execute this work by effective use of a suitable design/analysis software package or a solution for a real time problem.

Mini Project will have mid semester and end semester presentation. Mid semester presentation will include identification of the problem and the relevant literature concerning to the solution. End semester presentation should be done on the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions along with the contribution. Continuous assessment will be monitored by the department committee formulated by the head of the department. At the end of the semester student shall submit a detailed report in the prescribed format to the department

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Trained to face an audience and try to answer the question raised during the Interviews	Apply

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19SHAG1201		Course Title: TEACHING AND LEARNING IN ENGINEERING (Common to all PG Programme)	
Course Category: Humanities		Course Level: Introductory	
L:T:P(Hours/Week) 2:0:0	Credits:-	Total Contact Hours: 30	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Use Outcome based approach in teaching courses.
2. Conduct lecture/practical/tutorial sessions using active learning methods.
3. Conduct higher order assessments using rubrics.

Unit I Outcome Based Approach **10 Hours**

Outcome based Education- Need & Approach- Washington accord- Graduate attributes- Learning outcomes –Blooms Taxonomy

Unit II Active Learning Methods **10 Hours**

Design and Delivery plan for lectures/practical/tutorial sessions-Need for Active learning methods-Active learning strategies- Benefits of Active learning Methods

Unit III Assessments **10 Hours**

Assessments- types of assessments-need for rubrics, Types of rubrics- Assessment using rubrics

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO 1: Use outcome-based approach in teaching courses in engineering programmes.	Apply
CO 2: Conduct lecture/practical/tutorial sessions using active learning methods.	Apply
CO 3: Conduct higher order assessments using rubrics.	Apply

Reference Book(s):

R1. William G. Spady and Francis Aldrine A. Uy (2014). Outcome-Based Education: Critical Issues and Answers, ISBN: 978-971-0167-41-8, Maxcor Publishing House, Inc.

R2. Dr. William G. Spady, Wajid Hussain, Joan Largo, Dr. Francis Uy (2018). Beyond Outcomes Accreditation: Exploring the Power of 'Real' OBE Practices.

R3. Richard M. Felder, Rebecca Brent (2016), Teaching and Learning STEM: A Practical Guide, John Wiley & Sons Inc

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Web References:

1. cid.buu.ac.th/information/Eric_Soulsby_Assessment_Notes.pdf
2. www4.ncsu.edu/unity/lockers/users/f/felder/public/.../Active/Active-learning.pdf
3. https://tomprof.stanford.edu/posting/1491-Common Active Learning Mistakes

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Comprehensive Evaluation (Internal)	Assignment 1	1	20	100
	Assignment 2	2	20	
	Assignment 3	3	20	
	MCQ	1,2,3	20	
	Descriptive Pattern Test	1,2,3	20	

- **Student will be finally awarded with three levels based on the score as follows:**

Marks Scored	Levels
70% & above	Good
30- 69%	Average
< 30%	Fair

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

SEMESTER II - ELECTIVES

Course Code: 19STEN1201	Course Title: ADVANCED STEEL DESIGN		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Design various types of structural steel connections.
2. Analyze and design steel towers.
3. Design of steel chimneys, bunkers and silos
4. Analyze and design cold formed structural steel members.
5. Design composite beams, slabs and columns

Unit I DESIGN OF CONNECTIONS **9 Hours**

Types of connections -Welded and bolted -Throat and root Stresses in fillet welds -Seated Connections -Un-stiffened and stiffened seated connections -Moment resistant connections -Clip angle connections -Framed HSFG bolted connections

Unit II ANALYSIS AND DESIGN OF TOWERS **9 Hours**

Micro wave towers – Transmission line towers – Loads on towers - Shape, sag and tension in uniformly loaded conductors -Analysis of towers – Design of member in towers.

Unit III DESIGN OF CHIMNEYS **9 Hours**

Types, joints, lining and ladder of chimneys - Forces acting on chimneys - Design of self-supporting chimneys and guyed chimneys - Design concept of bunkers and silos

Unit IV COLD FORMED STEEL **9 Hours**

Introduction - Advantages and types of cold formed steel sections -Local buckling and lateral buckling - Design of flexural and axially loaded compression member - Combined bending and compression - Design of tension members - Direct strength method

Unit V INTRODUCTION TO COMPOSITE MEMBERS **9 Hours**

Composite beams and slabs - In filled and encased columns - uniaxial and eccentrical composite columns

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Outcomes		Cognitive Level
At the end of this course, student will be able to:		
CO.1.	Design various types of structural steel connections.	Apply
CO.2.	Analyze and design steel towers.	Analyze
CO.3.	Design of steel chimneys, bunkers and silos	Apply
CO.4.	Analyze and design cold formed structural steel members.	Apply
CO.5.	Design composite beams, slabs and columns	Apply

Reference Book(s):

R1. L. S. Jayagopal and D.Tensing, Design of Steel Structures, Vikas Publishing, 2015

R2. Teaching resource for, "Structural Steel Design," Volume 1, 2 & 3, Institute for Steel Development and Growth (INSDAG), 2002.

R3. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company, 1996

Web References:

1. https://nptel.ac.in/courses/105106113/18

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1202	Course Title: DESIGN OF BRIDGES		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the basics and code specifications for bridge design.
2. Analyze, design and detail the short span bridges.
3. Explain the basic principles in the design of long span bridges.
4. Analyze, design and detail the Prestressed Concrete bridges.
5. Analyze and design the substructures and bridge bearings.

Unit I INTRODUCTION **9 Hours**

Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations

Unit II SHORT SPAN BRIDGES **9 Hours**

Load distribution theories, analysis and design of slab bridges, tee beam bridges and box culverts.

Unit III LONG SPAN BRIDGES **9 Hours**

Design principles of continuous bridges, box girder bridges and balanced cantilever bridges.

Unit IV PRESTRESSED CONCRETE BRIDGES **9 Hours**

Flexural and torsional parameters – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – short term and long-term deflections - Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms - Design of girder section – End block.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V DESIGN OF PLATE GIRDER BRIDGES, BEARINGS AND SUBSTRUCTURES **9 Hours**

Design of riveted and welded plate girder bridges for highway and railway loading – wind effects – main section, splicing, curtailment, stiffeners – Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of foundations.

Course Outcomes At the end of this course, student will be able to:	Cognitive Level
CO.1. Explain the basics and code specifications for bridge design.	Understand
CO.2. Analyze, design and detail the short span bridges.	Analyze
CO.3. Explain the basic principles in the design of long span bridges.	Understand
CO.4. Analyze, design and detail the Prestressed Concrete bridges.	Analyze
CO.5. Analyze and design the substructures and bridge bearings.	Analyze

Reference Book(s):

R1. N. Krishna Raju, Design of Bridges, Oxford & IBH Publishing, New Delhi, 2005.
R2. N. Krishna Raju, Prestressed Concrete Bridges, CBS publishers, New Delhi, 2010.

Web References:

1. https://nptel.ac.in/courses/105105165

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1203	Course Title: DESIGN OF HIGH-RISE BUILDINGS		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the general principle in design and different type of loadings on tall structures
2. Solve the problems of various structural systems
3. Analysis and design of tall buildings
4. Explain the sectional shape, properties and resisting capacity of structural m elements.
5. Solve the problems in stability of tall buildings

Unit I INTRODUCTION **9 Hours**

Classification of buildings according to NBC -Design philosophy, materials for tall buildings - High strength concrete - Vertical city concepts – Factors affecting height, growth and form - Human comfort criteria. Types of loads -Gravity loading -Impact and construction loads. Wind loading - Earthquake loading -Quasi static approach- Equivalent lateral force.

Unit II BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS **9 Hours**

Different system for load distribution in steel and concrete - Vertical and horizontal load resistant systems - Rigid frames - braced frames - in filled frames - shear walls -Rosman's analysis – Design aspect – RC frame and shear wall interaction – Equivalent frame method wall frames - tubular systems - outrigger braced systems - Mega systems.

Unit III ANALYSIS AND DESIGN **9 Hours**

Analysis and Design principles of various horizontal load transfer systems - approximate methods - Modelling for accurate analysis - 3D analysis -Basic principles Member forces - displacements. Analysis for various secondary effects.

Unit IV STRUCTURAL ELEMENTS **9 Hours**

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

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V STABILITY OF TALL BUILDINGS **9 Hours**

Stability Analysis - Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, P - effect and various methods of analysis - influence of foundation instability, out of plumb effects - Elastic Deformations. Dynamic Analysis

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. To understand the general principle in design and different type of loadings on tall structures	Understand
CO.2. Solve the knowledge in the behavior of various structural systems	Apply
CO.3. Impart them to analysis and design of tall buildings	Analyze
CO.4. To study the sectional shape, properties and resisting capacity of structural m elements.	Understand
CO.5. Solve the problems in stability of tall buildings	Apply

Reference Book(s):

R1. Bryan Stafford Smith and Alexcoull, Tall Building Structures - Analysis and Design, John Wiley and Sons, Inc.,1991.

R2. Taranath B. S., Structural Analysis and Design of Tall Buildings, McGraw Hill,1988.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1204	Course Title: DESIGN OF ADVANCED CONCRETE STRUCTURES		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Design of RCC beams and columns using limit state design method
2. Design multistoried RC Frames
3. Develop an idea of designing special R.C. elements
4. Design and detailing of flat slabs and grid floors
5. Determine the inelastic behaviour of concrete beams using IS Codes

Unit I REVIEW OF LIMIT STATE DESIGN **9 Hours**

Design for limit state of collapse - Design of beams for combined effect of shear, bending moment and torsion - Design of slabs - Design of short and slender columns including biaxial bending – detailing of reinforcements - Design for limit state of serviceability - Calculation of deflection and crack width as per IS: 456 – 2000

Unit II DESIGN OF CONTINUOUS BEAMS AND FRAME **9 Hours**

Design and detailing of continuous beams and portal frames-design of multibay, multistoried R.C. frames: preliminary design-use of substitute frames for calculating stress resultants caused by gravity loading-portal and cantilever methods for lateral loads -detailing of reinforcements.

Unit III DESIGN OF SPECIAL R.C. ELEMENTS **9 Hours**

Classification and design principles of R.C. walls - Shear walls- - Design of curved beams and deep beams- Checking for Local Failures- Design of Ribbed slab.

Unit IV DESIGN OF FLAT SLABS AND GRID FLOORS **9 Hours**

Design of flat slab - Hillerberg's strip method - Equivalent frame method - ACI method - Design of grid floors-detailing of reinforcements.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V INELASTIC BEHAVIOR OF CONCRETE BEAMS AND FRAMES **9 Hours**

Inelastic behaviour of concrete beams - Baker's method –moment rotation curves-moment redistribution - Design of cast-in-situ joints in frames. Detailing requirements for ductility, durability and fire resistance.

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Design of RCC beams and columns using limit state design method	Apply
CO.2. Design multistoried RC Frames	Apply
CO.3. Develop an idea of designing special R.C. elements	Apply
CO.4. Design and detailing of flat slabs and grid floors	Apply
CO.5. Determine the inelastic behaviour of concrete beams using IS Codes	Apply

Reference Book(s):

R1. Unnikrishna Pillai and Devdas Menon, Reinforced concrete Design, 3rd Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2017.

R2. Park R. and Paulay T., Reinforced Concrete Structures, Wiley India Pvt Ltd, New Delhi, 2009.

Web References:

1. https://nptel.ac.in/courses/105105105/16

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1205	Course Title: DESIGN OF INDUSTRIAL STRUCTURES		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain various types of industrial structures and its design methodologies
2. Design bunkers, silo.
3. Design various industrial floors
4. Design chimney
5. Design tower and Frames

Unit I REQUIREMENTS OF INDUSTRIAL BUILDING **9 Hours**

Classification of Industries and Industrial structures – planning for layout requirements regarding Lighting, Ventilation and Fire Safety – Protection against noise and vibration – Guidelines from Factories Act.

Unit II DESIGN FOR BUNKERS AND SILOS **9 Hours**

Stand pipes – Jessen& Rankine's theories – design of silos – design of bunkers

Unit III DESIGN OF INDUSTRIAL FLOORS **9 Hours**

Ground floor – Pavement design – Mezzanine floors – Gratings – chequered plates – composite deck slabs

Unit IV DESIGN FOR CHIMNEYS **9 Hours**

Self-supporting chimney – guyed chimney – design for foundation – braced chimney

Unit V DESIGN FOR TOWERS & FRAMES **9 Hours**

Design of Towers – Design for wind – Design of frames for wind & axial loads

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Explain various types of industrial structures and its design methodologies	Understand
CO.2. Design bunkers, silo.	Apply
CO.3. Design various industrial floors	Apply
CO.4. Design chimney	Apply

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

CO.5. Design towers and frames	Apply

Reference Book(s):

R1. A.R. Santhakumar and S.S. Murthy, 'Transmision Line Structures', Tata McGraw-Hill 1992.

R2. Dr. K. Rajagopalan, 'Storage Structures', Routledge,. 2004.

R3. S.N. Manohar, Tall Chimneys, 'Design and Construction', Tata McGraw-Hill, 1985.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1206	Course Title: CONSTRUCTION FACILITIES USING COMPOSITE MATERIALS		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the concept of composite materials
2. Explain about mechanical properties and analysis of composite laminae
3. Verify the behavior of glass – fibre laminates
4. Solve problems on structural design with properties
5. Explain the design of GRP Box beams

Unit I INTRODUCTION **9 Hours**

Requirements of structural materials– Influence of nature of materials in structural form– Nature of structural materials– Homogeneous and composite materials

Unit II MACRO-MECHANICAL PROPERTIES AND ANALYSIS OF COMPOSITE LAMINAE **9 Hours**

Assumptions and Idealization– stress-strain relationship – Isotropic and orthotropic laminae– Macro mechanical Analysis of composite laminae: introduction, Assumptions and Limitations – Stiffness characteristics of glass reinforced laminae – Stress-Strain relationships in continuous discontinuous fiber laminae – strength characteristics of glass reinforced laminae.

Unit III BEHAVIOR OF GLASS FIBRE-REINFORCED LAMINATES **9 Hours**

Stiffness characteristics of laminated composites – Behavior of laminated beams and plates – Strength analysis and failure criteria, Effect of inter laminar structures – Glass Reinforced composites – Continuously reinforced laminates- uni-directionally and multi directionally continuously reinforced laminates – Stiffness and Strength properties.

Unit IV GRP PROPERTIES RELEVANT TO STRUCTURAL DESIGN **9 Hours**

Adhesive, mechanical, Combinational, Transformed sections Short and long-term strength and Stiffness properties – Temperature and fire effects – Structural joints

Unit V DESIGN OF GRP BOX BEAMS **9 Hours**

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Experimental Behavior – Effect on Beam performance – Modulus of Elasticity, Compressive strength – I value – prevention of compression buckling failure – Behavior under long term loading – Design of Stressed skinned roof structure

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Explain the concept of composite materials	Understand
CO.2. Explain about mechanical properties and analysis of composite laminae	Understand
CO.3. Verify the behavior of glass-fibre laminates	Understand
CO.4. Solve problems on structural design with properties	Apply
CO.5. Explain the design of GRP Box beams	Understand

Reference Book(s):

R1. Holmes. M. and Just. D.J., GRP in Structural Engineering, Narosa Publications, New Delhi, 2008

R2. Robart M. Jones, Mechanical of Composite Materials McGraw Hill Publishing Co., 2002.

R3. Bhagwan D Agarvalm, and Lawrence J Brutman, Analysis and Performance of Fiber Composites John Willy and Sons. 2004.

R4. https://nptel.ac.in/courses/105/106/105106117/

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

SEMESTER III

SEMESTER III - ELECTIVES

Course Code: 19STEN1301	Course Title: DESIGN OF PRESTRESSED CONCRETE STRUCTURES		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. To study the analysis of PSC flexural members
2. To carry out the complete design the flexural member and understand the difference in behavior of reinforced and Prestressed concrete
3. To study analysis and design of continuous beams
4. To design the PSC special structures
5. To study analysis and design of composite beam member

Unit I PRINCIPLES OF PRESTRESSING **9 Hours**

Principles of Prestressing - types of prestressing system, Need for High Strength materials. Analysis for Ultimate strength - Losses, deflection (short-long term), cable layouts.

Unit II DESIGN FOR FLEXURAL, SHEAR ,TORSION AND ANCHORAGE ZONE **9 Hours**

Concept of Limit State design, Determination of ultimate flexural strength – Codal provisions – Design of flexural members, Shear resistance in beams – Design for shear in rectangular and flanged beams- Design for torsion and bending - Anchorage Zone

Unit III DESIGN OF CONTINUOUS BEAMS **9 Hours**

Analysis and design of continuous beams - Methods of achieving continuity – Concept of concordance and linear transformations - Single storied rigid frames – Choice of cable profiles.

Unit IV DESIGN OF PSC SPECIAL STRUCTURES **9 Hours**

Concept of circular prestressing - design of prestressed concrete pipes and cylindrical water tanks - Design of poles and piles - Application in the design of piles, flag masts

and transmission line poles.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V DESIGN OF COMPOSITE BEAMS **9 Hours**

Composite beams - analysis and design, Role of concrete shrinkage in design. Propped and un-propped construction. Ultimate strength calculations. Partial prestressing – Necessity and its advantages. analysis and design concepts

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. To study the analysis of PSC flexural members	Apply
CO.2. To carry out the complete design the flexural member and understand the difference in behavior of reinforced and Prestressed concrete	Apply
CO.3. To study analysis and design of continuous beams	Apply
CO.4. To design the PSC special structures	Apply
CO.5. To study analysis and design of composite beam member	Apply

Reference Book(s):

R1. Krishna Raju, Prestressed Concrete, Tata McGraw Hill Publishing Co, New Delhi, 2016.
R2. Sinha.N.C.andRoy.S.K, Fundamentals of Prestressed Concrete, S. Chand and Co, New Delhi 1998.
R3. Antoine E. Naaman, Prestressed Concrete Analysis and Design Third Edition 2012
R4. Rajagopalan.N, Prestressed Concrete, Narosa Publications, New Delhi, 2008

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1302	Course Title: CONSTRUCTION TECHNIQUES AND MANAGEMENT		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Illustrate the sequence involved in various types of substructure constructions
2. Describe the techniques involved in super structure constructions.
3. Outline the construction techniques of special structures.
4. Explain the types of construction equipment.
5. Explain the equipment management and safety practices

Unit I SUB STRUCTURE CONSTRUCTION **9 Hours**

Box jacking - pipe jacking - Under water construction of diaphragm walls and basement - Tunnelling techniques - piling techniques - caisson - cofferdam - cable anchoring and grouting - laying operations for built up offshore system - shoring for deep cutting – Dewatering system.

Unit II SUPER STRUCTURE CONSTRUCTION **9 Hours**

Vacuum dewatered concrete flooring – concrete paving technology – Slip form constructions – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – in-situ pre-stressing in high rise structures - aerial transporting, handling and erecting lightweight components on tall structures.

Unit III CONSTRUCTION OF SPECIAL STRUCTURES **9 Hours**

Erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrapers - bow string bridges - cable stayed bridges – launching and pushing of box decks – construction sequence and methods in domes – support structure for heavy equipment and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

Unit IV CONSTRUCTION EQUIPMENT **9 Hours**

Fundamentals of Earthwork operations - Earth moving operations - Types of Earthwork equipment – Tractors, Motor Graders, scrapers, Front end waders, Earth movers, conveyors – Aggregate production - Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Compaction Equipment - Equipment for dredging, tunnelling, trenching and piling.

Unit V FUNDAMENTALS OF CONSTRUCTION MANAGEMENT **9 Hours**

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Equipment: Identification – Planning – Equipment management in projects – Maintenance management. Safety Management: Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives.

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Illustrate the sequence involved in various types of substructure constructions.	Understand
CO.2. Describe the techniques involved in super structure constructions.	Understand
CO.3. Outline the construction techniques of special structures.	Understand
CO.4. Explain the types of construction equipment.	Understand
CO.5. Explain the equipment management and safety practices	Understand

Reference Book(s):

R1. Robertwade brown, practical foundation engineering hand book, McGraw Hill Publications, 1995

R2. Patrick powers J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.

R3. Construction safety management" - https://nptel.ac.in/courses/105104161/2#

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1303	Course Title: PREFABRICATED OF STRUCTURES		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. To gain knowledge on the establishment of prefabricates plant, design principle and IS code specifications
2. To understand the behavior of various prefabricated structural members, floors, stairs, roofs and walls.
3. To understand the different methods in production of prefabricated elements
4. To understand the various construction techniques and equipment for transportation, erection of precast elements
5. To Impart knowledge about the application of prefabricated structures

Unit I GENERAL PRINCIPLES OF FABRICATION **9 Hours**

Prefabricated construction, necessity, advantages, disadvantages Specific requirements for planning and layout of prefabrication plant - IS Code specifications.– Types of prefabrication –Modular coordination – Standardization- stages of loading and, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

Unit II PREFABRICATED ELEMENTS **9 Hours**

Prefabricated structures - Long wall and cross-wall large panel buildings, Framed buildings with partial and curtain walls, one way and two way prefabricated slabs, floor panels, ribbed floor panels – footings – Joints for different structural connections – Provisions for non- structural fastenings – Expansion joints in pre-cast construction - Leak prevention, joint sealants.

Unit III PRODUCTION TECHNOLOGY **9 Hours**

Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening.

Unit IV HOISTING TECHNOLOGY **9 Hours**

Equipment for hoisting and erection – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads. Construction techniques, large panel construction- lift slab system, Glover system, Constains's Jack - block system, Constain V-plate system, Bison system, Silber –Kuhi system, control of construction processes. Equipment for horizontal and vertical transportation.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Unit V APPLICATIONS **9 Hours**

Designing and detailing of precast unit for factory structures – Purlins, Principal rafters, roof trusses, lattice girders, gable frames – Single span single storeyed frames – Single storeyed buildings – slabs, beams and columns.

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. To gain knowledge on the establishment of prefabricates plant, design principle and IS code specifications	Understand
CO.2. To understand the behavior of various prefabricated structural members, floors, stairs, roofs and walls.	Understand
CO.3. To understand the different methods in production of prefabricated elements	Understand
CO.4. To understand the various construction techniques and equipment for transportation, erection of precast elements	Understand
CO.5. To Impart knowledge about the application of prefabricated structures	Understand

Reference Book(s):

R1. Mokk. L., Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.

R2. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland BetorVerlag, 2009.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STEN1304	Course Title: GEOENVIRONMENTAL ENGINEERING		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Understand the basic concepts of Geoenvironmental Engineering
2. Explain the importance of soil-water contamination interaction
3. Explain the concepts of different contamination systems
4. Explain the various soil-water contamination remediation methods at site
5. Describe the concepts of soil characterization

Unit I FUNDAMENTALS OF GEOENVIROMENTAL ENGINEERING **9 Hours**

Scope of geoenvironmental engineering - multiphase behavior of soil – role of soil in geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on geoenvironment - case histories on geoenvironmental problems

Unit II SOIL-WATER-CONTAMINANT INTERACTION **9 Hours**

Soil mineralogy characterization and its significance in determining soil behavior – soil-water interaction and concepts of double layer – forces of interaction between soil particles– importance of unsaturated soil in geoenvironmental problems - water retention curves - water flow in saturated and unsaturated zone. Soil-water-contaminant interactions and its implications – Factors effecting retention and transport of contaminants

Unit III WASTE CONTAINMENT SYSTEM **9 Hours**

Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment –different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities.

Unit IV CONTAMINANT SITE REMEDIATION **9 Hours**

Site characterization – risk assessment of contaminated site - remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation

Unit V ADVANCED SOIL CHARACTERIZATION **9 Hours**

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation – use of GPR for site evaluation - introduction to geotechnical centrifuge modeling.

Course Outcomes At the end of this course, student will be able to:	Cognitive Level
CO.1. Understand the basic concepts of Geoenvironmental Engineering	Understand
CO.2. Explain the importance of soil-water contamination interaction	Apply
CO.3. Explain the concepts of different contamination systems	Apply
CO.4. Explain the various soil-water contamination remediation methods at site	Apply
CO.5. Describe the concepts of soil characterization	Apply

Reference Book(s):

R1. R1. Rowe R.K.,"Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2000.

R2. R2. Reddi L.N. and Inyang, H. I.,"Geoenvironmental Engineering,Principles and Applications" Marcel Dekker Inc. New York, 2000.

R3. R3. Yong, R. N.,"Geoenvironmental Engineering, Contaminated Soils,Pollutant Fate, and Mitigation" CRC Press, New York, 2001.

R4. R4. Sharma H.D. and Reddy K.R.,"Geoenvironmental Engineering:Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004.

R5. R5. Fredlund D.G. and Rahardjo, H.,"Soil Mechanics for Unsaturated Soils" Wiley-Interscience, USA, 1993.

R6. R6. Mitchell, J.K.,"Fundamentals of Soil Behavior" Wiley, 2005. 7. Hillel D.,"Introduction to Environmental Soil Physics" Academic Press, New York, 2003

Web References:

1.https://nptel.ac.in/courses/105/103/105103025/

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STPN5301	Course Title: Project - I		
Course Category: Lab/practical		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

OUT LINE

The project aims to develop the work practice to apply theoretical and/or practical tool/technique to solve industry problem or recent scientific research. The student individually works on a specific topic approved by the head of the department. The topic may be experimental/analytical/computer simulation/case study. They can select any topic relevant to his/her interest. Work of each student shall be guided by one or more faculty members of the department. The students shall be encouraged to do their work in the institute itself. If found essential, they may be permitted to carry out their phase II work outside the institute. Each student must keep a project progress workbook, which shall be checked periodically throughout the semester by the guide and the head of the department.

Project - I

Project - I consist of preliminary work. It will be evaluated by three reviews of the work and the submission of the report. First review would highlight the topic, scope and objective, methodology and expected outcome. Second and third review evaluates the progress of the work and scope of the work which is to be completed in the IV semester. 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 to the area of work and the methodology. The students will be evaluated through a viva-voce examination by a panel of examiners.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

Course Code: 19STPN5401	Course Title: Project - II		
Course Category: Lab/practical		Course Level: Mastery	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Project – II

The student should continue the project I work on the selected topic as per the formulated methodology. The work will be evaluated by four reviews and the submission of the project report. At the end of the semester, after completing the work to the satisfaction of the supervisor(s) and the internal review committee, the report should be submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners.

Passed in BOS meeting

BOS Convener

Approved in AC 10th meeting

BOS Chairperson

OPEN ELECTIVES

Course Code: 19STOC1301	Course Title: SAFETY ENGINEERING		
Course Category: Open Elective		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

CO.1. Understand the concepts and techniques of safety Engineering.

CO.2. Understand the safety and health provisions related to hazardous processes

CO.3. Understand the fire prevention systems and protective equipment

CO.4. Understand the safety standards in construction industry

CO.5. Understand the various legislations applicable to an industrial unit

Unit I CONCEPTS AND TECHNIQUES **9 Hours**

Evolution of modern safety concept- general concepts of management – planning for safety for optimization of productivity - quality and safety-line and staff functions for safety-budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety.

Unit II HAZARDOUS WASTE MANAGEMENT **9 Hours**

Hazardous waste management in India-waste identification, characterization and classification technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes-incineration and nitrification - hazards due to bio-process dilution-standards and restrictions – recycling and reuse.

Unit III FIRE ENGINEERING AND EXPLOSION CONTROL **9 Hours**

Fire chemistry – Dynamics of fire behavior – Fire properties of solid, liquid and gas – Fire spread – Toxicity of products of combustion. Building evaluation for fire safety – Fire load –Fire resistance materials and fire testing –Structural Fire protection – Exits and egress. Statutory Rules and Techniques of fire fighting - Indian Explosive acts and rules –Techniques of fire fighting and demonstration.

Unit IV SAFETY IN CONSTRUCTION **9 Hours**

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General safety consideration – analyzing construction jobs for safety – Contract document – Safety certificate for statutory authorities for old building and construction. Safety in Erection and closing operation - Construction materials –Specifications – suitability – Limitations. Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears. Selection, operation and maintenance of Industrial Trucks –Cranes

Unit IV ACTS AND RULES **9 Hours**

Indian Boiler Act 1923, Factories Act – 1948 - static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, Water Act 1974 , Air Act 1981: workman compensation act, rules - electricity act and rules – Explosives Act 1983 - Pesticides Act- Environment Act - 1986 - hazardous wastes (management and handling) rules 1989 - building and other construction workers act 1996.

Course Outcomes	**Cognitive Level**
At the end of this course, student will be able to:	
CO.1. Understand the concepts and techniques of safety Engineering.	Understand
CO.2. Understand the safety and health provisions related to hazardous processes	Understand
CO.3. Understand the fire prevention systems and protective equipment	Understand
CO.4. Understand the safety standards in construction industry	Understand
CO.5. Understand the various legislations applicable to an industrial unit	Understand

Reference Book(s):

R1. D.S.S.Gangulya and C. S. Changeriya Safety Engineering, Chetan Publication; 2016
R2. K. Ehteshami, Handbook of Fire Protection Engineering, Khanna Book Publishing, 2019
R3. S.K. Bhattacharjee, Safety Management in Construction (Principles and Practice), Khanna Book Publishing, 2011
R4. Sunil S. Rao, R.K. Jain and H.L. Saluja Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Book Publishing, 2019
R5. R.K. Jain and Prof. Sunil S. Rao, Industrial Safety, Health and Environment Management Systems, Khanna Book Publishing, 2000

Web References:

1. https://nptel.ac.in/courses/110/105/110105094/

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BOS Chairperson

Course Code: 19STOC1302	Course Title: WASTE TO ENERGY		
Course Category: Open Elective		Course Level: Practice	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Discuss the issues related to solid waste management.
2. Develop a management plan for fly ash
3. Enumerate the process and benefits of recycling plastic and industrial wastes
4. Explain the process of recovery of biofuel from waste and biomass
5. Suggest suitable alternatives for the reuse of wastewater

Unit I INTRODUCTION **9 Hours**

Solid waste- Sources – Domestic, Industrial and agricultural sources – Industrial waste – Mineral waste – Minimising options- Recovery and Recycle – Composting – Vermicomposting – Incineration – Energy from waste – Pyrolysis, Chemical processing

Unit II FLY ASH **9 Hours**

Introduction – Direct replacement of cement – Waste Land development – Soil amendment to grow crops – Utilisation of fly ash in afforestation, Limitation of land application of fly ash.

Unit III PLASTIC AND INDUSTRIAL WASTE **9 Hours**

Introduction – Amount and types of plastic – Recycling of plastic waste – Cement manufacture from industrial solid waste – Paper industry waste – Calcium carbide industry waste.

Unit IV BIOFUELS AND BIOETHANOL **9 Hours**

Bio ethanol technologies – Bio hydrogen and its applications – Methanogenesis from agro-industrial residues – Bio mass – Gasifier based power plants

Unit IV WASTEWATER **9 Hours**

Introduction – Reuse, Quality – Basic treatment processes – Benefits of reuse in agriculture – Costs of reuse projects and economic justification – Factors essential for the success of reuse projects – Case study

Course Outcomes	Cognitive Level
At the end of this course, student will be able to:	
CO.1. Discuss the issues related to solid waste management.	Understand
CO.2. Develop a management plan for fly ash	Understand

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CO.3. Enumerate the process and benefits of recycling plastic and industrial wastes	Understand
CO.4. Explain the process of recovery of biofuel from waste and biomass	Understand
CO.5. Suggest suitable alternatives for the reuse of wastewater	Understand

Reference Book(s):

R1. Agarwal, S.K., Wealth from waste, Kul Bushan Nangia, APH Publishing Corporation, New Delhi, 2005

R2. Nemerow, N.L., Industrial waste pollution, Addison-Wesley Publishing Company Inc., USA, 1978.

R3. Wesley Eckenfelder Jr, W., Industrial water pollution control, McGraw Hill book Co., New Delhi, 1989.

R4. Mahajan, SP., Pollution control in process industries, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1989.

Web References:

1. https://nptel.ac.in/syllabus/112104042/
2. https://nptel.ac.in/courses/105108070/
3. https://nptel.ac.in/courses/105105177/

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BOS Chairperson