FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

CURRICULUM AND SYLLABUS

(2022 Regulation)

M. TECH. STRUCTURAL ENGINEERING
REGULATION – 2022 (Full Time)

(For students admitted from the Academic Year 2022-23)

Department Vision

To achieve the pinnacle of success in the area of sustainable constructions and green technologies, thus stimulating economic growth and making the society a better place to live in

Department Mission

The mission of the Department of Civil Engineering is:

M1: To produce graduates who possess technical competence in their chosen specialty area of Structural Engineering with integrity and commitment

M2: To prepare them to serve and contribute as innovators, professional engineers, and leadersin the global community

Program Educational Objectives

The Program Educational Objectives of the Structural Engineering program are designed to produce skilled Engineers who could effectively contribute to the Structural Engineering profession with an ability to meet its current andfuture challenges

PEO 1: To apply fundamental technical knowledge and skills to find creative solutions to technological challenges and problems in various areas of basic sciences and engineering.

PEO 2: To analyze, design and use skills in order to formulate and solve Structural Engineering problems.

PEO 3: To practice engineering in a responsible, professional and ethical manner and implementeco-friendly sustainable technologies for the benefit of industry and society.

PEO 4: To create knowledge through research and development in Structural Engineering and allied fields andmodernize the teaching levels.

PEO 5: To make students professionally competent by enhancing their communication skills, team spirit, leadership and also to prepare them for lifelong learning through innovative and research activities.

PROGRAM OUTCOMES

PO1	**Apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.**
PO2	**Problem analysis: Identify, formulate and solve engineering problems in the domain of Structural Engineering field.**
PO3	**Use different software tools for Analysis and Design structural engineering domain.**
PO4	**Design and conduct experiments, analyse and interpret data, for development of simulation experiments.**
PO5	**Function as a member of a multidisciplinary team with sense of ethics, integrity and social Responsibility.**
PO6	**Functioning as a team in an ethical manner emphasizing on solving environmental, social and global challenges**
PO7	**Shaping managerial skills to become good decision makers, strategists and entrepreneurs**
PO8	**Apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice**
PO9	**Demonstrate knowledge and understanding of the engineering and management principles and apply these to once own work as a member and leader in a team to manage projects and multidisciplinary environments**

LIST OF PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: The ability to develop new materials, design and research projects in different fields of Structural Engineering using software and experimental techniques.

PSO 2: Ability to develop the teaching professionals and to engage in R&D works with ethical and societal responsibility.

PSO3: Ability to apply the knowledge in various structural engineering fields.

Mapping of Mission With PEOs

Mission/PEOs	PEO1	PEO2	PEO3	PEO4	PEO5
M1	2	3	3	3	2
M2	3	2	3	3	2

Mapping of PEOs with PSOs

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
PEO1	3	2	3	3	3	2	1	1	3
PEO2	3	3	3	2	2	1	2	2	3
PEO3	1	2	2	2	3	2	2	3	3
PEO4	2	3	2	1	2	2	2	1	2
PEO5	2	3	2	1	3	3	2	2	2

Mapping of PEOs With POs

PEO/PSO	PSO1	PSO2	PSO3
PEO1	2	3	3
PEO2	3	2	3
PEO3	2	3	2
PEO4	3	2	3
PEO5	1	3	2

Correlation Strength :- 3: High , 2: Medium , 1 : Low

Total Credits: 68
Credit for I & IV Semester: 68 Credit

Program Components

• Basic Science (Mathematics) include according to program - 1		
• Program Core theory	-	4
• Program Core Laboratory	-	4
• Program Elective	-	5
• Open Elective	-	1
• Open Lab	-	-
• Management paper	-	-
• Foreign Language	-	-
• Audit course	-	2
• Universal Human values	-	-
• Inter disciplinary theory	-	1
• Inter disciplinary Lab	-	-
• ETL	-	-
• Technical Skills	-	3
• Soft skill	-	-
• Project /mini project	-	2

M. Tech – Structural Engineering (Full Time)
Curriculum and Syllabus
2022 Regulation

I SEMESTER								
S.No	**Course Code**	**Course Title**	**Ty/Lb/ETL/ IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1.	**EMMA22005**	Advanced Engineering Mathematics for Structural Engineers	Ty	3	1/0	0/0	4	BS
2.	**EMSE22001**	Theory of Elasticity and Plasticity	Ty	3	1/0	0/0	4	PC
3.	**EMSE22EXX**	Program Elective – I	Ty	3	0/0	0/0	3	PE
4.	**EMSE22EXX**	Program Elective – II	Ty	3	0/0	0/0	3	PE
5.	**EMSE22L01**	Computer Aided Structural design - Laboratory	Lb	0	0/0	4/0	2	PC
6.	**EMSE22L02**	Advanced Concrete Laboratory	Lb	0	0/0	4/0	2	PC
7.	**EMCC22001**	Research Methodology and IPR	Ty	3	0/0	0/0	3	ID
8.	**EMCC22IXX**	Audit Course 1	IE	2	0/0	0	0	ID
		TOTAL		17	2	8	21	

Credits Sub Total: 21

II SEMESTER								
S.No	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1.	**EMSE22002**	FEM in Structural Engineering	Ty	3	1/0	0	4	PC
2.	**EMSE22003**	Structural Dynamics	Ty	3	0/0	0/0	3	PC
3.	**EMSE22EXX**	Program Elective – III	Ty	3	0/0	0/0	3	PE
4.	**EMSE22EXX**	Program Elective – IV	Ty	3	0/0	0/0	3	PE
5.	**EMSE22L03**	Structural Engineering Laboratory	Lb	0	0/0	4/0	2	PC
6.	**EMSE22L04**	Structural Engineering Design Studio	Lb	0	0/0	4/0	2	PC
7.	**EMSE22I01**	Term Paper`	IE	0	0/0	0/4	2	PC
8.	**EMCC22IXX**	Audit Course 2	IE	2	0/0	0	0	ID
		TOTAL		**14**	**1**	**12**	**19**	

Credits Sub Total: 19

III SEMESTER								
S.No	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1.	**EMSE22004**	Experimental Techniques and Instrumentation	Ty	3	0/0	0/0	3	PC
2.	**EMSE22EXX**	Program Elective – V	Ty	3	0/0	0/0	3	PC
3.	**EMOL22I01**	Open Elective (NPTEL/SWAYAM/any MOOC Online courses approved by AICTE/UGC)	IE	3	0/0	0/0	3	PC
4.	**EMSE22I02**	Summer Internship	IE	0	0/0	4/0	2	PC
5.	**EMSE22L05**	Dissertation Phase I	Lb	0	0/0	0/10	5	P
		TOTAL		**9**	**0**	**14**	**16**	

Credits Sub Total: 16

IV SEMESTER								
S.No	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1.	**EMSE22L06**	Dissertation Phase II	Lb	0	0/0	10/10	10	P
2.	**EMSE22I03**	Research Publication	IE	0	0/0	2/2	2	PC
		TOTAL		**0**	**0**	**24**	**12**	

Credits Sub Total: 12

TOTAL CREDITS = 21+ 19 + 16+ 12 = 68

PROGRAM ELECTIVE -I								
S.No	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C	Category
1.	EMSE22E01	Theory of Thin Plates and Shells	Ty	3	0	0	3	PE
2.	EMSE22E02	Theory and Applications of Cement Composites	Ty	3	0	0	3	PE
3.	EMSE22E03	Theory of Structural Stability	Ty	3	0	0	3	PE
4.	EMSE22E04	Soil Structure Interaction	Ty	3	0	0	3	PE

PROGRAM ELECTIVE -II								
S.No	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C	Category
5.	EMSE22E05	Repair and Rehabilitation of Structures	Ty	3	0	0	3	PE
6.	EMSE22E06	Structural Health Monitoring	Ty	3	0	0	3	PE
7.	EMSE22E07	Structural Optimization	Ty	3	0	0	3	PE
8.	EMSE22E08	Prefabricated Structures	Ty	3	0	0	3	PE

PROGRAM ELECTIVE -III								
S.No	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C	Category
9.	EMSE22E09	Advanced Steel Design	Ty	3	0	0	3	PE
10.	EMSE22E10	Design of Formwork	Ty	3	0	0	3	PE
11.	EMSE22E11	Tall Structures	Ty	3	0	0	3	PE
12.	EMSE22E12	Design of Masonry Structures	Ty	3	0	0	3	PE

PROGRAM ELECTIVE -IV								
S.No	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C	Category
13.	EMSE22E13	Design of Advanced Concrete Structures	Ty	3	0	0	3	PE
14.	EMSE22E14	Advanced Design of Foundations	Ty	3	0	0	3	PE
15.	EMSE22E15	Advanced Structural Analysis	Ty	3	0	0	3	PE
16.	EMSE22E16	Design of Industrial Structures	Ty	3	0	0	3	PE

PROGRAM ELECTIVE -V								
S.No	Course Code	Course Title	Ty/Lb/ETL/IE	L	T/SLr	P/R	C	Category
17.	**EMSE22E17**	Design of Prestressed Concrete Structures	Ty	3	0	0	3	PE
18.	**EMSE22E18**	Analysis of Laminated Composite Plates	Ty	3	0	0	3	PE
19.	**EMSE22E19**	Fracture Mechanics of Concrete Structures	Ty	3	0	0	3	PE
20.	**EMSE22E20**	Earthquake Resistance Structures	Ty	3	0	0	3	PE

AUDIT COURSE								
S.No	Course Code	Course Title	Ty/Lb/ETL/IE	L	T	P	C	Category
1	**EMCC22I01**	English for Research Writing	**IE**	**2**	**0**	**0**	**0**	ID
2	**EMCC22I02**	Disaster Management	**IE**	**2**	**0**	**0**	**0**	ID
3	**EMCC22I03**	Sanskrit for Technical Knowledge	**IE**	**2**	**0**	**0**	**0**	ID
4	**EMCC22I04**	Value Education	**IE**	**2**	**0**	**0**	**0**	ID
5	**EMCC22I05**	Constitution of India	**IE**	**2**	**0**	**0**	**0**	ID
6	**EMCC22I06**	Pedagogy Studies	**IE**	**2**	**0**	**0**	**0**	ID
7	**EMCC22I07**	Stress Management by Yoga	**IE**	**2**	**0**	**0**	**0**	ID
8	**EMCC22I08**	Personality Development through Life Enlightenment Skills	**IE**	**2**	**0**	**0**	**0**	ID
9	**EMCC22I09**	Research Publication Ethics	**IE**	**2**	**0**	**0**	**0**	ID

Credit distribution

SEMESTER	CREDITS
I	21
II	19
III	16
IV	12
TOTAL	**68**

SEMESTER-I

Course Code : EMMA22005	Course Name : ADVANCED ENGINEERING MATHEMATICS FOR STRUCTURAL ENGINEERS	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: UG level Mathematics	TY	3	1	0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To provide the Concept of Tranformations.
- To teach one and two dimensional variables.
- To enable the knowledge of Estimation Theory.

COURSE OUTCOMES (COs) :	
CO1	To understand the Transform methods
CO2	To be able to solve Calculus of variation
CO3	To understand the concepts of One dimensional methods
CO4	To be able to solve the concepts of Two dimensional methods
CO5	To analyze the Estimation Theory

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	3	2	2	3	1	1	2	2
CO2	3	2	1	2	2	2	2	2	3
CO3	3	3	1	2	2	3	1	1	2
CO4	3	2	2	2	1	2	2	2	1
CO5	3	3	1	2	1	1	2	1	2

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	2
CO3	3	2	2
CO4	3	3	3
CO5	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project			
	√											

Course Code **EMMA22005**	**Course** Name : **ADVANCED ENGINEERING MATHEMATICS FOR STRUCTURAL ENGINEERS**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: UG level Mathematics	TY	3	1	0	4
L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab						

UNIT I TRANSFORM METHODS **12 hrs**

Laplace Transform methods for one dimensional wave equation – Displacements in a string – Fourier Transform methods – One dimensional heat conduction problems in infinite and semi- infinite rod.

UNIT II CALCULUS OF VARIATIONS **12 hrs**

Variation and its properties – Euler's equations – Functionals dependent on First and higher order derivatives – Functionals depend on functions of several independent variables – Problems with moving boundaries – Direct methods – Ritz and Kantorovich methods.

UNIT III ONE DIMENSIONAL RANDOM VARIABLES **12 hrs**

Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Exponential, and normal distributions – Functions of a Random variable.

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES **12 hrs**

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Correlation – Regression.

UNIT V ESTIMATION THEORY **12 hrs**

Unbiased estimators – Method of moments –Maximum likelihood estimation – Curve fitting by Principle of least squares.

Total no. of hrs: 60

Reference Books:

1. Sneddon I.N., Elements of Partial Differential Equations, Dover Publications, (2006).

2. Sankara Rao K., Introduction to Partial Differential Equations (3rd ed.), PHI, (2010).

3. Gupta A.S., Calculus of variations with applications, Prentice Hall of India, (2004).

4. Richard Johnson A., Miller & Freund's Probability and statistics for Engineers (8th ed), Prentice Hall of India, (2009).

5. Richard Johnson A., Wichern .D.W, Applied Multivariate Statistical Analysis (6th ed), Prentice Hall of India, (2007).

Course Code : **EMSE22001**	Course Name : **THEORY OF ELASTICITY AND PLASTICITY**	**Ty/Lb/ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite :Mechanics of Solids /Strength of materials	**Ty**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To understand the concept of 3D stress, strain analysis and its Applications to simpleproblems

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To remembering the basics knowledge about the Elasticity and Plasticity
CO2	To understand the concept of stress, strain of 2D and 3D for Elastic and plastic structures
CO3	To applying the concept of of elasticity and equip them with the knowledge toindependently handle the problems of elasticity
CO4	To analyze the stress and strain for Elasticity and Plasticity
CO5	To inculcate the habit of researching and practicing in the field of elasticity and Plasticity

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**1**
CO2	**3**	**3**	**2**
CO3	**3**	**3**	**3**
CO4	**3**	**3**	**1**
CO5	**3**	**2**	**2**

3/2/1 indicates strength of correlation, 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project
				√					

Course Code : **EMSE22001**	Course Name : **THEORY OF ELASTICITY AND PLASTICITY**	**Ty/Lb/ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite :Mechanics of Solids /Strength of materials	**Ty**	**3**	**1/0**	**0/0**	**4**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: BASIC CONCEPTS **12 Hrs**

Analysis of stress and strain - Equations of equilibrium and compatibility -Stress strain relationship - Generalized Hook's law

UNIT II: PLANE STRESS AND PLANE STRAIN 2D PROBLEMS **12 Hrs**

Plane stress and plane strain -2D Problems in Cartesian coordinates- Airy's stress function - Problemsin 2D - Polar coordinate

UNIT III: TORSION **12 Hrs**

Torsion of non-circular section - methods of analysis, St. Venant's theory - Torsion of elliptical sections Torsion of triangular sections - Prandtl's membrane analogy - Torsion of rolled profiles – torsion of thin rectangular section and hollow thin walled sections.

UNIT IV: ENERGY METHODS 12 **Hrs**

Energy methods - principle of virtual work - energy theorem - Rayleigh Ritz methods - Finite Difference method.

UNIT V: INTRODUCTION TO PROBLEMS IN PLASTICITY **12 Hrs**

Physical assumption - criteria of yielding, yield surface, Flow rule (plastic stress strain relationship). Elastic plastic problems of beams in bending - plastic torsion.

Total No of Hours: 60

REFERENCES

1. *Timoshenko, S. and Goodier T.N. "Theory of Elasticity", McGraw Hill Book Co., Newyork, II Edition 1988.*
2. *Sadhu Singh, "Theory of Elasticity", Khanna Publishers, New Delhi 1988.*
3. *Sadhu Singh, "Theory of Plasticity", Khanna Publishers, New Delhi 1988.*
4. *Chwo P.C. and Pagano, N.J. "Elasticity Tensor, Dyadic and Engineering applications", D.Van Nestrand Co., In Co., 1967.*
5. *Chenn, W.P. and Henry D.J. "Plasticity for Structural Engineers", Springer Verlag Newyork 1988.*
6. *Verma, PDS, "Theory of Elasticity", Vikas Publishing Pvt. Ltd. New Delhi -1997.*

Course Code : **EMSE22L01**	Course Name: **COMPUTER AIDED STRUCTURAL DESIGN - LABORATORY**	**Ty/Lb/ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Design of Concrete structures	**Lb**	**0**	**0/0**	**4/0**	**2**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : Student should aware of computer application of structural design

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To remember the basic knowledge about theory of structures
CO2	To understand the structural components and computer application
CO3	To analysis of structural components for various loading conditions using structural.analysis software
CO4	To design the building frames using software tools
CO5	Apply seismic analysis concepts to structures using Etabs

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**3**
CO2	**2**	**1**	**2**
CO3	**3**	**2**	**3**
CO4	**1**	**2**	**3**
CO5	**3**	**1**	**2**

3/2/1 indicates strength of correlation, 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project
									√

Course Code : **EMSE22L01**	Course Name: **COMPUTER AIDED STRUCTURAL DESIGN-LABORATORY**	**Ty/Lb/ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Design of Concrete structures	**Lb**	**0**	**0/0**	**4/0**	**2**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

LIST OF EXPERIMENTS

1. Analysis of Symmetrical Building Frames (Gravity Load Only) using STADD PRO Software.
2. Analysis of Symmetrical Building Frames (Wind Load Only) using STADD PRO Software.
3. Analysis of Symmetrical Building Frames (Earthquake Load Only) using STADD PRO Software.
4. Analysis of Un-Symmetrical Building Frames (Gravity Load Only) using STADD PRO Software.
5. Analysis of Un-Symmetrical Building Frames (Wind Load Only) using STADD PRO Software.
6. Analysis of Un-Symmetrical Building Frames (Earthquake Load Only) using STADD PRO Software.
7. Analysis of Symmetrical Building Frames (Gravity Load ,Wind Load Only) using Etabs Software.
8. Analysis of Symmetrical Building Frames (Earthquake Load Only) using Etabs Software. Plate
9. Analysis of Un-Symmetrical Building Frames (Gravity Load,Wind Load) using Etabs Software.
10. Analysis of Un-Symmetrical Building Frames (Earthquake Load Only) using Etabs Software.

Total No of Hours: 60 Hrs

REFERENCE :

1. *STAADPro. Manual*
2. *Etabs. Manual*
3. *Dr*. Krishnaraju.N, AdvancedR.C.Design,CBS Publishers & Distributors Pvt Ltd, 2012

Course Code : **EMSE22L02**	Course Name : **ADVANCED CONCRETE LABORATORY**	**Ty/Lb /ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Need to study Concrete technology	**Lb**	**0**	**0/0**	**4/0**	**2**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES: This course provides a thorough knowledge of material selection through the material testing based on specification.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	Ability to design the concrete structures and performance of concrete
CO2	Get the knowledge about the Self Compacting concrete, minerals and chemical admixtures
CO3	Specification of Concrete Material testing
CO4	To design the building frames using software tools
CO5	Apply seismic analysis concepts to structures using Etabs

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**1**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**1**	**3**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**1**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**
CO2	**3**	**2**	**3**
CO3	**2**	**1**	**1**
CO4	**3**	**3**	**3**
CO5	**1**	**2**	**3**

3/2/1 indicates strength of correlation, 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project
									√

Course Code : **EMSE22L02**	Course Name : **ADVANCED CONCRETE LABORATORY**	**Ty/Lb /ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Need to study Concrete technology	**Lb**	**0**	**0/0**	**4/0**	**2**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

LIST OF EXPERIMENTS

1. Mix design of concrete as per IS, ACI & BS methods for high performance concrete.
2. Flow Characteristics of Self Compacting concrete.
3. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
4. Permeability of Concrete.

a. Rapid chloride Penetration Test,
    a. Freeze and Thaw test,
    b. Acid test
    c. Alkali aggregate reaction test
    d. VCC testing for fire resistance
    e. Autoclaving

Total No. of Hours: 60

REFERENCES

1. *Purushothaman, P, Reinforced Concrete Structure Structural Elements : Behaviour Analysis and Design , Tata Mc Graw Hill, New Delhi 1986.*
2. *Varghese, P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India New Delhi, 1995.*
3. *Krishna Raju, N.Advanced Reinforced Concrete Design, CBS Publishers and New Delhi Distributors, 1986.*
4. *Neville, A.M., Properties of Concrete , Pitman Publishing Limited, London.*
5. *Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi.*

Course Code: EMCC22001	Course Name : Research Methodology and IPR	Ty/Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite: core subjects	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits T/L Theory/Lab

OBJECTIVE: The goal is to emphasize the importance of innovation and creativity by understanding the research concepts and ethics which will aid to build the nation IPR status.

COURSE OUTCOMES (COs) : By doing this course students will

CO1	Understand research problem formulation by Analyzing research related information and its execution by following research ethics
CO2	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO3	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO4	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	2	3	3	3	3	2	3	3	2	
CO2	2	3	3	3	3	2	3	3	2	
CO3	2	3	3	3	3	2	3	3	2	
CO4	2	3	3	3	3	2	3	3	2	

COs / PSOs	PSO1	PSO2	PSO3	
CO1	3	3	3	
CO2	3	3	3	
CO3	3	3	3	
CO4	3	3	3	

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplina	Skill component	Practical / Project			
							√					

Course Code : EMCC22001	Course Name : Research Methodology and IPR	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite : None	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT 1:SELECTION, ANALYSIS AND STATEMENT OF THE RESEARCH PROBLEM; 9 hrs

Literature Review and Formulation of Objectives – using the following Critical thinking Skills – Drawing a Concept map, Oral Communication, Debating, Questioning, Collaborating, Evaluation and Reasoning.

UNIT 2 :RESEARCH DESIGN 9 hrs

Types of Study, Types of Data, Measures of Variablility, Setting up the Hypotheses, data collection techniques and tools, sampling, Describing data – Charts and graphs ; Data processing – Categorization, coding, summarization.

UNIT 3: DATA ANALYSIS AND REPORT WRITING: 9 hrs

Statistical measures, Regression and correlation, significance test; Report writing – Purpose, format, content, editing and evaluation. Using Citation tools; Report for specific purposes – Theses, Journals, Grant application. Oral presentation to an audience; use of project management digital tools and plagiarism checking.

UNIT 4 : INTRODUCTION TO INTELLECTUAL PROPERTY 9 hrs

Types of intellectual property rights – Patent, Copyright, Trade Mark, Industrial Design, Geographical Indication, Trade Secrets - Traditional Knowledge. Elements of Patentability - Novelty, Non Obviousness (Inventive Steps), Industrial Application – Non patentable inventions – Process of patenting – National and International – Form and Fees for IP India

UNIT 5:PRIOR ART SEARCH, PATENT DRAFTING 9 hrs

Drafting patent Claims – Types of claims - Registration Procedure, Rights and Duties of Patentee; Patent infringement; Licensing – Franchising - Joint ventures; Non-Disclosure Agreements (NDAs) - Material Transfer Agreements (MTAs).

Total No. of Hours : 45

References:

- C. Vijayalakshmi and C. Sivapragasam (2011) Research Methods – Tips and Techniques, , MJP Publishers
- Deboraj Rumsey (2010) Statistics Essentials for Dummies, Wiley Publishing Incorporated
- Bouchoux (2013) Intellectual Property, DELMAR CENGAGE Learning, USA
- V K Ahuja (2017) Law Relating to Intellectual Property Rights, LexisNexis Butterworths India

IMPORTANT WEB LINKS

- https://www.wipo.int/portal/en/index.html
- http://ipindia.nic.in/
- https://www.epo.org
- https://www.uspto.gov

SEMESTER-II

Course Code : **EMSE22002**	Course Name : **FEM IN STRUCTURAL ENGINEERING**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Knowledge of Mathematics and Mechanics of Solids	**Ty**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES: To study the energy principles, finite element concept. Stress analysis, meshing. Nonlinearproblems and applications.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To introduce various basic concept of Fem
CO2	To develop one, two and three dimensional element properties
CO3	To Solve continuum problems using finite element analysis
CO4	To apply the finite Elements methods in Liner and Non- Liner Problems
CO5	To apply the finite Elements methods in various Software

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**
CO2	**3**	**3**	**3**
CO3	**3**	**2**	**2**
CO4	**2**	**3**	**3**
CO5	**3**	**2**	**3**

3/2/1 indicates strength of correlation, 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project
				√					

Course Code : **EMSE22002**	Course Name : **FEM IN STRUCTURAL ENGINEERING**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Knowledge of Mathematics and Mechanics of Solids	**Ty**	**3**	**1/0**	**0/0**	**4**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I : INTRODUCTION 12**Hrs**

Boundary Value Problem - Approximate Solution - Variation and Weighted Residual Methods - Ritz and Gale kin Formulations - Concepts of Approximation and Finite Elements - Displacement and Shape Functions - Weak Formulation - Minimum Potential Energy - Generation of Stiffness Matrix and Load Vector.

UNIT II : STRESS ANALYSIS 12 **Hrs**

Two Dimensional problems - Plane Stress, Plain Strain and Axi symmetric Problems - Triangular and Quadrilateral Elements - Natural Coordinates - Isoperimetric Formulation - Numerical Integration - Plate Bending and Shell Elements - Brick Elements - Elements for Fracture Analysis.

UNIT III: MESHING AND SOLUTION PROBLEMS **12 Hrs**

Higher Order Elements - p and h Methods of refinement - IIL conditioned Elements - Discrimination Errors - Auto and Adaptive Mesh Generation Techniques - Error Evaluation.

UNIT IV : NONLINEAR AND VIBRATION PROBLEMS **12 Hrs**

Material and Geometric No linearity - Methods of Treatment - Consistent System Matrices – Dynamic Condensation - Eigen Value Extraction.

UNIT V THERMAL ANALYSIS **12 Hrs**

Application to Thermal analysis Problem

Total No of Hours: 60

REFERENCES

1. *Bathe , K.J., Finite Elements Procedures in Engineering analysis, Prentice Hall Inc., New Delhi 1995.*
2. *Zienkiewicz, O.C, and Taylor, R.L., The Finite Elements Methods , Mc Graw Hill New Delhi, 1987.*
3. *Chandrupatla, R.T. and Belegundu, A.D ., Introduction to Finite Elements in Engineering, 2nd Edition , Prentice Hall of India, New Delhi 1997.*
4. *Moaveni,S., Finite Element Analysis : Theory and Application with ANSYS, Prentice Hall Inc., New Delhi 1999.*

Course Code : **EMSE22003**	Course Name : **STRUCTURAL DYNAMICS**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Knowledge of Mathematics and Mechanics of Solids	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES: To study the energy principles, finite element concept. Stress analysis, meshing. Nonlinear problems and applications.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To remembering the principles of structural dynamics theories
CO2	To understand the fundamental knowledge of the Structural dynamics
CO3	To applying the new concept of structural dynamics
CO4	To analyze the study dynamic response of single and Multi-degree of freedom system using fundamental theory and equation of motion.
CO5	To prepare them for designing the structures for wind, earthquake and other dynamic load

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**1**	**2**
CO2	**1**	**2**	**3**
CO3	**2**	**1**	**2**
CO4	**1**	**2**	**3**
CO5	**3**	**2**	**2**

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project
				√					

Course Code : **EMSE22003**	Course Name : **STRUCTURAL DYNAMICS**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Knowledge of Mathematics and Mechanics of Solids	**Ty**	**3**	**0/0**	**0/0**	**3**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I : INTRODUCTION **9 Hrs**

Foundational objective of structural dynamic analysis - D Alembert's principle - Rayleigh-Ritz method - Energy methods - Types of prescribed loadings - Basic structural concepts – ductility – Hysteresis - Rigid body dynamics - Vectorial representation

UNIT II: BASIC PRINCIPLES OF MOTION **9 Hrs**

Simple harmonic motion - Fourier transformations - Damping properties - Mass properties, Free and forced vibrations.

UNIT III: SINGLE DEGREE FREEDOM SYSTEMS **9 Hrs**

Dynamic response to time dependent transient and steady state - Forcing functions - Damped & un-damped response - Damping: vibration isolation, Response of time domain & Frequency domain.

UNIT IV: MULTI DEGREE FREEDOM SYSTEMS **9 Hrs**

Two degrees of freedom systems - Orthogonal properties - Rayleigh's method, Stodola - Vianolla Method - Method of matrix iterations - Lumped mass matrix, Multi degree freedom system - Determination of frequency and modes - Transfer matrix response determination.

UNIT V: DYNAMIC ANALYSIS OF SYSTEMS WITH DISTRIBUTED PROPERTIES **9 Hrs**

Flexural vibration of uniform beams - Numerical Evaluation of Dynamic Response - Central Difference Method - New Mark method - Earthquake response of linearly elastic buildings and linearly inelastic buildings - Dynamics of base isolated buildings.

Total No of Hours: 45

***Note: (Use of approved data books permitted)**

REFERENCES

2. *Clough R.W and Penzien,J., Dynamics of Structures , Mc Graw Hill, New Delhi 1975.*
3. *Paz Mario, Structural Dynamics, Academic Press, Los Angeles 1985.*
4. *Anderson R.A., Fundamentals of vibration, Amerind Publishing Co. New Delhi, 1972.*
5. *Roy R.Craig, Jr., Structural Dynamics - An Introduction to computer methods , John Wiley & Sons, Los Angeles.1981.*

Course Code : **EMSE22L03**	Course Name: **STRUCTURAL ENGINEERING – LABORATORY**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/ R**	**C**
	Prerequisite : Need to study Structural Analysis I & II	**Lb**	**0**	**0/0**	**4/0**	**2**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : Student should aware of computer application of structural design

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To Know about the basic knowledge of Concrete structures
CO2	Conduct Non destructive tests on exiting Concrete structures
CO3	Apply Engineering Principles to understand behaviour of structural elements
CO4	Design high Grade Concrete and study the parameters affecting its Performance
CO5	To create the new innovative ideas related to structural behavior

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**2**
CO2	**2**	**2**	**3**
CO3	**2**	**3**	**1**
CO4	**1**	**2**	**3**
CO5	**2**	**2**	**3**

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1– Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project
									√

Course Code : **EMSE22L03**	Course Name: **STRUCTURAL ENGINEERING – LABORATORY**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite : Need to study Structural Analysis I & II	**Lb**	**0**	**0/0**	**4/0**	**2**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

LIST OF EXPERIMENTS

1. Study of behavior of RC Beams under flexure
2. Study of behavior of RC Beams under Shear a
3. Study of behavior of RC Beams under Torsion
4. Non-Destructive testing of concrete
5. Prefabricated modular Members
6. Study of Pre-Tensioning Concrete members
7. Study of Post Tensioning Concrete members

Total No of Hours: 60

REFERENCE :

1. *R. Park and T. Paulay, "Reinforced Cement Concrete Structures", MISL-WILEY Series, Wiley India Pvt. Ltd, 2009.*
2. *M.S. Shetty, "Concrete Technology", Eighth edition, S Chand Publishing; 2018.*
3. *Relevant IS codes.*

Course Code : **EMSE22L04**	Course Name : **STRUCTURAL ENGINEERINGDESIGN STUDIO**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Design of concrete structures	**Lb**	**0**	**0/0**	**4/0**	**2**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES: Student should aware of computer application of structural design.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	Design steel structures/components by different design processes
CO2	Analyze and design beams and columns for stability and strength, and drift
CO3	Use the available software for dynamic analysis
CO4	Design high Grade Concrete and study the parameters affecting its Performance
CO5	To create the new innovative ideas related to structural behavior

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**1**
CO3	**3**	**2**	**1**	**3**	**2**	**2**	**1**	**1**	**2**
CO4	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**2**
CO2	**2**	**3**	**3**
CO3	**1**	**2**	**3**
CO4	**2**	**1**	**3**
CO5	**1**	**1**	**2**

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1– Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplin ary	Skill component	Practical / Project
									√

Course Code : **EMSE22L04**	Course Name : **STRUCTURAL ENGINEERINGDESIGN STUDIO**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Design of concrete structures	**Lb**	**0**	**0/0**	**4/0**	**2**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

LIST OF EXPERIMENTS

1. Program Using Arrays and Functions for Matrix Manipulation.
2. Programs to Draw Bending Moment and Shear Force Diagrams. Using Graphic in C
3. Program for Design of Slabs. Using Excel
4. Program for Design of Beams. Using Excel
5. Program for Design of Column and Footing Using Excel
6. Analysis of Truss Using STAAD Pro.
7. Analysis of Multistoried Space Frame, Using STAAD Pro.
8. Analysis of Bridge Deck Slab.

Total No of Hours: 60

REFERENCES:

1. *Computer Aided Design by C.S.Krishnamoorthy and S.Rajeev.*
2. *Computational Structures by S.Rajasekharan.*

Course Code : **EMSE22I01**	Course Name : **TERM PAPER**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
	Prerequisite: Nil	**IE**	**0**	**0/0**	**0/4**	**2**
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

A term paper is an elaborate research-based work on a particular topic in the domain of study. The student must choose a topic of his interest from the domain of study for a term paper. The term paper can be an original research article or review article. In case of review article, the student must refer atleast 50 research/review articles and critically review other researcher's work. The term paper may be 10 -20 pages in length. The general guidelines for writing the term paper as follows:

1. Abstract
2. Introduction to explain about the broad and general statement on the topic chosen.
3. Aim /Objective of the term paper.
4. Description of methodology, concepts and arguments.
5. Identify the research gap and suggest possible future works.
6. Conclusion

Three reviews will be conducted to monitor the progress of the work.At the end of the semester, presentation must be made by the student and Viva- Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

SEMESTER-III

Course Code : **EMSE22004**	Course Name : **Experimental Techniques and Instrumentation**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Need to study Structural Analysis I & II	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To learn the principles of measurements of static and dynamic response of Structures and carryout the analysis of results

COURSE OUTCOMES (Cos) : (3 – 5)
At the end of the course, students will be able to

CO1	To learn about measurements of strain, variation and wind blow
CO2	To Understand the various devices that are used for vibrating systems
CO3	To applying the knowledge about measurements and techniques
CO4	To analyse the structures by non-destructive testing method and model analysis
CO5	To create a new thought about the **Instrumentation**

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**

COs/PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**3**
CO2	**3**	**2**	**1**
CO3	**1**	**2**	**3**
CO4	**3**	**2**	**2**
CO5	**2**	**2**	**3**

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1– Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter disciplinary	Skill component	Practical / Project
				√					

Course Code : **EMSE22004**	Course Name : **Experimental Techniques and Instrumentation**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Need to study Structural Analysis I & II	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: FORCES AND STRAIN MEASUREMENT **9 Hrs**

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges

- Electronic load cells - Proving Rings - Calibration of Testing Machines - Longterm monitoring – vibrating wire sensors - Fibre optic sensors.

UNIT II: MEASUREMENT OF VIBRATION AND WIND FLOW **9 Hrs**

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

UNIT III : DISTRESS MEASUREMENTS AND CONTROL **9Hrs**

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

UNIT IV: NON-DESTRUCTIVE TESTING METHODS **9 Hrs.**

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

UNIT IV: MODEL ANALYSIS **9 Hrs.**

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

Total No of Hours: 45

REFERENCES:

1. Dalley .J.W and Riley.W.F, "Experimental Stress Analysis", McGraw Hill Book Company, N.Y. 1991

2. Ganesan.T.P, "Model Analysis of Structures", University Press, India, 2000.

3. Ravisankar.K.and Chellappan.A., "Advanced course on Non-Destructive Testing and Evaluation ofConcrete Structures", SERC, Chennai, 2007.

4. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 2006.

5. Sirohi.R.S., Radhakrishna.H.C, "Mechanical Measurements", New Age International (P) Ltd.

Course Code : **EMOL22I01**	Course Name : Open Elective (On Line Course through NPTEL/SWAYAM/Any MOOC	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Need to	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

Students should register for the online course with a minimum course duration of 8 weeks through the online portals such as NPTEL/SWAYAM/Any MOOC in the beginning of the semester. The course can be core/interdisciplinary in such a way that the same course is not repeated during the course of his study. Students are expected to attend the online classes regularly and submit the weekly assignments before the due dates. Students should appear for the online examination and submit the certificate at the end of the semester.Internal examination will be conducted by the examiners duly appointed by the head of the department.

Course Code: EMSE22I02	Course Name: SUMMER INTERNSHIP	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	0	0/0	4/0	2

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES

Students must undergo three – week practical training in Civil engineering related organizations so that they Become aware of the practical applications of theoretical concepts studied in the classrooms. Students have to undergo three-week practical training in Civil Engineering related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations

Course Code: EMSE22L05	Course Name : DISSERTATION PHASE I	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	0/10	5

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Work in a team and develop multidisciplinary, research skills
CO2	Identifying the challenges and issues of the industry
CO3	Explore innovative ideas in civil engineering field
CO4	Develop projects based on industrial and field requirements
CO5	Develop design projects based on industrial requirements.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	3	3	3			
CO2	3	3	2	3	3	3	3	2	3			
C03	3	3	3	3	3	3	3	3	3			
CO4	3	3	3	3	2	3	3	2	3			
CO5	3	3	3	2	3	2	3	2	3			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	2	2	3				
CO2	1	2	3				
C03	2	3	3				
CO4	1	1	2				
CO5	2	2	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
									√			

Course Code: EMSE22L05	Course Name : DISSERTATION PHASE I	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	10/0	5

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE

The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

M.Tech projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase IIof the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

SEMESTER-IV

Course Code: EMSE22L06	Course Name : DISSERTATION PHASE II	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	10/10	10

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Work in a team and develop multidisciplinary ,research skills
CO2	Identifying the challenges and issues of the industry
CO3	Explore innovative ideas in civil engineering field
CO4	Develop projects based on industrial and field requirements
CO5	Develop design projects based on industrial requirements.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	2	3
C03	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	2	3	3	2	3
CO5	3	3	3	2	3	2	3	2	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	2	3
CO2	1	2	3
C03	2	3	3
CO4	1	1	2
CO5	2	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
									√			

Course Code: EMSE22L06	Course Name : DISSERTATION PHASE II	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	10/10	10

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE

The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.

M. Tech projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

Course Code: EMSE22I03	Course Name : RESEARCH PUBLICATION	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	IE	0	0/0	2/2	2
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/EmbeddedTheory and Lab						

OBJECTIVE

Students are supposed to prepare and publish the article based on either his term paper or area of research in peer reviewed referred journal. Code of research publication ethics should be followed. After publishing the article students should present a seminar in presence of department faculties and PG students. At the end of semester viva examination will be conducted by the examiners appointed by the Head of the department.

PROGRAM ELECTIVE -I

Course Code : **EMSE22E01**	Course Name : **THEORY OF THIN PLATES AND SHELLS**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite : Strength of Materials/ Structural Alalysis	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/EmbeddedTheory and Lab

OBJECTIVES: Study the behaviour and design of shells, design of plates.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	Ability to learn about behaviour and analysis of thin plates
CO2	Understand Isotropic and orthotropic plates, bending and twisting of plates; Numerical solutions.
CO3	Study the behaviour and design of shells, design of plates
CO4	To Analyze the Various Problems using different theories based on plate and shells
CO5	Toapply a new knowledge related with different theories based on plate and shells

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	2	3	2	3	1	3	2	3	2	
CO2	1	3	1	3	2	3	1	2	1	
C03	2	3	3	3	3	3	2	3	2	
CO4	3	3	2	3	2	3	1	2	3	
CO5	2	3	3	3	3	3	2	2	3	

COs / PSOs	PSO1	PSO 2	PSO3	
CO1	1	2	3	
CO2	3	2	2	
C03	3	2	3	
CO4	1	2	2	
CO5	2	2	3	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					✓							

Course Code : **EMSE22E01**	Course Name : **THEORY OF THIN PLATES AND SHELLS**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite : Strength of Materials/ Structural Alalysis	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: BENDING OF RECTANGULAR PLATES **9 Hrs**

Introduction to plate theory - Small deflection of laterally loaded thin rectangular plates for pure bending. Navier's and Levy's solution for various lateral loading and boundary conditions (No derivation) - Numerical examples.

UNIT II : BENDING OF CIRCULAR PLATES **9 Hrs**

Energy methods for rectangular and circular plates with clamped edges subjected to symmetric loadings.

UNIT III : CLASSIFICATION OF SHELLS **9 Hrs**

Introduction to curved surfaces and classification of shells - Membrane theory of spherical shells - cylindrical shells - hyperbolic paraboloids - elliptic paraboloid and conoids.

UNIT IV : MEMBRANE THEORY **9 Hrs**

Axially symmetric bending of shells of revolution - Closed cylindrical shells - water tanks, sphericalshells and Geckler's approximation - Bending theory of doubly curved shallow shells.

UNIT V : FLEXURE THEORY **9 Hrs**

Design and detailing of folded plates with numerical examples Design and Detailing of simple shellproblems – spherical domes, water tanks, barrel vaults and hyperbolic paraboloid roofs

Total No of Hours: 45

REFERENCES

1. *Flugge, Stresses in shells, 2nd ed., Springer – Verglag, Berlin, 1960*
2. *Sziland, R. Theory and Analysis of Plates (Classical and Numerical Methods) Prentice Hall, Ijc.New Jersy, 1974.*
3. *Billington, D.P. Thin Shell concrete structures 2nd ed. McGraw Hill Book Co., New York, 1965.*
4. *Ugural, Il. Theory and practice of shell structures, Wilhelm Ernst and John Berlin, 1968.*
5. *Timoshenko.S and Krieger.S.W., Theory of Plates and Shells, McGraw Hill Co., New York 1990.*

Course Code : **EMSE22E02**	Course Name : **THEORY AND APPLICATIONS OF CEMENT COMPOSITES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Concrete Technology/ Composite Materials	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To understand various construction procedures from sub structure to super structure and also the equipment needed for construction of various types of structures from foundation to super structure

COURSE OUTCOMES (Cos) : (3 – 5)

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

CO1	Formulate constitutive behaviour of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete by understanding their strain- stress behaviour
CO2	Classify the materials as per orthotropic and anisotropic behaviour.
CO3	Estimate strain constants using theories applicable to composite materials.
CO4	Analyse and design structural elements made of cement composites.
CO5	To create e new idea about cement concrete in the construction field.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9				
CO1	2	1	2	3	2	1	2	1	3				
CO2	3	2	1	2	3	2	3	2	2				
C03	1	2	3	1	2	3	2	3	3				
CO4	2	3	1	2	3	2	3	1	3				
CO5	1	2	3	2	3	1	3	2	2				

COs / PSOs	PSO1	PSO2	PSO3						
CO1	3	2	3						
CO2	3	1	2						
C03	2	3	1						
CO4	3	2	3						
CO5	2	1	2						

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E02**	Course Name : **THEORY AND APPLICATIONS OF CEMENT COMPOSITES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Concrete Technology/ Composite Materials	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I – INTRODUCTION **9 Hrs**

Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

UNIT II - MECHANICAL BEHAVIOUR **9 Hrs**

Mechanics of Materials Approach to Stiffness - Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

UNIT III - CEMENT COMPOSITES **9 Hrs**

Types of Cement Composites, Terminology, Constituent Materials andtheir Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

UNIT IV - MECHANICAL PROPERTIES OF CEMENT COMPOSITES **9 Hrs**

Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

UNIT V - APPLICATION OF CEMENT COMPOSITES **9 Hrs**

FRC and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures. CompositeMaterials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.

Total No of Hours: 45 Hrs

REFERENCES

1. *Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis,BSP Books, 1998.*
2. *Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.*
3. *New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983.*

Course Code : EMSE22E03	Course Name : THEORY OF STRUCTURAL STABILITY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite : Need to study Structural Analysis I & II	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To study the concept of buckling and analysis of structural elements

COURSE OUTCOMES (Cos) : (3 – 5)
At the end of the course, students will be able to

CO1	To learn the classical methods of structural analysis in columns
CO2	To understand the method of solving in beams,columns and frames and plates
CO3	To apply the concept of virtual work to find the deflection beams,columns and frames and plates
CO4	To analyze the structures by calculating forces and displacements in structures due to given loads and imposed deformations
CO5	To evaluate the bending moment using slope deflection, moment distribution and approximate methods

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	2	3	2	1	2	1	3
CO2	3	2	1	2	3	2	3	2	2
C03	1	2	3	1	2	3	2	3	3
CO4	2	3	1	2	3	2	3	1	3
CO5	1	2	3	2	3	1	3	2	2

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	2	3
CO2	3	1	2
C03	2	3	1
CO4	3	2	3
CO5	2	1	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							
Approval												

Course Code : EMSE22E03	Course Name : THEORY OF STRUCTURAL STABILITY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite : Need to study Structural Analysis I & II	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: BUCKLING OF COLUMNS **9 Hrs**

Concept of stability approaches to stability analysis - characteristics of stability problems - Columns - Buckling of columns with various end conditions, imperfect columns - Elastically supported columns - non-prismatic columns - Built-up columns - Inelastic buckling - Experimental study of column behaviour - Empirical column formulae - Buckling of bars on elastic foundations - Large deflection of buckled bars.

UNIT II: BUCKLING OF BEAM-COLUMNS AND FRAMES **9 Hrs**

Beam-column theory - Application to buckling of frames.

UNIT III: TORSIONAL AND LATERAL BUCKLING **9 Hrs**

Combined tensional and flexural buckling - Lateral Buckling - Lateral buckling of beams - pure bending of simply supported beam and cantilever - numerical solutions.

UNIT IV: BUCKLING OF PLATES **9 Hrs**

Buckling of thin plates - various edge conditions, inelastic buckling - post buckling strength.

UNIT V: APPROXIMATE METHODS **9 Hrs**

Energy methods - Iterative procedure and Finite element formulation.

Total No of Hours: 45

REFERENCES

1. *Allen, H.G., and Bulson, P.S., Background to Buckling, McGraw Hill Book Company, New Delhi 1980.*
2. *Smitses, Elastic Stability of Structures, Prentice Hall, New Delhi 1973.*
3. *Chajes, A. Principles of Structures Stability Theory, Prentice Hall, New Delhi 1974.*
4. *Ashwini Kumar, Stability Theory of Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.*
5. *Timoshenko, S., and Gere., Theory of Elastic Stability, McGraw Hill Book Company, New Delhi 1961*
6. *Brush and Almorth.,Buckling of Bars, Plates and Shells, McGraw Hill Book Company, New Delhi*

Course Code : **EMSE22E04**	Course Name: **SOIL STRUCTURE INTERACTION**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Basic Concept of Soil Mechanics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To study about soil – Foundation Interaction problems Analysis of pile Foundation

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	Understand Soil structure interaction Concept and behaviour
CO2	Understand Engineering properties like field density, shear strength, permeability, compaction and consolidation
CO3	Calculate shear, UCC, consolidation and triaxial compressive strength value of soil sample
CO4	Analyze different types of frame structure foundation on stratified natural deposits with Linear and Non-linear stress- strain characteristics.
CO5	Evaluate action of group of pile foundation considering stress- strain characteristics of real soil

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	
CO2	**2**	**1**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	
C03	**2**	**2**	**3**	**1**	**3**	**2**	**1**	**3**	**2**	
CO4	**3**	**2**	**3**	**1**	**2**	**3**	**2**	**1**	**2**	
CO5	**3**	**2**	**3**	**2**	**3**	**1**	**2**	**3**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	
CO1	**2**	**3**	**3**	
CO2	**1**	**1**	**3**	
C03	**3**	**2**	**2**	
CO4	**2**	**1**	**3**	
CO5	**3**	**3**	**2**	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E04**	Course Name: **SOIL STRUCTURE INTERACTION**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Basic Concept of Soil Mechanics	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: SOIL-FOUNDATION INTERACTION **9 Hrs**

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

UNIT II: BEAM ON ELASTIC FOUNDATION- SOIL MODELS **9 Hrs**

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

UNIT III: PLATE ON ELASTIC MEDIUM **9 Hrs**

Infinite plate, Winkler, Two parameters, isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions

UNIT IV: ELASTIC ANALYSIS OF PILE **9 Hrs**

Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, analysis of pile group,Interaction analysis, Load distribution in groups with rigid cap.

UNIT V: LATERALLY LOADED PILE **9 Hrs**

Load deflection prediction for laterally loaded piles, Sub-grade reaction and elastic analysis, Interaction analysis,Pile raft system, Solutions through influence charts

Total No of Hours: 45

REFERENCES

1. *Selva durai, A.P.S.., Elastic Analysis of Soil Foundation Interaction,Elsevier,1979*
2. *Poulos, H.G., and Davis,E.H., Pile Foundation Analysis and Design, John Wiley,Tata McGraw Hill Publishing Co. 2nd Edition,Berlin 1988.*
3. *Scott,R.F.,Foundation Analysis,Prentice Hall,1981 New Jercy*
4. *Structure Soil Interaction - State of Art Report,Institution of Structural Engineers, New Delhi 1978.*
5. *ACI 336, Suggested Analysis and Design Procedures for combined footings and Mats, American Concrete Institute, Delhi,1988*

PROGRAM ELECTIVE -II

Course Code : **EMSE22E05**	Course Name : **REPAIR AND REHABILITATION OF STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Basic Level Repair and Rehabilitation of Structures	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

COURSE OUTCOMES (Cos) : (3 – 5)
At the end of the course, students will be able to

CO1	Ability to learn about the health of structure using static field methods and dynamic field tests
CO2	Diagnosis the distress in the structure understanding the causes and factors.
CO3	Students to know about repairs and rehabilitation measures of the structure
CO4	Ability to investigation structural related problems
CO5	Suggest repairs and rehabilitation measures of the structure

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**2**	**1**	**2**	**3**	**2**	**1**	**2**	**1**	**3**	
CO2	**3**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**2**	
C03	**1**	**2**	**3**	**1**	**2**	**3**	**2**	**3**	**3**	
CO4	**2**	**3**	**1**	**2**	**3**	**2**	**3**	**1**	**3**	
CO5	**1**	**2**	**3**	**2**	**3**	**1**	**3**	**2**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**3**
CO2	**3**	**1**	**2**
C03	**2**	**3**	**1**
CO4	**3**	**2**	**3**
CO5	**2**	**1**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E05**	Course Name : **REPAIR AND REHABILITATION OF STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Basic Level Repair and Rehabilitation of Structures	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I MAINTENANCE AND REPAIR STRATEGIES **9 Hrs**

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration**.**

UNIT II SERVICEABILITY AND DURABILITY OF CONCRETE **9 Hrs**

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion - Effects of cover thickness and cracking.

UNIT III MATERIALS FOR REPAIR **9 Hrs**

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

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS **9 Hrs**

Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Expoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidated structures – case studies

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES **9 Hrs**

Repairs to overcome low member strength. Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

Total No of Hours: 45

TEXT BOOKS:

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials,
2. Maintenance and Repair”, Longman Scientific and Technical UK, 1991.
3. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987

REFERENCES:

1. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2008.
2. Dov Kominetzky.M.S., " Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
3. Ravishankar.K., Krishnamoorthy.T.S, " Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
5. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013

Course Code : **EMSE22E06**	Course Name : **STRUCTURAL HEALTH MONITORING**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Static and Dynamic distress/ Repair and Rehabilitation	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

COURSE OUTCOMES (Cos) : (3 – 5)
At the end of the course, students will be able to

CO1	Ability to learn about the health of structure using static field methods and dynamic field tests
CO2	Diagnosis the distress in the structure understanding the causes and factors.
CO3	Students to know about repairs and rehabilitation measures of the structure
CO4	Ability to investigation structural related problems
CO5	Suggest repairs and rehabilitation measures of the structure

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**2**	**1**	**2**	**3**	**2**	**1**	**2**	**1**	**3**	
CO2	**3**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**2**	
C03	**1**	**2**	**3**	**1**	**2**	**3**	**2**	**3**	**3**	
CO4	**2**	**3**	**1**	**2**	**3**	**2**	**3**	**1**	**3**	
CO5	**1**	**2**	**3**	**2**	**3**	**1**	**3**	**2**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**3**
CO2	**3**	**1**	**2**
C03	**2**	**3**	**1**
CO4	**3**	**2**	**3**
CO5	**2**	**1**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E06**	Course Name : **STRUCTURAL HEALTH MONITORING**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Static and Dynamic distress/ Repair and Rehabilitation	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: STRUCTURAL HEALTH **9 Hrs**

Factors affecting Health of Structures - Causes of Distress - Regular Maintenance.

UNIT II: STRUCTURAL HEALTH MONITORING **9 Hrs**

Concepts - Various Measures -Structural Safety in Alteration - Structural Audit - Assessment of Health of Structure - Collapse and Investigation - Investigation Management - SHM Procedures.

UNIT III TESTING **9 Hrs**

Testing: Static Field Testing – Dynamic field testing - Stress history data - Dynamic load allowance tests - Ambient vibration tests - Forced Vibration Method - Dynamic response methods.

UNIT VI DYNAMIC FIELD TESTING **9 Hrs**

Types of Dynamic Field Test- Stress History Data- Dynamic Response Methods- Hardware for Remote Data Acquisition Systems- Remote Structural Health Monitoring.

UNIT V INTRODUCTION TO REPAIRS AND REHABILITATIONS OF STRUCTURES **9 Hrs**

Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Total No of Hours: 45

REFERENCES:

1. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components_Methods with Applications,Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan,Taylor and Francis Group, London, UK, 2006.
4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc,2007

Course Code : **EMSE22E07**	Course Name: **STRUCTURAL OPTIMIZATION**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study Linear and Nonlinear Structures	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To The objective of this course is to make students to learn principles of optimization,

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	Understand Structural optimization based on Optimal criteria.
CO2	Computation of derivatives of response quantities with respect to design variables.
CO3	Non-linear programming by different methods.
CO4	To implement the optimization Concepts for the structural engineering problems.
CO5	To evaluate different methods of optimization.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**2**	**1**	**2**	**3**	**2**	**1**	**2**	**1**	**3**	
CO2	**3**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	**2**	
C03	**1**	**2**	**3**	**1**	**2**	**3**	**2**	**3**	**3**	
CO4	**2**	**3**	**1**	**2**	**3**	**2**	**3**	**1**	**3**	
CO5	**1**	**2**	**3**	**2**	**3**	**1**	**3**	**2**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**			
CO1	**3**	**2**	**3**			
CO2	**3**	**1**	**2**			
C03	**2**	**3**	**1**			
CO4	**3**	**2**	**3**			
CO5	**2**	**1**	**2**			

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E07**	Course Name: **STRUCTURAL OPTIMIZATION**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study Linear and Nonlinear Structures	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I INTRODUCTION **9 Hrs**

Introduction to optimization - engineering applications of optimization - Formulation of structural optimization problems as programming problems - Optimization Techniques- Classical optimization techniques- single variable optimization- multivariable optimization with no constraints- unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques- Lagrange multipliers techniques and feasibility techniques.

UNIT II LINEAR PROGRAMMING **9 Hrs**

Standard form of linear programming, geometry of linear programming problems-solution of a system of linear simultaneous equations- pivotal production of general systems of equations- simplex algorithms-revised simpler methods- duality in linear programming.

UNIT III NON-LINEAR PROGRAMMING **9 Hrs**

One dimensional minimization methods- elimination methods-Fibonacci method- golden section method-interpolation methods- quadratic and cubic methods-Unconstrained optimization methods-direct search methods-random search methods- descent methods

UNIT IV CONSTRAINED OPTIMIZATION TECHNIQUES **9 Hrs**

Direct methods- the complex methods- cutting plane method-exterior penalty function methods for structural engineering problems- Formulation and solution of structural optimization problems by different techniques.

UNIT V GEOMETRIC AND DYNAMIC PROGRAMMING **9 Hrs**

Geometric programming, conversion of NLP as a sequence of LP/ geometric programming- Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming

Total No of Hours : 45

REFERENCE :

1. Spunt, "Optimum Structural Design"- Prentice Hall

2. S.S. Rao, "Optimization – Theory and Practice"- Wiley Eastern Ltd.

3. Uri Krisch, "Optimum Structural Design"- McGraw Hill

4. Richard Bronson, "Operation Research"- Schaum's Outline Series

5. Bhavikatti S.S.- "Structural optimization using sequential linear programming"- Vikas publishing house

Course Code : **EMSE22E08**	Course Name : **PREFABRICATED STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study Concrete Technology and Construction Materials	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To Study the design principles, analysis and design of elements

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To learn the basic principle of fabricated structures
CO2	To Understand the concept of Structural prefabricated elements
CO3	To know abnormal loads which are hazardous to prefabricated structures
CO4	To analyze the Structural elements
CO5	To familiarize with joining techniques used for prefabrication

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**2**	**1**	**2**	**3**	**3**	**2**	**2**	**3**	
CO2	**2**	**1**	**2**	**3**	**2**	**3**	**1**	**2**	**3**	
C03	**2**	**3**	**3**	**2**	**1**	**3**	**2**	**3**	**2**	
CO4	**1**	**2**	**3**	**2**	**3**	**2**	**1**	**2**	**1**	
CO5	**2**	**3**	**2**	**3**	**1**	**2**	**3**	**2**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**			
CO1	**1**	**2**	**3**			
CO2	**2**	**3**	**3**			
C03	**3**	**2**	**3**			
CO4	**2**	**3**	**2**			
CO5	**2**	**3**	**3**			

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E08**	Course Name : **PREFABRICATED STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study Concrete Technology and Construction Materials	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: INTRODUCTION **9 Hrs**

Concept of planning and layout of prefabricated plant. IS Code specification. Modular co-ordination,

standardization, production, transportation, erection, stages of loading and coal provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

UNIT II: REINFORCED CONCRETE **9 Hrs**

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls

UNIT III: FLOORS, STAIRS AND ROOFS **9 Hrs**

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints

UNIT IV: WALLS **9 Hrs**

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, types of wall joints, Leak prevention, joint sealants, sandwich wall panels.

UNIT V: ACCESSORIES AND PLUMPING **9 Hrs**

Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, Water leakage, damp proofing

Total No of Hours: 45

***Note: (Use of approved data books permitted)**

REFERENCES

1. *B.Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam/ London/ New York, 1966.*
2. *Koncz.T., Manual of Precast Concrete Construction, Vol.I II and III, Bauverlag, GMBH, 1971.*
3. *Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precase Concrete, Netherland Betor Verlag, London 1978.*
4. *Lasslo Mokk, Prefabricated Concrete for Industrial and Public Sectors, Akademiai Kiado, Budapest, 1964.*
5. *Murashev.V., Sigalov.E., and Bailov.V., Design of Reinforced Concrete Structures, Mir Publishers, London 1968.*
6. *CBRI, Building Materials and Components, 1990, India.*
7. *Gerostiza. C.Z., Hendrikson, C., Rehat D.R., Knowledge Based Process Planning for Constructionand Manufacturing, Academic Press, Inc., London 1989.*

PROGRAM ELECTIVE-III

Course Code : **EMSE22E09**	Course Name: **ADVANCED STEEL DESIGN**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of steel Structures Structures	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : General principle in the design of steel structures such as Various types of connections, Steel transmission line towers, Plastic method of structural analysis and Analysis and design of industrial structures.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To know the general principle of steel structures in various field.
CO2	To understand the Various types of connections, Steel transmission line towers.
CO3	Analyze and design of beam and column stability and strength
CO4	Design welded and bolted connections and Plastic Analysis
CO5	Design of Industrial structures & Pre-Engineered Building

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**1**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**2**	
C03	**3**	**2**	**3**	**1**	**2**	**3**	**2**	**1**	**3**	
CO4	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	
CO5	**3**	**2**	**3**	**2**	**3**	**1**	**2**	**3**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	
CO1	**1**	**2**	**3**	
CO2	**3**	**2**	**3**	
C03	**3**	**3**	**3**	
CO4	**2**	**3**	**2**	
CO5	**3**	**2**	**3**	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E09**	Course Name: **ADVANCED STEEL DESIGN**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of steel Structures Structures	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I GENERAL **9 Hrs**

Beams subjected to biaxial bending - Built-up Purlins - Various types and design -Design of Wind girders-Beam-columns - With various support conditions-Design of foundations-with lateral forces.

UNIT II CONNECTIONS **9 Hrs**

Bearing type joints - unstiffened and stiffened seat connections - moment resisting connection of brackets-bolted and welded-semi-rigid connections.

UNIT III TOWERS **9 Hrs**

Basic structural configurations - free standing and guyed towers - loads on towers -wind loads - foundation design - design criteria for different configurations and transmission line towers

UNIT IV PLASTIC ANALYSIS **9 Hrs**

Theory of plastic bending - Plastic hinge concept - Mechanism method – Application to continuous beams and portal frames-Plastic moment distribution - Analysis of Gable frames - instantaneous centre of rotation - Connections.

UNIT V INDUSTRIAL BUILDINGS AND PRE-ENGINEERED BUILDINGS **9 Hrs**

Industrial buildings-braced and unbraced - Gable frames with gantry-Rigid industrial frames-Fire resistant design-Fatigue resistant design-Standard design loads – Advantages of pre engineered buildings - Framing systems for Pre Engineered steel buildings – Characteristics of Pre Engineered steel buildings

Total No of Hours: 45

REFERENCE :

1 Subramanian. N, "Design of Steel Structures: Theory and Practice", Oxford university Press, U.S.A, Third Edition, 2011.
2. Dugga l.S.K, "Design of Steel Structures", McGraw Hill New Delhi, 2010
3. Dayaratnam. P, "Design of Steel Structures,"Chand. S, Limited, New Delhi.2008.
4. John. E, Lothers, "Structural Design in Steel", Prentice Hall, 1999.
5. Neal. B.G, "Plastic Method of Structural Analysis", Taylor & Francis, Third Edition, 1985.
6. Edwin .H, Gaylord, Charles .N, Gaylord, James .E, Stallmeyer, "Steel Structures", McGraw Hill, New Delhi, 1980.
7. Ramchandra, "Design of Steel Structures", Vol I & II Standard Book House, Delhi, 1975.
8. Arya.S and Ajmani.J.L, "Design of Steel Structures", Nem Chand & Bros, Roorkee

Course Code : **EMSE22E10**	Course Name: **DESIGN OF FORMWORK**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Building Materials	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To understand requirement of formwork and Judge the formwork failures throughcase studies

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To remember the basic concept about the construction materials.
CO2	To know the behavior of tall buildings due to various types of loads.
CO3	To Select the proper formwork, accessories and material.
CO4	Design the form work for Beams, Slabs, columns, Walls and Foundations and special structures.
CO5	To Judge the formwork failures through case studies

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**1**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	
CO2	**2**	**3**	**2**	**1**	**3**	**2**	**3**	**3**	**2**	
C03	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	
CO4	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**3**	
CO5	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**3**
CO2	**3**	**2**	**3**
C03	**2**	**3**	**2**
CO4	**3**	**2**	**3**
CO5	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E10**	Course Name: **DESIGN OF FORMWORK**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Construction Materials	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: INTRODUCTION **9 Hrs**

Requirements and Selection of Formwork.

UNIT II: FORMWORK MATERIALS **9 Hrs**

Timber- Plywood- Steel- Aluminium- Plastic- and Accessories- Horizontal and Vertical Formwork Supports.

UNIT III: FORMWORK DESIGN **9 Hrs**

Concepts- Formwork Systems and Design for Foundations- Walls- Columns- Slab and Beams.

UNIT IV: FLYING FORMWORK **9 Hrs**

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

UNIT V: FORMWORK FAILURES **9 Hrs**

Causes and Case studies in Formwork Failure- Formwork Issues in MultiStory Building Construction.

Total No of Hours: 45

REFERENCES

1. *Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015.*
2. *Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.*
3. *IS 14687: 1999, False workfor Concrete Structures - Guidelines, BIS.*

Course Code : **EMSE22E11**	Course Name: **TALL STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Concrete technology/ Structural dynamics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To study the behaviour, analysis and design of tall structures.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To know the structural element behaviour, analysis and design
CO2	Understand the Design philosophy, details types of loading and performance of concrete
CO3	Ability to analysis the stability tall structure buildings
CO4	Evaluate a natural frequency of contentious elements
CO5	Apply a new techniques for controlling the vibration of the structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**1**	**2**	**1**	**2**	**2**	**1**	**3**	**2**	
CO2	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	
C03	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	
CO4	**3**	**3**	**3**	**2**	**3**	**1**	**3**	**2**	**3**	
CO5	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**3**
CO2	**2**	**3**	**2**
C03	**1**	**2**	**3**
CO4	**2**	**2**	**3**
CO5	**3**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E11**	Course Name: **TALL STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Concrete technology/ Structural dynamics	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: DESIGN CRITERIA **9 Hrs**

Design philosophy- Loading- Sequential loading and materials - high performance Concrete - Fiber reinforced Concrete - Light weight Concrete - Design mixes.

UNIT II: LOADING AND MOVEMENT **9 Hrs**

Gravity Loading: Dead and live load- methods of live load reduction-Impact- gravity loading, construction load

Wind loading: Static and dynamic approach- Analytical and wind tunnel experimental method.

Earthquake loading: Equivalent lateral force- modal analysis- combinations of loading working stress design-Limit state design- plastic design.

UNIT III: BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS **9 Hrs**

Factors affecting growth- Height and Structural form- High rise behaviour Rigid frames- braced frames- Infilled frames- shear walls- coupled shear walls- wall-frames- tubular- cores- futrigger - braced and hybrid mega system.

UNIT IV: ANALYSIS AND DESIGN **9 Hrs**

Modeling for approximate analysis- Accurate analysis and reduction techniques- Analysis of building as total structural system considering overall integrity and major subsystem interaction- Anlysis for member forces-drift and twist- computerised general three dimensional analysis.

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

UNIT V: STABILITY OF TALL BUILDINGS **9 Hrs**

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

Total No of Hours: 45

REFERENCES

1. *Dr. Y.P.Gupta, Editor. Proceedings National Seminar on High Rise Structures Design and Construction practices for middle level cities Nov. 14 -16, 1995, New Age International Limited, Publishers, Madras -20.*
2. *Wilf gang Schuller, High Rise Building Structures, John Wiley and Sons, New Jercy 1977.*
3. *Taranath B.S., Structural Analysis and Design of Tall Building, McGraw Hill, 1988.*
4. *Bryan stafford Smith, Alexcoull, Tall Building Structures , Analysis and Design,John Wiley and Sons, Inc New Jercy 1977*

Course Code : **EMSE22E12**	Course Name: **DESIGN OF MASONRY STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of concrete structures I & II	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To study the behaviour, analysis and design of masonry structures

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	Knowledge about the strength and stability of concrete materials and structures
CO2	Understand the behaviour of the masonry structures in various load conditions.
CO3	Learned about the design parameters using code provisions
CO4	Ability to design the masonry structures by applying different loads.
CO5	To apply the innovative idea for masonry structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**2**	
CO2	**2**	**3**	**2**	**1**	**3**	**2**	**3**	**3**	**2**	
C03	**2**	**3**	**2**	**3**	**2**	**1**	**1**	**2**	**3**	
CO4	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**3**	
CO5	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**3**
CO2	**3**	**2**	**3**
C03	**2**	**3**	**2**
CO4	**3**	**2**	**3**
CO5	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E12**	Course Name: **DESIGN OF MASONRY STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of concrete structures I & II	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: MATERIALS,STRENGTH AND STABILITY **9 Hrs**

Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

Strength and stability of axially loaded masonry walls-effect of unit strength- mortar strength- joint thicknes,-rate of absorption- effect of curing- effect of ageing- workmanship- Compressive strength formulae based on elastic theory and empirical formulae

UNIT II: DESIGN CONSIDERATIONS: **9 Hrs**

Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars

UNIT III: DESIGN OF MASONRY SUBJECTED TO AXIAL LOADS: **9 Hrs**

Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

UNIT IV: DESIGN OF WALLS SUBJECTED TO ECCENTRIC LOADS: **9 Hrs**

Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

UNIT V: DESIGN OF LATERALLY AND TRANSVERSELY LOADED WALLS: **9 Hrs**

Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs.

Total No of Hours: 45

REFERENCES

1. Building Code Requirements for Masonry Structures (TMS 502-08/ACI 530-08/ASCE 5- 08)

2. Specifications for Masonry Structures (ACI 530.1-08/ASCE 6-08/TMS 602-08)

PROGRAM ELECTIVE-IV

Course Code : **EMSE22E13**	Course Name: **DESIGN OF ADVANCED CONCRETE STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of concrete structure -I	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To study the behaviour, analysis and design of R.C. structures.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To remember the Knowledge about the design detailing of structural elements.
CO2	To understand about the design in different structural components like beams, columns, slabs, walls plates etc
CO3	To analyze the details of reinforced concrete structures.
CO4	To design the RC structures in the construction field.
CO5	To introduce the new concept in reinforced concrete structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**			
CO2	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**1**			
C03	**2**	**3**	**2**	**1**	**2**	**3**	**2**	**3**	**3**			
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**1**			
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	**3**		**3**		**3**							
CO2	**2**		**3**		**1**							
C03	**2**		**1**		**2**							
CO4	**3**		**3**		**3**							
CO5	**3**		**2**		**3**							

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E13**	Course Name: **DESIGN OF ADVANCED CONCRETE STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of concrete structure -I	Ty	3	0/0	0/0	3

UNIT I: OVERALL REVIEW **9 Hrs**

Review of limit state design of beams - Slabs and columns according to IS 456-2000 - Calculation of deflection and crack width according to IS 456-2000.

UNIT II: DESIGN OF SPECIAL RC ELEMENTS **9 Hrs**

Design of Slender columns - Design of R.C walls - Ordinary and shear walls - Design of Corbels - Deep – beams and grid floors.

UNIT III: FLAT SLABS AND FLAT PLATES **9 Hrs**

Design of flat slabs and flat plates according to ACI method - Design of shear load - reinforcement and edge(spandrel) beams - Yield line theory and Hillerberg method of design of slabs.

UNIT IV: INELASTIC BEHAVIOUR OF CONCRETE BEAMS **9 Hrs**

Inelastic behavior of concrete beams - moment - rotation curves - moment redistribution - Baker's method of plastic design - Design of cast-in-situ joints in frames.

UNIT V: DESIGN AND DETAILING OF STRUCTURES **9** Hrs

Detailing for ductility - Fire Resistance of buildings - Field control of concrete - Strengthening of existing structures - Design and detailing of structures according to different codes.

Total No of Hours: 45

REFERENCES

1. *Purushothaman, P, Reinforced Concrete Structure Structural Elements: Behaviour Analysis and Design , Tata Mc Graw Hill, New Delhi 1986.*
2. *Varghese, P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India New Delhi, 1995.*
3. *Krishna Raju, N.Advanced Reinforced Concrete Design, CBS Publishers and New Delhi Distributors, 1986.*

Course Code : **EMSE22E14**	Course Name:**ADVANCED DESIGN OF FOUNDATIONS**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Soil Mechanics and Foundation Engineering	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To provide understanding of advanced topics of soil mechanics and design of differenttypes of foundations

COURSE OUTCOMES (Cos) :

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

CO1	To remember the basic knowledge about the foundations
CO2	Understand reason behind the structure and foundation failure
CO3	Apply the principles of soil mechanics to decide upon the suitability of shallow or deep foundations
CO4	To analyze the critical failure modes of retaining walls
CO5	To evaluate the load carrying capacity of various shallow and deep foundations

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	**3**	**3**	**2**	**3**	**2**	**3**	**1**	**3**	**2**			
CO2	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**			
C03	**3**	**1**	**2**	**3**	**2**	**3**	**2**	**3**	**1**			
CO4	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**			
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**1**	**3**			

COs / PSOs	**PSO1**	**PSO2**	**PSO3**				
CO1	**3**	**3**	**2**				
CO2	**3**	**2**	**3**				
C03	**2**	**3**	**1**				
CO4	**3**	**2**	**3**				
CO5	**1**	**3**	**1**				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							
Approval												

Course Code : **EMSE22E14**	Course Name: **ADVANCED DESIGN OF FOUNDATIONS**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Soil Mechanics and Foundation Engineering	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: FOUNDATIONS: AN INTRODUCTION 9 Hrs

General considerations: Functions of foundations. Requisites of satisfactory foundations. Different types of foundations. Definition of shallow and deep foundation. Selection of type of foundation. Advantages and limitations of various types of foundations. Design considerations . Footings subjected to eccentric loading. Conventional procedure for proportioning footings for equal settlements. Open excavation: Open foundation excavations with unsupported slopes. Supports for shallow and deep excavations. Stress distribution in sheeting and bracing of shallow and deep excavations. Stability of bottom of excavations..

UNIT II: SHALLOW FOUNDATIONS 9 Hrs

Shallow Foundations: Definitions, Bearing Capacity of Footings; Terzaghi, Mayerhof and Skempton's analysis. Effect of Rising and Lowering of Water Table on Bearing Capacity; Settlement: Permissible, Total and Differential Settlements as per IS Code. Plate Load test, Standard Penetration and Cone Penetration Tests for Determining Allowable Bearing Pressure Raft foundations: Bearing capacity equations. Design considerations. Conventional design procedure for rigid mat. Uplift pressures. Methods of resisting uplift. Floating foundations.

UNIT III: PILE FOUNDATIONS 9 Hrs

Uses of piles. Classification of piles based on purpose and material. Determination of type and length of piles. Determination of bearing capacity of axially loaded. Single vertical pile. Static and dynamic formulae. Determination of bearing capacity by penetration tests and pile load tests (IS methods). Negative skin friction. Group action and pile spacing. Analysis of pile groups. Load distribution by Culmann's method. Caissons and piers: Open (well) caissons. Box (floating) caissons. Pneumatic caissons. Construction details and design considerations of well foundations. Drilled piers and their construction details.

UNIT IV: WELL FOUNDATIONS 9 Hrs

Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.

UNIT V: MACHINE FOUNDATIONS 9Hrs

Machine Foundation: Design Criteria, Free and Forced Vibrations for Single Degree of Freedom systems, Undamped and Damped Case, Types of Machine Foundations.

Total No of Hours: 45

TEXT BOOKS

1. *Khan I.H., "A Text Book of Geotechnical Engineering", Prentice-Hall of India Pvt. Ltd., Delhi, India.*
2. *Kaniraj, S.R., "Design Aids in Soil Mechanics and Foundation Engineering", Tata Mc Graw Hill New Delhi.*
3. *Punmia B.C., Soil Mechanics & Foundations, Laxmi, 1988*
4. *N.J, USA. Teng W.C., Foundation Design, PHI, 1984 Terzaghi & Peck, Soil Mechanics in Engineering Practice, Asia Publishing*
5. *Arora K.R., Soil Mechanics & Foundation Engg., Standard Publications, 1987.*

Course Code : **EMSE22E15**	Course Name : **ADVANCED STRUCTURAL ANALYSIS**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study Structural Analysis I & II	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To analyze structural engineering systems by various approaches

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To learn about the fundamental concept of stiffness and flexibility matrix
CO2	To understand the knowledge about substructures
CO3	Get knowledge about shear wall and analyze the concept of substructure techniques
CO4	Analyze the skeleton structures using matrix methods.
CO5	Use of computer package for understanding problems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	**1**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**			
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**			
C03	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**			
CO4	**3**	**2**	**1**	**2**	**3**	**3**	**2**	**3**	**3**			
CO5	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**			

COs / PSOs	**PSO1**	**PSO2**	**PSO3**				
CO1	**2**	**3**	**3**				
CO2	**3**	**2**	**2**				
C03	**1**	**3**	**3**				
CO4	**3**	**2**	**2**				
CO5	**2**	**3**	**3**				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							
Approval												

Course Code : **EMSE22E15**	Course Name : **ADVANCED STRUCTURAL ANALYSIS**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study Structural Analysis I & II	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: FUNDAMENTAL CONCEPTS **9 Hrs**

Static and Kinematic indeterminacy - Concepts of stiffness and flexibility - Energy concepts - Principle of minimum potential energy and minimum complementary energy - Development of element flexibility and element stiffness matrices for truss - beam and grid elements.

UNIT II: STIFFNESS METHOD (Systems Approach) **9 Hrs**

Basis of stiffness method - Degrees of freedom - Force displacement relationships - Nodal stiffness.

UNIT III: FLEXIBILITY METHOD (Systems Approach) **9 Hrs**

Flexibility coefficients - Basis of the method - Application to various types of structures.

UNIT IV: COMPUTER APPLICATION 9 **Hrs**

Computer Applications and use of Computer packages - Programming techniques and problems.

UNIT V: ANALYSIS BY SUBSTRUCTURE TECHNIQUE 9 **Hrs**

A special analysis procedure - static condensation and sub structuring - initial and thermal stresses - Shear walls - Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls.

Total No of Hours: 45

REFERENCES

1. *Rajasekharan S. and Sankarasubramainian G., "Computational Structural Mechanics", Prentice Hall, India, 2001.*
2. *Manikaselvam – Elements of Matrix Analysis and Elastic Stability, Khanna Publishers, New Delhi Sixth Edition-2009.*
3. *Negi, "Structural Analysis" , Tata Mc Graw Hill Publishing Company 2007.*
4. *W.Weaver and J.H.Gere, "Matrix Analysis of Framed Structures", Van Nastran, 1980.*
5. *McGuire, W., and Gallagher, R.H., Matrix Structural Analysis , John Wiley and Sons, 1979.*
6. *John L.Meek., Matrix Structural Analysis , Mc Graw Hill Book Company, 1971.*

Course Code : **EMSE22E16**	Course Name: **DESIGN OF INDUSTRIAL STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of steel Structures	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : The objectives of this course is to make students to learn principles and Design ofindustrial building

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To learn principles of Design of industrial building
CO2	To design different components of industrial structures and to detail the structures
CO3	To evaluate the performance of the Pre- engineered buildings
CO4	To design various structures such as Bunkers, Silos, Cooling Towers, Chimneys, and Transmission Towers with required foundations.
CO5	To plan industrial structures for functional requirements

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**			
CO2	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**1**	**3**			
C03	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**			
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**			
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	**3**		**3**		**3**							
CO2	**3**		**1**		**2**							
C03	**2**		**3**		**2**							
CO4	**3**		**2**		**1**							
CO5	**3**		**3**		**3**							

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							
Approval												

Course Code : **EMSE22E16**	Course Name: **DESIGN OF INDUSTRIAL STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of steel Structures	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I INTRODUCTION 9 Hrs

Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders, trusses, gable frames

UNIT II GANTRY GIRDER 9 Hrs

Analysis and design of gantry girder, purlins, girts, bracings including all connections.

UNIT III TRANSMISSION TOWERS 9 Hrs

Analysis of transmission line towers for wind load and design of towers including all connections.

UNIT IV COLD FORMED STRUCTURES 9 Hrs

Forms of light guage sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light guage sections. Concept of local buckling of thin elements. Limiting width to thickness ratio. Post buckling strength.

UNIT V PRE – ENGINEERED STRUCTURES 9 Hrs

Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light guage sections, Design of flexural members (Laterally restrained / laterally unrestrained).

Total No. of Hours: 45

REFERENCES

1. Bureau of Indian Standards, IS 800-2007, IS 875-1987, IS-801-1975. Steel Tables, SP 6 (1) – 1984

2. N Subramanian- "Design of Steel Structure" oxford Press

***3.** B.C. Punmia, A.K. Jain "Design of Steel Structures", Laxmi Publications, New Delhi.*

4. . Ramchandra and Virendra Gehlot " Design of Steel Structures " Vol 1 and Vol.2, Scientific Publishers, Jodhpur

5. Duggal "Limit State Design of Steel Structures" TMH

PROGRAM ELECTIVE -V

Course Code : **EMSE22E17**	Course Name: **DESIGN OF PRESTRESSED CONCRETESTRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Basic mathematical calumniation and design	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : Principle of prestressing, analysis and design of prestressed concrete structures

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	Student shall have a knowledge on methods of prestressing and composite construction
CO2	Recognize the effects of transfer and development length on flexural and shear strengths
CO3	Evaluate and analyze the stresses under various conditions
CO4	Calculate prestress losses for simple prestressed concrete girders
CO5	Student should be able to design various prestressed concrete structural elements

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**1**	
CO2	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	
C03	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	
CO4	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**3**	
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**2**
CO2	**3**	**2**	**3**
C03	**3**	**3**	**3**
CO4	**2**	**1**	**2**
CO5	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E17**	Course Name: **DESIGN OF PRESTRESSED CONCRETESTRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Basic mathematical calumniation and design	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I INTRODUCTION AND CODAL PROVISIONS **9 Hrs**

Principles of Prestressing - types and systems of prestressing, need for High Strength materials, Analysis methods losses, deflection (short-long term), camber, cable layouts. Behaviour under flexure - codal provisions (IS, British ACI), ultimate strength. Design of flexural members,

UNIT II DESIGN OF COMPRESSION MEMBERS **9 Hrs**

Design for Shear, bond and torsion. Design of End blocks and their importance Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks. Design of compression members with and without flexure - its application in the design piles, flagmasts and similar structures.

UNIT III COMPOSITE BEAMS **9 Hrs**

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

UNIT IV CONTINUOUS BEAMS **9 Hrs**

Application of prestressing in continuous beams, concept of linear transformation, concordant cable profile and cap cables.

UNIT V DESIGN OF SPECIAL STRUCTURES **9 Hrs**

Special structures like prestressed folded plates, prestressed cylindrical shells, prestressed concrete poles.

Total No of Hours: 45

REFERENCES

1.T.Y.Lin, Design of Prestressed Concrete Structures, John Wiley and Sons, Inc Berlin, 3rd edition, 1981.

1.*Leonhardt.F., Prestressed Concrete, Design and Construction, Wilhelm Ernst and Shon, Berlin, 2nd edition, 1964.*

2.Prestressed Concrete by Krishna Raju, Tata McGraw Hill Publishing Co. 5th edition, 2012

4.Fundamentals of Prestressed Concrete by N.C.Sinha & S.K.Roy S.Chand & Co.,New Delhi 2011.

Course Code : **EMSE22E18**	Course Name:**ANALYSIS OF LAMINATED COMPOSITE PLATES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Applied Mechanics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : Students will be able to analysis of composite plates by using various methods of differentstructural components.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To remember the basic concept about the various theories of mechanics
CO2	To understand the concept of composite plates
CO3	Analyse the rectangular composite plates using the analytical methods.
CO4	Analyse the composite plates using advanced finite element method
CO5	Develop the computer programs for the analysis of composite plates.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**1**	
CO2	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	
C03	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	
CO4	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**3**	
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**2**
CO2	**3**	**2**	**3**
C03	**3**	**3**	**3**
CO4	**2**	**1**	**2**
CO5	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E18**	Course Name:**ANALYSIS OF LAMINATED COMPOSITE PLATES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Applied Mechanics	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I INTRODUCTION **9 Hrs**

Displacement Field Approximations for Classical Laminated Plate Theory (CLPT) and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT.

UNIT II GOVERNING EQUATIONS. **9Hrs**

Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

UNIT III INTRODUCTION TO FINITE ELEMENT METHOD **9Hrs**

Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses.

UNIT IV RECTANGULAR LAMINATED PLATES **9Hrs**

Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT, Finite Element Model, C0Element Formulation, Post Computation of Stresses.

UNIT V RECTANGULAR COMPOSITE PLATES **9Hrs**

Analysis of Rectangular Composite Plates using Analytical Methods..

Total No of Hours: 45

REFERENCES

1. Mechanics *of Laminated Composites Plates and Shells, Reddy J. N., CRC Press.*

Course Code : **EMSE22E19**	Course Name: **FRACTURE MECHANICS OF CONCRETE STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study failure theory of structures	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: CreditsT/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To impart knowledge on the mechanisms of failure and non linear fracture mechanics.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To learn the Fundamentals of Fracture Mechanics and fracture cracking
CO2	Know about the analysis and model of fracture failure
CO3	Ability to know Nonlinear Fracture Mechanics
CO4	Analyse the mechanics of concrete structures in various field.
CO5	To impart knowledge on the mechanisms of failure and non linear fracture mechanics.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**1**	
CO2	**3**	**2**	**3**	**3**	**1**	**2**	**3**	**2**	**3**	
C03	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**1**	**3**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	
CO1	**3**	**3**	**3**	
CO2	**3**	**3**	**1**	
C03	**2**	**2**	**2**	
CO4	**3**	**2**	**2**	
CO5	**3**	**3**	**3**	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E19**	Course Name: **FRACTURE MECHANICS OF CONCRETE STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Need to study failure theory of structures	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I : FUNDAMENTALS **9 Hrs**

Fundamentals of Fracture Mechanics, Mechanisms of fracture and crack growth

UNIT II : FRACTURE CRACKING **9 Hrs**

Cleavage fracture, ductile fracture, fatigue cracking, Environment assisted cracking, Quasi brittle materials.

UNIT III : FRACTURE ANALYSIS **9 Hrs**

Service failure analysis, linear elastic fracture mechanics, Griffith's criteria, stress intensity factors, crack tip plastic zone, Erwin's plastic zone correction, R curves, compliance, J Integral, nonlinear analysis ,Review of concrete behaviour in tension and compression, Basic frameworks for modeling of quasibrittle materials.

UNIT IV : NON LINEAR FRACTURE MECHANICS **9 Hrs**

Nonlinear Fracture Mechanics – Discrete crack concept/Smeared crack concept, Size effect, Plasticity models for concrete – Associated and non-associated flow, Failure surfaces for quasibrittle materials.

UNIT V : MODELS **9 Hrs**

Concept of CTOD and CMD, Material models, crack models, band models, models based on continuum damage mechanics

Total No of Hours: 45

REFERENCES

1. Elementary engineering fracture mechanics – David Broek – Sijthoff & Noordhoff – Alphen aan den Rijn – Netherlands

2. Fracture mechanics of concrete structures – Theory and applications – Rilem Report – Edited by L. Elfgreen – Chapman and Hall – 1989.

3. Fracture mechanics – applications to concrete – Edited by Victor, C. Li, & Z.P. Bazant – ACI SP 118.

4. Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi.

5. Venkataraman and Patel "Structural Mechanics with introduction to Elasticity and Plasticity" – Mcgraw Hill, 1990. 6. Shanes – "Introduction to Solid Mechanics – II Edition, PH, 1989.

Course Code : **EMSE22E20**	Course Name: **EARTHQUAKE RESISTANCE STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Structural Dynamics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : To learn the principles of measurements of static and dynamic response of Structures and carryoutthe analysis of results.

COURSE OUTCOMES (Cos) :
At the end of the course, students will be able to

CO1	To study the basic concepts of engineering seismology and ground motion characteristics
CO2	To understand the strength and capacity design principles of earthquake resistant design.
CO3	Ability to know the various types of buildings under static and dynamic forces
CO4	Design various beam-column joints as per ductility requirements
CO5	Analyze and design unreinforced and reinforced masonry and concrete shear wall structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**			
CO2	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**			
C03	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**3**			
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**			
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	**3**		**3**		**3**							
CO2	**3**		**3**		**3**							
C03	**3**		**3**		**3**							
CO4	**3**		**3**		**3**							
CO5	**3**		**3**		**3**							

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Interdisciplinary	Skill component	Practical / Project			
					√							

Course Code : **EMSE22E20**	Course Name: **EARTHQUAKE RESISTANCE STRUCTURES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite : Design of Reinforced Concrete and Masonry Buildings	Ty	3	0/0	0/0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab						

UNIT I: HISTORICAL **9 Hrs**

Elements of Engineering Seismology - Theory of Vibration - Response Spectrum-Indian Seismicity - Earthquake History - Behaviour of Structures in the past Earthquakes.

UNIT II: DESIGN CONCEPTS **9 Hrs**

Seismic Design Concepts - Cyclic load behaviour of RC, Steel and Prestressed Concrete elements – Design spectrum - Principles of capacity design.

UNIT III: CODAL PROVISIONS **9 Hrs**

Provisions of Seismic Code (IS 1893) - Building systems frames, shear walls, Braced Frames, Combinations - Torsion.

UNIT IV: DESIGN AND DETAILING **9 Hrs**

Performance of Regular Buildings 3 D Computer Analysis of Building Systems (Theory Only) - Design and Detailing of frames - Shear walls and Frame walls.

UNIT V: SPECIAL PROBLEMS AND CASE STUDIES **9 Hrs**

Structural Configuration - Seismic performance - Irregular Buildings - Soil performance, Modern Concepts – Base Isolation - Adoptive system - Case studies.

Total No of periods: 45

REFERENCE BOOKS

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
3. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons

AUDIT COURSE-1&2

Audit Course I & II							
S.No	Course Code	Course Name	TY/LB/ IE	Teaching Scheme			
				L	T/S.Lr	P/R	C
1	EMCC22I01	English for Research paper Writing	IE	2	0/0	0/0	0
2	EMCC22I02	Disaster Management	IE	2	0/0	0/0	0
3	EMCC22I03	Sanskrit for Technical Knowledge	IE	2	0/0	0/0	0
4	EMCC22I04	Value Education	IE	2	0/0	0/0	0
5	EMCC22I05	Constitution of India	IE	2	0/0	0/0	0
6	EMCC22I06	Pedagogy Studies	IE	2	0/0	0/0	0
7	EMCC22I07	Stress Management by Yoga	IE	2	0/0	0/0	0
8	EMCC22I08	Personality Development through Life Enlightenment Skills	IE	2	0/0	0/0	0
9	EMCC22I09	Research Publication Ethics	IE	2	0/0	0/0	0

Course Code: EMCC22I01	Course Name: ENGLISH FOR RESEARCH PAPER WRITING	Ty/Lb/IE	L	T/S. Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives To know the art of writing the research paper and thesis
To Ensure the good quality of paper at very first-time submission .

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Understand that how to improve your writing skills and level of readability
CO2	Learn about what to write in each section
CO3	Understand the skills needed when writing a Title

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	3	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I01	Course Name: ENGLISH FOR RESEARCH PAPER WRITING	Ty/Lb/IE	L	T/S. Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit I **5 Hrs**

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

Unit II **5 Hrs**

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

Unit III **5 Hrs**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

Unit IV **5 Hrs**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction,
skills needed when writing a Review of the Literature

Unit V **5 Hrs**

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

Unit VI **5 Hrs**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL HOURS: 30

Reference Books:

1. Goldbort R (2016) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2016) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (2018), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2017

Course Code: EMCC22I02	Course Name: DISASTER MANAGEMENT	Ty/Lb/IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO2	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO3	Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	3	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I02	Course Name: DISASTER MANAGEMENT	Ty/Lb/IE	L	T/S. Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit I

Introduction **5 Hrs**

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

Unit II **5 Hrs**

Repercussions Of Disasters And Hazards:

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

Unit III **5 Hrs**

Disaster Prone Areas In India :

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards WithSpecial Reference To Tsunami; Post-Disaster Diseases And Epidemics

Unit IV **5 Hrs**

Disaster Preparedness And Management : Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard;Evaluation of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental AndCommunity Preparedness.

Unit V **5 Hrs**

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

Unit VI **5 Hrs**

Disaster Mitigation : Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation,Programs Of Disaster Mitigation In India.

TOTAL HOURS: 30

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

Course Code: EMCC22I03	Course Name : SANSKRIT FOR TECHNICAL KNOWLEDGE	Ty/Lb/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives To get a working knowledge in illustrious Sanskrit, the scientific language in the world Learning of Sanskrit to improve brain functioning , to develop the logic in mathematics, science & other subjects enhancing the memory power. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Understanding basic Sanskrit language
CO2	Ancient Sanskrit literature about science & technology can be understood
CO3	Being a logical language will help to develop logic in students

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	3	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I03	Course Name : SANSKRIT FOR TECHNICAL KNOWLEDGE	Ty/Lb/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit I **10 hrs**

Alphabets in Sanskrit,Past/Present/Future Tense,Simple Sentences

Unit II **10 hrs**

Order, Introduction of roots, Technical information about Sanskrit Literature

Unit III **10 hrs**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL HOURS : 30

Reference Books:

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Code: EMCC22I04	Course Name : VALUE EDUCATION	Ty/Lb/IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives .

- Students will be able to
- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Knowledge of self-development
CO2	Learn the importance of Human values
CO3	Developing the overall personality

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	3	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I04	Course Name : VALUE EDUCATION	Ty/Lb/IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit 1: **6 Hrs**

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments

Unit 2: 8 **Hrs**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

Unit 3: 8 **Hrs**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Unit 4: 8 **Hrs**

Character and Competence –Holy books vs Blind faith. Self-management and Good health .Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TOTAL HOURS : 30

Reference:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course Code: EMCC22I05	Course Name : CONSTITUTION OF INDIA	Ty/Lb/ IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	3	1	1	1	
CO4	1	1	1	1	1	3	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1
CO4	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I05	Course Name : CONSTITUTION OF INDIA	Ty/Lb/ IE	L	T/S .Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit 1: **6 hrs**

History of Making of the Indian Constitution:

History Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble Salient Features

Unit 2: **6 hrs**

Contours Of Constitutional Rights & Duties:

Fundamental Rights, Right to Equality , Right to Freedom , Right against Exploitation, Right to Freedom of Religion , Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy and Fundamental Duties.

Unit 3: **6 hrs**

ORGANS OF GOVERNANCE:

Parliament Composition, Qualifications and Disqualifications, Powers and Functions Executive President, Governor Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

Unit 4: **6 hrs**

Local Administration:

District's Administration head: Role and Importance,Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4: **6 hrs**

Election Commission: Role and Functioning.Chief Election Commissioner and Election Commissioners.State Election Commission: Role and Functioning.Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL HOURS: 30

Reference Books:

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

Course Code: EMCC22I06	Course Name : PEDAGOGY STUDIES	Ty/Lb/ETL	L	T/S.Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives Students will be able to: 4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. 5. Identify critical evidence gaps to guide the development.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	3	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I06	Course Name : PEDAGOGY STUDIES	Ty/Lb/ETL	L	T/S. Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit I:

Introduction and Methodology: **6 hrs**

Aims and rationale, Policy background, Conceptual framework and terminology ,Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

Unit II:

Thematic overview: **6 hrs**

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit III: Evidence on the effectiveness of pedagogical practices **6 hrs**

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit IV: Professional development: **6 hrs**

Alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit V: Research gaps and future directions: **6 hrs**

Research design, Contexts, Pedagogy, Teacher education, Curriculum and Assessment, Dissemination and research impact.

TOTAL HOURS: 30

Reference Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher Education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

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Course Code: EMCC22I07	Course Name: STRESS MANAGEMENT BY YOGA	Ty/Lb/ETL	L	T/S.Lr	P/R	C
	Prerequisite : **Basic Knowledge of Yoga**	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives

To Understand the Basic Concepts of Yoga

To Gain knowledge on Ashtanga yoga

To Acquire knowledge of Techniques and Practice of Yogasanas

To Understand stress and the causes. To Attain the knowledge about stress busting through yoga

CO1	Understand the Basic Concepts of Yoga
CO2	Gain knowledge on Ashtanga yoga
CO3	To Understand stress and the causes
CO4	Acquire knowledge of Techniques and Practice of Yogasanas
CO5	Attain the knowledge about stress busting through yoga

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	1	1	1	1	
CO4	1	1	1	1	1	3	1	1	1	
CO5	1	1	1	1	1	2	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1
CO4	1	1	1
CO5	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I07	Course Name: STRESS MANAGEMENT BY YOGA	Ty/Lb /ETL	L	T/S .Lr	P/R	C
	Prerequisite : **Basic Knowledge of Yoga**	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit 1: **6 hrs**

What is stress - Symptoms of stress - Why is stress helpful - Why is stress harmful - Stress versus burnout - Main types of stress - Know your stressors - Tips to Manage Stress

Unit 2: **6 hrs**

Strength, Weaknesses, Opportunities and Threats (SWOT) Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem. Emotional Intelligence, What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions

Unit 3: **6 hrs**

What is Yoga – Definition and Its Branches - Hatha Yoga – Kundalini Yoga – Tantra Yoga – Kriya Yoga – Introduction To Ashtanga Yoga

Unit 4: **6 hrs**

Mechanism of Stress related diseases: Psychic, Psychosomatic, Somatic and Organic phase. Role of Meditation & Pranayama on stress – physiological aspect of Meditation. Constant stress & strain, anxiety, conflicts resulting in fatigue among Executive. Contribution of Yoga to solve the stress related problems of Executive

Unit 5: **6 hrs**

Meaning and definition of Health – various dimensions of health (Physical, Mental, Social and Spiritual) – Yoga and health – Yoga as therapy. Physical fitness. Stress control exercise – Sitting meditation, Walking meditation, Progressive muscular relaxation, Gentle stretches and Massage.

TOTAL HOURS : 30

Reference Books:

1. *Andrews, Linda Wasmer., (2005). Stress Control for peace of Mind. London: Greenwich Editions Lalvani, Vimla., (1998). Yoga for stress. London: Hamlyn*
2. *Nagendra, H.R., and Nagarathana, R., (2004). Yoga perspective in stress management. Bangalore: Swami Vivekananda Yoga Prakashana.*
3. *Nagendra, H.R., and Nagarathana, R., (2004). Yoga practices for anxiety & depression. Bangalore: Swami Sukhabodhanandha Yoga Prakashana.*
4. *Sukhabodhanandha, Swami., (2002). Stress Management. Banglore: Prasanna trust.*
5. Udupa, K.N., (1996). Stress management by Yoga. NewDelhi: Motilal Banaridass Publishers Private Limited

Course Code: EMCC22I08	Course Name : PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	Ty/Lb/ETL	L	T/S.Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives To learn to achieve the highest goal happily , To become a person with stable mind, pleasing personality and determination. To awaken wisdom in student

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3	Study of Neetishatakam will help in developing versatile personality of students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	1	1	1	1	1	3	1	1	1	
CO2	1	1	1	1	1	3	1	1	1	
CO3	1	1	1	1	1	3	1	1	1	

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

3/2/1 indicates Strength of Correlation 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit course
										✓

Course Code: EMCC22I08	Course Name : PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	Ty/Lb/ETL	L	T/S. Lr	P/R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab						

Unit 1: **10 hrs**

Neetisatakam-Holistic development of personality

Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism)Verses- 26,28,63,65 (virtue) Verses-52,53,59(dont's)Verses-71,73,75,78(do's)

Unit 2: **10 hrs**

Approach to day to day work and duties.

Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

Unit 3: **10 hrs**

Statements of basic knowledge.

Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63.

TOTAL HOURS : 30

Reference Books:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Code: EMCC22I09	Course Name : RESEARCH PUBLICATION ETHICS	T / L/ ETP/IE	L	T / S.Lr	P/ R	C
	Prerequisite: core subjects	IE	2	0/0	0/0	2

T/L/ : Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits T/L Theory/Lab

OBJECTIVE:

- To understand the philosophy of science and ethics, research integrity and publication ethics.
- To identify research misconduct and predatory publications.
- To understand indexing and citation databases, open access publications, research metrics (citations, h-index, impact Factor, etc.).

COURSE OUTCOMES (COs) : By doing this course students will

CO1	Understand the ethical issues related to Research and Publication
CO2	Get to know about different types of plagiarism and ways for avoiding plagiarism
CO3	Know about best practices and guidelines in publication ethics and also learns to avoid Publication misconduct
CO4	Get to know about Violation of publication ethics, authorship and contributor ship and get to identify about Predatory publishers and journals.
CO5	Get to know about various open sources database and research metrics like indexing, citation etc.,

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
CO1	2	3	3	3	3	2	3	3	2	
CO2	2	3	3	3	3	2	3	3	2	
CO3	2	3	3	3	3	2	3	3	2	
CO4	2	3	3	3	3	3	3	3	3	
CO5	2	3	3	3	3	2	3	3	2	

COs / PSOs	PSO1	PSO2	PSO3
CO1	2	3	3
CO2	2	3	3
CO3	2	3	2
CO4	2	3	3
CO5	2	3	3

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Audit Course
										✓

Course Code: EMCC22I09	Course Name : Research Publication Ethics	T / L/ ETP/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Core subjects	IE	2	0/0	0/0	0
T/L/ : Theory/Lab L : Lecture T : Tutorial P : Practical/Project R : Research C: Credits T/L Theory/Lab						

Unit 1. Introduction **6 Hrs.**

Introduction to philosophy: Definition, nature and scope, concept, branches - Ethics: Definition, moral philosophy, nature of moral judgments and reactions – Ethics with respect to Science and Research Intellectual honesty and research integrity.

Unit II: Scientific Conduct **6 Hrs.**

Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) Redundant Publications: Duplicate and over lapping publications, salami slicing – Selective reportingand misrepresentation of data.

Unit III: Publication Ethics -I **6 Hrs.**

Publication ethics: Definition, introduction and importance – Best practices/standards setting initiativesand guidelines: COPE, WAME etc. Publication misconduct: definition, Concept, problems that lead to unethical behavior and vice-versa, types.

Unit IV: Publication Ethics – II **6 Hrs.**

Violation of publication ethics, authorship and contributor ship – Identification of publication misconduct, complaints and appeals – Predatory publishers and journals – Subject specific ethicalissues, Complaints and appeals: examples and fraud from India and Abroad.

Unit V: Data Bases and Research Metrics **6 Hrs.**

Open Access publication and Initiatives – Indexing databases – Citation databases, Web of Science,Scopus, etc. – Impact factor of journals as per Journal Citation report .SNIP, SJR, IPP, Cite Score - Metrics: h-index,gindex,i10index,altmetrics – Conflict of interest.

TOTAL HOURS : 30

References:

1. Bird A 2006, Philosophy of Science, Routledge
2. MacIntyre &Alasdair, 1967, A Short History of Ethics, London.
3. Chaddah, P20 1 8, Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 9789387480865.
4. On Being a Scientist: A Guide to Responsible Conduct in Research, 2009, National Academy of Sciences, National Academy ofEngineering and Institute of Medicine. 3rd edition, National Academies Press.
5. Resnik, D. B 201 1, what is ethics in research & why is it important. National Institute of Environmental Health Sciences,pp.1—10. https://www.niehs.nih.gov/research/reso_uuces/bioethics/whatis/index.cfm
6. Bcall, J 2012, Predatory publishers are corrupting open access, Nature, Vol. 489, no.7415,pp. 179—179. https://d0i.org/lO.1 03 8/48917%,Ethics in Science Education, 2019Indian National Science Academy (INSA), Research and Governance,