Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

CURRICULUM & SYLLABUS

BACHELOR OF TECHNOLOGY
CIVIL ENGINEERING – PART TIME

DEPARTMENT OF

CIVIL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING
B.Tech. Civil Engineering (Part Time)Curriculum – 2022 Regulation

VISION OF THE DEPARTMENT OF CIVIL ENGINEERING

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

THE MISSION OF THE DEPARTMENT OF CIVIL ENGINEERING

M1: To produce graduates who possess technical competence in the field of Civil Engineering with integrity and commitment
M2: To prepare them to serve and contribute as professional engineers, innovators, leaders and entrepreneurs in the global community

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of the department are:

PEO 1: To apply fundamental knowledge of basic sciences and engineering to find creative solutions to challenges in civil engineering
PEO 2: To analyze, design and apply skills to address civil engineering problems.
PEO 3: To practice civil engineering in a professional and ethical manner and to implement sustainable technologies for the benefit of industry and society.
PEO 4: To enhance knowledge through research and development in civil engineering using current technologies
PEO 5: To produce professionally competent engineers by improving their software skills, communication skills, managerial skills and entrepreneurship quality to prepare them for lifelong learning

PROGRAM SPECIFIC OUTCOMES (PSOs)

The Program Specific Objectives of the department is to produce professional Civil Engineers with the potential:

PSO 1: To analyze, design and apply technical knowledge with up-to-date skills to solve civil engineering complexities
PSO 2: To function as an individual or in a team to find sustainable solutions in civil engineering domain through research and development

PROGRAM OUTCOMES (POs)

The general Program outcomes of Civil Engineering are as follows:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The Engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Faculty of Engineering and Technology

Regulation 2022 – Framework

Total Credits: 100

Credit for I To VII Semester: 100 Credits

Program Components

• Basic Science (Mathematics) include according to program - 2		
• Program Core theory	-	14
• Program Core Laboratory	-	7
• Program Elective	-	5
• Open Elective	-	-
• Open Lab	-	-
• Management paper	-	1
• Foreign Language	-	-
• Audit course	-	-
• Universal Human values	-	-
• Inter disciplinary theory	-	-
• Inter disciplinary Lab	-	-
• ETL	-	2
• Technical Skills	-	-
• Soft skill	-	-
• Project /mini project	-	2

Curriculum with Course codes for B.Tech (Civil Engineering – Part Time)

I SEMESTER								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBMA22005	Mathematics III For Mechanical and Civil Engineers	Ty	3	1/0	0/0	4	BS
2	EBCE22002	Mechanics of Solids	Ty	3	1/0	0/0	4	PC
3	EBCE22003	Hill and advanced Surveying	Ty	3	0/0	0/0	3	PC
4	EBCE22L01	Surveying Laboratory	Lb	0	0/0	3/0	1	PC
5	EBCE22EXX	Program Elective I	Ty	3	0/0	0/0	3	PE
Credits Sub Total							**15**	

II SEMESTER								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBMA22008	Statistical and Numerical methods for Mechanical and Civil Engineers	Ty	3	1/0	0/0	4	BS
2	EBCE22004	Strength of Materials	Ty	3	1/0	0/0	4	PC
3	EBCE22005	Fluid Mechanics and Hydraulic Engineering	Ty	3	1/0	0/0	4	PC
4	EBCE22L02	Strength of Materials Laboratory	Lb	0	0/0	3/0	1	PC
5	EBCE22L03	Fluid Mechanics and Hydraulic Machinery Laboratory	Lb	0	0/0	3/0	1	PC
Credits Sub Total							**14**	

Note:

Ty/Lb/ETL/IE: Theory/Lab/Embedded Theory and lab/Internal evaluation
L/T/SLr/P/R/C: Lecture/Tutorials/Supervised Learning/Practical/Research/Credit

HS:Humanities and Social Science, ES:Engg.Science, BS:Basic Science, PC:Program core, PE:Program Elective, OE:Open Elective, P:Project

III SEMESTER								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22006	Environmental Engineering	Ty	3	1/0	0/0	4	PC
2	EBCE22007	Soil Mechanics	Ty	3	1/0	0/0	4	PC
3	EBCE22008	Concrete Technology	Ty	3	0/0	0/0	3	PC
4	EBCE22ET1	Building Materials	ETL	1	0/0	2/0	2	PC
5	EBCE22L06	Soil Mechanics Laboratory	Lb	0	0/0	3/0	1	PC
Credits Sub Total							**14**	

IV SEMESTER								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22009	Structural Analysis	Ty	3	1/0	0/0	4	PC
2	EBCE22010	Design of Concrete structures	Ty	3	1/0	0/0	4	PC
3	EBCE22011	Foundation Engineering	Ty	3	1/0	0/0	4	PC
4	EBCE22ET2	Remote Sensing and GIS	ETL	1	0/0	2/0	2	PC
5	EBCE22L07	Concrete Laboratory	Lb	0	0/0	3/0	1	PC
Credits Sub Total							**15**	

Note:

Ty/Lb/ETL/IE: Theory/Lab/Embedded Theory and lab/Internal evaluation
L/T/SLr/P/R/C: Lecture/Tutorials/Supervised Learning/Practical/Research/Credit

HS:Humanities and Social Science, ES:Engg.Science, BS:Basic Science, PC:Program core, PE:Program Elective, OE:Open Elective, P:Project

V SEMESTER								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22012	Design of Steel Structures	Ty	3	1/0	0/0	4	PC
2	EBCE22013	Estimation And Quantity Surveying	Ty	3	1/0	0/0	4	PC
3	EBCE22015	Transportation Engineering	Ty	3	0/0	0/0	3	PC
4	EBCE22L04	AUTOCADD laboratory	Lb	0	0/0	3/0	1	PC
5	EBCE22L09	Structural design studio	Lb	0	0/0	3/0	1	PC
Credits Sub Total							**13**	

VI SEMESTER								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22014	Construction Management	Ty	3	1/0	0/0	4	PC
2	EBCE22EXX	Program Elective II	Ty	3	0/0	0/0	3	PE
3	EBCE22EXX	Program Elective III	Ty	3	0/0	0/0	3	PE
4	EBCE22I05	Project Phase – I	IE	0	0/0	3/3	2	P
Credits Sub Total							**12**	

Note:

Ty/Lb/ETL/IE: Theory/Lab/Embedded Theory and lab/Internal evaluation
L/T/SLr/P/R/C: Lecture/Tutorials/Supervised Learning/Practical/Research/Credit

HS:Humanities and Social Science, ES:Engg.Science, BS:Basic Science, PC:Program core, PE:Program Elective, OE:Open Elective, P:Project

VII SEMESTER								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCC22ID3	Total Quality Management	Ty	3	0/0	0/0	3	ID
2	EBCE22EXX	Program Elective IV	Ty	3	0/0	0/0	3	PE
3	EBCE22EXX	Program Elective V	Ty	3	0/0	0/0	3	PE
4	EBCE22L11	Project Phase – II	Lb	0	0/0	12/12	8	P
Credits Sub Total								**17**

TOTAL CREDITS: 100

Note:

Ty/Lb/ETL/IE: Theory/Lab/Embedded Theory and lab/Internal evaluation
L/T/SLr/P/R/C: Lecture/Tutorials/Supervised Learning/Practical/Research/Credit

HS:Humanities and Social Science, ES:Engg.Science, BS:Basic Science, PC:Program core, PE:Program Elective, OE:Open Elective, P:Project

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE I								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22E01	Engineering Geology	Ty	3	0/0	0/0	3	PE
2	EBCE22E02	Cleaner Production	Ty	3	0/0	0/0	3	PE
3	EBCE22E03	Building Technology and Habitat Engineering	Ty	3	0/0	0/0	3	PE
4	EBCE22E04	Architecture and Town Planning	Ty	3	0/0	0/0	3	PE

PROGRAM ELECTIVE II								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22E05	Hydrology	Ty	3	0/0	0/0	3	PE
2	EBCE22E06	Environmental Impact Assessment	Ty	3	0/0	0/0	3	PE
3	EBCE22E07	Bridge Structures	Ty	3	0/0	0/0	3	PE
4	EBCE22E08	Irrigation Engineering	Ty	3	0/0	0/0	3	PE

PROGRAM ELECTIVE III								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22E09	Prestressed Concrete Structures	Ty	3	0/0	0/0	3	PE
2	EBCE22E10	Housing Planning and Design	Ty	3	0/0	0/0	3	PE
3	EBCE22E11	Industrial Waste Management	Ty	3	0/0	0/0	3	PE
4	EBCE22E12	Cost Effective Buildings	Ty	3	0/0	0/0	3	PE

PROGRAM ELECTIVE IV								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22E13	Structural Dynamics and Earth Quake Engineering	Ty	3	0/0	0/0	3	PE
2	EBCE22E14	Dam Engineering	Ty	3	0/0	0/0	3	PE
3	EBCE22E15	Industrial Structures	Ty	3	0/0	0/0	3	PE
4	EBCE22E16	Advanced Environmental Engineering	Ty	3	0/0	0/0	3	PE

PROGRAM ELECTIVE V								
S.NO.	**Course Code**	**Course Title**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**	**Category**
1	EBCE22E17	Repair and Rehabilitation of Structures	Ty	3	0/0	0/0	3	PE
2	EBCE22E18	Municipal Solid Waste Management	Ty	3	0/0	0/0	3	PE
3	EBCE22E19	Finite Element Analysis	Ty	3	0/0	0/0	3	PE
4	EBCE22E20	Pre Fabricated Structures	Ty	3	0/0	0/0	3	PE

Table 1: Components of Curriculum and Credit distribution for Civil Engineering

Course Component	Description	No. of Courses	Credits	Total	Credit Weightage (%)	Contact hours
Basic Science	Theory	2	8	8	8	120
	Lab	0	0			0
	ETL	0	0			0
Engineering Science	Theory	-	-	-	-	-
	Lab					
	ETL					
Humanities and Social Science	Theory	-	-	-	-	-
	Lab					
	ETL					
Program Core	Theory	14	53	64	64	795
	Lab	7	7			315
	ETL	2	4			90
Program Electives	Theory	5	15	15	15	225
	Lab	0	0			0
	ETL	0	0			0
Open Elective	Theory	-	-	-	-	-
	Lab					
	ETL					
Inter-disciplinary	Theory	1	3	3	3	45
	Lab	0	0			0
	ETL	0	0			0
Skill Component		-	-	-	-	-
Project		2	10	10	10	90
Others if any		-	-	-	-	-
		33		100	100	1680

Table 2:

Revision/modification done in syllabus content:

S.No	Course (Subject) Code	Course (Subject) Name	Concept/ topic if any, removed in current curriculum	Concept/ topic added in the new curriculum	% of Revision/ Modification done
1	EBCE22003	Hill and Advanced Surveying	-	Curve Setting, Geodetic surveying, field astronomy	60%
2	EBCE22005	Fluid Mechanics and Hydraulic Engineering	Positive displacement pumps, air vessels	-	20%
3	EBCE22L09	Structural Design Studio	-	1. Program for Design of Slabs. Using Excel 2. Program for Design of Beams. Using Excel 3. Program for Design of Column and Footing Using Excel	40%

Table 3:

List of New courses/value added courses/life skills/Electives/interdisciplinary/courses focusing on employability/ entrepreneurship/ skill development.

S.No	New courses (Subjects)	Value added courses	Life skill	Electives	Inter Disciplinary	Focus on employability/ entrepreneurship/ skill development
1	Advanced Environmental Engineering			Engineering Geology		Hill and Advanced Surveying
2	Fundamentals of nanoscience			Cleaner Production		Total Quality Management
3				Building Technology and Habitat Engineering		Project Phase – I
4				Architecture and Town Planning		Project Phase – II
5				Hydrology		Structural design studio
6				Environmental Impact Assessment		
7				Bridge Structures		
8				Irrigation Engineering		
9				Prestressed Concrete Structures		
10				Housing Planning and Design		
11				Industrial Waste Management		
12				Cost Effective Buildings		
13				Structural Dynamics and Earth Quake Engineering		
14				Dam Engineering		
15				Industrial Structures		
16				Advanced		

				Environmenta l Engineering		
17				Repair and Rehabilitation of Structures		
18				Municipal Solid Waste Management		
19				Finite Element Analysis		
20				Pre Fabricated Structures		

I SEMESTER

Subject Code **EBMA22005**	Subject Name **: Mathematics III for Mechanical and Civil Engineers**	**Ty/ Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: First year Engineering 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 be able to apply the concepts in Differential Equations
To understand the concepts in Fourier series
To analyze the Problems in wave equations
To analyze the problems in Heat equations.
To understand the concepts in Laplace and Fourier Transforms

COURSE OUTCOMES (COs) :

CO1	To understand the concepts of Partial Differential equations
CO2	To be able to find fourier series solutions
CO3	To be able to apply the concepts of PDE in Wave and Heat problems
CO4	To be able to apply laplace transforms
CO5	To be able to apply Fourier transforms

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	3	3	1	1	2	2	1	1	2
CO2	2	2	1	3	1	2	1	2	3	1	1	2
CO3	3	2	1	3	2	3	2	1	1	2	1	3
CO4	3	2	1	2	1	3	2	1	1	1	1	2
CO5	3	3	1	2	1	2	2	1	1	2	2	3

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

Subject Code **EBMA22005**	Subject Name **: Mathematics III for Mechanical and Civil Engineers**	**Ty/ Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: First year Engineering 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 PARTIAL DIFFERENTIAL EQUATIONS 12 Hrs

Formation of PDE by eliminating arbitrary constants and eliminating arbitrary functions – Solutions of standard types of first order equations – Lagrange's equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12 Hrs

Dirichlet's conditions – General Fourier series – Half range Sine & Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12 Hrs

Classification of second order linear partial differential equations – Solutions of one dimensional wave equation, one-dimensional heat equation – Steady state solution of two dimensional heat equation (Cartesian coordinates only) – Fourier series solutions.

UNIT IV LAPLACE TRANSFORMS 12 Hrs

Transforms of simple functions – Properties of Transforms – Inverse Transforms – Transforms of Derivatives and Integrals – Periodic functions – Initial and final value theorems – Convolution theorem – Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients and Linear simultaneous differential equations of first order with constant coefficients.

UNIT V FOURIER TRANSFORMS 12 Hrs

Statement of Fourier integral theorem – Fourier transform pairs – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's theorem.

Total no. of hrs: 60

Reference Books:

1) Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2008).

2) Veerarajan T., *Engineering Mathematics (for semester III)*, Tata McGraw Hill Publishing Co., (2005).

3) Singaravelu, *Transforms and Partial Differential Equations*, Meenakshi Agency, (2017).

4) Kreyszig E., *Advanced Engineering Mathematics (9 th ed.)*, John Wiley & Sons, (2011).

5) Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers, (2012).

Subject Code: EBCE22002	Subject Name : MECHANICS OF SOLIDS	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Mechanics	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

OBJECTIVE :

- To learn fundamental concepts of Stress, Strain and deformation of soild applications of bars and thin cylinders
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyze a complex two dimensional state of stress and plane trusses

COURSE OUTCOMES (COs) : (3- 5)

CO1	To learn the fundamental concepts of stress and strain in the design of various structural components and machines
CO2	To understand the mechanism of load transfer in beams, the induced stress resultants and deformations
CO3	To apply the bending and shear principles to determine the bending, shear stresses and deflection produced in a beam subjected to system of loads
CO4	To analyze the forces in Trusses using different methods and design shafts for the given load
CO5	To evaluate the stresses due to impact and suddenly applied loads

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	1	1	1	1	1	3
CO2	3	3	3	3	1	2	1	1	1	1	1	3
C03	3	3	3	3	1	2	1	1	1	1	1	3
C04	3	3	3	3	1	2	1	1	1	1	1	3
C05	3	3	3	3	1	2	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
C03	3	3
C04	3	3
C05	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			
				✓								

Subject Code: EBCE22002	Subject Name : MECHANICS OF SOLIDS	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Mechanics	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 TO FORCE CONCEPT 12 Hrs

Equivalent system of forces, rigid bodies, external & internal forces-Application of Statics of Particles-Free body Diagram Concurrent & Non Concurrent Forces - Principles of transmissibility- Equivalent forces & Varignon's theorem. Tension, Compression and Shear stress – Lateral Strain- Poisson's Ratio- Volumetric Strain – Deformation of Simple and Compound Bars - Elastic constants – Composite Sections .

UNIT II CENTRE OF GRAVITY AND MOMENT OF INERTIA 12 Hrs

Areas and volumes - Centroid of simple areas and volumes by integration - Centroid of composite areas - Second moment of areas - Radius of Gyration - Parallel axis and Perpendicular axis theorems - Moment of Inertia of simple areas by Integration -Moment of Inertia of Composite Areas - Mass Moment of Inertia of thin plates and simple solids.

UNIT III BENDING MOMENT & SHEAR FORCE 12 Hrs

Introduction to Bending and S.F- Beams and support conditions – types of supports – types of loads - shear forces and bending moment diagrams for simply supported beams, cantilevers and overhanging beams with all loads.

UNIT IV ANALYSIS OF STATICALLY DETERMINATE PLANE TRUSSES 12 Hrs

Stability and equilibrium of plane frames – Perfect frames - Types of Trusses – Analysis of forces in trusses member – Method of joints – Method of Sections – Tension co-efficient method – Graphical method

UNIT V BENDING STRESS IN BEAMS & TORSION OF SHAFTS 12 Hrs

Theory of simple bending-expression for bending stress-Section modulus-bending stress in symmetrical sections-Theory of torsion-Torsion of circular, hollow circular shafts and power -close coiled helical springs and leaf springs

Total No of Hours: 60

TEXT BOOKS

1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2007. 2.
2. Bhavikatti. S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2010
3. Dr.R.K.Bansal A text book of Strength of Materials, Laxmi Publications,New Delhi 1996.
4. S. Ramamirutham and R.Narayanan, Strength of Materials, Dhanpat Rai Publications, New Delhi,1989.

REFERENCES

1. *Kazimi S.M.A. " Solid Mechanics ", Tata McGraw Hill Publishing Company, New Delhi, 1991.*
2. *Laudner T.J. and Archer R.R., " Mechanical of Solids in Introduction ",McGraw Hill International Editions*
3. *William A.Nash, " Theory and Problems of Strength of Material" Schaum's outline series, Mc Graw Hill International Editions 1994*

Subject Code: EBCE22003	Subject Name : HILL AND ADVANCED SURVEYING	Ty/ Lb/ ETL/IE	L	T / S.Lr	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

OBJECTIVE :

- To introduce the principles of various surveying methods and applications to Civil Engineering projects

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, the student will be able to:

CO1	Understand the principles of basic survey instruments in civil engineering fields, concept of contouring and the ways of plotting.
CO2	Understand the concept of tachometric surveying, Control surveying, Survey adjustments, Astronomical surveying and Photogrammetric.
CO3	Understand the concept Photogrammetry, Total station, Hydrographic survey and cartography.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	1	-	-	3	-	-	-
CO2	3	2	-	2	-	1	-	-	3	-	-	-
CO3	3	2	-	2	-	1	-	-	3	-	-	-

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	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			
				✓								

Subject Code: EBCE22003	Subject Name : HILL AND ADVANCED SURVEYING	Ty/ Lb/ ETL/IE	L	T / S.Lr	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 I : INTRODUCTION OF CHAIN SURVEYING COMPASS SURVEYING 8 Hrs

Definition - principles - classification - survey instruments - ranging and chaining - reciprocal ranging - setting perpendiculars –errors - traversing. Prismatic compass - surveyor's compass - bearing - systems and conversions - local attraction – magnetic declination - dip - adjustment of error

UNIT II TACHEOMETRIC SURVEYING 8 Hrs

Introduction, purpose, principle & use of tacheometry, Instrument used & stadia hairs & Fixed hair methods of tacheometry, Tacheometry constant & Problems Anallatic lens theory, subtense bar, Field work in tacheometry. Reduction of readings, errors and precisions. Difference between Theodolite & Tacheometer.

UNIT III GEODETIC SURVEYING 9 Hrs

Introduction & object of Geodetic Surveying, Principal & classification of triangulation system, Selection of base line and stations, Orders of triangulation-triangulation figures, Station marks and signals-marking signals, Examples on Phase error, Extension of base, reduction of centre, selection and marking of stations

UNIT IV CONTOURING AND CURVE SETTING 12 Hrs

Contouring - methods –characteristics and uses of contours - plotting - calculation of areas and volumes- earth work volume- Types of curves used in roads and railway alignments-Notations of simple circular curve Designation of the curve-Setting simple circular curve by offsets from long chord and Rankines method of deflection angles

UNIT V FIELD ASTRONOMY 8 Hrs

Introduction & Instruments & purpose, Astronomical terms, Time & conversion of time, Abbreviations, Determination of azimuth , Latitude and longitude & Examples of azimuth , Latitude and longitude

Total No of Hours: 45

Text Books

1. Arora, K.R., Surveying Vol. I, II & III, Standard Book House. New Delhi
2. Basak, N.N., Surveying and Levelling, Tata Mcgraw Hill, New Delhi
3. Agor, R., Surveying and Levelling, Khanna Publishers, New Delhi

Reference Books:

1. Duggal, S. K., Surveying Vol. I & II, Tata Mcgraw Hill, New Delhi
2. Subramanian, R., Surveying & Levelling, Oxford University Press, New Delhi
3. Punamia, B.C., Surveying Vol. I, II & III, Laxmi Publications
4. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune VidhyarthiGruh

Subject Code: EBCE22L01	Subject Name : SURVEYING LABORATORY	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Hill and Advanced Surveying	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- To train the students with the practical knowledge on basic surveying methods for construction and road purpose

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, the student will be able to:

CO1	Prepare the survey sheet according to the method used
CO2	Apply theoretical considerations in field and other engineering projects
CO3	Able to survey the area using different methods of plane tabling and compass survey and to adjust the compass traverse graphically
CO4	Record the reduced levels using various methods of levelling and measurement of horizontal & vertical angles by Theodolite
CO5	Setting out works for foundation marking, use of stereoscope for 3-D viewing, Co-ordinate measurements by GPS and Traversing by Total station

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	2	1	1	3	1	2	3
CO2	3	2	3	3	3	2	1	1	3	1	2	3
CO3	3	2	3	3	3	2	1	1	3	1	2	3
CO4	3	2	3	3	3	2	1	1	3	1	2	3
CO5	3	2	3	3	3	2	1	1	3	1	2	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓					✓			

Subject Code: EBCE22L01	Subject Name : SURVEYING LABORATORY	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Hill and Advanced Surveying	Lb	0	0/0	3/0	1
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab						

UNIT I CHAIN SURVEYING 6 Hrs

Ranging – Chaining – Traverse

UNIT II COMPASS SURVEYING 6 Hrs

Determination of distance between two inaccessible points with compass - Surveying of a given area by prismatic compass (closed traverse) and plotting after adjustment - Correction for Local Attraction by Prismatic Compass

UNIT III PLANE TABLE SURVEYING 9 Hrs

Triangulation to find distance between inaccessible points with and without known scale – Three-Point Problem – Two-Point Problem.

UNIT IV LEVELLING 12 Hrs

Study of levels and leveling staff – Fly leveling using dumpy level – Fly leveling using tilting level – Check leveling.

UNIT V THEODOLITE 12 Hrs

Study of Theodolite Measurement of angles by reiteration and repetition – Measurement of vertical angles - Tangential system (using theodolite, leveling staff) - Stadia system (using theodolite, leveling staff) - Sub tense system (using theodolite, tape, cross staff, leveling staff)

Total No of Hrs: 45

TEXT BOOKS

1. Punmia B.C., “Surveying ", Vols. III, Laxmi Publications, Mumbai,1999 and I, II.
2. N.N Basak, “ Surveying and Levelling ", Tata McGraw – Hill Publishing Company Limited New Delhi, 2004.

REFERENCES

1. *Clark D., "Plane and Geodetic Surveying ", Vols. II and C.B.S. Publishers, I and Distributors, New Delhi, Sixth Edition, 1991.*
2. *James M. Anderson and Edward M. Mikhail, "Introduction to Surveying ", McGraw Hill Book Company, New Delhi, 1995*

II SEMESTER

Subject Code **EBMA22008**	Subject Name **: Statistical and Numerical Methods for Mechanical and Civil Engineers**	**Ty/ Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: First year Engineering 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 be able to apply the concepts in Statistics
To understand the concepts in Probability
To understand the concepts in Numerical methods
To be able to solve Algebraic and Transcendental equations.
To understand the concepts in Interpolation

COURSE OUTCOMES (COs) :

CO1	To be able to analyze Statistical data
CO2	To be able to understand probability theory
CO3	To be able to understand the concepts in Numerical methods
CO4	To be able to solve algebraic and Transcendental equations
CO5	To be able to apply Interpolation concepts

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	3	1	1	1	2	2	1	3
CO2	3	3	1	3	2	2	1	1	2	1	2	2
CO3	2	3	1	2	2	3	3	1	1	2	2	3
CO4	2	3	1	1	1	3	3	1	1	2	1	2
CO5	3	2	1	3	1	2	3	1	1	2	2	2

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

Subject Code **EBMA22008**	Subject Name **: Statistical and Numerical Methods for Mechanical and Civil Engineers**	**Ty/ Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: First year Engineering 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 BASICS OF STATISTICS 12 hrs

Variables – Uni-variate Data – Frequency Distribution – Measures of Central Tendency – Mean –Median –Mode – Quartiles – Measures of Dispersion – The Range – Quartile Deviation –Standard Deviation – Relative Measures of Dispersion – Coefficient of Variation – Quartile Coefficient of Variation.

UNIT II PROBABILITY AND RANDOM VARIABLE 12 hrs

Axioms of Probability – Conditional probability – Total probability – Baye's Theorem – Random variable – Probability mass function – Probability density function – Properties – Moments (Definition and simple problems).

UNIT III BASICS OF NUMERICAL METHODS 12 hrs

Curve fitting-Method of group averages-Principle of least square-Method of moments-Finite differences-Operators (Forward, Backward & Shifting) -Relationship between the operators.

UNIT IV SOLUTION OF EQUATIONS 12 hrs

Solution of Algebraic and Transcendental equations – Method of false position – Iteration method – Newton-Raphson method – Solution of Linear system of equations – Gauss Elimination method – Gauss-Jordan method – Iterative methods – Gauss-Jacobi method – Gauss-Seidel method – Matrix Inversion by Gauss-Jordan method.

UNIT V INTERPOLATION 12 hrs

Newton forward and backward differences – Central differences – Stirling's and Bessel's formulae – Interpolation with Newton's divided differences – Lagrange's method.

Total no. of hrs: 60

Reference Books:

1. Veerarajan T., *Probability, Statistics and, Random Processes*, Tata McGraw Hill Publishing Co., (2008).
2. Singaravelu, *Probability and Random Processes*, Meenakshi Agency, (2017).
3. Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S.Chand & Co., (2007).
4. Veerarajan T., *Numerical Methods*, Tata McGraw Hill Publishing Co., (2005).
5. Sastry S.S., *Introductory Methods of Numerical Analysis*, Prentice Hall of India, (2003).
6. Kandasamy P., Thilagavathy, Gunavathy K., *Numerical Methods (Vol.IV)*, S.Chand & Co., (2008).

Subject Code: EBCE22004	Subject Name : STRENGTH OF MATERIALS	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: 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

OBJECTIVE :

- To impart knowledge about deflection in beams by various methods
- To impart knowledge about analyzing the structural elements by energy concepts and finding stresses and deflection
- To impart knowledge about behavior of columns, critical loads and design of columns

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, Students will have

CO1	Thorough knowledge in analysis of indeterminate beams and use of energy method for estimating the slope and deflections of beams and trusses
CO2	To understand beams and failure of materials
CO3	To apply the energy principles to solve practical problems
CO4	To analyze indeterminate beams for various loading conditions
CO5	To assess the behavior of columns

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	1	1	1	1	2	3
CO2	3	3	3	3	1	2	1	1	1	1	2	3
CO3	3	3	3	3	1	2	1	1	1	1	2	3
CO4	3	3	3	3	1	2	1	1	1	1	2	3
CO5	3	3	3	3	1	2	1	1	1	1	2	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code: EBCE22004	Subject Name : STRENGTH OF MATERIALS	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: 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 BENDING OF BEAMS 10 Hrs

Bending of Beams of Symmetrical and Unsymmetrical Sections – Box sections and its importance — Winkler Bach Formula - Shear Center Simple problems

UNIT II ENERGY PRINCIPLES 11 Hrs

Strain energy and strain energy density - Strain energy in tension, shear, flexure and torsion - Castigliano's & Engessor's energy theorems- Principle of Virtual Work- Application of energy theorems for computing deflection in Determinate structures – Maxwell's reciprocal theorem.

UNIT II DEFLECTIONS 13 Hrs

Methods of Deflection Determination of Deflection curve – computation of slopes and deflections in Determinate Beams - Double Integration method – Macaulay's method – Area Moment method –Conjugate Beam method.

UNIT IV INDETERMINATE BEAMS 13 Hrs

Propped Cantilever and Fixed Beams - Fixed End Moments and Reactions for Standard cases of Loading - Continuous Beams - Theorem of Three Moments - Analysis of Continuous Beams - S.F. and B.M. Diagrams for Continuous Beams.

UNIT V COLUMNS 13 Hrs

Eccentrically Loaded Short Columns Middle Third Rule - Core of Section - Columns of Unsymmetrical Sections - Rankine – Gordon Formula Eccentrically Loaded Long Columns. Theories of Failure - Principal Stress, Principal Strain, Shear Stress, Strain Energy and Distortion Energy Theories.

Total No of Hrs: 60

TEXT BOOKS

1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2007.
2. Bhavikatti. S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2010.
3. R.S. Khurmi, "Engineering Mechanics of Solids ", Prentice Hall of India, New Delhi, 1997.
4. S.S Ratan, "Strength of Materials ", Tata McGraw Hill Publishing Company, New Delhi, 2008

REFERENCES

1. *Laudner T.J. and Archer R.R., " Mechanical of Solids in Introduction ",McGraw Hill International Editions, New Delhi,1994..*
2. *William A.Nash, " Theory and Problems of Strength of Material" Schaum's outline series, Mc Graw Hill International Editions, New Delhi, 1994*

Subject Code: EBCE22005	Subject Name : FLUID MECHANICS AND HYDRAULIC ENGINEERING	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: None	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

OBJECTIVE :

- To know the importance, application and inter-relationship of various properties of fluid.
- To study theories those explain the behavior and performance of fluid when the fluid is flowing through the pipe.
- To understand the utilization of dimensional analysis as a tool in solving problems in the field of fluid mechanics.

COURSE OUTCOMES (COs) : (3- 5)

CO1	To learn about the basics of fluid mechanics and various properties of fluids
CO2	To understand various forces on plane and curved surfaces and the concepts of buoyancy
C03	To apply the principles of fluid kinematics and dynamics
C04	To analyze boundary layer flow and flow through pipes
C05	To evaluate various models like distorted models and various dimensionless numbers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	1	1	1	1	1	3
CO2	3	3	3	3	2	3	1	1	1	1	1	3
C03	3	3	3	3	2	3	1	1	1	1	1	3
C04	3	3	3	3	2	3	1	1	1	1	1	3
C05	3	3	3	3	2	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
C03	3	3
C04	3	3
C05	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			
				✓								

Subject Code: EBCE22005	Subject Name : FLUID MECHANICS AND HYDRAULIC ENGINEERING	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: None	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 FLUID STATICS AND PROPERTIES 12 Hrs

Definitions - Fluid and Fluid Mechanics - Dimensions and Units - Fluid properties –Viscosity, Compressibility, Surface tension and Capillarity, Continuum - concept of system and control volume- Pascal's law and Hydrostatic equation - buoyancy -meta centric height – pressure measurement – gauges and manometers.

UNIT II FLUID KINEMATICS AND DYNAMICS 12 Hrs

Stream, streak and path lines - classification of flows - continuity equation - stream and potential functions –flow nets – velocity and acceleration measurement-Problems- Euler and Bernoulli's equations - application of Bernoulli's equation - discharge measurement -Hagen Poiseuille equation .

UNIT III FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS 12 Hrs

Darcy Weisbach formula -Major and minor losses of flow in pipes – pipes in series and in parallel – Dimensional analysis - Buckingham π -theorem.

UNIT IV UNIFORM AND RAPIDLY VARIED FLOW 12 Hrs

Open channel flow - types and regime of flow - velocity distribution in open channel - specific energy - critical flow and its computation - Uniform flow - velocity measurement - manning's and Chezy's formula - determination of roughness coefficients - most economical sections- Rectangular, Circular and Trapezoidal channel sections .Hydraulic jump - types - energy dissipation – surges

UNIT V PUMPS AND TURBINES 12 Hrs

Introduction – classification – Rotodynamic pumps: centrifugal pumps – work done – losses – spe12ific speed - minimum speed to start the pump- multistage pumps- parallel and series- reciprocating pump –work done- slip - Pelton wheel turbine –work done-Francis turbine –work done- Kaplan turbine –work done.

Total No of Hrs: 60

TEXT BOOKS

1. Dr.R. K. Bansal., "Fluid Mechanics and Hydraulic Machines ", Laxmi Publications 2015.
2. Fox, Robert W. And McDonald, Alan T., “Introduction to Fluid Mechanics ",John Willey & sons

REFERENCES

1. *Streeter, Victor l. And Wylie, Benjamin E., “Fluid Mechanics ", McGraw-Hill Ltd., 1998.*
2. *Natarajan M.K., “Principles of Fluids Mechanics ", Anuradha Agencies, Kumbakonam, 1995*

Subject Code: EBCE22L02	Subject Name : STRENGTH OF MATERIALS LABORATORY	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Mechanics of Solids	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- The objective of the strength of materials lab is to demonstrate the basic principles in the area of strength and mechanics of materials and structural analysis to the undergraduate students through a series of experiments. In this lab the experiments are performed to measure the properties of the materials such as impact strength, tensile strength, compressive strength, hardness, ductility etc.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Measure tensile, shear and torsion capacity of steel rods
CO2	Understand the tensile, shear and torsional capacity of steel rods
CO3	Demonstrate and conduct experiment to find impact strength, hardness value of metal specimens, compression of springs and deflection of metal beams
CO4	Analyze the Hardness values of metals like mild steel, brass, copper and aluminum
CO5	Evaluate the deflection and impact values of metal specimens

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	3	1	1	3	1	1	3
CO2	3	2	2	3	3	3	1	1	3	1	1	3
CO3	3	2	2	3	3	3	1	1	3	1	1	3
CO4	3	2	2	3	3	3	1	1	3	1	1	3
CO5	3	2	2	3	3	3	1	1	3	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓					✓			

Subject Code: EBCE22L02	Subject Name : STRENGTH OF MATERIALS LABORATORY	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Mechanics of Solids	Lb	0	0/0	3/0	1
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab						

1. Tension test on mild steel rod
2. Compression test on wooden specimen
3. Double shear test on mild steel and aluminum rods
4. Torsion test on mild steel rod
5. Impact test on metal specimen
6. Hardness tests on metals like mild steel, brass, copper and aluminum
7. Deflection test on metal beam
8. Compression test on helical spring

Total No of Hours: 45

References:

1. Timoshenko S.P, &Young, D.H. Strength of Materials – East West Press Ltd. 3. Relevant 813 code. Venon john, Engineering Materials, 3rt Edition, McMillan Co.Ltd.,

Subject Code: EBCE22L03	Subject Name : FLUID MECHANICS & HYDRAULIC MACHINERY LABORATORY	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Fluid Mechanics and Hydraulic Engineering	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- To learn the aim, working principle, components and function of hydraulic equipments.
- To get hand-on experience in the operation of hydraulic machines.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Measure theoretical discharge in pipes, Venturimeter, orificemeter and notches
CO2	Understand the working principle of orificemeter, venturimeter, pumps and turbines
CO3	Demonstrate and conduct experiment to find characteristic curves of various pumps and turbines
CO4	Compare characteristic curves of various pumps and turbines
CO5	Evaluate the major and minor energy losses in pipes

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	3	1	1	3	1	1	3
CO2	3	2	3	3	3	3	1	1	3	1	1	3
CO3	3	2	3	3	3	3	1	1	3	1	1	3
CO4	3	2	3	3	3	3	1	1	3	1	1	3
CO5	3	2	3	3	3	3	1	1	3	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓					✓			

Subject Code: EBCE22L03	Subject Name : FLUID MECHANICS & HYDRAULIC MACHINERY LABORATORY	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Fluid Mechanics and Hydraulic Engineering	Lb	0	0/0	3/0	1
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab						

UNIT I FLOW MEASUREMENT 12 Hrs

i. Venturimeter.
ii. Orifice meter.

UNIT II LOSSES IN PIPES 9 Hrs

Estimation of major energy and minor losses in pipes

UNIT III PUMPS 12 Hrs

Performance characteristics of
i. Rated speed centrifugal pump.
ii. Gear pump.
iii. Reciprocating pump**.**

UNIT IV TURBINES 12 Hrs

Performance characteristics of Pelton wheel turbine and Francis turbine.

Total No of Hrs: 45

TEXT BOOKS

1. Dr. R. K.Bansal., "Fluid Mechanics And Hydraulic Machines ", Lakshmi Publications (P) Ltd.New Delhi 2005.
2. Fox, Robert w. and Mcdonald, Alan T., "Introduction to Fluid Mechanics ",John Willey & Sons, New Jersey

REFERENCES

1. *Streeter, Victor L. And Wylie, Benjamin e., "Fluid Mechanics ", McGraw-Hill Ltd.New Delhi, 1998.*
2. *Natarajan M.K., "Principles of Fluids Mechanics ", Anuradha agencies, Vidayal karuppur, kumbakonam, 1995*

III SEMESTER

Subject Code: EBCE22006	Subject Name : ENVIRONMENTAL ENGINEERING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Chemistry and Industrial Chemistry	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

- **OBJECTIVE** :
- To impart knowledge in fundamental theory and design of conventional water treatment facilities.
- To impart knowledge in fundamental theory and design of conventional wastewater treatment facilities.
- To impart knowledge on the principles used to design advanced wastewater treatments.
- To develop the ability to solve a specific problem right from its identification till the successful solution of the same

COURSE OUTCOMES (COs) : (3- 5)

CO1	Impart knowledge in fundamental theory and design of conventional water and wastewater treatment facilities
CO2	Understand drinking water supply and waste water systems, including water transport, treatment and distribution and the ability to design and evaluate water supply and waste water project alternatives
CO3	Applying water quality and waste water criteria and standards, and their relation to public health
CO4	Analyze challenging practical problems and find solution by formulating proper methodology
CO5	Evaluate the methods of sewage disposal and formulate effective waste management strategies

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	3	3	3	2	2	2	2
CO2	3	3	2	3	3	3	3	3	2	2	2	2
CO3	3	3	2	3	3	3	3	3	2	2	2	2
CO4	3	3	2	3	3	3	3	3	2	2	2	2
CO5	3	3	2	3	3	3	3	3	2	2	2	2

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code: EBCE22006	Subject Name : ENVIRONMENTAL ENGINEERING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Chemistry and Industrial Chemistry	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 PLANNING FOR WATER SUPPLY SYSTEMS 12 Hrs

Scope of environmental engineering – role of environmental engineer – Public water supply systems – objectives – design period – population forecasting – water demand – sources of water – sources selection – water quality – characterization – sources of wastewater –estimation of storm runoff.

UNIT II WATER TREATMENT 12 Hrs

Screening - types of screening - plain sedimentation – sedimentation with coagulation – settling & flotation - filtration - disinfection

UNIT III SEWAGE TREATMENT – PRIMARY TREATMENT 12 Hrs

Objectives – unit operations & processes – principles, functions and design of screen, grit chambers and primary sedimentation tanks.

UNIT IV : SEWAGE TREATMENT – SECONDARY TREATMENT 12 Hrs

Secondary treatment – activated sludge process and trickling filter; other treatment methods – stabilization ponds and septic tanks – advances in sewage treatment.

UNIT V: SEWAGE DISPOSAL AND SLUDGE MANAGEMENT 12 Hrs

Methods – dilution – self purification of surface water bodies – oxygen sag curve – land disposal – sewage farming – deep well injection – soil dispersion system. Thickening – sludge digestion – biogas recovery - drying beds – conditioning and dewatering – sludge disposal.

Total No of Hrs: 60

TEXT BOOKS

1. Garg, S.K., Environmental Engineering, Vols. I &II, Khanna Publishers, New Delhi, 1994
2. C.S.Shah, Water Supply And Sanitation, Galgotia Publishing Company, New Delhi, 1994

REFERENCES

1. *Manual on Water Supply And Treatment, Ministry Of Urban Development, Government Of India, New Delhi, 1999.*
2. *Manual on sewerage and sewage treatment, CPHEEO, Ministry Of Urban Development, Government Of India, New Delhi, 1993.*
3. *H.S.Peavy, D.R.Rowe and George Tchobanoglous, Environmental Engineering, Mcgraw-Hill Book Company, New Delhi, 1995.*

Subject Code: EBCE22007	Subject Name : SOIL MECHANICS	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Geology	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

OBJECTIVE :

- Provide the description and classification of soil and analysis of stresses in soils under different loading conditions ; To develop an understanding of the principles of effective stress in saturated soils, and its application to one dimensional compression and consolidation

COURSE OUTCOMES (COs) : (3- 5)

CO1	Provide the description and classification of soil and Analysis of stresses in soils under different loading conditions.
CO2	To understand the principles of effective stress in saturated soils and its application to one dimensional compression and consolidation
CO3	To apply the concept of shear strength of soil and slope stability for practical applications
CO4	To analyze the slopes using method of slices and friction circle method
CO5	To evaluate stress distribution in soil media using influence charts

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	1	1	1	1	1	3
CO2	3	3	3	3	2	3	1	1	1	1	1	3
CO3	3	3	3	3	2	3	1	1	1	1	1	3
CO4	3	3	3	3	2	3	1	1	1	1	1	3
CO5	3	3	3	3	2	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code: EBCE22007	Subject Name : SOIL MECHANICS	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Geology	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**

Nature of soil - phase relationships - soil description and classification for engineering purposes - IS classification system - soil compaction - theory, comparison of laboratory and field compaction methods – factors influencing compaction.

UNIT II : SOILWATER AND WATER FLOW **12 Hrs**

Soil water - static pressure in water – capillary stresses- permeability measurement in the laboratory and field - factors influencing permeability of soil - seepage –introduction to flow nets - simple problems.

UNIT III: STRESS DISTRIBUTIONS AND SETTLEMENT **12 Hrs**

Effective stress concepts in solids - stress distribution in soil media - use of influence charts - components of settlement – factors influencing settlement of soil -immediate and consolidation settlement - Tergazhi's one-dimensional consolidation theory – computation of rate of settlement

UNIT IV: SHEAR STRENGTH **12 Hrs**

Shear strength of cohesive and cohesion less soils - Mohr - Coulomb failure theory - saturated soil mass – measurement of shear strength, direct shear - triaxial compression, UU, CU and CD Test.

UNIT V : SLOPE STABILITY **12 Hrs**

Slope failure mechanisms - types - infinite slopes - finite slopes - total stress analysis for saturated clay –method of slices - friction circle method - use of stability number .

Total No of Hrs: 60

TEXT BOOKS

- V.N.S. Moorthy, “soil mechanics and foundation engineering ", ubs publications and Distribution ltd, New Delhi, 1999.
- Gopal Ranjan and Rao A.S.R., “Basic and Applied Soil Mechanics ", Wiley eastern ltd., New Delhi (india), 1997.
- Arora K.R., “soil mechanics and foundation engineering ", standard publishers And distributors, New Delhi, 1997.

REFERENCES

- Holtz R.D. And kovacs W.D., “Introduction to geotechnical engineering ", Prentice-hall, New Delhi, 1995.
- Mccarthy D.F., “Essentials of soil mechanics and foundations ", Prentice-Hall, New Delhi, 97.
- Sutten B.H.C., “Solving problems in soil mechanics", Longman group scientific And technical, U.K. England, 1994
- Dass, B.M, “Principles of geotechnical engineering”, Thompson books

Subject Code: EBCE22008	Subject Name : CONCRETE TECHNOLOGY	Ty / LB/ ETL/IE	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: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- 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
- To develop the ability to solve a specific problem right from its identification till the successful solution of the same

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, the student will be able to:

CO1	Understand about concrete making materials , supplementary cementations materials and design the concrete mix for the required strength
CO2	Will acquire knowledge on handling of different types of construction equipments
CO3	To take up challenging practical problems and find solution by formulating proper methodology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	2	-	-	-	-	2	-
CO2	3	3	3	-	-	2	-	-	-	-	2	-
CO3	3	3	2	-	-	2	-	-	-	-	2	-

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	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			
				✓								

Subject Code: EBCE22008	Subject Name : CONCRETE TECHNOLOGY	Ty / LB/ ETL/IE	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: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

UNIT I CONCRETE MAKING MATERIALS 8 Hrs

Manufacture and Components of Portland Cement- Hydration Process- Types of Cement, Aggregates - Classification and Properties Admixtures.

UNIT II MIX DESIGN 10 Hrs

Properties of Fresh Concrete- Workability, Segregation and Bleeding of Concrete - Factors influencing Mix Proportions - I.S and ACI Methods of Mix Design.

UNIT III PROPERTIES OF HARDENED CONCRETE 8 Hrs

Strength - Creep and Shrinkage - Durability of Concrete - Chemical Attack - Different Types of FRC - Properties and Applications.

UNIT IV SUB STRUCTURE CONSTRUCTION 9 Hrs

Piling techniques – Sheet piles – Under water construction of Diaphragm wall and basement – Driving diaphragm walls – Driving well and caisson – Sinking coffer dam – Shoring for deep cutting – Well points – Dewatering and stand by plant equipment for underground open excavation

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UNIT V SUPER STRUCTURE AND CONSTRUCTION EQUIPMENTS 10 Hrs

Construction sequences in cooling Towers, Bunkers, Silos and Chimney – Pre- stressed construction – In situ pre-stressing in high rise structures – Erecting light weight components on tall structures. Types of earth work equipment's - Tractors, Motor graders, Scrappers - Equipment for compaction – Batching and mixing and concreting.

Total No of Hrs: 45

TEXT BOOKS

1. Shetty. M.S., Concrete Technology, S.Chand and Co, Pune,1984
2. Arora S.P. And Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Roy and Sons, New Delhi, 1997.
3. Peurifoy, R.L., Ledbetter, W.D And Schexnayder, C., 'Consruction Plaaning, Equipment and Methods' V Edition McGraw Hill, Singapore, 1995

REFERENCES

1. *Krishnasamy. K.T., Concrete Technology, Dhanapt Rai - New Delhi – 1985*
2. *Neville, properties of concrete elbs, 1977.*
3. *Sharma S.C., Building Construction, Khanna Publishers, New Delhi.1998*

Subject Code: EBCE22ET1	Subject Name : BUILDING MATERIALS	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Industrial Chemistry	ETL	1	0/0	2/0	2

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

OBJECTIVE :

- To impart knowledge on different materials and properties
- To understand the engineering aspects related to buildings

COURSE OUTCOMES (COs) : (3- 5)

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

CO1	Identify and characterize building materials
CO2	Understand the manufacturing process of bricks and cement
CO3	To have a clear understanding about foundation and its type

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	3	2	-	-	-	-	-
CO2	3	3	-	3	-	3	2	-	-	-	-	-
CO3	3	3	-	3	-	3	2	-	-	-	-	-

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	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			
				✓					✓			

Subject Code: EBCE22ET1	Subject Name : BUILDING MATERIALS	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Industrial Chemistry	ETL	1	0/0	2/0	2

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

UNIT I BRICKS, AGGREGATES AND CEMENT 9 Hrs

Bricks – Classification – Manufacturing process – Test on bricks – Aggregate: Natural Stone Aggregate – Industrial By- product – Crushing strength, impact strength, and flakiness – Abrasion resistance – Grading – sand – Bulking. Cement: Cement Ingredients – Manufacturing Process – Types – Testing of Cement

UNIT II MASONRY& MORTAR 9 Hrs

Masonry - stone masonry - rubble and Ashlar masonry - Brick masonry - Bond - Definition need and scope - Types of bonds - English and Flemish bond - merits and demerits - composite masonry - solid and hollow block masonry-soil-cement bricks-Load bearing and non-load bearing walls- Codal provisions.Mortar – Preparation of Lime and Cement Mortar- Concrete – Ingredients – Manufacturing Process – Batching Plant – Ready Mix Concrete - Paints - Plastics – Glass

UNIT III SUB STRUCTURE AND SUPER STRUCTURE 9 Hrs

Substructure – Setting Out of Foundation and Trenches – Excavation and Timbering – Foundation –Shallow Foundation – Deep Foundation. Super Structure.

UNIT IV FLOOR, ROOF & STAIR CASE 9 Hrs

Floors - Types of floor - Details of concrete and terrazzo floors - Roofs - Types of Roofs - Types of Flat roofs - sloping roofs -different types and usage - shell roofs - roof coverings-AC sheets-GI sheets-FRP roofs Water proofing treatment of roofs -tar felt treatment- chemical treatment- Types of weathering courses .Stair Case – Definition – Types of Stair – General Dimension and Requirements – Layout of Stair Case.

UNIT V BUILDING SERVICES 9 Hrs

Damp Proofing- Acoustics Treatment – Thermal Insulation – Fire Protection – Ventilation – Earth Quake Protection- Integration of services in buildings - water supply & plumbing layout for a residential building - elevators & escalators - planning & installation - basic components of the electrical system for a residence .

Total No of Hrs: 45

PRACTICE SESSIONS

Include practice sessions for Assessment of physical properties of bricks such as absorption, shape and size, structure, soundness, Hardness, presence of soluble salts, Hardness, impact and water absorption test etc for stones, different types of bonds for bricks and stones, defects in timber

TEXT BOOKS

1. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Building Construction" - Laxmi Publications (P) ltd., New Delhi.
2. Rangwala, S.C. Engineering Materials, Charotar Publishing House, 8th ed.1983. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and method of Construction, Dhanpat roy and Sons, 1997.

REFERENCES

1. *Taylor, G.D .Materials of Construction, USA Longman Inc, 1989.*
2. *Arora and Bindra, Building Materials and Building Construction, Dhanpat Raj*

Subject Code: EBCE22L06	Subject Name : SOIL MECHANICS LABORATORY	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Soil Mechanics	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- To illustrate some of the principles taught during the soil mechanics course.
- To impart knowledge of laboratory and index testing methods commonly used in Soil & foundation engineering.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Knowledge to determine Index properties of the soils like water content, specific gravity and Atterberg limits
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	Test the soil to assess its ability to withstand the load
CO5	Determine the permeability and coefficient of consolidation values

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	1	3	1	1	3	1	1	3
CO2	3	2	2	3	1	3	1	1	3	1	1	3
CO3	3	2	2	3	1	3	1	1	3	1	1	3
CO4	3	2	2	3	1	3	1	1	3	1	1	3
CO5	3	2	2	3	1	3	1	1	3	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓					✓			

Subject Code: EBCE22L06	Subject Name : SOIL MECHANICS LABORATORY	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Soil Mechanics	Lb	0	0/0	3/0	1

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. Specific gravity of soil solids

2. Grain size distribution - Sieve analysis - Hydrometer analysis

3. Atterberg limits test – Liquid limit, Plastic limit and shrinkage limit tests

4. Field density Test

5. Determination of moisture - Density relationship using standard proctor.

6. Permeability determination (constant head and falling head methods)

7. Direct shear test on cohesion less soil

8. Unconfined compression test in cohesive soil

9. Tri axial compression test in cohesion less soil

10. Laboratory Vane shear test in cohesive soil

11. One dimensional Consolidation test (Determination of coefficient of consolidation only)

Total No of Hrs: 45

REFERENCES

1. *"Soil Engineering Laboratory Instruction Manual ", Published by the Engineering College Co-operative Society, Chennai, 1996.*
2. *Lambe T.W., "Soil Testing for Engineers ", John Wiley and Sons, New York, 1990.*
3. *"I.S.Code of Practice (2720) Relevant Parts ", as amended from time to time.*

IV SEMESTER

Subject Code: EBCE22009	Subject Name : STRUCTURAL ANALYSIS	Ty / LB/ ETL/IE	L	T / S.Lr	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: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :
This course introduces students to the classical methods of structural analysis, i.e., methods for calculating forces and displacements in structures due to given loads and imposed deformations. Both determinate and indeterminate structures are covered.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Discover the behavior of arches and suspension bridges under various loads
CO2	To understand the concept of slope deflection method, moment distribution method and plastic analysis
CO3	To apply the method of tension coefficient to determine the member forces in space structures
CO4	To analyze the structures for moving loads and draw influence line diagrams
CO5	To evaluate the shape factor and influence lines of statically determinate structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	1	1	1	1	1	1	3
CO2	3	3	3	3	1	1	1	1	1	1	1	3
CO3	3	3	3	3	1	1	1	1	1	1	1	3
CO4	3	3	3	3	1	1	1	1	1	1	1	3
CO5	3	3	3	3	1	1	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code: EBCE22009	Subject Name : STRUCTURAL ANALYSIS	Ty / LB/ ETL/IE	L	T / S.Lr	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: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab						

UNIT I DEFLECTION OF DETERMINATE STRUCTURES 12 Hrs

Principles of virtual work for deflections - Deflections of pin-jointed plane frames and rigid Plane Frames. Introduction to analysis of space trusses using method of tension coefficients – Beams curved in plan.

UNIT II SLOPE DEFLECTION AND MOMENT DISTRIBUTION METHOD 12 Hrs

Analysis of continuous Beams – cantilever beams - Continuous beams and rigid frames (with and without sway) - Symmetry and Asymmetry -Portal Frames. Stiffness and carry over factors –Balance – Distribution and carryover of moments - Analysis of continuous Beams - Plane rigid frames with and without sway – Structural frames

UNIT III MOVING LOADS AND INFLUENCE LINES (DETERMINATE) 12 Hrs

Influence lines for reactions in statically determinate structures – influence lines for member forces in pin jointed frames – Influence lines for shear force and bending moment in beam sections

UNIT IV ARCHES AND SUSPENSION BRIDGES 12 Hrs

Arches structural forms – Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches – Settlement and temperature effects

Analysis of suspension bridges – Un stiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

UNIT V MATRIX METHOD FOR INDETERMINATE FRAMES AND PLASTIC ANALYSIS 12 Hrs

Equilibrium and compatibility - Determinate Vs indeterminate structures –Indeterminacy - primary structure - Compatibility conditions - Analysis of indeterminate pin-jointed plane frames, continuous beams. Element and global stiffness and flexibility matrices– Co-ordinate transformations – transformations of stiffness matrices - Analysis of Continuous Beams.

Total no of hrs: 60

TEXT BOOKS

1. R.Vaidyanathan, P.Perumal,, Comprehensive Structural Analysis Vol 1 and vol.2, Laxmi Publications, 2004
2. Bhavikatti S.S Structural Analysis Vol 1 and vol.2, Vikas Publishing House Pvt. Ltd New Delhi
3. S.Ramamrutham, R.Narayan, Theory of structures, Dhanpatrai publications,1993

REFERENCES

1. *Analysis of Structures: Strength and Behaviors T.S. Thandavamoorthy, oxford University press, New Delhi, 2005.*
2. *Matrix analysis of framed structures – William Weaver, Jr & James M.Gere, CBS Publishers & Distributors, Delhi, 1995*
3. *Structural Analysis – A Matrix Approach – G.S.Pandit & S.P.Gupta, Tata McGraw-Hill, New Delhi, 1998*
4. *Manicka Selvam V.K.,Elementary Matrix Analysis of Structures, Khanna Publishers Mumbai,1990.*
5. *Coates R.C., Coutie M.G. and Kong F.K., Structural Analysis, ELBS and Nelson, Newjersey,1990.*

Subject Code:	Subject Name: DESIGN OF CONCRETE STRUCTURES	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22010	Prerequisite: Structural Analysis	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

OBJECTIVE : The purpose of this study is to impart comprehensive knowledge on the design of reinforced concrete structural elements such as beams, columns, slabs and footings. Brings about an understanding of the behavior of reinforced concrete and the design philosophies

COURSE OUTCOMES (COs) : (3- 5)
At the end of the course, the student will be able to:

CO1	Understanding the behavior of reinforced concrete and the design philosophies
CO2	Applying the concept of Concrete design to making the projects.
CO3	Analyze and Practicing the design concepts with Indian Standard codes
CO4	Evaluate the design methods for concrete elements
CO5	To create comprehensive knowledge on the design of reinforced concrete structural elements such as beams, columns, slabs and footings

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code:	Subject Name: DESIGN OF CONCRETE STRUCTURES	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22010	Prerequisite: Structural Analysis	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, LIMIT STATE DESIGN OF BEAMS AND SLABS 12 Hrs

Properties of different grades of concrete and steel, Behavior of RC members, Permissible stresses - Stress block parameters, Stress strain relationship - Failure criteria Analysis - Introduction to IS 456-2000, SP: 16 - Design and detailing of singly reinforced & doubly reinforced beam - Design and detailing of one-way and two-way slab panels – Flat Slabs (Design of beams and slabs for combined shear, bending and torsion).

UNIT II LIMIT STATE DESIGN OF COLUMNS AND FOOTINGS 12 Hrs

Basic assumptions - Design and detailing of reinforced concrete short columns of rectangular and circular cross sections under axial load - Column under compression and bi axial bending using IS 456:2000 - Design and detailing of isolated footing for column subjected to axial loads, Design and detailing of Axially and eccentrically loaded Rectangular footings, Design and detailing of Combined Rectangular footings for Two Columns.

UNIT III DESIGN OF STAIRCASE AND WATER TANK 12 Hrs

Introduction to ductile detailing & provisions of IS 13920, Design of Staircases - Design of circular and rectangular water tanks resting on ground. Design of staging and foundations

UNIT IV RETAINING WALLS 12 Hrs

Design of retaining walls – Cantilever and Counter fort retaining walls

UNIT V YIELD LINE THEORY AND INTRODUCTION TO BRICK MASONRY 12 Hrs

Application of virtual work method to square, rectangular, circular and triangular slabs, Design of masonry walls, and pillars as per NBC and IS codes

Total No of Hrs: 60

TEXT BOOKS

1. N.Krishna Raju "Design of Reinforced Concrete Structures", CBS publishers & Distributors. Latest Edition, IS456:200.
2. S.Ramamrudham ,Design of Reinforced Concrete Structures, Dhanpat Rai publishing company(p) Ltd New Delhi.
3. Varghese P C, Limit State Design of Reinforced Concrete, Prentice Hal of India, Private, Limited New Delhi, 1997.

REFERENCES

1. *Ashok K. Jain Reinforced concrete- Limit state design- New chand & Bros, Roorkee 1997.*
2. *Dayarathnam.P, Brick and Reinforced Brick Structures, Oxford and IBH Publishing House, 1999.*
3. *IS: 456- 2000 "Indian Standard for Plain and reinforced concrete – code of practice "Bureau of Indian Standard".*
4. *A.P Arul Manikam "Structural Engineering" .*
5. *Design aids to IS 456-1978 (SP16).*
6. *SP 34 Handbook on Concrete Reinforcement and Detailing, BIS 1987.*
7. *IS 1905:1987, Code of practice for structural use of unreinforced masonry Bureau of Indian Standards.*

Subject Code: EBCE22011	Subject Name : FOUNDATION ENGINEERING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Soil Mechanics	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

OBJECTIVE :

- At the end of this course student acquires the capacity to investigate the soil condition and to design suitable foundation

COURSE OUTCOMES (COs) : (3- 5)

CO1	Discover the behavior and nature of the soil
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	PO10	PO11	PO12
CO1	3	3	3	3	2	3	3	1	1	1	2	3
CO2	3	3	3	3	2	3	3	1	1	1	2	3
CO3	3	3	3	3	2	3	3	1	1	1	2	3
CO4	3	3	3	3	2	3	3	1	1	1	2	3
CO5	3	3	3	3	2	3	3	1	1	1	2	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code: EBCE22011	Subject Name : FOUNDATION ENGINEERING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Soil Mechanics	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 : SOIL EXPLORATION **12 Hrs**

Scope and objectives – method of exploration – angering and boring – wash boring and rotary drilling – depth of boring – spacing of bore hole - sampling –representative and undisturbed - sampling – sampling techniques –split spoon sampler,thin tube sampler,stationary piston sampler - bore log and report – penetration tests (spt and scpt) .

UNIT II : SHALLOW FOUNDATION **12 Hrs**

Introduction – location and depth of foundation – codal provisions – bearing capacity of shallow foundation on homogeneous deposits – terzaghi's formula and bis formula – factors affecting bearing capacity – problems- bearing capacity from in situ tests(spt, scpt and plate load) allowable bearing pressure – components of settlement – determination of settlement of foundation on granular and clay deposit – total and differential settlement – allowable settlement –- codal provisions .

UNIT III : FOOTINGS AND RAFTS **12 Hrs**

Types of foundation – contact pressure distribution below footings, design of footings, Isolated footing, combined footings ,mat foundation - types - Applications-proportioning- floating foundation .

UNIT IV : PILE FOUNDATION **12 Hrs**

Types of piles and their function – factors influencing the selection of pile – carrying capacity of single pile in granular and cohesive soils – static formulae - dynamic formulae (engineering news and hiley's) – capacity from insitu tests (spt and scpt) – negative skin friction - uplift capacity – group capacity by different methods(feld's rule,converse-labarra formula and block failure criterion) – settlement of pile groups – interpretation of pile load test(routine test only) – forces on pile caps – under reamed piles – capacity under compression and uplift .

UNIT V : RETAINING WALLS **12 Hrs**

Plastic equilibrium in soils – active and passive states – rankine's theory – cohesionless, effect of water table and cohesive soil - coloumb's wedge theory – condition for critical failure plane - earth pressure on retaining walls of simple configurations – graphical methods (rebhann and culmann's method)– stability analysis of retaining walls.

Total No of Hrs: 60

TEXT BOOKS

- Arora, k.r. Soil Mechanics And Foundation Engineering, Standard Publishers And Distributors, New Delhi, 1997.
- Gopal Ranjan and Rao, A.S.R. Basic and Applied Soil Mechanics, Wiley Eastern Ltd., New Delhi (India), 1997.
- V.N.S. Moorthy, " Soil Mechanics And Foundation Engineering ", Ubs Publications And Distribution Ltd, New Delhi, 1999.

REFERENCES

- Bowles J.E. Foundation Analysis And Design, McGraw hill, 1994.
- Dass, B.M , "Principles Of Geotechnical Engineering", Thompson Books, Singapore ,5th edition, 2003
- Kaniraj, S.R," Design Aids In Soil Mechanics And Foundation Engineering", Tata Mcgraw Hill Publishing Company Ltd , New Delhi ,2002
- Swamisaran, "Analysis And Design Of Structures – Limit State Design", Oxford Ibh Publishing Co Pvt Ltd. New delhi , 1998

Subject Code: EBCE22ET2	Subject Name : REMOTE SENSING AND GIS	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Geology, Engineering survey	ETL	1	0/0	2/0	2

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

OBJECTIVE :

- Introduce the principles of remote sensing to students who are beginners in this field.
- Fundamental knowledge on the physics of remote sensing.
- Aerial photographic techniques, image interpretation techniques ,to create basic understanding of GIS concepts.
- To develop the ability to solve a specific problem right from its identification till the successful solution of the same

COURSE OUTCOMES (COs) : (3- 5)

CO1	Enumerate the concepts of Electro Magnetic energy, spectrum and spectral signature curves for practical problems
CO2	Understand the concepts of satellite, sensors and characteristics of different platforms
CO3	Apply the concepts of DBMS in GIS
CO4	Analyze raster and vector data and modeling in GIS, Apply GIS in land use, disaster management, ITS and resource information system
CO5	Take up challenging practical problems and find solution by formulating proper methodology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	1	1	1	1	1	3
CO2	3	3	3	3	3	2	1	1	1	1	1	3
CO3	3	3	3	3	3	2	1	1	1	1	1	3
CO4	3	3	3	3	3	2	1	1	1	1	1	3
CO5	3	3	3	3	3	2	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓					✓			

Subject Code: EBCE22ET2	Subject Name : REMOTE SENSING AND GIS	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Geology, Engineering survey	ETL	1	0/0	2/0	2
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 TO REMOTE SENSING 9 HRS

Definition – components of remote sensing – , Energy sources and radiation principles, electromagnetic radiation (EMR) –EMR spectrum, active and passive remote sensing – platforms — visible, infra red (IR), near IR, middle IR , thermal IR and microwave – black body radiation - Planck's law – Stefan-Boltzman law.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS 9 HRS

Atmospheric characteristics, scattering of EMR – Raleigh, MIE, non-selective and Raman scattering – EMR interaction with water vapour and ozone – atmospheric windows – significance of atmospheric windows – EMR interaction with earth surface materials – radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffuse reflection surface- spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface

UNIT III OPTICAL AND MICROWAVE REMOTE SENSING SYSTEMS 9 HRS

Satellites - classification – based on orbits – sun synchronous and geo synchronous – based on purpose – earth resource satellites, communication satellites, weather satellites, spy satellites, spectral, radiometric and spatial resolutions, Multispectral, thermal and hyper spectral sensing, along and across track scanners – description of sensors in land sat, spot, irs series – current satellites - radar – speckle - back scattering – side looking airborne radar – synthetic aperture radar – radiometer – geometrical characteristics

UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9 HRS

GIS – components of GIS, data – spatial and non-spatial – maps – types of maps – projection – types of projection - raster and vector data structures – comparison of raster and vector data structure – GIS analysis using raster and vector data – DEM for Slope, Aspect, Flow direction, Flow pathways, Flow accumulation, Streams, Catchment area delineation, retrieval, reclassification, overlaying, buffering – data output.

UNIT V IMAGE PROCESSING AND APPLICATIONS OF RS & GIS 9 HRS

Visual interpretation of satellite images – elements of interpretation - interpretation keys, Digital Image Processing - application of remote sensing and GIS – urban applications - integration of GIS and remote sensing – Remote sensing applications for watershed management, Rainfall runoff modeling, Irrigation management, Flood mapping, Drought assessment, Environment and ecology, urban analysis –resources information systems.

PRACTICAL SESSIONS

Include practical sessions for Digitization - Point, Line, Polygon and Surface Data, Building topology – measuring distance and area, Adding attribute data – querying on attribute data, Onscreen digitization - Data Conversion – Vector to Raster, Raster to Vector, Generation of DEM: from contours, spot heights, Vector Analysis – Buffering, Overlay and Network analysis, Data Output: Bar charts, Map compilation

Total No of Hours : 45

TEXT BOOKS ,

1. Anji Reddy, Remote Sensing and Geographical Information Systems, B.S. Publications, New Delhi, 2001
2. M.G. Srinivas (edited by), Remote Sensing Applications, Nervosa Publishing House, New Delhi, 2001.

REFERENCE

1. *Lillesand T.M. And Kiefer R.W. Remote Sensing And Image Interpretation, John Wiley And Sons, Inc, New York, 1987.*
2. *Janza.F.J., Blue, H.M., Johnston, J.E.., "Manual of Remote Sensing Vol.I American Society of Photogrammetry, Virginia, U.S.A, 1975.*
3. *Burrough P.A, Principle Of Gis For Land Resource Assessment, Oxford, 1990*
4. *QGIS-1.8-UserGuide, http://docs.qgis.org/pdf/QGIS-1.8-UserGuide-en.pdf,2013*
5. *Getting to Know ArcGIS for Desktop,ISBN: 9781589483088 2013*
6. *Understanding GIS: An ArcGIS Project Workbook, ISBN: 9781589482425 2011*

Subject Code: EBCE22L07	Subject Name : CONCRETE LABORATORY	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Building Materials	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- The objective of the concrete lab is to test the basic properties ingredients of concrete, fresh and hardened concrete properties.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Outline the importance of testing of cement, fine and coarse aggregates and its properties
CO2	Understand the concept of workability and testing of fresh and hardened concrete
CO3	Demonstrate and conduct experiment on cement, fine aggregates, coarse aggregates and concrete
CO4	Compare the strength properties of different grades of concrete
CO5	Assess the different properties of cement, fine aggregates, coarse aggregates and concrete

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	1	3	1	1	3	1	1	3
CO2	3	2	2	3	1	3	1	1	3	1	1	3
CO3	3	2	2	3	1	3	1	1	3	1	1	3
CO4	3	2	2	3	1	3	1	1	3	1	1	3
CO5	3	2	2	3	1	3	1	1	3	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓					✓			

Subject Code: EBCE22L07	Subject Name : CONCRETE LABORATORY	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Building Materials	Lb	0	0/0	3/0	1
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

UNIT I : CEMENT **15 Hrs**

1. Test for fineness
2. Test for setting times including normal consistency test
3. Mortar cube preparation and testing

UNIT II : AGGREGATES **15 Hrs**

1. Sieve analysis test - Grade Curves
2. Crushing Value - Test
3. Test on Aggregates - Los Angeles Abrasive Testing Machine

UNIT III : CONCRETE: **15 Hrs**

1. Cube compression test
2. Tension test of concrete - cylinder split test
3. Flexural test on concrete specimen
4. Test using Vee Bee consistometer
5. Compaction factor test
6. Mix design using test parameters and assessing the strength of concrete

Total No of Hrs: 45

TEXT BOOKS

1. Shetty. M.S., Concrete Technology, S.Chand and Co, Pune,1984

REFERENCES

1. *Krishnasamy. K.T., Concrete Technology, Dhanapt Rai - New Delhi – 1985*
2. *Neville, properties of concrete elbs, 1977.*

V SEMESTER

Subject Code:	Subject Name : **DESIGN OF STEEL STRUCTURES**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
EBCE22012	Prerequisite: Structural analysis	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

OBJECTIVE:

- To introduce the student to material behaviour and Load and Resistance Factor Design methodology.
- To design and analyze tension members and compression members.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The students would have knowledge on the design of structural steel members subjected to compressive, tensile and bending forces, as per current code.
CO2	To understand the connections and their structural efficiency
CO3	Classify and design the structural steel components of industrial building
CO4	To analyze tension, compression and flexural members for the imposed load
CO5	To design structural systems such as roof trusses and gantry girders

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	1	3	1	1	2	1	2	3
CO2	3	3	3	3	1	3	1	1	2	1	2	3
CO3	3	3	3	3	1	3	1	1	2	1	2	3
CO4	3	3	3	3	1	3	1	1	2	1	2	3
CO5	3	3	3	3	1	3	1	1	2	1	2	3

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

Subject Code: EBCE22012	Subject Name : DESIGN OF STEEL STRUCTURES	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Structural analysis	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

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Connections using rivets, welding, bolting – Design of bolted and welded joints – Eccentric connections - Efficiency of joints.

UNIT II TENSION MEMBERS 12 Hrs

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag

UNIT III COMPRESSION MEMBERS 12 Hrs

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of laced and battened type columns – Design of column bases – Gusseted base

UNIT IV BEAMS 12 Hrs

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to uniaxial and biaxial bending – Design of plate girders - Intermediate and bearing stiffeners – Flange and web splices.

UNIT V ROOF TRUSSES AND INDUSTRIAL STRUCTURES 12 Hrs

Roof trusses – Roof and side coverings – Design of purlin and elements of truss; end bearing – Design of gantry girder.

Total No of Hrs: 60

TEXTBOOKS:

1. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013
2. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2 nd Edition, 2013.
3. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.

REFERENCES:

1. Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002
2. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005
3. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009
4. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2009.
5. IS 800 :2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007

Subject Code:	Subject Name: ESTIMATION AND QUANTITY SURVEYING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22013	Prerequisite: None	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

OBJECTIVE :

- To study the functional planning of buildings as per standards
- To study the estimate types and terms involved in estimation
- To study the important specifications necessary for the works in buildings
- To study the concepts of tenders and contracts

COURSE OUTCOMES (COs) : (3- 5)

At the end of this course the student shall be able to

CO1	Prepare various types of estimation and find out the quantity of works involved
CO2	Understand and Prepare specifications for various items of construction works
CO3	Calculate the mortgage, lease and depreciation value of buildings
CO4	Estimate the quantity of works involved in road works, water supply and sanitary works
CO5	Carry out analysis of rates and bill preparation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	1	1	1	1	1	3	3
CO2	3	3	3	3	1	1	1	1	1	1	3	3
CO3	3	3	3	3	1	1	1	1	1	1	3	3
CO4	3	3	3	3	1	1	1	1	1	1	3	3
CO5	3	3	3	3	1	1	1	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code:	Subject Name: ESTIMATION AND QUANTITY SURVEYING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22013	Prerequisite: None	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 ESTIMATION 12 Hrs

Types of estimates- units of measurements-methods of estimates – advantages- estimation of load bearing and framed structures –estimate of quantities in residential building- calculation of quantities of brick work, RCC, PCC, white washing ,color washing and painting / varnishing – calculation of brick work and RCC works in arches – estimate of joineries for paneled and glazed doors ,windows, ventilators, handrails etc.

UNIT II ESTIMATE OF OTHER STRUCTURES 12 Hrs

Estimating of septic tank, soak pit – Sanitary and water supply installations – Water supply pipe line – Sewer line – Tube well – Open well – Estimate of bituminous and cement concrete roads-estimation of retaining walls and culverts.

UNIT III SPECIFICATIONS AND TENDERS 12 Hrs

Data –schedule of rates- analysis of rates-specifications-sources-detailed and general specifications – tenders- e-tender contracts- contracts types– preparation of tender notice and documents-arbitration and legal requirements

UNIT IV VALUATION 12 Hrs

Necessity – basics of value engineering –capitalized value – depreciation and its methods – escalation _ value of building – calculation of standard rent – mortgage- lease.

UNIT V REPORT PREPARATION AND CASH FLOW 12 Hrs

Principle of report preparation – report on estimate of residential building- commercial building -culvert – roads – water supply and sanitary installations – tube wells – open wells.

Total No of Hrs: 60

TEXT BOOKS

1. B.N.Dutta, Estimating And Costing In Civil Engineering –UBS publishers and distribution Pvt Ltd, 2003.
2. Mr. B.Kanagasabapathy, M/S. Ehilalarasi Kanagasabapathy,Practical Valuation – Vol I, Thiruchirappalli, 1995.
3. Kohl, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S.Chand & CompanyLtd., 2004.
4. Rangwala, “Estimating, Costing and Valuation”, Charotar Publishing House Pvt Ltd., 2012.

REFERENCES

1. *G.S.Birdie, A Text Book On Estimating And Costing, Dhanpat Rai And Sons, New Delhi,1995.*
2. *Mr. B.Kanagasabapathy, M/S. Ehilalarasi Kanagasabapathy, Fixation of Fair Rent , Thiruchirappalli, 1995.*

Subject Code: EBCE22015	Subject Name : TRANSPORTATION ENGINEERING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Soil Mechanics, Surveying	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

OBJECTIVE :

- To understand the aspects of design, construction and maintenance of tracks for the safe and efficient movement of public and goods.
- To have an overall knowledge of the design and construction of Highway, airport, docks, harbors and ports as a whole.
- To develop the ability to solve a specific problem right from its identification till the successful solution of the same

COURSE OUTCOMES (COs) : (3- 5)

CO1	Thorough knowledge on planning, design, construction of highway, railway, airport and docks
CO2	Ability to understand planning, construction and maintenance aspects of highways, Railways, Airports and Harbor
CO3	Ability to take up challenging practical problems and find solution by formulating proper methodology
CO4	Analyze the geometric aspects to plan the shortest route
CO5	Evaluate the requirements for construction of docks and harbors

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	1	1	1	1	3	3
CO2	3	3	3	3	2	3	1	1	1	1	3	3
CO3	3	3	3	3	2	3	1	1	1	1	3	3
CO4	3	3	3	3	2	3	1	1	1	1	3	3
CO5	3	3	3	3	2	3	1	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
				✓								

Subject Code: EBCE22015	Subject Name : TRANSPORTATION ENGINEERING	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Soil Mechanics, Surveying	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 : HIGHWAY PLANNING AND ALIGNMENT 9 Hrs

Significance of highway planning –History of road development in India – Classification of highways – Locations and functions – Factors influencing highway alignment – Soil suitability analysis - Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II: GEOMETRIC DESIGN OF HIGHWAYS 9 Hrs

Typical cross sections of Urban and Rural roads — Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves - Gradients, Special consideration for hill roads - Hairpin bends – Lateral and vertical clearance at underpasses.

UNITIII: RAILWAYS PLANNING CONSTRUCTION AND MAINTENANCE 10 Hrs

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, - Track Stress, coning of wheels, creep in rails, defects in rails - Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings. Tunneling Methods, drainage and ventilation –Calculation of Materials required for track laying - Construction and maintenance of tracks – Modern methods of construction & maintenance

UNIT IV: AIRPORT PLANNING & DESIGN 9 Hrs

Airport planning, components of airports, airport site selection Runway design- orientation, geometric design and correction for gradients Terminal area, airport layout, airport buildings, passenger facilities, parking area and airport zoning

UNIT V: HARBOUR ENGINEERING 8 Hrs

Definition of terms - harbors, ports, docks, tides and waves. Harbors – requirements, classification – site investigation for locations, planning and layouts Terminal facilities – port buildings, warehouse, transit sheds, inter-modal transfer facilities, mooring accessories, navigational aids coastal structures piers, breakwaters, wharves, jetties, quays.

Total No of Hrs: 45

TEXT BOOKS

1. Saxena Subhash C and Satyapal Arora, A Course In Railway Engineering, Dhanpat Rai And Sons, Delhi, 1998.
2. Khanna S K, Arora M G and Jain S S, Airport Planning And Design, Nemchand And Brothers, Roorkee, 1994.
3. Khanna K And Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001.
4. Kadiyali l r, Principles and Practice of Highway Engineering, Khanna technical Publications, Delhi
5. Dr K.P.Subramaniyam, Transportation Engineering, Scitech Publishers, Chennai 2003

REFERENCES

1. *IRC standards, 2002*
2. *Bureau of Indian Standards (bis) publications on highway materials, 1998*
3. *Rangwala, Railway Engineering, Charotar Publishing House, Mumbai, 1995*

Subject Code: EBCE22L04	**Subject Name : AUTOCADD laboratory**	**Ty/ Lb/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	Lb	0	0/0	3/0	1

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

OBJECTIVE : To provide the student with an appreciation of the capabilities and limitations of the AutoCAD program.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Draw plan, section and elevation for various structures
CO2	Understand geometric construction and basic commands in Autocad
CO3	Prepare the building plans satisfying the principles of planning and byelaws.
CO4	Prepare detailed working drawings of doors, windows, roof trusses and staircases
CO5	Ability to manipulate drawings through editing and plotting techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	3	3	1	2	3	1	1	3
CO2	3	2	3	2	3	3	1	2	3	1	1	3
CO3	3	2	3	2	3	3	1	2	3	1	1	3
CO4	3	2	3	2	3	3	1	2	3	1	1	3
CO5	3	2	3	2	3	3	1	2	3	1	1	3

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

Subject Code: EBCE22L04	Subject Name : AUTOCADD laboratory	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	3/0	1
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab						

EXPERIMENTS

1. Learn and use basic AutoCAD commands - manage drawing using layers, colour and line types - complete basic cad drawings, with borders, text and dimensions - use and edit text and text styles – Method of scales in various drawing - understand and the use of blocks.
2. Development of line plan for residential building. one for single storied building
3. Development of line plan for residential building. one for two storied building
4. Submission drawing for residential building including its planning and with area and parking statements and all other details as per the norms and local bye-laws.
5. Industrial buildings with roof truss.
6. To draw the 3D view of residential building.

Total No of Hrs: 45

TEXT BOOKS

1. Civil Engg. Drawing & House planning – B.P.Verma, Khanna publishers, Delhi,1990
2. Building drawing & detailing – Dr. Balagopal & T.S.Prabhu, Spades publishers, Calicut,1989.

REFERENCES

1. *Building drawing – Shah, Tata McGraw-Hill, New Delhi,2000.*
2. *Building planning & drawing – Dr. N.Kumaraswamy, A.Kameswara Rao, Charotar publishing house. Mumbai,1997.*
3. *Shah, Kale and Patki, Building drawing, Tata McGraw-Hill New Delhi,,1998.*

Subject Code: EBCE22L09	Subject Name: **Structural design studio**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Structural Analysis	Lb	0	0/0	3/0	1

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

OBJECTIVE :

- Student should be aware of computer application of structural design

COURSE OUTCOMES (COs) : (3- 5)

CO1	Verify theoretical formulas by conducting experiments
CO2	Analyze statically determinate beams, trusses
CO3	Develop projects based on industrial and field requirements
CO4	Determine deflections of beams and frames using classical methods
CO5	Analyze the bridge decks for moving loads

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	3	1	2	3	1	3	3
CO2	3	3	3	3	3	3	1	2	3	1	3	3
CO3	3	3	3	3	3	3	1	2	3	1	3	3
CO4	3	3	3	3	3	3	1	2	3	1	3	3
CO5	3	3	3	3	3	3	1	2	3	1	3	3

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

Subject Code: EBCE22L09	Subject Name: **Structural design studio**	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Structural Analysis	Lb	0	0/0	3/0	1
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. Program for Design of Slabs. Using Excel
2. Program for Design of Beams. Using Excel
3. Program for Design of Column and Footing Using Excel
4. Introduction to staad pro - Joint, Member/Element, Mesh Generation with flexible user-controlled numbering
5. Analyse and design any beam with any loading type and any kind of supports.
6. Analyse and design of any 2D Frame with any loading type for any load sets.
7. Portal frame with 5 load combinations- Analysis
8. Analyse steel structures with truss elements.

Total No of Hrs: 45

TEXT BOOKS

1. N.Krishna Raju "Design of Reinforced Concrete Structures", CBS publishers & Distributors. Latest Edition, IS456:200.
2. S.Ramamrudham ,Design of Reinforced Concrete Structures, Dhanpat Rai publishing company(p) Ltd New Delhi.
3. Varghese P C, Limit State Design of Reinforced Concrete, Prentice Hal of India, Private, Limited New Delhi, 1997.
4. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009
5. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005

REFERENCES

1. *Dayarathnam.P, Brick and Reinforced Brick Structures, Oxford and IBH Publishing House, 1999.*
2. *IS: 456- 2000 "Indian Standard for Plain and reinforced concrete – code of practice "Bureau of Indian Standard".*
3. *Design aids to IS 456-1978 (SP16).*
4. *SP 34 Handbook on Concrete Reinforcement and Detailing, BIS 1987.*
5. *IS 800 :2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007*
6. *Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002*

VI SEMESTER

Subject Code: EBCE22014	Subject Name: **CONSTRUCTION MANAGEMENT**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: NONE	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

OBJECTIVE :

- To make the students aware of the various construction techniques and practices.
- To introduce a concepts of projects formulation

COURSE OUTCOMES (COs) : (3- 5)

CO1	The student should be able to plan construction projects, schedule the activities using network diagrams
CO2	Determine the cost of the project, control the cost of the project by creating cash flows and budgeting and to use the project information as decision making tool
CO3	Knowledge about different methods of planning
CO4	Analyze construction documents for planning and management of construction processes
CO5	Apply electronic based technology to manage the construction process

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	3	1	1	1	2	3	3
CO2	3	3	3	3	3	3	1	1	1	2	3	3
CO3	3	3	3	3	3	3	1	1	1	2	3	3
CO4	3	3	3	3	3	3	1	1	1	2	3	3
CO5	3	3	3	3	3	3	1	1	1	2	3	3

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

Subject Code: EBCE22014	Subject Name: CONSTRUCTION MANAGEMENT	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: NONE	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 NETWORK TECHNIQUES 12 Hrs

Introduction to network techniques - Use of CPM and PERT for planning - Scheduling and control of construction work, bar charts Error in networks, Types of nodes and node numbering systems.

UNIT II CONSTRUCTION PLANNING 12 Hrs

Basic concepts in the development of construction plan - Planning for construction and site facilities using networks - Preparation of construction schedules for jobs, materials, and equipment using CPM. .

UNIT III COST CONTROL OF CONSTRUCTION 12 Hrs

Construction quality control and inspection - Significance of variability and estimation of risks - Construction cost control - Crashing of networks.

UNIT IV QUALITY AND SAFETY DURING CONSTRUCTION 12 Hrs

Importance of Quality and safety – Organizing for quality and safety – safety measures – Prevention of fire at construction site – Elements and organization of quality - Quality assurance techniques.

UNIT V MANAGEMENT INFORMATION SYSTEM 12 Hrs

Definition of MIS – Requirement of MIS – Database approach – Types of project information – Accuracy and use of information.

Total No of Hrs: 60

TEXT BOOKS

1. Chitkara, K.K "Consruction Project Management Planning "Scheduling And Control, Tata Mc Graw – Hill Publishing Co., Newdelhi, 1998.
2. S. Seetharaman - Construction Engineering & Management, Dhanpat Rai Publications ,Pune,1995.

REFERENCES

1. *Construction Management - Sangareddy And Meyyappan,Prathibha Publications,Cbe,1994.*
2. *Moder. J., C. Phillips And Davis, "Project Management With Cpm, Pert And Precedence Diagramming,1999.*
3. *Prasanna Chandra, " Project Management ", Tmh ,New Delhi,1997.*

Subject Code: EBCE22I05	Subject Name: **PROJECT PHASE-I**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: ALL	IE	0	0/0	3/3	2

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

OBJECTIVE :

- To guide the students such a way that the students carry out a comprehensive work on the chosen topic which will stand them in good stead as they face real life situations.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Work in a team and develop multidisciplinary, research skills
CO2	Understand how to identify the issues and challenges of industry
CO3	Prepare report on the application of emerging technologies in the Construction industry
CO4	Explore innovative ideas in civil engineering design field
CO5	Develop design projects based on industrial and field requirements

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

Subject Code: EBCE22I05	Subject Name: **PROJECT PHASE-I**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: ALL	IE	0	0/0	3/3	2

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

Students are expected to do the Project in a group of 3 to 4 students. They should identify the area/topic of the Project and should collect the literatures related to the project. Students intending to do Industrial projects will approach the industries with the support of the university, identify the industrial problem and finalize the project. In case of Industrial projects apart from Industry guide, a guide has to be appointed by the department. At the end of the Semester the students should submit their Project Phase - I report to the Department and Viva -Voce examination will be conducted by the examiners duly appointed by the Head of the department.

OBJECTIVE

To guide the students such a way that the students carry out a comprehensive work on the chosen topic which will stand them in good stead as they face real life situations

- The project work is to enable the students to work in convenient groups of not more than four members in a group on a project involving theoretical and experimental studies related to civil engineering. Every project work shall have a guide who is a member of the faculty of the university.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusions. This final report shall be typewritten form as specified in the guidelines.
- The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

Total No of Hrs: 45

VII SEMESTER

Subject Code: EBCC22ID3	Subject Name: **TOTAL QUALITY MANAGEMENT**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	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

OBJECTIVE :

The student will learn:

- To acquaint the students with the basic concept of Total Quality (TQ)
- To understand the customers' expectations and plan TQM accordingly
- To give understand International Quality Certification Systems – ISO 9000 and other standards
- To understand concepts related to quality of services in contemporary environment

COURSE OUTCOMES (COs) : (3- 5) Students will be able to

CO1	Understand the Quality Policies (Level 2)
CO2	Understand the Concepts of Total Quality Management (Level 2)
CO3	Apply Total Quality Management tools in Industry (Level 3)
CO4	Apply the Modern tools of Quality Control (Level 3)
CO5	Acquiring knowledge about Modern Trends and Concepts in Manufacturing Management (Level 2)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	2	3	3	-	-	3	3	2	3	2
CO2	-	3	2	-	-	3	-	3	2	3	-	2
CO3	3	2	-	2	2	-	3	2	-	2	2	2
CO4	-	-	3	3	3	-	3	2	2	2	2	2
CO5	3	3	3	3	3	3	-	2	3	2	2	2

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	-	2	3	3
CO2	-	2	3	3
CO3	-	2	3	3
CO4	-	2	3	3
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			
							✓					

Subject Code: EBCC22ID3	Subject Name: **TOTAL QUALITY MANAGEMENT**	Ty / LB/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	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 QUALITY POLICY, PLANNING AND MANAGEMENT 9 Hrs

Evolution of quality as a strategy- Definitions of quality, Quality Philosophies of Deming, Crosby and Miller, Service Vs product Quality, Customer focus, Quality and Business performance leadership for quality management, Quality planning, Designing for Quality and Manufacturing for Quality, Vision, Mission statements and Quality policy.

UNIT – II BASIC CONCEPTS F TOTAL QUALITY MANAGEMENT 9 Hrs

Total Quality management- TQM models, human and system Components, Continuous Improvement Strategies, Deming wheel, Internal External Customer concept, Customer satisfaction Index, Customer retention, Team work and team building, Empowerment, TQM culture, Quality Circle, 5S principle, Top Management commitment.

UNIT – III QUALITY MANAGEMENT TOOLS 9 Hrs

Quality management tools - Principles and applications of quality Function deployment, Failure Mode and Effect Analysis (FMEA), Taguichi Techniques, Basic tools- Statistical techniques and graphical tools and diagrams.

UNIT - IV VARIOUS CONCEPTS OF QC TECHNIQUES 9 Hrs

Modern QC techniques - Japanese Production Related Techniques: Just in time (JIT) – Quality circles – Total productive maintenance (TPM) – Kaizen – Kanban – 5S concepts – Toyota production systems – JIDOKA – ANDON etc. Concepts on quality management systems (QMS – ISO 9000 – 2000) – Environmental Management Systems (EMS – ISO – 14000)

UNIT- V MODERN TREND AND CONCEPTS IN MANUFACTURING MANAGEMENT 9 Hrs

Modern Trend and Concept in Manufacturing Management: Business processes reengineering (BPR) – Lean / flexible – manufacturing systems – Six sigma concepts. Quality Leadership-Quality Awards –Quality Tools-Quality Function Deployment.

Total No of Hrs: 45

Reference Books:

1. Jill A. Swift, Joel E.Ross and Vincent K.Omachonu, Peinciples of Total Quality, St.Lucie Press, US, 1998.
2. Samuel K.Ho, TQM, An integrated approach, kogan page India Pvt Ltd, 2002
3. Dale H.N Besterfield et al, Total Quality management, Pearson Education Asia, 2001
4. RoseJ.E. Total Quality ManagementKogan page India Pvt Ltd, 1993.
5. Mullar Max,' Essentials of Materail Management,Amacom

Subject Code: EBCE22L11	Subject Name: **PROJECT PHASE-II**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: ALL	Lb	0	0/0	12/12	8

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

OBJECTIVE :

- The objective of project work is to enable the students to work in convenient groups of not more than four members in a group on a project involving theoretical and experimental studies related to civil engineering.

COURSE OUTCOMES (COs) : (3- 5) Students will be able to

CO1	Work in a team and develop multidisciplinary, research skills
CO2	Understand how to identify the issues and challenges of industry
CO3	Prepare report on the application of emerging technologies in the Construction industry
CO4	Explore innovative ideas in civil engineering design field
CO5	Develop design projects based on industrial and field requirements

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

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

Subject Code: EBCE22L11	Subject Name: **PROJECT PHASE-II**	**Ty / LB/ ETL/IE**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: ALL	Lb	0	0/0	12/12	8

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

To make the students to make use of the knowledge and skill developed during their four years of study and to apply them for making an innovative product/process for the development of society and industries. Students are expected to do a Project work either in an Industry or at the University in the field of relevant Engineering /inter-disciplinary /multi-disciplinary area in a group of 3 or 4 students. The work to be carried out in Phase II should be continuation of Phase I. Each group will be allotted a guide based on the area of Project work. In case of industrial Project external guide has to be allotted from Industry. Inter disciplinary/multi-disciplinary project can be done with students of different disciplines as a group. Monthly reviews will be conducted during the semester to monitor the progress of the project by the project review committee. Students have to submit the Project thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by the examiners duly appointed by the Controller of Examination. In case of industrial project certificate in proof has to be included in the report along with the bonafide certificate.

OBJECTIVE

- The objective of project work is to enable the students to work in convenient groups of not more than four members in a group on a project involving theoretical and experimental studies related to civil engineering.
- Every project work shall have a guide who is a member of the faculty of the university.
- Fourteen periods per week shall be allotted in the time table for this important activity and this time shall be utilized by the students to receive directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars the progress made in the project.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusions.
- Final report shall be typewritten form as specified in the guidelines. The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

PROGRAM ELECTIVE - I

Subject Code: EBCE22E01	Subject Name : ENGINEERING GEOLOGY	Ty/Lb/ ETL/IE	L	T / S.Lr	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

OBJECTIVE :

- To understand the importance of geological knowledge such as earth, earthquake and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor as well as to choose types of foundation

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, the student will be able to:

CO1	Identify and classify rock using basic geologic classification systems
CO2	Understand geologic concepts and approaches.
CO3	Identify the various lithological units and its applications in civil engineering
CO4	Analyze the different rocks and minerals based on their property
CO5	Evaluate the geological conditions necessary for construction of dams, tunnels, buildings and road cuttings

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	3	2	1	1	1	2	3
CO2	3	2	2	3	3	3	2	1	1	1	2	3
CO3	3	2	2	3	3	3	2	1	1	1	2	3
CO4	3	2	2	3	3	3	2	1	1	1	2	3
CO5	3	2	2	3	3	3	2	1	1	1	2	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E01	Subject Name : ENGINEERING GEOLOGY	Ty/Lb/ ETL/IE	L	T / S.Lr	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 I GENERAL GEOLOGY 9 Hrs

Geology in civil engineering - branches of geology - earth structure and composition - elementary knowledge on continental drift and plate tectonics. Seismo tectonics of the Indian plate, seismic zones of India, Weathering - work of rivers, wind, glaciers.

UNIT II MINERALOGY 9 Hrs

Physical properties of minerals - study of rock forming minerals - quartz family. Feldspar family, augite, hornblende, biotite, muscovite, calcite, garnet - properties, behavior and engineering significance of clay minerals –fundamentals of process of formation of ore minerals - coal and petroleum - their origin and occurrence in India.

UNIT III PETROLOGY 9 Hrs

Classification of Soil and Rock, Types of rock and origin: Igneous (extrusive and intrusive), sedimentary and metamorphic rocks, description occurrence, engineering properties of following rocks. Igneous rocks - granite, diorite, gabbro, pegmatite, dolerite and basalt sedimentary rocks sandstone, limestone, shale, conglomerate and breccia. Metamorphic rocks, quartzite, marble, slate, phyllite, gneiss and schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD 9 Hrs

Strength Behavior of Soil and Rock , Stress and strain in rock, failure and shear failure of soil and rock, folds, faults and joints in rock, consequences of failure (earthquakes), Bearing on engineering construction. Seismic and electrical methods for civil engineering investigations.

UNIT V GEOLOGICAL INVESTIGATIONS IN CIVIL ENGINEERING 9 Hrs

Geologic Mapping and Remote Sensing, Topographic maps, geologic maps, aerial photographs, LIDAR, SAR, interpretation for civil engineering projects - geological conditions necessary for construction of dams, tunnels, buildings, road cuttings, landslides - causes and preventions. Sea erosion and coastal protection.

Total No of Hrs: 45

TEXT BOOKS

1. Parbin singh, “Engineering and General geology ", S. K. Kataria & Sons, 2009
2. D. Venkat Reddy “Engineering Geology”, Vikas publishing House New Delhi, 2010
3. Krynine and Judd, “Engineering Geology and Geotechniques ", McGraw Hill Book Company, New Delhi 1990.

REFERENCE

1. *Legeet, “Geology and Engineering ", McGraw Hill Book Company, New Delhi*
2. *Blyth, “Geology for Engineers ", elbs, Pune 1995*

Subject Code:	Subject Name **CLEANER PRODUCTION**	Ty/Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E02	Prerequisite: NIL	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

OBJECTIVE :

- To develop a basic knowledge about the cleaner production and apply the same in the field application.
- To educate the students on complete management principles related to Cleaner Production and Control of Industrial Pollution.

COURSE OUTCOMES (COs) : (3- 5)

The students completing the course will have an

CO1	Understanding sustainable development and cleaner production concept
CO2	Applying the concept of cleaner Production
CO3	Analyze and implement cleaner production program
CO4	Evaluate the Process and equipment optimization, reuse, recovery, recycle, raw material substitution.
CO5	To create comprehensive knowledge to conduct waste audit in an industry and implement waste minimization techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	1	1	3	3
CO2	3	3	3	3	3	3	3	1	1	1	3	3
CO3	3	3	3	3	3	3	3	1	1	1	3	3
CO4	3	3	3	3	3	3	3	1	1	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name **CLEANER PRODUCTION**	Ty/Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E02	Prerequisite: NIL	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

Sustainable Development - Indicators of Sustainability - Sustainability Strategies - Barriers to Sustainability – Cleaner Production (CP) in Achieving Sustainability - Environmental Policies and Legislations - Regulations to Encourage Pollution Prevention and Cleaner Production – Regulatory versus Market Based Approaches

UNIT II CLEANER PRODUCTION CONCEPT 9 Hrs

Definition - Importance - Benefits - Promotion - Barriers - Role of Industry, Government and Institutions - Environmental Management Hierarchy - Source Reduction Techniques - Process and equipment optimisation, reuse, recovery, recycle, raw material substitution.

UNIT III CLEANER PRODUCTION PROJECT DEVELOPMENT AND IMPLEMENTATION 9 Hrs

Overview of CP Assessment Steps and Skills, Preparing for the Site Visit, Information Gathering, and Process Flow Diagram, Material Balance, Establishing a Program - Organizing a Program - Preparing a Program Plan - Measuring Progress - Pollution Prevention and Cleaner Production Awareness Plan - Waste audit - Environmental Statement.

UNIT IV LIFE CYCLE ASSESSMENT 9 Hrs

Elements of LCA - Life Cycle Costing - Eco Labelling - Design for the Environment – International Environmental Standards - ISO 14001 - Environmental audit.

UNIT V CASE STUDIES 9 Hrs

Industrial applications of CP, LCA, EMS and Environmental Audits.

Total No of Hrs: 45

REFERENCES

1. *Paul L Bishop (2000) " Pollution Prevention: Fundamentals and Practice " McGraw-Hill International New York.*
2. *World Bank Group (1998) "Pollution Prevention and Abatement Handbook"*
3. *"Towards Cleaner Production ", World Bank and UNEP, Washington D.C.*
4. *Prasad modak, C.Viswanathan and Mandar parasnis (1995)"Cleaner Production Audit ", Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok.*

Subject Code: EBCE22E03	Subject Name: BUILDING TECHNOLOGY AND HABITAT ENGINEERING	Ty/Lb/ ETL/IE	L	T / S.Lr	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

OBJECTIVE : To select appropriate construction materials and practices in construction field.

COURSE OUTCOMES (COs) : (3- 5)

After successful completion of this course, the students should be able to

CO1	Understanding the various materials used in building construction
CO2	Applying the concept of climate and its influence in construction
CO3	Analyze and Practice the importance of thermal control, ventilation and air movement in building.
CO4	Evaluate the design and application methods of geosynthetic materials
CO5	To create New Technology in Building construction

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	3	3	1	1	1	2	3
CO2	3	3	2	3	2	3	3	1	1	1	2	3
CO3	3	3	2	3	2	3	3	1	1	1	2	3
CO4	3	3	2	3	2	3	3	1	1	1	2	3
CO5	3	3	2	3	2	3	3	1	1	1	2	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E03	Subject Name **BUILDING TECHNOLOGY AND HABITAT ENGINEERING**	Ty/Lb/ ETL/IE	L	T / S.Lr	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 I BUILDING STONES 9 Hrs

Requirement of good building stone- characteristics - testing.Lime: Properties- Classifications -Manufacture - Testing of lime. Pozzolona: Natural and Artificial pozzolonas. Timber - Defects - Seasoning - Decay - Preservation, Tiles- Flooring and roofing tiles-specification-tests. Paints varnishes and distempers, Common constituents, types and desirable properties.

UNIT II MISCELLANEOUS MATERIALS 9 Hrs

Insulating Materials - Thermal and sound insulating material desirable properties and type. Geosynthetics and its applications .Lintels –Arches – Stairs- different types and its components. Doors, Windows and Ventilations - Classification - Technical terms-Classification and Types

UNIT III ROOF 9 Hrs

Types of roofs – wooden trusses .Finishing works - Plastering, pointing, painting, white washing, colour washing, distempering; Damp proofing ant termite treatment.

UNIT IV CLIMATE AND COMFORT 9 Hrs

Global climatic factors – Elements of climates –Classification of tropical climates- site climate .The desirable conditions- Thermal comfort factors-Thermal comfort indices – Effective temperature

UNIT V THERMAL CONTROL 9 Hrs

Means of thermal control – Mechanical control- structural control- ventilation and air movement

Total No of Hrs: 45

REFERENCES:

1. *Gurucharan Singh, Building materials,,1996*
2. *Rangwala S. C, Engineering Materials, Charotar Publishing House, 1992, Anand*
3. *Punmia B. C, Building Construction, Laxmi Publlications, 1999, New Delhi.*
4. *Rangwala S. C, Building Construction, Charotar Publishing House, 1992, Anand*
5. *Huntington W.C, Building Construction, John Wiley, 1959, New York.*
6. *Koenigsberger,Manual of Tropical Housing and Building, Orient Longman Ltd*

Subject Code:	Subject Name ARCHITECTURE AND TOWN PLANNING	Ty/Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E04	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

OBJECTIVE :
To impart knowledge on architectural design of structures as per the zoning regulations

COURSE OUTCOMES (COs) : (3- 5)
After successful completion of this course, the students should be able to

CO1	Understanding architectural design of structures
CO2	Applying the concept of land requirement as per the zoning regulations
CO3	Analyze and Practice Landscape design
CO4	Manipulate Surveys and analysis of a town
CO5	To create comprehensive knowledge on the design of Town Planning

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	3	2	2	2	3	3
CO2	3	3	3	3	2	3	3	2	2	2	3	3
CO3	3	3	3	3	2	3	3	2	2	2	3	3
CO4	3	3	3	3	2	3	3	2	2	2	3	3
CO5	3	3	3	3	2	3	3	2	2	2	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name ARCHITECTURE AND TOWN PLANNING	Ty/Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E04	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 I ARCHITECTURAL DEVELOPMENT 9 Hrs

Natural and built environment, historic examples, factors influence architectural development.

UNIT II PRINCIPLES OF ARCHITECTURAL DESIGN 9 Hrs

Design methods, primary elements, form, space, organization, circulation, proportion and scale, ordering principles

UNIT III FUNCTIONAL PLANNING OF BUILDINGS 9 Hrs

Planning, designing and construction, general building requirements, permit and inspection (as per the National building Code)

UNIT IV EVOLUTION OF TOWNS 9 Hrs

History and trends in town planning: origin and growth, historical development of town planning in ancient valley civilizations; Objects and necessary of town planning; Surveys and analysis of a town; New Concepts in town planning: Garden city movement, Linear city and Satellite city concepts, Neighborhood Planning

UNIT V PLANNING PRINCIPLES, PRACTICE AND TECHNIQUES 9 Hrs

Elements of City plan, Estimating future needs, Planning standards, Zoning - its definition, procedure and districts, height and bulk zoning, F. A. R., Master Plan; Concepts of Urban planning, Design and Landscaping.

Total No of Hrs: 45

TEXT BOOKS

1. B. Gallion and S. Eisner, The Urban Pattern: City planning and Design - C B S publishers, 5th edition, 2005.
2. D. K. Francis Ching, Architectures: Form, Space and Order, John Wiley, 2nd edition 1996.

REFERENCES

1. *National Building Code of India 2005, BIS, New Delhi.*
2. *S. Eisner, A. B. Gallion and S. Eisner, The Urban Pattern: City planning and Design, John Wiley 6th edition 1996.*

PROGRAM ELECTIVE – II

Subject Code:	Subject Name: HYDROLOGY	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E05	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

OBJECTIVE :

To get exposure in the field of hydrology; To know the basic concepts in hydrology. To study the features of precipitation, evaporation and infiltration; To learn basics, estimation, and modeling of runoff;. To understand estimation, forecasting and control of flood; To familiarize computer applications in hydrology

COURSE OUTCOMES (COs) : (3- 5)

CO1	The students will gain knowledge on hydrologic cycle, hydrometeorology and formation of precipitation
CO2	The students will be able to apply the various methods of field measurements and empirical formulae for estimating the various losses of precipitation, stream flow, flood and flood routing
CO3	Analyze and manipulate the hydrological measurements
CO4	Determine the meteorological related data
CO5	Create comprehensive knowledge on concepts of groundwater and hydraulics of subsurface flows

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	1	1	3	3
CO2	3	3	3	3	3	3	3	1	1	1	3	3
CO3	3	3	3	3	3	3	3	1	1	1	3	3
CO4	3	3	3	3	3	3	3	1	1	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name: HYDROLOGY	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E05	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 I INTRODUCTION 9 Hrs

Definition & Scope- Practical applications-Hydrological cycle – Transitory systems- formation, Types and forms of precipitation – Winds and their movement–Climate & weather season in India-Catchment area

UNIT II PRECIPITATION 9 Hrs

Measurement of Precipitation-Recording & Non- Recording Rain Gauges-Intensity duration Analysis-Intensity frequency duration Analysis- Average depth of precipitation over an areas-Depth area duration analysis-Rain gauge network.

UNIT III EVAPORATION & INFILTRATION 9 Hrs

Introduction- Evaporation process- Factors affecting Evaporation- Evaporation Estimation-Evaporation measurement- Evapo transpiration- Factors affecting infiltration-measurement of infiltration- Infiltration Equations

UNIT IV STREAM FLOW MEASUREMENT & HYDROGRAPH ANALYSIS 9 Hrs

Introduction-Measurement of stage-discharge measurement –area velocity method (Current meter method)-moving boat method- Stage discharge relationships – Flow measurements – Features of hydrograph- base flow-Hydrograph separation

UNIT V GROUND WATER HYDROLOGY 9 Hrs

Occurrence of ground water – Types of aquifer – Dupuit's assumptions – Darcy's law – Estimation of aquifer parameters – Pump tests.

Total No. of Hrs: 45

REFERENCES

1. *Jeya Rami Reddy.P,Hydrology, Laximi Publications, New Delhi, 2004.*
2. *Subramanya K.,Hydrology,Tata McGraw Hill Co., New Delhi, 1994*
3. *Patra.K.C, Hydrology and Water Resources Engineering, Narosa Publications, 2008, 2 nd Edition, New Delhi.*
4. *Chow V.T., Maidment D.R., Mays L.W., "Applied Hydrology,McGraw Hill Publications, NewYork, 1995*

Subject Code:	Subject Name: ENVIRONMENTAL IMPACT ASSESSMENT	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E06	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

OBJECTIVE

To know the objectives, capability, and limitations of environmental impact assessment.

To learn methodologies and legal aspects of environmental impact assessment;

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand and carry out scoping and screening of developmental projects for environmental and social assessments
CO2	Explain different methodologies for environmental impact prediction and assessment
CO3	Analyze environmental impact assessments and environmental management plans
CO4	Evaluate the design methods of EIA
CO5	Provide new methods and concepts in EIA

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	1	1	3	3
CO2	3	3	3	3	3	3	3	1	1	1	3	3
CO3	3	3	3	3	3	3	3	1	1	1	3	3
CO4	3	3	3	3	3	3	3	1	1	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name: ENVIRONMENTAL IMPACT ASSESSMENT	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E06	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 I INTRODUCTION 9 Hrs

Impact of development on environment and Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS) – Objectives – Historical development – EIA capability and limitations – Legal provisions on EIA.

UNIT II METHODOLOGIES 9 Hrs

Methods of EIA – Strengths, weaknesses and applicability – Appropriate methodology – Case studies.

UNIT III PREDICTION AND ASSESSMENT 9 Hrs

Socio Economic Impact – Assessment of Impact on land, water and air, energy impact; Impact on flora and fauna; Mathematical models; public participation – Reports – Exchange of Information – Post Audit – Rapid EIA.

UNIT IV MATHEMATICAL MODELS FOR ASSESSMENT 9 Hrs

Use the mathematical models in EIA – Water quality, air quality and noise; assumptions and limitations.

UNIT V ENVIRONMENTAL MANAGEMENT PLAN 9 Hrs

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna, addressing the issues related to the project affected people.

Total No. of Hrs:45

TEXT BOOKS

1. Canter, R.L. Environmental Impact Assessment, McGraw Hill Inc., New Delhi, 1996.
2. S.K.Shukla and P.R.Srivastava, Concepts in Environmental Impact Analysis, Common Wealth Publishers, New Delhi, 1992.

REFERENCES

1. *John G.Rau and David C Hooten (Ed)., Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1990.*
2. *Environmental Assessment Source book, Vol. I, II & III. The World Bank, Washington, D.C., 1991.*
3. *Judith Petts, Hand book of Environmental Impact Assessment Vol. I & II, Blackwell Science, 1999.*

Subject Code: EBCE22E07	Subject Name BRIDGE STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Design of concrete 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

OBJECTIVE :

To make the student to know about various bridge structures, selection of appropriate bridge structures and design it for given site conditions.

COURSE OUTCOMES (COs) : (3- 5)

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

CO1	Understand the basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.
CO2	Identify the sizing of bridge elements ie., develop a clear understanding of conceptual design
CO3	Analyze the load flow mechanism and identify loads on bridges
CO4	Evaluate the design of bridges starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements
CO5	To create modern Bridge elements and structures in Projects

Mapping of Course Outcomes with Program Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E07	Subject Name BRIDGE STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Design of concrete 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 INTRODUCTION 9 Hrs

Design of through type steel highway bridges for IRC loading - Design of stringers, cross girders and main girders - Design of deck type steel highway bridges for IRC loading - Design of main girders.

UNIT II STEEL BRIDGES 9 Hrs

Design of pratt type truss girder highway bridges - Design of top chord, bottom chord, web members - Effect of repeated loading - Design of plate girder railway bridges for railway loading - Wind effects - Design of web and flange plates - Vertical and horizontal stiffeners.

UNIT III REINFORCED CONCRETE SLAB BRIDGES 9 Hrs

Design of solid slab bridges for IRC loading - Design of kerb - Design of tee beam bridges - Design of panel and cantilever for IRC loading.

UNIT IV REINFORCED CONCRETE GIRDER BRIDGES 9 Hrs

Design of tee beam - Courbon's theory - Pigeaud's curves - Design of balanced cantilever bridges - Deck slab - Main girder - Design of cantilever - Design of articulation.

UNIT V PRESTRESSED CONCRETE BRIDGES 9 Hrs

Design of prestressed concrete bridges - Preliminary dimensions - Flexural and torsional parameters -Courbon's theory - Distribution coefficient by exact analysis - Design of girder section - Maximum and minimum prestressing forces - Eccentricity - Live load and dead load shear forces - cable zone in girder –Check for stresses at various sections - Check for diagonal tension - Diaphragms - End block - Short term and long term deflections.

Total No. of Hrs: 45

TEXT BOOKS

1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 1990.
2. Ponnuswamy S., " Bridge Engineering ", Tata McGraw Hill, New Delhi, 1996.

REFERENCES

1. Phatak D.R., " Bridge Engineering ", Satya Prakashan, New Delhi, 1990.

Subject Code: EBCE22E08	Subject Name IRRIGATION ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	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

OBJECTIVE :

The student also shall know the irrigation management practices of the past, present And future. The structures involved the elementary hydraulic design of different Structures and the concepts of maintenance shall also form part. Finally, the student shall be in a position to conceive and plan any type of irrigation project.

COURSE OUTCOMES (COs) : (3- 5)

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

CO1	To know the irrigation management practices of the past, present and future.
CO2	The knowledge on the structures involved in the elementary hydraulic design of different structures and the concepts of maintenance of irrigation structures
CO3	To conceive and plan any type of irrigation project

Mapping of Course Outcomes with Program Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12
CO1	1	2	2	2	2	-	-	-	-	-	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	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			
					✓							

Subject Code: EBCE22E08	Subject Name IRRIGATION ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	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 I : INTRODUCTION **9 Hrs**

Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – Crop and crop seasons – consumptive use of water – Duty – Factors affecting duty – Irrigation Efficiencies – Planning and Development of irrigation projects.

UNIT II: IRRIGATION METHODS **8 Hrs**

Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and Demerits – Sprinkler irrigation – Drip irrigation.

UNIT III : DIVERSION AND IMPOUNDING STRUCTURES **10 Hrs**

Weirs – elementary profile of a weir – weirs on pervious foundations - Types of Impounding structures - Tanks, Sluices and Weirs – Gravity dams – Earth dams – Arch Dams – Spillways – Factors affecting location and type of dams – Forces on a dam – Hydraulic design of dams.

UNIT IV : CANAL IRRIGATION **9 Hrs**

Alignment of canals – Classification of canals – Canal drops – Hydraulic design of drops – Cross drainage works – Hydraulic design of cross drainage works – Canal Head works – Canal regulators – River Training works.

UNIT V: IRRIGATION WATER MANAGEMENT **9 Hrs**

Need for optimization of water use – Minimizing irrigation water losses – On farm Development works – Percolation ponds – Participatory irrigation management – Water Users associations – Changing paradigms in water management – Performance evaluation.

Total No of Hrs: 45

TEXT BOOKS

* Asawa, G.L., “Irrigation Engineering”, New Age International Publishers, New Delhi, 2000.
* Sharma, R.K., and Sharma, T.K., “Irrigation Engineering”, S.Chand and Company,New Delhi, 2000.

REFERENCES

* Basak, N.N., “Irrigation Engineering”, Tata McGraw-Hill Publishing Co., New Delhi, 2000.
* Garg, S.K., “Irrigation Engineering,” Laxmi Publications, New Delhi, 1999.
* Gupta, B.L., and Amir Gupta, “Irrigation Engineering”, SatyaPraheshan, New Delhi

PROGRAM ELECTIVE – III

Subject Code: EBCE22E09	Subject Name: PRESTRESSED CONCRETE STRUCTURES	T / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Design of Concrete 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

OBJECTIVE :

- Prestressing methods, principles and concepts are essential for the basic concept of the subject .
- Analysis of prestress and the resultant stresses using different concepts is dealt here;
- Determination of losses in concrete & Anchorage zone stresses in end block can be brought out using IS method

COURSE OUTCOMES (COs) : (3- 5)

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	PO10	PO11	PO12
CO1	3	3	3	3	2	1	1	1	1	1	1	3
CO2	3	3	3	3	2	1	1	1	1	1	1	3
CO3	3	3	3	3	2	1	1	1	1	1	1	3
CO4	3	3	3	3	2	1	1	1	1	1	1	3
CO5	3	3	3	3	2	1	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E09	Subject Name PRESTRESSED CONCRETE STRUCTURES	T / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Design of Concrete 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 INTRODUCTION – THEORY AND BEHAVIOUR 9 Hrs

Basic concepts – Advantages – Materials required – Systems and methods of pre -stressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons .

UNIT II DEFLECTION 9 Hrs

Deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections - Losses of pre-stress – Losses of prestress - types - losses due to elastic deformation of concrete - shrinkage of concrete - creep of concrete - friction - anchorage slip – Estimation of crack width

UNIT III DESIGN 9 Hrs

Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria.

UNIT IV CIRCULAR PRESTRESSING 9 Hrs

General features & Design of prestressed concrete tanks – Prestressed concrete Poles, Shapes, Features & Design- Prestressed concrete sleepers – Development – Types- Design, Static & dynamic loads

UNIT V COMPOSITE CONSTRUCTION 9 Hrs

Analysis for stresses – Estimate for deflections – Flexural and shear strength of composite members– General aspects – pretension pre-stressed bridge decks – Post tensioned pre-stressed bridge decks –Advantages over R.C.C bridges- Design Principles of post tensioned prestressed concrete slab bridge deck, T Beam slab bridge deck & Continuous two span beam deck

Total No of Hrs: 45

TEXT BOOKS

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi, 2011
2. S.Ramamrutham, Prestressed concrete, Dhanpatrai Publishing company,2014
3. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH Publishing Co.Pvt. Ltd. 1997.
4. Rajagopalan.N, Prestressed Concrete, Alpha Science, 2002.

REFERENCES

1. *Ramaswamy G.S., Modern Prestressed Concrete Design, Arnold Heinimen, New Delhi, 1990*
2. *Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay 1995*

Subject Code:	Subject Name: HOUSING PLANNING AND DESIGN	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E10	Prerequisite: Building Drawing Practice	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

OBJECTIVE :

A house plan is a set of construction or working drawings that define all the construction specifications of a residential House A truly successful project is one where project goals are identifies early on and where the interdependencies of all building systems are coordinated concurrently from the planning and programming phase.

COURSE OUTCOMES (COs) : (3- 5)

After successful completion of this course, the students should be able to

CO1	Understanding the Plan the buildings, as per the law and rules and regulations
CO2	Applying the concept of Housing Planning
CO3	Analyze the slum clearance project and prepare plan for plot map cost flow .
CO4	Evaluate the design methods for House Planning and design
CO5	To create and identify the new housing projects

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name: HOUSING PLANNING AND DESIGN	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E10	Prerequisite: Building Drawing Practice	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 TO HOUSING 9 Hrs

Definition of Basic Terms – House, Home, Household, Apartments - Objectives of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Local bodies' Bye-laws at Urban and Rural Level and Development Control Regulations, Institutions for Housing at National, State and Local levels.

UNITII HOUSING PROGRAMMES 9 Hrs

Basic Concepts – Contents and Standards for Housing Programmes - Sites and Services, Neighbourhood, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programme, Role of Public, Private and Non-Government Organisations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9 Hrs

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems).

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9 Hrs

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation.

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9 Hrs

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

Total No of Hrs: 45

TEXT BOOKS

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 1999.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.

REFERENCES

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 200.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 1994.
3. National Housing Policy, 1994, Government of India.

Subject Code:	Subject Name	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	INDUSTRIAL WASTE MANAGEMENT					
EBCE22E11	Prerequisite: Environmental Engineering	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

OBJECTIVE :

To impart knowledge on various environmental legislations

To understand the treatment of industrial wastes

To impart knowledge on the pollution potential of major industries and the methods of controlling the same

COURSE OUTCOMES (COs) : (3- 5)

After successful completion of this course, the students should be able to

CO1	Suggest the industrial waste disposal methods on land and water environment
CO2	Conduct waste audit in an industry and implement waste minimization techniques
CO3	Analyze and Practice the waste management concepts
CO4	Evaluate the methods for various aspects in waste management
CO5	Identify the impacts on environment due to various industrial effluents

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	1	1	3	3
CO2	3	3	3	3	3	3	3	1	1	1	3	3
CO3	3	3	3	3	3	3	3	1	1	1	3	3
CO4	3	3	3	3	3	3	3	1	1	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name **INDUSTRIAL WASTE MANAGEMENT**	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E11	Prerequisite: Environmental Engineering	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

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Hazardous Wastes – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes – Pollution Control Boards.

UNIT II CLEANER PRODUCTION 9 Hrs

Waste management Approach – Waste Audit – Volume and strength reduction – material and process modifications – Recycle, reuse and byproduct recovery – Applications.

UNIT III TREATMENT OF INDUSTRIAL WASTEWATER 9 Hrs

Equalisation – Neutralisation – removal of suspended and dissolved organic solids - Chemical oxidation – Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management.

UNIT IV TREATMENT AND DISPOSAL OF HAZARDOUS WASTES 9 Hrs

Physio chemical treatment – solidification – incineration – Secured landfills – Legal Provisions.

UNIT V CASE STUDIES 9 Hrs

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants.

Total No. of Hrs: 45

TEXT BOOKS

1. M.N.Rao & A.K.Dutta, Wastewater Treatment, Oxford IBH Publication, 1995.
2. W .W. Eckenfelder Jr., Industrial Water Pollution Control, McGraw-Hill Book Company, New Delhi, 1994.

REFERENCES

1. T.T.Shen, Industrial Pollution Prevention, Springer, 1999.
2. R.L.Stephenson and J.B.Blackburn, Jr., Industrial Wastewater Systems Hand book, Lewis Publisher, New York,
3. H.M.Freeman, Industrial Pollution Prevention Hand Book, McGraw Hill Inc., New Delhi, 1995.

Subject Code: EBCE22E12	Subject Name **COST EFFECTIVE BUILDINGS**	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Concrete and Construction Technology	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

OBJECTIVE : The goal of low-cost housing is to save money while also maintaining buildings quality without sacrificing the strength, performance and life of the structure.

COURSE OUTCOMES (COs) : (3- 5)
After successful completion of this course, the students should be able to

CO1	Understanding the cost effective techniques and environmental friendly materials in construction
CO2	Apply and Identify the effects of global warming in construction
CO3	Analyze and Practice the design of green building concepts and its benefits in construction field
CO4	Evaluate the design methods for green buildings
CO5	To create comprehensive knowledge on the design of green buildings using modern technology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	1	1	3	3
CO2	3	3	3	3	3	3	3	1	1	1	3	3
CO3	3	3	3	3	3	3	3	1	1	1	3	3
CO4	3	3	3	3	3	3	3	1	1	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	3	3

COs /	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E12	Subject Name **COST EFFECTIVE BUILDINGS**	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Concrete and Construction Technology	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 TO COST EFFECTIVE CONSTRUCTION 12HRS

Introduction to the concept of cost effective construction -Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime-Poszolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials-Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials.

UNIT II TECHNOLOGIES & METHODS IN CONSTRUCTION 12 HRS

Environment friendly and cost effective Building Technologies - Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames - Water tanks - Septic Tanks - Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof -Pre-engineered and ready to use building elements - wood products - steel and plastic - Contributions of agencies

UNIT III GLOBAL WARMING & THE RELEVANCE OF GREEN BUILDINGS 7 HRS

Global Warming – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions - Green Buildings – Definition - Features-Necessity – Environmental benefit - Economical benefits- Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials- Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.

UNIT IV GREEN BUILDING 7 HRS

Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings - Embodied Energy in Materials-Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.

UNIT V GREEN DESIGN 7 HRS

Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)

Total No of Hours : 45

REFERENCES:

1. *K S Jagadeesh, B V Venkatta Rama Reddy & K S Nanjunda Rao ,Alternative Building Materials and Technologies , New Age International Publishers.*
2. *Asko Sarja ,Integrated Life Cycle Design of Structures , SPON Press.*
3. *D S Chauhan and S K Sreevasthava , Non conventional Energy Resources , New Age International Publishers.*
4. *Laurie Backer, Buildings How to Reduce Cost, Cost Ford.*

PROGRAM ELECTIVE IV

Subject Code: EBCE22E13	Subject Name: STRUCTURAL DYNAMICS AND EARTH QUAKE ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Structural Analysis	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

OBJECTIVE :

To develop systematically from basic principles of structural dynamics the characteristic of dynamic behaviour of the structure, namely, response spectrum

To expose important aspects of various theories of cause of earthquake and measurement of its effects on the structure as loads

COURSE OUTCOMES (COs) : (3- 5)

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

CO1	Understanding of the behavior of EQ resistant structures
CO2	Applying the knowledge to analyze structures subjected to dynamic loading
CO3	The knowledge to design the structures for seismic loading as per code provisions
CO4	Evaluate the design methods for EQ resistant structures
CO5	Identify, formulate and solve free and forced vibrations response of structural systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E13	Subject Name: STRUCTURAL DYNAMICS AND EARTH QUAKE ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Structural Analysis	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 SINGLE DEGREE OF FREEDOM SYSTEMS 9 Hrs

Formulation of equation of motion-free and forced vibrations-response to dynamic Loading-effect of damping

UNIT II MODAL ANALYSIS 9 Hrs

Free and forced vibration of un-damped and damped MDOF systems- equation of Motions- evaluation of natural frequencies and modes

UNIT III INTRODUCTION TO EARTH QUAKE ENGINEERING 9 Hrs

Elements of engineering seismology- characteristics of earth quake engineering- earth quake history- Indian seismicity.

UNIT IV BEHAVIOUR OF STRUCTURES AND SOIL 9 Hrs

Performance of structures under past earth quakes- lessons learnt from past earth Quakes- behavior of soil under earth quake loading- soil liquefaction- soil structure Interaction effects.

UNIT V EARTH QUAKE RESISTANT DESIGN 9 Hrs

Concept of Earth quake resistant design- provisions of seismic code IS-1893 (part I)- 2002- response spectrum- design spectrum- seismic coefficient- design of buildings.

Total No of Hrs: 45

TEXT BOOKS

1. Clough R. W, and Penzien J, Dynamics of structures, Second Edition, Mc Graw- Hill International edition,New Delhi, 1993
2. Mario Paz, structural dynamics- theory and computations, Third Editions CBS Publishers,New Delhi, 1990.

REFERENCES

1. *Minoru Wakabayashi, Design of earth quake resistant buildings,Mc Graw- Hill book company, New York 1986*
2. *Anil K Chopra, Dynamics Of Structures- Theory and applications to Earth quake engineering, Prentice hall inc, 2001*

Subject Code:	Subject Name: DAM ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E14	Prerequisite: Irrigation Engineering	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

OBJECTIVE :
To impart a knowledge on types of dam, its functions and design principles.

COURSE OUTCOMES (COs) : (3- 5)
At the end of the course, the student will be able to:

CO1	Thorough knowledge on Dam structures
CO2	Applying the concept for design of earth dams, gravity dams and rock fill dams
CO3	Analyse spillways and energy dissipation structures
CO4	Calculate the load factors for Dam Structures
CO5	To create comprehensive knowledge on the design of various types of Dams

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name: DAM ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E14	Prerequisite: Irrigation Engineering	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

Types of Dam, merits and demerits, dam site selection, selection of dam, Forces acting on gravity Dam, Methods of analysis of gravity Dam, Modes of failure and stability requirements, Design criteria and factor of safety.

UNIT II GRAVITY DAM 9 Hrs

Elementary profile of a gravity dam, Low and high gravity dams, Zoning of dams, Galleries in dams,Temperature control in mass concrete; gravity dams subjected to earthquakes.

UNIT III BUTTRESS AND ARCH DAMS 9 Hrs

Buttress and Arch dams, Types, selection, merits and demerits, Elementary design Principles of Arch and Buttress dams.

UNIT IV EARTH DAM 9 Hrs

Earth Dam their component and functions, causes of failure. Factors influencing the design of an earthdam. Design criteria for Earth Dam.

UNIT V SPILLWAY 9 Hrs

Elementary idea of design for spillway and energy dissipaters.

Total No of Hrs: 45

TEXT BOOKS

1. R.S. Varshney "Concrete Dams", by 1982, NCB, Roorkee
2. Design of Small Dams, USBR 1960, Calcutta, Oxford and IBH
3. W.P. Creager, J. Justin,.Daud Hinds, "Engineering for Dams" Vol. I-III, Wiley, N.Y., USA.
4. IS: 6512-1984, Criteria for Design of solid Gravity Dams.
5. IS:1893-1984, , Criteria for Earthquake resistant Design of structures.

REFERENCES

1. NPTEL course materials from different IITs

Subject Code:	Subject Name : INDUSTRIAL STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E15	Prerequisite: Design of Concrete Structures, Design of Steel 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

OBJECTIVE :

This course deals with some of the special aspects with respect to Civil Engineering structures in industries.

COURSE OUTCOMES (COs) : (3- 5)

At the end of this course the student shall be able to.

CO1	Discuss the planning and functional requirements of Industrial structures
CO2	Applying design concepts, and constructional aspects of Industrial structures
CO3	Analyze the importance of various construction materials for Industrial Construction
CO4	Evaluate the design of RC structures in Industry
CO5	Discover the modern technology used in Industrial Structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name : INDUSTRIAL STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E15	Prerequisite: Design of Concrete Structures, Design of Steel 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 PLANNING 9 Hrs

Classification of Industries and Industrial structures – General requirements for industries like cement, chemical and steel plants – Planning and layout of buildings and components.

UNIT II FUNCTIONAL REQUIREMENTS 9 Hrs

Lighting – Ventilation – Accounts – Fire safety – Guidelines from factories act.

UNIT III DESIGN OF STEEL STRUCTURES 9 Hrs

Industrial roofs – Crane girders – Mill buildings – Design of Bunkers and Silos

UNIT IV DESIGN OF R.C. STRUCTURES 9 Hrs

Silos and bunkers – Chimneys – Principles of folded plates and shell roofs

UNIT V PREFABRICATION 9 Hrs

Principles of prefabrication – Prestressed precast roof trusses- Functional requirements for Precast concrete units

Total No. of Hrs: 45

TEXT BOOKS

1. Reinforced Concrete Structural elements – P. Purushothaman
2. Pasala Dayaratnam – Design of Steel Structure - 1990

REFERENCES

1. *Henn W. Buildings for Industry, Vols. I and II, London Hill Books, 1995*
2. *Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi 1990*
3. *Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982*

Subject Code:	Subject Name : ADVANCED ENVIRONMENTAL ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E16	Prerequisite: Environmental Engineering	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

OBJECTIVE :
This course deals with some of the special concepts in Environmental Engineering

COURSE OUTCOMES (COs) : (3- 5)
At the end of this course the student shall be able to.

CO1	Discuss the planning and functional requirements of Environmental structures
CO2	Applying design concepts, and constructional aspects of Environmental structures
CO3	Analyze the importance of various construction materials for Environmental structures Construction
CO4	Evaluate the design of Environmental structures
CO5	Discover the modern technology used in Environmental Structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	1	1	3	3
CO2	3	3	3	3	3	3	3	1	1	1	3	3
CO3	3	3	3	3	3	3	3	1	1	1	3	3
CO4	3	3	3	3	3	3	3	1	1	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name : ADVANCED ENVIRONMENTAL ENGINEERING	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E16	Prerequisite: Environmental Engineering	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 URBANISATION & POLLUTION **9 Hrs**

Consequences of urbanization, demand of resources by the public - Sources of Pollution to the urban environment: Status of pollution levels in major cities- Slum formation: Impact of slum on general quality of life on Urban elite – status of slum settlements in major cities.

UNIT II AIR & NOISE POLLUTION IN URBAN ENVIRONMENT **9 Hrs**

Air Pollution Sources: Nature of air pollution in the Urban environment due to human activities of industrialization, effect of air pollution on Urban Environment. Air pollution Indices for Assessment of status of Urban air quality. - Sources of noise pollution in Urban areas, effect ofnoise pollution on Urban environment, status of noise pollution in major cities.

UNIT III WATER AND LAND POLLUTION IN URBAN ENVIRONMENT **9 Hrs**

Water Demands and Pollution in Urban areas: Nature of water pollutants and assimilative capacity of natural Urban aquatic systems. Urban water quality indices – Sources of land pollution in urban areas: Impact of urban soil pollution on quality of living system – prediction of soil pollution indices.

UNIT IV MANAGEMENT OF URBAN ENVIRONMENT QUALITY **9 Hrs**

Land use planning – traffic management. Safe municipal water supply and planning of safe municipal water supply and drainage system – solid waste management including disposal – abatement of noise pollution – Provision of zones – regulation of settlements.

UNIT V CONSERVATION AND DISASTER MANAGEMENT **9 Hrs**

Natural Conservation: Planning of urbanization on ecological basis, preservation and development of green recovery areas. - Urban Disaster Management: Management of Industrial explosions, landslides, earthquakes, Floods and Management of epidemics.

Total No. of Hrs: 45

REFERENCES

1. Varshney, C.K., "Water Pollution and Management", Wiley Eastern Ltd., New Delhi, 1998.

2. Plowden, S., "The Cost of Noise", London, Metra, 1996.

3. Fallion, A.B. & E. Simon, "The Urban Pattern", Van Nistrand, New York.

4. M.J. Suess& S.R. Craxford, "Manual on Urban Air Quality", WHO, Copenhagen.

PROGRAM ELECTIVE V

Subject Code:	Subject Name REPAIR AND REHABILITATION OF STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E17	Prerequisite: Concrete and Construction Technology	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

OBJECTIVE

To make the students to gain the knowledge on quality of concrete, durability aspects, causes of deterioration.

To make the students to gain the knowledge on assessment of distressed structures, repairing of structures and demolition procedures.

COURSE OUTCOMES (COs) : (3- 5)

After successful completion of this course, the students should be able to

CO1	Suggest maintenance and repair strategies
CO2	Assess the durability of concrete under various climatic conditions
CO3	Analyze the suitable materials for repair, rehabilitation and retrofitting techniques
CO4	Evaluate the design methods for repair, rehabilitation and retrofitting techniques
CO5	Apply repair, rehabilitation and retrofitting techniques for field projects

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code:	Subject Name REPAIR AND REHABILITATION OF STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCE22E17	Prerequisite: Concrete and Construction Technology	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 MAINTENANCE AND REPAIR STRATEGIES 9 Hrs

Maintenance- Repair and Rehabilitation. Facts of Maintenance - Importance of Maintenance- Various aspects of Inspection- Assessment procedure for evaluating a damaged structure, Causes of deterioration.

UNIT II STRENGTH 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.

UNIT III SPECIAL CONCRETES 9 Hrs

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength and High-performance concrete, Vacuum concrete, Self-compacting concrete, Whisper concrete Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9 Hrs

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, Cathodic protection.

UNIT V RETROFITTING AND DEMOLITION TECHNIQUES 9 Hrs

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – Engineered demolition methods - Case studies.

Total No of Hrs: 45

TEXTBOOKS:

1. Shetty M.S., "Concrete Technology - Theory and Practice", S. Chand and Company, 2008.
2. Gambhir. M.L., "Concrete Technology", McGraw Hill, 2013
3. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 1991.

REFERENCES:

1. *Ravi Shankar. K. Krishnamoorthy. T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.*
2. *Dov Kominetzky. M.S., "Design and Construction Failures”, Galgotia Publications Pvt. Ltd., 2001*
3. *CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.*
4. *Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987*

Subject Code: EBCE22E18	Subject Name MUNICIPAL SOLID WASTE MANAGEMENT	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Environmental Engineering	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

OBJECTIVE :

The student is expected to know about the various effects and legislations for the municipal solid waste.
To understand the various sources, characterization, processing and the disposal methods of municipal solid wastes.

COURSE OUTCOMES (COs) : (3- 5)

After completion of the course, student will be able to:

CO1	Understand the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management
CO2	Applying waste minimization plan and design storage, collection, transport, processing and disposal of municipal solid waste
CO3	Assess the management concepts in MSW
CO4	Determine the Processing techniques and Equipment in MSW management
CO5	Create, identify and design waste containment systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	1	1	3	3
CO2	3	3	3	3	3	3	3	1	1	1	3	3
CO3	3	3	3	3	3	3	3	1	1	1	3	3
CO4	3	3	3	3	3	3	3	1	1	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	3	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E18	Subject Name MUNICIPAL SOLID WASTE MANAGEMENT	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Environmental Engineering	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 SOURCES AND TYPES 9 Hrs

Sources and types of solid wastes in a Municipality; Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

UNIT II ON-SITE STORAGE & PROCESSING 9 Hrs

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

UNIT III COLLECTION AND TRANSFER 9 Hrs

Methods of Collection – types of vehicles – Manpower – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

UNIT IV OFF-SITE PROCESSING 9 Hrs

Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, options under Indian conditions.

UNIT V DISPOSAL 9 Hrs

Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills.

Total No. of Hrs: 45

TEXT BOOKS

1. George Techobanoglous et.al., Integrated Solid Waste Management, McGraw Hill Publishers, 1993.
2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, Waste Management, Springer, 1994.

REFERENCES

1. *Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 200*
2. *R.E.Landreth and P.A.Rebers, Municipal Solid Wastes – problems and Solutions, Lewis Publishers, 1997*
3. *Bhide A.D. and Sundaresan, B.B., Solid Waste Management in Developing Countries; INSDOC, 1993.*

Subject Code: EBCE22E19	Subject Name FINITE ELEMENT ANALYSIS	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Structural analysis	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

OBJECTIVE

The objective is to equip students with fundamentals of finite element principles so as to enable them to understand the behaviour of various finite elements and to be able to select appropriate elements to solve physical and engineering problems with emphasis on structural and thermal engineering applications.

COURSE OUTCOMES (COs) : (3- 5)

After successful completion of this course, the students should be able to

CO1	Students will be able to understand computer codes for any structural problems using FE techniques
CO2	Apply the concept of the differential equations and their relationship in the analysis of structures
CO3	Analyze the numerical methods by FEM concept
CO4	Evaluate the logic and methods used in FEM
CO5	To create comprehensive knowledge on FEM analysis

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E19	Subject Name FINITE ELEMENT ANALYSIS	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Structural analysis	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 – VARIATIONAL FORMULATION 8 Hrs

General filed problems in Engineering – Modelling – Discrete and Continuous models – Characteristics – Difficulties involved in solution – The relevance and place of the finite element method – Historical comments – Basic concept of FEM, Boundary and initial value problems – Gradient and divergence theorems – Functionals – Variational calculus – Variational formulation of VBPS. The method of weighted residuals – The Ritz method.

UNIT II FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS 8 Hrs

One dimensional second order equations – discretisation of domain into elements – Generalised coordinates approach – derivation of elements equations – assembly of elements equations – imposition of boundary conditions – solution of equations – Cholesky method – Post processing – Extension of the method to fourth order equations and their solutions – time dependant problems and their solutions – example from heat transfer, fluid flow and solid mechanics.

UNIT III FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS 9 Hrs

Second order equation involving a scalar-valued function – model equation – Variational formulation – Finite element formulation through generalised coordinates approach – Triangular elements and quadrilateral elements – convergence criteria for chosen models – Interpolation functions – Elements matrices and vectors – Assembly of element matrices –boundary conditions – solution techniques.

UNIT IV ISOARAMETRIC ELEMENTS AND FORMULATION 10 Hrs

Natural coordinates inn 1, 2 and 3 dimensions – use of area coordinates for triangular elements in - 2 dimensional problems – Isoparametric elements in 1,2 and 3 dimensional – Largrangean and serendipity elements – Formulations of elements equations in one and two dimensions - Numerical integration.

UNIT V APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSION 10 Hrs

Equations of elasticity – plane elasticity problems – axis symmetric problems in elasticity Bending of elastic plates –Time dependent problems in elasticity – Heat – transfer in two dimensions – incompressible fluid flow.

Total No. of Hrs: 45

TEXT BOOKS

1. J.N.Reddy, “An Introduction to Finite Element Method”, McGraw-Hill Book Co., Intl. Edition, 1985.

REFERENCES

1. *Rienkiewics, “The finite element method, Basic formulation and linear problems”, Vol.1, 4/e, McGraw-Hill,Book Co.*
2. *S.S.Rao, “The Finite Element Method in Engineering”, Pergaman Press, 1989.*
3. *C.S.Desai and J.F.Abel, “Introduction to the Finite Element Method”, Affiliated East West Press 1972*

Subject Code: EBCE22E20	Subject Name PREFABRICATED STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	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

OBJECTIVE :

To impart knowledge to students on modular construction, industrialised construction and design of prefabricated elements and construction methods.

COURSE OUTCOMES (COs) : (3- 5)

The student shall be able to

CO1	Students can understand the basics of prefabricated elements
CO2	Apply the construction methods in prefabricated elements
CO3	Assess the utilization of various code provisions regarding progressive collapse
CO4	Calculate the efficiency of prefabricated elements.
CO5	To Practice and create comprehensive knowledge on the design of prefabricated structures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	1	1	1	1	1	3
CO2	3	3	3	3	1	3	1	1	1	1	1	3
CO3	3	3	3	3	1	3	1	1	1	1	1	3
CO4	3	3	3	3	1	3	1	1	1	1	1	3
CO5	3	3	3	3	1	3	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	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			
					✓							

Subject Code: EBCE22E20	Subject Name PREFABRICATED STRUCTURES	TY / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	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

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS 9 Hrs

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT III DESIGN PRINCIPLES 9 Hrs

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT IV JOINT IN STRUCTURAL MEMBERS 9 Hrs

Joints for different structural connections – Dimensions and detailing – Design of expansion joints.

UNIT V DESIGN FOR ABNORMAL LOADS 9 Hrs

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

Total No. of Hrs: 45

TEXT BOOKS

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

REFERENCES

1. *Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.*
2. *Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.*