

**Government College of Engineering, Chh. Sambhajinagar (Aurangabad)**  
 (An Autonomous Institute of Government of Maharashtra)  
 Teaching and Evaluation Scheme of New CBCS Pattern with effect from 2023-24  
**B. Tech. Program in Civil Engineering**  
**Semester VII**

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	Category	Course Code	Course Name	Th	T	PR	Credits	ISE I	ISE II	ISE III	ESE	Total (100)
1	PC	CEPC4001	Construction Management	3	-	-	3	15	15	10	60	100
2	OE	CEOE0040	Open Elective-IV *	3	-	-	3	15	15	10	60	100
3	PE	CEPE4005 CEPE4006 CEPE4007 AMPE4003 AMPE4004	PE IV	3	-	-	3	15	15	10	60	100
4	PE	CEPE4045 CEPE4046 CEPE4047 AMPE4043 AMPE4044	PE-V	3	-	-	3	15	15	10	60	100
5	HSMC	CEHS1030	HSMC-IV *	3	-	-	3	15	15	10	60	100
6	PC	CEPC4002	Lab-Construction Management	-	-	2	1	25			25	50
7	Project	CEPC4028	Project-I	-	-	12	6	75			75	150
8	Project	CEPC4003	Industrial Training				1	25			25	50
9			Activity I(Stress Management by Yoga/Club Activity)			2	-					
10			Activity II(Cultural activity/Sports activity)			2	-					
<b>Total</b>				<b>15</b>	<b>-</b>	<b>14</b>	<b>23</b>	<b>300</b>			<b>400</b>	<b>750</b>

\*The syllabus for Open Elective and HSMC offered by the Civil Engineering Department is already available under the syllabus of S. Y. B. Tech. in Annexure

### Professional Elective IV

Course name	Course Code
Optimization Techniques	CEPE4005
Industrial Waste Treatment	CEPE4006
Dock, Harbours & Tunnel Engineering	CEPE4007
Design of Advanced RC Structures	AMPE4003
Design of Advance Steel Structures	AMPE4004

### Professional Elective V

Course name	Course Code
Water Resources System Management	CEPE4045
Environmental Impact Assessment	CEPE4046
Advanced Foundation Engineering	CEPE4047
Advance Seismic Analysis & Design	AMPE4043
Pre-stressed Concrete Design	AMPE4044

### Semester VIII

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	Category	Course Code	Course Name	Th	T	PR	Credits	ISE I	ISE II	ISE III	ESE	Total (100)
1	OE	CE/AM	Open Elective V *	3	-	-	3	15	15	10	60	100
2	Project	CEPC4029	Project II			16	8	100			100	200
<b>Total</b>				<b>3</b>	<b>-</b>	<b>16</b>	<b>11</b>	<b>140</b>			<b>160</b>	<b>300</b>

\*The syllabus for Open Elective and HSMC offered by the Civil Engineering Department/ Applied mechanics Department is already available under the syllabus of S. Y. B. Tech. in Annexure

<b>Open Elective Course I (Even Semester)</b>			
Sr. No.	Course Name	Course Code	Offered by Civil Engineering
1	Disaster Management	CEOE1010	

<b>Open Elective Course II (Odd Semester)</b>			
Sr. No.	Course Name	Course Code	Offered by Civil Engineering
1	Watershed Management	CEOE0020	

<b>Open Elective Course IV (Odd Semester)</b>			
Sr. No.	Course Name	Course Code	Offered by Civil Engineering
1	Infrastructure Management	CEOE0040	

<b>Open Elective Course V (Even Semester)</b>			
Sr. No.	Course Name	Course Code	Offered by Civil Engineering
1	Civil Engineering Structures	CEOE1050	

<b>Humanity Course II (Odd Semester)</b>			
Sr. No.	Course Name	Course Code	Offered by Civil Engineering
1	Finance & Accounting	CEHS0020	
<b>Humanity Course III (Even Semester)</b>			
Sr. No.	Course Name	Course Code	Offered by Civil Engineering
1	Constitution of India & Professional Ethics	CEHS1030	

<b>Humanity Course IV (Odd Semester)</b>			
Sr. No.	Course Name	Course Code	Offered by Civil Engineering
1	Operation Research	CEHS0040	

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**Civil Engineering Department**

**Curriculum Comparison for GECA and AICTE**

Sr No	Category	Suggested Breakup of Credits (Total 160) by AICTE	Suggested by Department
1	Humanities and Social Sciences including Management courses	12	12
2	Basic Science courses	25	20
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24	25
4	Professional core courses	48	58
5	Professional Elective courses relevant to chosen specialization/branch	18	15
6	Open subjects–Electives from other technical and/or emerging subjects	18	15
7	Project work, seminar and internship industry or elsewhere	15	15
8	Mandatory Courses (Environmental Studies, Induction training)	(non-credit)	
	Total	160	160

## CEPC4001:Construction Management

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test-I	15 Marks
Total Credits	3	Class Test-II	15 Marks
		Teacher's Assessment	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

**Prerequisite:** Prerequisite not required

**Course Description:** Construction Management (CM) is a professional service that uses specialized, project management techniques to supervise, guide, review or direct the actions related with the planning, design, and construction of a project, from its beginning to its end. The purpose of CM is to control a project's time, cost and quality. Common responsibilities of a Construction Manager include Project Management Planning, Cost Management, Time Management, Quality Management, Contract Administration, Safety Management, Risk Management and Professional Practice. Professional practice includes specific activities, such as defining the responsibilities and management structure of the project management team, organizing and leading by implementing project controls, defining roles and responsibilities, developing communication protocols, and identifying elements of project design and construction likely to give rise to disputes and claims. This course introduces the abovesaid aspects which are useful to civil engineer to perform and complete the project successfully.

**Course Outcome:** On successful completion of this course ,students will be able to

CO	Course Outcomes
CO1	Describe the role of Engineer as a manager on site
CO2	Plan, schedule and control the activities onsite
CO3	Analyze the situation on construction field to take the decision
CO4	Implement various operations related with construction

### Detailed Syllabus

Unit 1	<p><b>Introduction and Overview</b></p> <p>Construction, management: Necessity, application of management functions viz. Planning, Organizing, Staffing, Leading and controlling to the construction. Roles of clients, contractors, consultants. Overview of construction, Construction sequence, Specifications of typical construction items, Construction Industry–Nature, Characteristics, Size and Structures. Construction manager: Role, Qualities, Ethics, Duties, Responsibilities, Authorities. General principles of BOT system</p>
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Unit 2	<p><b>Construction Scheduling and Network Analysis</b></p> <p>Construction scheduling: Network analysis, bar charts, Programme Evaluation and Review Techniques (PERT) and Critical Path method(CPM). Basics of construction industry and organizational structure; Engineering economy in construction projects-personnel, monitoring and control work study in constructions - contracting. Bidding and law for engineers-value engineering, safety engineering etc.</p>
Unit3	<p><b>Resource and Financial Management</b></p> <p>Introduction to resource leveling and allocation, 4-M's in Construction –Men , Money, Machine and Material. Material Management: definition by international federation of purchasing and material management, Objectives, Role Functions, Qualities, of material manager Material forecasting. Inventory Control-Necessity, Techniques, ABC analysis, Lead-time, safety stocks, Material Evaluation using differential indices. Financial Accounting Systems, Accounting methods</p>
Unit4	<p><b>Construction Equipments, Project Appraisal and Safety Engineering</b></p> <p>Project feasibility analysis based on Technical, Financial and social benefits. Accident cost, injury sources and causes, Effective safety Programme occupational health hazards, Personal protective equipment, Preparation of safety Programme for construction works Earth Moving Equipments: Power Shovels, Back-Hoe, Drag-line, Excavator, Dozers, Scrapers, Use of Trucks and Dumpers, Work Cycle, Suitability of Use, Factors affecting Selection, Calculation of Out Put estimation and economics of equipment, Concrete Mixers, Cranes, Road Construction Equipments etc. DifferentEquipmentassociatedin a chain. Useful life estimation of equipments.</p>
Unit5	<p><b>Management Information System (MIS)</b></p> <p>Legal Aspect and Laws Applicable to Construction Industry: Works contract act, Child labour act, Workman’s compensation Act, Employees provided fund Act 1952,Minimumwages Act, Payment of bonus Act 1965 Risk Management: Introduction–Principal-Types, Origin, Costs of Risks. Risk Control –Role of Risk Manager, Risk, financing methods –Insurance, Fundsashborrowing, external borrowing. Application of MIS: System Development, Data processing, Flow charting, DBM, Data Communication System, Developments, Data processing, <i>Application</i> in Civil Engineering Industry.</p>



**Recommended Books:**

1. Kumar Neeraj Jha, 'Construction Project Management-Theory and Practice' Pearson Publication
2. Peurify, Schexnayder, Shapira, Construction Planning, Equipment and Methods, Tata Mc Graw-Hill Publication(Latest Edition)
3. Sandra Christensen Weber, 'Scheduling Construction Projects-Principles and Practices' Pearson Publication
4. L.S.Srinath, 'PERT and CPM-Principles and Applications' Affiliated East-West Press Pvt. Ltd Publication
5. S.C.Sharma, ' Construction Equipment and its Management' Khanna Publishers

**Mapping of Course outcome with Program Outcomes**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2	2	3				3			
CO2	3	3		3	2	2	3	2			3	2	1	
CO3	3	3	3	2					3		3		2	
CO4	3	3			3	3			3		3	2	1	

**1: Low 2: Moderate 3: Strong**

**Assessment:**

ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

- 1) Simulation
- 2) Application development
- 3) Power point presentation of case studies
- 4) Question & answer / Numerical solution
- 5) Study of Industry processes and its presentation
- 6) Mini projects
- 7) Attendance in the class

**Assessment Pattern**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	03	02		06
K2	Understand	05	05		18
K3	Apply	05	05	05	18
K4	Analyze	02	03	05	18
K5	Evaluate				
K6	Create				

<b>Total Marks 100</b>	15	15	<b>10</b>	<b>60</b>
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**Assessment Table**

<b>Assessment Tool</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>
	<b>K1,K2,K3,K4</b>	<b>K1,K2,K3,K4</b>	<b>K1,K2,K3,K4</b>	<b>K1,K2,K3,K4</b>
ISE I	08	07		
ISE II			08	07
ISE III	02	02	03	03
ESE	15	15	15	15
Total	25	24	26	25




## CEOE 0040 - OE-IV- Infrastructure Management

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	ISE I	15Marks
Total Credits	3	ISE II	15Marks
		ISE III	10Marks
		End Semester Examination	60Marks
		Total	100Marks

**Course Outcome:** On successful completion of this course, students will be able to

Course Outcomes	
CO1	Have a technical knowledge of deterioration, maintenance, and repairs techniques.
CO2	Function as a professional engineer within the context of the lifecycle management of infrastructure assets.
CO3	Have the understanding of economic constraints to develop a management plan for critical infrastructure structures and systems for the needs of society.

### Detailed Syllabus

Unit-1	Basic Concepts Related to Infrastructure scenario in India, transportation infrastructure, Urban infrastructure in India, rural infrastructure in India, introduction to special economic zone, infrastructure finance .
Unit-2	Construction Management Scheduling, contract management, quality and safety management, economics of construction, financing of infrastructure projects. Maintenance of Infrastructure Assets Impact of failure, risk analysis, monitoring, performance, resilience, service life, repair, condition assessment, no-destructive testing and evaluation.
Unit-3	Planning and Creation of Infrastructure Assets Environment impact assessment, life cycle cost and analysis, sustainable design and construction, service life of structure, quality control and assurance.
Unit-4	Private Involvement in Infrastructure Overview of infrastructure privatization, benefits of infrastructure privatization, problems of infrastructure privatization, case studies on privatization of infrastructure projects in India.
Unit-5	Risks in Infrastructure Planning and Implementation Economic and demand risks, political risks, socio-environmental risks, legal and contractual issues in infrastructure, challenges in construction and maintenance of infrastructure.

**Recommended Books:**

1. B. Sengupta, “Construction Management and Planning”, Tata McGraw Hill Publication.
2. Srinath L.S., “ PERT and CPM: Principles and Applications ”, 3rd Edition, Affiliated East West Press, Delhi.
3. N.S.Grigg, “Infrastructure Engineering and Management”, John Wiley and Sons.
4. W.R. Hudson, R. Hass, W. Uddin, “Infrastructure Management”, McGraw-Hill Inc.

**Mapping of Course outcome with Program Outcomes**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	3	-	-	3	3	-	-	3		
CO2	1		1	-		-	1	-	2	-	-	3	2	
CO3	1		3	1	2	2		2	-	2	-	3		1

**1: Low 2: Moderate 3: Strong**

**Assessment:** ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

**Assessment Pattern**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember			05	10
K2	Understand	08	08	05	15
K3	Apply	07	07		20
K4	Analyze				15
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

**Assessment table**

Assessment Tool	K1,K2	K2,K3	K2,K3	K2 ,K 3	K2
	CO1, CO2, CO3	CO1, CO2, CO3	CO1, CO2, CO3	CO1, CO2, CO3	CO1, CO2, CO3
ISE I (15 Marks)	03	03	03	04	02
ISE II(15 Maeks)	03	03	03	04	02
ISE III (10 Marks)		04	04	02	
ESE Assessment (60 Marks)	05	20	15	15	05
Total	11	30	25	25	9

## CEOE4005: PEIV-Optimization Techniques

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	Class Test-I	15 Marks
Total Credits	3	Class Test-II	15 Marks
		Teacher's Assessment	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

**Prerequisite:** Prerequisite not required

**Course Description:**

This course is to develop a strong foundation in understanding the basic concepts of optimization techniques, linear programming and queuing theory

**Course Outcome:** After successful completion of the course, students will be able to:

CO	Course Outcomes
CO1	Understanding the Concept of optimization and classification of optimization problems.
CO2	Formulation simplex methods variable with upper bounds
CO3	Study the Queuing Model, poisson and exponential distributions
CO4	Understand the maximization and minimization of convex functions and to study types of constraints

**Detailed Syllabus:**

Unit 1	<b>Introduction</b> Concept of optimization – classification of optimization – problems.
Unit 2	<b>Linear Programming</b> Examples of linear programming problems – formulation simplex methods variable with upper bounds – principle- duality -dual simplex method - sensitivity analysis – revised simplex procedure – solution of the transportation problem – assignment – network minimization – shortest route problem – maximal two problem – L.P. representation of networks.
Unit 3	<b>Queuing Theory</b> Queuing Model, poisson and exponential distributions -Queues with combined arrivals and departures-random and series queues.
Unit 4	<b>Unconstrained Optimization</b> Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convergence – univariate search – steepest and descent methods- matcher reeves method -conjugate gradient method.

Unit 5	<b>Constrained Optimization</b> Necessary and sufficient condition – equality constraints, inequality constraints - Kuhn – Tucker conditions – gradient projection method – penalty function methods – cutting plane methods of Subgradients.
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### Books Recommended

1. Rao S.S., "Optimization – Theory and applications", Wiley Eastern Ltd., 1979.
2. David G. Luenberger, "Introduction to Linear and Non Linear Programming", Addison Wesley Publishing Co. 1973.
3. Hadley G. "Nonlinear and – dynamic programming" Addison Wesley Publishing Co. 1964.
4. Cordan C.C. Beveridge and Robert S. Snelberger, "Optimization, Theory and Practice" McGraw Hill Co. 1970.
5. Harndy A. Taha. "operations Research, An Introduction", Macmillan Publishers Co. New York, 1982.
6. Beightler and S. others, "Foundations of Optimization Pill", New Delhi, 1979.

### Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2			2		1		2					
CO2		3	2		1	2	2		2			2		1
CO3		2	2		3		2		2					
CO4		1	3				2	2		2				1

**1: Low 2: Moderate 3: Strong**

### Assessment:

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class
8. Mini projects
9. Attendance in the class

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		15
K2	Understand	5	5		15
K3	Apply	5	5	5	15
K4	Analyze			5	15
K5	Evaluate				
K6	Create				
Total Marks: 100		15	15	10	60

**Assessment table:**

Assessment Tool	K1	K2	K3	K4	K5
	CO1 to CO4	CO1 to CO4	CO1 to CO4	CO1 to CO4	CO1 to CO4
ISE I (15 Marks)	5	5	5	-	-
ISE II (15 Marks)	3	3	4	5	
ISE III (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	7	8	15	15	15
Total Marks :100	17	18	26	22	17



## CEPE 4007- PE IV- Docks, Harbours and Tunnel Engineering

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/ week	ISE I	15 Marks
Credits	3	ISE II	15 Marks
		ISE III	10 Marks
		End Semester Examination	60 Marks
Total Marks			100 Marks

**Pre-requisites:** Nil

**Course Description:** This syllabus aims to provide students with a comprehensive understanding of Docks, Harbours, and Tunnel Engineering, covering theoretical principles, practical applications, and real-world case studies.

**Course Outcomes:**

After completing the course, students will able:

CO	Course Outcomes
CO1	Develop a comprehensive master plan for harbor sites and docks, taking into account natural phenomena and incorporating various harbor and docks elements.
CO2	Oversee the construction of berthing structures, ensuring adherence to design specifications and safety standards.
CO3	Assess and determine the need for navigational aids and cargo storage facilities to optimize operational efficiency in harbors.
CO4	Supervise tunnel construction projects, ensuring the implementation of proper construction techniques and adherence to project timelines.
CO5	Execute and manage the maintenance processes for tunnels, addressing structural integrity, safety protocols, and necessary repairs to sustain long-term functionality.

**Detailed Syllabus:**

Unit 1	<b>Natural Phenomenon, Planning, and Site Investigations:</b> Understanding natural phenomena: Wind, Tide, and Current. Types of harbors and their design considerations. Ocean structures: Planning and design under the influence of natural forces. Port administration: Organizational structure and administrative processes. Choice of site for the harbor: Factors influencing site selection. Master plan for port planning: Comprehensive planning for harbor development. Hydrographic and Topographic Survey: Techniques and importance in site investigations.
Unit 2	<b>Berthing Structures: Fenders and Moorings:</b> Design and construction of berthing structures: Piers, Wharfs, Quay walls, and Jetties. Components of berthing structures: Dolphins, Trestles, Moles, and Moving Accessories. Types of fender systems and their applications. Mooring systems for secure docking and ship handling.
Unit 3	<b>Navigational Aids, Coastal Erosion, and Protection, Cargo Storage Facilities:</b> Importance and types of navigational aids: Buoys, Beacons, Light ships, Range lights,

	Radar Reflectors. Coastal erosion and its impact on harbor structures. Coastal zones and beach profile analysis. Coastal protection works: Methods and materials. Berth nourishment: Techniques and considerations. Cargo storage facilities: Transit Sheds, Open Storage, Cold Storage Buildings, Port Administration Buildings.
Unit 4	<b>Tunnel, Survey, and Construction:</b> Tunnel engineering: Shapes, sizes, and survey work. Use of explosives in tunnel construction: Types, Quantity, and Safety precautions. Detonators: Types and proper handling methods. Shaft construction: Location, size, and shape considerations. Tunneling methods in soft soil, rock, and contraction: Techniques and challenges. Tunneling Equipment: Tools and machinery used in tunnel construction.
Unit 5	<b>Tunnel Lining, Ventilation, and Drainage System:</b> Types of tunnel linings and suitable materials, with a focus on concrete lining. Tunnel ventilation systems: Importance and design considerations. Water sources in tunnels and methods of water handling. Dewatering and permanent drainage systems for tunnels.

### Recommended Books

1. Dock and Harbour Engineering by Oza, H P; Oza, G H. Charotar Publishers. Anand.
2. A course in Docks and Harbour Engineering by S.P.Bindra. Dhanpat Rai Publications, New Delhi.
3. Harbours, Docks and Tunnel Engineering by R. Srinivasan. Charotar Publishing House, Anand.
4. Road, Railway, Bridge and Tunnel Engineering by Ahuja and Birdi. Standard book house Delhi.
5. A Textbook of Strength of Materials, Prof. R. K Bansal, Laxmi Publications.
6. Tunnel Engineering Handbook by Kuesel, T. R., Parsons, R. L., and D. K. Yen. Springer; 2<sup>nd</sup> ed. 1996.
7. The Dock and Harbours engineer's reference book by Brysson Cunningham. ICE Virtual Library second edition.

### Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	3			1		1		1	2	
CO2	1	1	2		2	2		2	2		2	1	1	
CO3		2	1	1		2	2	1			2	1		
CO4	2	2	1		2		1	1	1	2		1	1	
CO5	1	1	2						2		2	1	1	

**1: Low 2: Moderate 3: Strong**

**Assessment:**

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		15
K2	Understand	5	5		15
K3	Apply	5	5	5	15
K4	Analyze			5	15
K5	Evaluate				
K6	Create				
Total Marks: 100		15	15	10	60

**Assessment table:**

Assessment Tool	K1	K2	K3	K4	K5
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)	8	7			
ISE II ( 15 Marks)	5	5	5		
ISE III (10 Marks)	3	3	2	2	
ESE Assessment (60 Marks)	15	25	30		
Total Marks :100	31	40	37	2	

## CEPE4006:PE IV-Industrial Waste Treatment

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	ISE I	15Marks
Total Credits	3	ISE II	15Marks
		ISE III	10Marks
		End Semester Examination	60Marks
		Total	100Marks

**Prerequisite:** Student should have studied course ‘ Environmental Studies’ and Environmental Engineering

### Course Description:

Industrial waste is the waste produced by industrial activity. This course deals with the pollution from major industries and methods of controlling and treatment of the same. The student is expected to know about the pollution strength of waste from industries and methods of controlling the same.

**Course Outcome:** On successful completion of this course, students will be able to

CO	Course Outcomes
CO1	Explain the characteristics of different types of industrial waste water and it's effects
CO2	Design the different treatment units
CO3	Explain the reuse ,recovery and recycle techniques of solid waste
CO4	Explain the rules and regulations related with industrial waste

### Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2		2	1							
CO2	3	3	3		3		3		2				1	
CO3	3	2	2		3		3		2					
CO4	3	2				3	3	2	2			2		

**1: Low 2: Moderate 3: Strong**

## Detailed Syllabus:

Unit 1	Types of industries and industrial pollution, Physical, Chemical, Organic and Biological properties of industrial wastewater and effects of the same on in land surface water, disposal method and standards
Unit 2	Chemical and biological treatment of wastewater, removal of dissolved inorganic solids, removal of color and Odour, removal of heavy metals from wastewater
Unit 3	Waste reduction alternatives for raw materials, process changes, housekeeping, preliminary treatment of wastes, collection of waste segregation, equalization, neutralization
Unit 4	Sources, Characteristics, waste treatment flow sheets for selected industries such as sugar, distillery, tannery, dairy and electroplating
Unit 5	Legal aspects related with Hazardous wastes management and handling, secured landfills

## Recommended Books:

1. Metcalf & Eddy, 'Waste water Engineering Treatment and Reuse' Tata McGraw-Hill Edition
2. 'Environment and Pollution Laws' Universal Publishing Co. Pvt. Ltd.
3. M.N.Rao, A.K.Datta, 'Waste water Treatment' Oxford & IBH Publishing Co. Pvt. Ltd.
4. Soli J Arceivala, 'Wastewater Treatment for Pollution Control', Tata Mc Graw-Hill Edition

## Assessment:

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	03	02		06
K2	Understand	05	05		18
K3	Apply	05	05	05	18
K4	Analyze	02	03	05	18
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

### Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4
	K1,K2,K3,K4	K1,K2,K3,K4	K1,K2,K3,K4	K1,K2,K3,K4
ISE I	08	07		
ISE II			08	07
ISE III	02	02	03	03
ESE	15	15	15	15
Total	25	24	26	25

## AMPE 4003- PE-IV- Design of Advanced Reinforced Concrete Structures

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	Class Test-I	15 Marks
Total Credits	3	Class Test-II	15 Marks
		Teacher's Assessment	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

**Pre requisites:** Usual undergraduate course in elementary theory and design of RCC structures should have been studied earlier.

### Course Description:

#### Objectives:

1. To make the students aware of the code provisions for design of advanced structures
2. To expose students to analysis of and design of advanced RCC structures.
3. To expose students to analysis and design of various steel structures.

### Course Outcomes

After successful completion of the course, students will be able to:

CO	Course Outcomes
CO 1	Design various industrial structures using relevant codes and standards
CO 2	Design and Detailing of RCC structures as per current Practice
CO 3	Design and detailing of industrial steel structures as per current practice
CO 4	Associate the design concept with overall design of advanced structures.
CO5	Design concept and plastic analysis of advanced structures

### Detailed Syllabus:

Unit 1	<b>Analysis and design of structures for storage of liquids:</b> Provisions of IS 3370; Durability requirements, crack width, deflection and strength analyses; various methods of analysis and design of sections. Analysis and design of liquid retaining overhead structures like water tanks circular and rectangular in plan and design of staging.
Unit 2	<b>A. Design and detailing of deep beams by IS 456.</b> <b>B. Analysis and design of reinforced shear walls:</b> Classification, Loads on shear walls, Design of rectangular and flanged shear walls, Moment of resistance of rectangular shear walls.
Unit 3	<b>A. Analysis and design of storage bins</b> Analysis and design of industrial square/circular bunkers and silos

	<b>B. Analysis and design of chimneys</b>
Unit 4	Analysis and design of industrial steel structure buildings
Unit 5	Plastic analysis and design for rectangular frames, gable frames. Beam columns.

**Assessment:**

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

**Recommended Books**

1. Punmia B. C., A K Jain and A K Jain, Comprehensive Design of RCC Structures, Laxmi Publications (P) Ltd, New Delhi
2. Varghese P. C., Advanced Reinforced Concrete Design, 2<sup>nd</sup> Edition, Prentice-Hall of India Pvt Ltd, New Delhi, 2005
3. Ramamrutham S., Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, New Delhi, 2007
4. Krishna Raju N., Advanced Reinforced Concrete Design, CBS Publishers & Distributors, Delhi
5. IS 456: 2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi.
6. Handbook on Concrete Reinforcement and detailing, Special Publication SP 34, Bureau of Indian Standards, New Delhi, 1987
7. IS: 800 – 2007 Code of Practice for General Construction in Steel
8. Comprehensive Design of Steel Structures, Punmia B.C., Jain A. K. Laxmi Publications (P) Ltd, New Delhi
9. Subramanian N., "Design of Steel Structure "Oxford University Press, New Delhi.
10. Duggal S.K., " Limit state Design of steel structures by Limit State Method " as per IS: 800- 2007 by Tata McGraw Hill Education Private limited New Delhi



## Evaluation Pattern

### Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	1	--	----			1	2					2
CO2	2	3	2	--	----	2		1	2					2
CO3	1	2	1	--	----				2					2
CO4	1	1	2	--	-	-				1				2
CO5	1	1	3	--	2	-		1						2

1: Low 2: Moderate 3: Strong

## Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE-I 15 Marks	ISE-II 15 Marks	ISE-III 10 Marks	End Semester Examination
K1	Remember	02	02	-	06
K2	Understand	03	04	02	12
K3	Apply	04	04	02	18
K4	Analyze	06	05	03	16
K5	Evaluate			03	08
K6	Create				
Total Marks 100		15	15	10	60

## Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1, K2, K3	K2, K3, K4	K2, K3, K4	K2, K3, K4,	K2, K3, K4,
ISE I Marks (15 Marks)	07	08	-	-	
ISE II Marks (15 Marks)	-	-	08	07	
ISE III (10 Marks)	02	02	02	02	02
ESE Marks (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	22	21	14

## AMPE 4004 PE-IV-Design of Advance Steel Structure

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	Class Test-I	15 Marks
Total Credits	3	Class Test-II	15 Marks
		Teacher's Assessment	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

**Prerequisite :** In conjunction with theory of courses Design of steel structure

**Course Description :** This course intends to provide students comprehensive knowledge on the design of steel structure. The course focuses on the five topics shown in detail syllabus.

### Course Outcomes

After successful completion of this course, the student will be able to

CO	Course Outcomes
CO 1	Analyze and design knee braced steel frame
CO 2	Understand the Concept of design gable portal steel frame
CO 3	Understand the Concept of design Open web frames for industrial shed
CO 4	Design and Select various types of plate girders
CO 5	Possess knowledge of design of steel structures, steel code provisions and behavior of structural steel.

### Detailed syllabus

Unit 1	Analysis and design of knee braced trussed bent with hinged, fixed and partially fixed bases without gantry. Design of knee brace, roof column and its base. Various types of column configurations in case of knee braced trussed bent with gantry loads. Design of stepped columns and bases under various load combinations.
Unit-2	Analysis and design of gable portal frame with and without gantry loads. Design of bracket supporting gantry loads.
Unit-3	Open web frames for industrial shed, trussed purlins, analysis and design of two storey building.
Unit-4	Design in light gauge steel - forms of light-gauge sections, local buckling of thin elements, multiple stiffened compression elements, axially loaded column, laterally supported beams.
Unit-5	<b>Plate Girder Bridges</b> - Types of floor systems, design of deck type plate Girder bridges for broad gauge railway, horizontal truss bracings and end cross frames.

**Recommended Books:**

1. Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi
2. A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nemchand & Bros., Roorkee
3. Teaching Resource for Structural Steel Design – INSDAG Kolkatta
4. IS: 800 – 1984 Code of Practice for General Construction in Steel
5. IS: 875 – 1964 Code of Practice for Structural Safety of Building: Loading Standards (Revised)
6. IS: 4137 – 1967 Code of practice for Heavy Duty electric Overhead Traveling Crane
7. Steel Designers Manual – ELBS
8. John E. Lotheres – Advanced Design in Structural Steel, Prentice Hall
9. D. Johnson Victor - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
10. T.R. Jagadeesh, M.A. Jayaram - Design of Bridge Structures, Prentice-Hall of India
11. N. Krishna Raju - Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
12. IS: 800 – 1984 Code of Practice for General Construction in Steel
13. IS: 875 – 1964 Code of Practice for Structural Safety of Building: Loading Standards (Revised)
14. IS: 1915 – 1961 Code of Practice for Steel Bridges
15. IS: 800 – 2007 Code of Practice for General Construction in Steel
16. Comprehensive Design of Steel Structures, B.C.Punmia, A.K.Jain ,Laxmi Publications(P)Ltd, New Delhi.

**Assessment:**

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

### Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	--	----				1					2
CO2	2	2	2	--	----	2			1					2
CO3	2	1	1	--	----				1					2
CO4	3	1	1	--	-	-			2					2
CO5	3	1	2	--	2	-			2					2

1: Low 2: Moderate 3: Strong

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE-I 15 Marks	ISE-II 15 Marks	ISE-III 10 Marks	End Semester Examination
K1	Remember	02	02	-	06
K2	Understand	03	04	02	12
K3	Apply	04	04	02	18
K4	Analyze	06	05	03	16
K5	Evaluate			03	08
K6	Create				
Total Marks 100		15	15	10	60

### Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1, K2, K3	K2, K3, K4	K2, K3, K4	K2, K3, K4	K4, K3
ISE I Marks (15 Marks)	07	08	-	-	-
ISE II Marks (15 Marks)	-	-	06	07	02
ISE III (10 Marks)	02	02	02	02	02
ESE Marks (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	20	21	16

## CEPE4045:PEV-Water Resources System and Management

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	ISE I	15Marks
Total Credits	3	ISE II	15Marks
		ISE III	10Marks
		End Semester Examination	60Marks
		Total	100Marks

**Prerequisite:**CE3010:WaterResourcesEngineering

**Course Description:** This course introduces the water resource system and its economic analysis. The course provides detailed knowledge of various methods that are used for system analysis. You will also learn various irrigation techniques, its design aspects and performance of those techniques, selection and design of various water conservation structures.

**Course Outcomes:**

After successful completion of the course, students will be able to

CO	Course Outcomes
CO1	Solve the optimization problem in water resources engineering
CO2	Analyze the economics of water resources project
CO3	Design micro irrigation system
CO4	Design water shed structures

**Detailed Syllabus:**

Unit 1	<p><b>Economics of Water Resources Systems:</b> General principles of system analysis, objectives of water resources system, economic analysis of water resources system, principles of engineering economy ,depreciation, benefit cost evaluation, direct and indirect benefits, discounting techniques-present worth method, rate of return method, benefit cost ratio method, annual cost method</p>
Unit 2	<p><b>Optimization Techniques</b> Methods of system analysis, Linear programming models, simplex method, graphical method, introductory concepts of dynamic programming, non-linear programming, stochastic programming, simulation</p>
Unit 3	<p><b>Canal Irrigation Management</b> Management of canal irrigation, need for canal irrigation management, inadequacies of canal irrigation management, objective and criteria of good canal irrigation management, methods of improving canal irrigation management, participatory irrigation management</p>
Unit 4	<p><b>Watershed Management</b> Watershed management, Conservation of land and water, necessity of watershed</p>

	development and management, funding sources, structures involved in water shed management, Area treatment, drainage line treatment, impact assessment
Unit 5	<b>Micro-irrigation</b> Sprinkler irrigation, types of sprinklers, layout of sprinkler irrigation system, design aspects of sprinkler irrigation system, Drip irrigation: types of drips, layout of drip irrigation system, design aspects of drip irrigation system

**Recommended Books:**

1. Loucks, D.P., Stedinger, J.R. and Haith, D.A., "Water Resources Systems Planning and Analysis", Prentice Hall Inc. New York
2. Chaturvedi, M. C., "Water Resources Systems Planning and Management", Tata Mc Graw Hill Pub. Co., New Delhi
3. Taha, H. A., "Operations Research", Prentice Hall of India, New Delhi.
4. Gupta, B.L. and Gupta Amit, "Water Resources Systems and Management", Standard Publishers Distributors, New Delhi
5. Asawa, G. L., "Irrigation Engineering", New Age International Pub. Co., New Delhi.
6. Michael, B.A.M., "Irrigation", Vikas Publishing House Pvt. Ltd., New Delhi

**Mapping of Course Outcome with Program Outcomes**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3		3		1		2				2	
CO2		3	3			2	2		2			2	2	
CO3		3	3		3		2		2				2	
CO4		3	3		3		2	2		2			2	

**1: Low 2: Moderate 3: Strong**

**Assessment:**

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		18
K2	Understand	5	5	2	18
K3	Apply	5	5	5	12
K4	Analyze			3	12
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

### Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4
	K1,K2	K2,K3	K2,K3	K3,K4
ISE I(15Marks)	10	5		
ISE II(15Marks)			10	5
ISE III(10 Marks)		2	5	3
ESE(60 Marks)	18	18	12	12
Total Marks 100	28	25	27	20

## CEPE4046:PE-V Environmental Impact Assessment

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	ISE I	15Marks
Total Credits	3	ISE II	15Marks
		ISE III	10Marks
		End Semester Examination	60Marks
		Total	100Marks

### Prerequisite:

### Objective:

1. Students will be able to learn environment impact assessment
2. Students will be able to learn environment management plan
3. Students will be able to do environmental audit

### Course Outcomes:

After successful completion of the course, students will be able to

CO	Course Outcomes
CO1	Learn about environment impact assessment
CO2	Learn environment management plan
CO3	Do the environmental audit

### Detailed syllabus:

Unit 1	General: Global and Indian Scenario. National Environmental Policy
Unit 2	Environmental Organizations for planning and implementation Sustainable Development
Unit 3	Preventive and reactive strategies for environmental pollution control. Environmental impact and risk assessment. Methodology: Adhoc, Checklist, Network, Matrix etc.
Unit 4	Environmental Management plan, Typical Case Studies of Environmental Impact Assessment Environmental impact statements
Unit 5	Environmental Audit Environmental Legislation Air, Water and Environmental Acts.



### Recommended Books:

- A Rosencranz, S.Divan, M.I.Noble, Environmental Law and policy in India Cases, Material sand statutes, Tripathi Pvt. Ltd, Bombay.
- S. Musharaf, Legal aspects of Environmental Pollution and its management,C.B.S.Publishers,Delhi19932.
- R.K.Jain, L.V.Urban, B.S.Staccy, H.E.Balkbach, Environmental Assessment, McGraw Hill Inc, NY.
- Rao, J.G. and wooten, Environmental Impact Analysis, Hand book 1980.
- Center, L.W. Environmental Impact Assessment, New York: Mc Graw Hill Book Company.1977.

### Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1		2				2		1				
CO2	2	2		2		1	2							
CO3	3	2		2		3	1	1						
CO4	2			2	2	2	1	1	2	1				
CO5				2			2	1	2	1	1			

**1: Low 2: Moderate 3: Strong**

### Assessment:

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

**Assessment Pattern**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember				06
K2	Understand	5	5		18
K3	Apply	5	5		18
K4	Analyze	5	5	5	18
K5	Evaluate			5	
K6	Create				
Total Marks 100		15	15	10	60

**Assessment Table**

Assessment Tool	CO1	CO2	CO3	CO4
	K1 to K6 as applicable	K1toK6 as applicable	K1 to K6 as applicable	K1 to K6 as applicable
ISE I(15Marks)		5	5	5
ISE II(15Marks)		5	5	5
ISE III(10 Marks)			5	5
ESE(60 Marks)	6	18	18	18
Total 100 Marks	6	28	33	33

## CEPE 4047: PE-V Advanced Foundation Engineering

Teaching Scheme		Evaluation Scheme	
Theory	3Hrs/Week	ISE I	15 Marks
Total Credits	3	ISE II	15 Marks
		ISE III	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

**Pre-requisites:** Geotechnical Engineering

**Course Description:** This course delves into the complexities of foundation engineering with a focus on expansive soils, covering topics such as clay mineralogy, swelling mechanisms, and design principles for foundations in expansive soil deposits. Additionally, it explores soil dynamics and machine foundations, including vibration analysis and design criteria. The course also deals with special foundations for structures like water tanks, silos, and marine structures, emphasizing geotechnical design principles and soil-structure interaction.

**Course Outcomes:**

After completing the course, students will be able to

CO	Course Outcomes
CO1	Comprehensive Understanding of Expansive Soils
CO2	Analyze soil behavior under dynamic loads and differentiate between static and dynamic load responses.
CO3	Understand the structural form and efficiency of shell foundations and apply general geotechnical design principles.
CO4	Apply pile design criteria and methods according to IS specifications, considering axial and lateral load analysis.
CO5	Explore various ground improvement techniques, including compaction, preloading, grouting, and soil reinforcement.

**Detailed Syllabus:**

Unit 1	Foundation on Expansive Soils: Introduction to expansive soils: Characteristics, occurrences, and challenges. Clay mineralogy and mechanism of swelling in expansive soils. Identification of expansive soils and determination of swelling potential. Swelling pressure, free swell, and free swell index. Classification of expansive soils and relevant tests (IS code method). Prediction of swell pressure from index properties. Damages in buildings on expansive soils and mitigation strategies. Environmental solutions: Soil replacement techniques, lime columns. Principles of design for foundations in expansive soil deposits. Structural solutions: Rigid foundations, under reamed piles, T Beams as strip footings for walls (basic aspects).
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Unit 2	Soil Dynamics and Machine Foundations: Introduction to soil dynamics and behavior under dynamic loads. Difference between static and dynamic load behavior of soil. Dynamic soil properties and their significance. Free vibrations and forced vibrations in soil. Types of machines and machine foundations. Vibration analysis of a machine foundation. General design criteria for machine foundations. Design criteria for foundations for reciprocating machines (IS specifications). Design procedure for block foundation for a reciprocating machine (IS code method). Vibration isolation and control techniques.
Unit 3	Special Foundations: Introduction to shell foundations: Structural form and efficiency. Different types of shell foundations. General principles of geotechnical design for shell foundations and soil-structure interaction. Special features of foundations for water tanks, silos, chimneys, and transmission line towers. Foundations for marine structures: Design principles and considerations.
Unit 4	Deep Foundations and Pile Design: Types of deep foundations: Piles, caissons, and well foundations. Pile load transfer mechanism and pile types. Pile design criteria and methods (IS specifications). Axial and lateral load analysis for piles. Pile load testing and instrumentation.
Unit 5	Ground Improvement Techniques: Introduction to ground improvement techniques. Compaction and preloading methods. Grouting and its applications. Soil reinforcement techniques. Vibro-compaction and dynamic compaction.

### Recommended Books:

1. Advanced Foundation Engineering by VNS Murthy. CBS Publishers
2. Dr. K. R. Arora. "Soil mechanics and foundation Engineering", Standard publishers' distributors, Delhi.
3. Advanced Foundation Engineering by Sitharam, T.G. Taylor & Francis Inc.
4. Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Grawhill
5. Design of Foundation Systems- Nainan P Kurian, Narosa publication house.
6. Foundation Design & Construction- M.J.Tamlinson, ELBS publication.
7. G. A. Leonards, Foundation Engineering, McGraw-Hill, 1962.

### Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2										
CO2	2	3		2		2							1	1
CO3		3		2									2	2
CO4		3		3									2	2
CO5		3		2		2								

**1: Low 2: Moderate 3: Strong**

### Assessment:

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

**Assessment Pattern:**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5		15
K2	Understand	5	5		15
K3	Apply	5	5	5	15
K4	Analyze			5	15
K5	Evaluate				
K6	Create				
Total Marks: 100		15	15	10	60

**Assessment table:**

Assessment Tool	K1	K2	K3	K4	K5
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)	3	5	7		
ISE II (15 Marks)		3	5	5	2
ISE III (10 Marks)	1	1	3	3	2
ESE Assessment (60 Marks)	5	10	20	8	7
Total Marks :100	9	19	35	16	11

**AMPE 4043: PE V- Advance Seismic Analysis & Design**

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	ISE-I	15 Marks
Total Credits	3	ISE-II	15 Marks
		ISE-III	10 Marks
		End-Semester Examination	60 Marks

**Prerequisite:** Must have undergone course AM-51002- Structural Dynamics & Earthquake Engineering

**Course Description:** Earthquake resistant design is an essential requirement in the analysis and design of structures. This is a course in continuation of the course in Structural Dynamics & Earthquake Engineering. This course is intended to give an insight into the advanced aspects of earthquake analysis and design after undergoing the basic course. The course aims to expose the students to numerical solutions of equations of motion, performance based design principles. The students are also exposed to the basics base isolation systems and various vibration control techniques. At the end of the course students will be able to contribute towards research in the area during their dissertation work.

**Course Outcomes:**

After successful completion of the course, students will be able to:

CO	Course Outcomes
CO1	Formulate analysis algorithm of MDOF structures using numerical integration methods
CO2	Compute the forces in an unsymmetrical building
CO3	Explain the principles of performance based seismic design and obtain performance point for a given seismic demand
CO4	Apply linear theory of base isolation to structures to find out the dynamic properties of a base isolated structure
CO5	Enlist different vibration control techniques and explain their behavior under seismic loading.

**Detailed Syllabus**

Unit 1	<b>Numerical Integration of Equations of Motion</b> Reduction of DOF, static condensation, modeling of MDOF systems, Rayleigh-Ritz method, selection of Ritz vectors, numerical evaluation of response, time-stepping methods, Newmark-Beta method
Unit 2	<b>Seismic analysis of unsymmetrical buildings</b> Seismic analysis of unsymmetrical structures, Centre of Mass and Centre of Stiffness, Eccentricity, Torsion, Modelling and Formulation of unsymmetrical buildings, Accidental eccentricity, Distribution of forces in buildings due to torsion
Unit 3	<b>Performance Based Design Approach</b> Performance based design, Performance criteria, Push-over analysis, capacity spectrum method, performance point, Different types of hinges
Unit 4	<b>Linear theory of base isolation</b> Vibration control systems, passive, active, hybrid and semi-active systems, base-isolation, base-isolation principles and systems, linear theory of base-isolation
Unit 5	<b>Passive vibration control techniques</b> Tuned mass dampers, Tuned Liquid dampers, Viscous dampers, Friction dampers, basic formulations

**Assessment:**

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher's Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

### Recommended Books

1. Clough R. W. and Penziene J., "Dynamics of Structures", Mc-Graw Hill, Latest Edition
2. Chopra A. K., "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Latest Edition.
3. Paz Mario, "Structural Dynamics", Springer, Latest Edition.
4. Kramer Steven, "Geotechnical Earthquake Engineering", Pearson Education, Latest Edition
5. Dowrick D.J., "Earthquake Resistant Design for Engineers", John Wiley Publishers, Latest Edition
6. Duggal S.K., "Earthquake Resistant Design of Structures", Oxford University press, Latest Edition
7. Hosur Vinod, "Earthquake Resistant Design of Building Structures", Wiley, Latest Edition
8. IS: 1893 (Part-I) -2016, "Criteria for earthquake resistant design of structures" Bureau of Indian Standards, New Delhi
9. IS:13920-2016, "Ductile Detailing of Reinforced Concrete Structures subjected to seismic forces-code of practice" Bureau of Indian Standards, New Delhi

### Evaluation Pattern

#### Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	----									1
CO2	2	1	1		3	2								2
CO3	3	2	2	1					1					2
CO4	3	2	3		-	-			1					2

CO5	3	1	2		2	-								
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1: Low 2: Moderate 3: Strong

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE-I 15 Marks	ISE-II 15 Marks	ISE-III 10 Marks	End Semester Examination
K1	Remember	02	02	-	06
K2	Understand	03	04	02	12
K3	Apply	04	04	02	18
K4	Analyze	06	05	03	16
K5	Evaluate			03	08
K6	Create				
Total 100 Marks		15	15	10	60

### Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1, K2, K3	K2, K3, K4	K2, K3, K4	K2, K3, K4	K4, K3
ISE I (15 Marks)	07	08	-	-	-
ISE II (15 Marks)	-	-	06	07	02
ISE III (10 Marks)	02	02	02	02	02
ESE Assessment (60 Marks)	12	12	12	12	12
Total 100 Marks	21	22	20	21	16

## AMPE4044: PE V- Pre-Stressed Concrete Design

Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	ISE-I	15 Marks
Total Credits	3	ISE-II	15 Marks
		ISE-III	10 Marks
		End-Semester Examination	60 Marks



**Prerequisite:** Not applicable

**Course Description:** This course equips the students to understand the mechanism of prestressing and behavior of pre-stressed concrete element. Students will be exposed to analysis of strength and behavior of prestressed concrete structures. The course will deal with limit state of design of prestressed concrete structures like beams, axially loaded members, slabs, composite sections, liquid tanks, pipes, sleepers etc. in relevance to codal provisions.

**Course Outcomes:**

After successful completion of the course, students will be able:

CO	Course Outcomes
CO1	To analyze the stresses and determine the behavior of determinate prestressed concrete beams
CO2	To design prestressed concrete slabs.
CO3	To appreciate the composite behavior and design composite sections.
CO4	To analyze the stresses and determine the behavior of indeterminate prestressed concrete beams
CO5	To apply prestressed concrete design concepts to various members like pipes, tanks, poles and sleepers.

**Detailed Syllabus**

Unit 1	<b>Analysis and Design of Determinate Prestressed Concrete Beams</b> Review of fundamentals of prestressing, Analysis of ultimate strengths of rectangular and flanged beams, Limit state design of rectangular and flanged beams (Type-I, Type-II, Type-III) for flexure, shear, torsion; Limit state of serviceability, Design of end block, Anchorage zone stresses in post-tensioned member.
Unit 2	<b>Design of Prestressed Concrete Slabs; Axially loaded members</b> Design of one way and two way prestressed concrete slabs, flat slab, Analysis and design of sections for axial tension, Design of compression member.
Unit 3	<b>Analysis of Composite section</b> Analysis of composite sections with precast PSC beams and cast-in-situ RC slab Stresses, Shrinkage, Deflection, and Flexural and shear strength of composite member, Design of composite member.
Unit 4	<b>Analysis and Design of Indeterminate Prestressed Concrete Elements</b> Analysis of continuous beams, primary and secondary moments, stresses, cable profile, line of prestress, linear transformation of cables, concordant cable profile, Analysis of ultimate load, Design of continuous beam and portal frames.
Unit 5	<b>Analysis and Design of Tanks, Pipes, Pole, and Sleepers</b> Analysis and design of circular tanks, pipes, Pole and railway sleepers.

**Recommended Books**

1. Krishna Raju N., “Prestressed Concrete”, Tata McGraw Hill Company, New Delhi, Latest Edition.
2. Mallic S. K. and Gupta A. P., “Prestressed Concrete”, Oxford and IBH publishing Co. Pvt. Ltd. Latest Edition.
3. Dayaratnam P., “Prestressed Concrete”, Oxford and IBH, Latest Edition.
4. Rajagopalan N., “Prestressed Concrete”, Alpha Science, Latest Edition.
5. Ramaswamy G. S., “Modern Prestressed Concrete Design”, ArnoldHeinimen, New Delhi, Latest Edition.
6. Lin T. Y., “Design of Prestressed Concrete Structures”, Third Edition, Wiley India Pvt. Ltd., New Delhi, Latest Edition.
7. David A. Sheppard, William R. and Phillips, “Plant Cast Precast and Prestressed Concrete-A Design Guide”, McGraw Hill, New Delhi, Latest Edition.
8. IS 1343: 2012, Code of Practice for Prestressed Concrete, Bureau of Indian Standard, New Delhi, 2012.

**Assessment:**

ISEI: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Teacher’s Assessment: Teachers Assessment is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Power point presentation of case studies
4. Question & answer / Numerical solution
5. Study of Industry processes and its presentation
6. Mini projects
7. Attendance in the class

**Mapping of Course outcome with Program Outcomes**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1		----				2					2
CO2	3	2	2		1									2
CO3	2	2	1	1					1					2
CO4	2	2	2		-				1					2
CO5	3	3	3	2	1				2					2

**1: Low 2: Moderate 3: Strong**

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE-I 15 Marks	ISE-II 15 Marks	ISE-III 10 Marks	End Semester Examination
K1	Remember	02	02	-	06
K2	Understand	03	03	02	12
K3	Apply	04	04	02	18
K4	Analyze	06	06	03	16
K5	Evaluate			03	08
K6	Create				
Total 100 Marks		15	15	10	60

### Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1, K2, K3	K2, K3, K4	K2, K3, K4	K2, K3, K4	K4, K3
ISE I (15 Marks)	07	06	02	-	-
ISE II (15 Marks)	-	-	05	07	03
ISE III (10 Marks)	02	02	02	02	02
ESE Marks (60 Marks)	12	12	12	12	12
Total 100 Marks	21	20	21	21	17

## CEPC4002: Lab-Construction Management

Teaching Scheme		Evaluation Scheme	
Practical	2Hrs/Week	ISE I- Term Work	25Marks
Total Credits	1	Practical Examination ESE	25 Marks
		Total Marks	50 Marks

**Prerequisite: Not Applicable**

**Course Description:**

Construction Management (CM) is a professional service that uses specialized, project management techniques to supervise, guide, review or direct the actions related with the planning, design, and construction of a project, from its beginning to its end. The purpose of CM is to control a project's time, cost and quality. Common responsibilities of a Construction Manager include Project Management Planning, Cost Management, Time Management, Quality Management, Contract Administration, Safety Management, Risk Management and Professional Practice. This course is useful to civil engineer to perform and complete the project successfully.

**Course Outcome:** After successful completion of the course, students will be able to

CO	Course Outcomes
CO1	Describe the role of Engineer as a manager on site
CO2	Plan, schedule and control the activities onsite
CO3	Analyze the situation on construction field to take the decision

**Assessment:** ISE I: Shall be on the basis of term work and interaction with students till coverage of curriculum.

ESE : Shall be on the basis Oral examination conducted by course coordinator and external examiner.

**Term Work:**

Term work shall consist of assignments on-

1. Bar chart/milestone chart for construction project.
2. Network representation, assigning durations to various activities by considering available resources, computation of duration of project, cost optimization resources scheduling.
3. To visit the construction site and study Inventory control, safety techniques adopted on construction project.
4. Cost analysis of construction equipments.
5. To do study of Benefit Cost ratio of project.
6. Use of at least one soft computing technique in construction management such as Primavera, MS Project, etc.
7. To study the vision, mission of reputed construction industries.

**Practical Examination/Viva Voce Examination:**

The panel of examiner shall consist of course coordinator as an internal examiner and one faculty member appointed by the Controller of Examination as an external examiner. The panel of examiners, as described above, shall evaluate the understanding/knowledge of the student by asking appropriate questions/asking students to perform/demonstrate experiments, etc.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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Outcome														
CO1	1	1	2		2	1		1	1	2	2	1		
CO2	1	1	2		2	1		1	1	2	2	1	1	
CO3		2	2		1	1							1	

**: Low                      2: Moderate                      3: Strong**

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	4			6
K2	Understand	5			7
K3	Apply	7			7
K4	Analyze	9			5
K5	Evaluate				
K6	Create				
<b>TotalMarks50</b>		<b>25</b>			<b>25</b>

### Assessment Table

Assessment Tool	CO1	CO2	CO3
	K1,K2, K3, K4	K1,K2, K3, K4	K1,K2, K3, K4
ISE I/TW (25 Marks)	08	07	10
ESE (25 Marks)	08	07	10
Total (50 Marks)	16	14	20

## CEPE 4028 Project I

Teaching Scheme		Evaluation Scheme	
Practical	2Hrs/Week	ISE I- Term Work	75 Marks
Total Credits	6	Practical Examination ESE	75 Marks
		Total Marks	150 Marks

**Pre-requisites:** Not Applicable

**Course Description:** This course offers civil engineering students an opportunity to undertake the preliminary work of a project on selected topic in civil engineering in order to solve a real-life problem. This course is intended to create research aptitude, problem solving and team work among undergraduate students. It also expects meaningful interaction with civil engineering industry.

**Course Outcomes:**

After completing the course, students will able:

CO	Course Outcomes
CO1	Search, interpret and compile literature on problem selected.
CO2	Formulation and development of methodology of working solutions to defined problems through systematic approach in laboratory or field.
CO3	To predict expected outcomes from pilot study.

**Term work:** Students will go through selected references from reference books, research papers, IS codes and Handbooks. Students would be encouraged to go to local industry and look for problems through interactions/discussions with concerned industries. This will help them to define a topic of project. Group of students comprising 6 to 9 members will be guided by a teacher (project supervisor). The term work submission file will contain complete information of project undertaken by respective group of students. Students shall submit the project report duly recommended by project supervisor before conduct of practical examination.

**Practical/Viva Voce Examination:** The students shall prepare presentation based on their project report and deliver it before the panel of examiners which shall consist of a supervisor and internal examiner appointed by department.

**Recommended Books:**

1. Reference books of Civil Engineering
2. IS Codes and manuals
- Other relevant National, International Codes and manuals
3. Standard Journal papers

**Mapping of Course outcome with Program Outcomes**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1		3		3	2			3						
CO2	3	3	3	3	2	1		2	3		3		2	2
CO3							3			3		2	2	2

**1: Low 2: Moderate 3: Strong**

### Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	12			18
K2	Understand	15			21
K3	Apply	21			21
K4	Analyze	15			15
K5	Evaluate				
K6	Create	12			
<b>TotalMarks150</b>		<b>75</b>			<b>75</b>

### Assessment Table

Assessment Tool	CO1	CO2	CO3
	K1,K2, K3, K4	K1,K2, K3, K4, K6	K1,K2, K3, K4
ISE I/TW (75 Marks)	24	21	30
ESE (75 Marks)	24	21	30
Total (150 Marks)	48	42	60

## CEPC 4003 Industrial Training

Teaching Scheme		Evaluation Scheme	
Practical	2Hrs/Week	ISE I- Term Work	25Marks
Total Credits	6	Practical Examination ESE	25 Marks
		Total Marks	50 Marks

**Pre-requisites:** Nil

**Course Description:** The Industrial Training course aims to provide students with hands-on

experience in the field of civil engineering by immersing them in real-world projects within industrial settings. Throughout the training period, students will have the opportunity to apply theoretical knowledge gained in the classroom to practical situations.

**Course Outcomes:**

After completing the course, students will be able to

CO	Course Outcomes
CO1	Gain practical experience in civil engineering projects within industrial settings.
CO2	Enhance their project management skills through hands-on involvement in project planning, execution, and evaluation.

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. Students should undergo training for minimum 4 weeks which can be completed during vacation after VI Semester and will be assessed in VII Semester.

**Term work:** At the conclusion of the training period, students will be required to submit a comprehensive final report detailing their experiences, accomplishments, and reflections during the Industrial Training. The final report should include a thorough analysis of the projects undertaken, the challenges encountered, and the lessons learned.

**Practical/Viva Voce Examination:** The students shall prepare presentation based on their Industrial Training Report and deliver it before the panel of examiners which shall consist of a supervisor and external examiner appointed by COE. The panel will examine the Report contents and presentation and award marks out of 25.

**Mapping of Course outcome with Program Outcomes and Program Specific Outcomes**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3		3	2			3						
CO2	3	3	3	3	2	1		2	3		3			

**1: Low 2: Moderate 3: Strong**

**Assessment Pattern**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	4			6
K2	Understand	5			7
K3	Apply	7			7
K4	Analyze	9			5
K5	Evaluate				



K6	Create			
<b>TotalMarks50</b>		<b>25</b>		<b>25</b>

### Assessment Table

Assessment Tool	CO1	CO2	CO3
	K1,K2, K3, K4	K1,K2, K3, K4	K1,K2, K3, K4
ISE I/TW (25 Marks)	08	07	10
ESE (25 Marks)	08	07	10
Total (50 Marks)	16	14	20

## Semester- VIII CEPE 4029 Project II

Teaching Scheme		Evaluation Scheme	
Practical	2Hrs/Week	ISE I- Term Work	100Marks
Total Credits	6	Practical Examination ESE	100 Marks
		Total Marks	200 Marks

**Pre-requisites:** Project I

**Course Description:** This course offers civil engineering students an opportunity to undertake detailed work of project I. Groups of students mainly focuses on solution of the pre-defined problem.

**Course Outcomes:**

After completing the course, students will able:

CO	Course Outcomes
CO1	Search, interpret and compile additional literature on Project I.
CO2	Refinement of Formulation and fine tuning of methodology of working solutions of Project I.
CO3	To analyze and interpret the solutions obtained for Project I through appropriate interpretation method and draw meaningful conclusion

**Term work:** Project II shall consist of work undertaken and defined in project I in laboratory or in the field. The group of students shall prepare a technical report and submit 3 hard copies signed by supervisor and submit it to COE for Viva-Voce examination.

**Practical/Viva Voce Examination:** The students shall prepare presentation based on their project II report and deliver it before the panel of examiners which shall consist of a supervisor and external examiner appointed by COE. The panel will examine the project II contents and presentation and award marks out of 200.

**Recommended Books:**

1. Reference books of Civil Engineering
2. IS Codes and manuals  
Other relevant National International Codes and manuals
3. Standard Journal papers

**Mapping of Course outcome with Program Outcomes**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3		3	2			3						
CO2	3	3	3	3	2	1		2	3		3		3	3
CO3							3			3		2	3	3

**1: Low 2: Moderate 3: Strong**

**Assessment Pattern**

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	16			23
K2	Understand	19			27

K3	Apply	27			27
K4	Analyze	19			23
K5	Evaluate				
K6	Create	19			
<b>Total Marks 200</b>		<b>100</b>			<b>100</b>

**Assessment Table**

Assessment Tool	CO1	CO2	CO3
	K1,K2, K3, K4	K1,K2, K3, K4, K6	K1,K2, K3, K4
ISE I/TW (100 Marks)	31	30	39
ESE (100 Marks)	31	30	39
Total (200 Marks)	62	60	78