Government College of Engineering, Chhatrapati Sambhajinagar

(An Autonomous Institute of Government of Maharashtra) Station Road, Osmanpura, *Chhatrapati Sambhajinagar*-431005(M.S.)
Phone- (0240) 2366101, 2366111, Fax (0240) 2332835

Curriculum for

Final Year B. Tech. in Civil Engineering with Multidisciplinary Minor Degree

(NEP Compliant)

(With Effect from Academic Year 2026-27)

Dr. S. S. Koranne
Head, Civil Engg.

Dr. Anil Karwankar
Dean , Academics

B.Tech. Civil Engineering Curriculum
With effect from Academic Year 2026–2027
Approved in the 32nd Academic Council Meeting, dated 28th July 2026

Vision of the Institute

To be globally recognized leader in technical education through industry integration and societal wellbeing.

Mission of the Institute

1. To build career-ready graduates through multidisciplinary learning and industry-sync curricula.
2. To promote ecosystem for cutting-edge research, patents, publications, IPR, innovation, technology transfer and entrepreneurship.
3. To be a premier trusted partner of government allied bodies, industries, and society.

Motto of the Civil Engineering Department

To Build Strong Nation through Dedication.

Vision of the Civil Engineering Department

"To develope Civil Engineers with global standards through industry integration, innovation for sustainable infrastructure and societal wellbeing".

Mission of the Civil Engineering Department

1. To impart industry-oriented and multidisciplinary Engineering education.
2. To encourage research, publications, innovation, patents and sustainable Civil Engineering practices.
3. To actively engage with industry, Government and society through consultancy, projects and outreach activities.

Program Outcomes

After the successful completion of the civil engineering Programme the graduates will be able to:

1. Independently carry out research/investigation and development.
2. Write and present a substantial technical report/document.
3. Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

Program Specific Outcomes

1. Plan, Design, Execute Building, Transportation and water related Engineering practices.
2. Apply subject domain knowledge to analyze and design the civil Engineering Structure

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Program outcomes (POs):

After the successful completion of the civil engineering programme the graduates will have:

1. Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK*1 to WK*4 respectively to develop the solution of complex engineering problems.
2. Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK*1 to WK*4)
3. Design creative solutions for complex engineering problems and design/ develop systems/ components/ processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required (WK*5)
4. Conduct investigations of complex engineering problems using research- based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions (WK*8).
5. Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems (WK*2 and WK*6)
6. The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment (WK*1, WK*5 and WK*7).
7. Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).
8. Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/ multi-disciplinary teams.
9. Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
10. Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK*8).

Programme Educational objectives (PEOS):

1. Graduates will apply strong foundations in mathematics, basic sciences, environmental studies, and core civil engineering principles to analyze and solve complex engineering problems.
2. Graduates will plan, design, and execute civil engineering and multidisciplinary projects in compliance with technical standards, considering economic feasibility, sustainability, environmental protection, societal needs, safety, and ethical responsibilities.
3. Graduates will effectively use modern engineering tools, advanced techniques, and digital technologies to deliver innovative, efficient, and practical civil engineering solutions.
4. Graduates will pursue successful careers in civil engineering and allied sectors, engage in higher education, research, professional development, and demonstrate leadership, teamwork, and continuous learning.

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STRUCTURE

SEMESTER – VII											
			Teaching Scheme			Continuous Evaluation in terms of Marks					
	Course Code	Course name	TH	T	PR	Credits	ISE I	ISE II	ISE III	ESE	Total
PEC		Programme Elective III	3	0	0	3	15	15	10	60	100
PEC		Lab-Programme Elective III	0	0	2	1			25	25	50
ELC	CEELC4001	Research Methodology	2	0	0	2	10	10	0	30	50
PEC		*Programme Elective – IV	3	0	0	3	15	15	10	60	100
PEC		Lab- Programme Elective IV	0	0	2	1			25	25	50
Project	CEPRJ4001	Project	0	0	8	4			100	100	200
Total			8	0	12	14	40	40	170	300	550

SEMESTER-VIII											
			Teaching Scheme			Continuous Evaluation in terms of Marks					
	Course Code	Course name	TH	T	PR	Credits	ISEI	ISEII	ISEIII	ESE	Total
PEC		**Programme Elective V	4	0	0	4	15	15	10	60	100
Project	CEINT4001	Internship	0	0	00	12			100	100	200
Total			4	0	00	16	15	15	110	160	300
GRAND TOTAL			**12**	**0**	**12**	**30**	**55**	**55**	**280**	**460**	**850**

* Elective IV: CEPEC4018 Traffic Engineering will be offered in online mode
** Elective V: all Courses will be offered in online mode.

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PROGRAMME ELECTIVE III

Sr . No.	Course Code	Course Title	Scheme of Teaching (Hrs/week)			Credit
			Theory	Tutorial	Practical	
1	AMPEC4001	Design of Bridges	3	0	0	3
2	CEPEC4001	Ground Water Engineering	3	0	0	3
3	CEPEC4002	Water Power Engineering	3	0	0	3
4	AMPEC4002	Design of Advanced RC Structures	3	0	0	3
5	CEPEC4003	Solid Waste Management	3	0	0	3
6	CEPEC4004	Construction Management	3	0	0	3
7	AMPEC4003	Lab-Design of Bridges	0	0	2	1
8	CEPEC4005	Lab-Ground Water Engineering	0	0	2	1
9	CEPEC4006	Lab-Water Power Engineering	0	0	2	1
10	AMPEC4004	Lab-Design of Advanced RC Structures	0	0	2	1
11	CEPEC4007	Lab-Solid Waste Management	0	0	2	1
12	CEPEC4008	Lab-Construction Management	0	0	2	1

PROGRAMME ELECTIVE IV

Sr. No.	Course Code	Course Title	Scheme of Teaching (Hrs./week)			Credit
			Theory	Tutorial	Practical	
1	AMPEC4005	Prestressed Concrete Design	3	0	0	3
2	CEPEC4009	Industrial Waste Management	3	0	0	3
3	CEPEC4010	Infrastructural Development	3	0	0	3
4	CEPEC4011	Advanced Geotechnical Engineering	3	0	0	3
5	AMPEC4006	Building maintenance and Repairs	3	0	0	3
6	CEPEC4018	*Traffic Engineering	4	0	0	4
7	AMPEC4007	Lab-Prestressed Concrete Design	0	0	2	1
8	CEPEC4012	Lab-Industrial Waste Management	0	0	2	1
9	CEPEC4013	Lab-Infrastructural Development	0	0	2	1
10	CEPEC4014	Lab-Advanced Geotechnical Engineering	0	0	2	1
11	AMPEC4008	Lab-Building maintenance and Repairs	0	0	2	1

**PROGRAMME ELECTIVE V

Sr. No.	Course Code	Course Title	Scheme of Teaching (Hrs./week)			Credit
			Theory	Tutorial	Practical	
1	AMPEC4009	Earthquake Analysis and Design	4	0	0	4
2	AMPEC4010	Advanced Structural Analysis	4	0	0	4
3	CEPEC4015	Water Recourses System and Management	4	0	0	4
4	CEPEC4016	Environmental Impact Assessment	4	0	0	4
5	CEPEC4017	Engineering Optimization	4	0	0	4
6	CEPEC4020	Smart Cities	4	0	0	4
7	AMPEC4011	Finite Element Method	4	0	0	4

PROGRAM ELECTIVE III AMPEC4001: Design of Bridges		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: AMESC1001, AMPCC2001, AMPCC2003, AMPCC3004

Course Description:

Infrastructure development is essential for development of our country. This need includes construction of roads and bridges on large scale. It is imperative therefore to create human resources capable of planning and designing of RCC and PSC bridge structures. This course offers an opportunity to Civil Engineering students to develop themselves to cater for the above - mentioned need of the society.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcomes
CO1	identify various types of bridges, their components, and their site-specific suitability
CO2	recognize standard design loads for respective bridge deck type
CO3	analyze various types of RC bridges and design their components
CO4	analyze various types of PSC bridges and design their components
CO5	identify and explain various components of bridge substructure, their types and loads on them.

Detailed Syllabus:

Unit 1	**Introduction:** Classification of bridges based on various factors like material, structural system etc. Components of a bridge and their function, Factors to be considered for selection of site and alignment. Introduction to various standards for highway as well as railway bridges, introduction to pre-stressed concrete in bridges.
Unit 2	**Design Loads for Bridges:** Introduction loading standards as per IRC, Type of Loads and Load combinations on bridge superstructure as per IRC, Analysis of bridge decks using various methods (Pigeaud's Method, Courbon's Method etc.), Introduction to Influence lines for bridge decks.

Unit 3	**Design of RC Bridges:** Design principles as per IRC codes, Design of solid slab bridges, slab and girder type bridge, Skew type etc.
Unit 4	**Design of PSC Bridges:** Design of pre-stressed concrete bridge decks and girders (simply supported and continuous type), Preliminary dimensions, Design of end blocks.
Unit 5	**Substructure in Bridges:** Components of substructure (Abutments, piers, wing walls, bed blocks, bearings, foundations),Types of abutments and piers, Types of foundations, Types of Loads on substructures, Guidelines for stability checks.

Text Books

1. **Raina V. K.**, Concrete Bridge Practice: Analysis, Design and Economics, Tata McGraw-Hill Publishing Company Limited, 4th Edition, 2014.
2. **Ponnuswamy S**., Bridge Engineering, Tata McGraw-Hill Publishing Company Limited, Latest Edition.
3. **Johnson, Victor D**., Essentials of Bridge Engineering, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 5th Edition, 2007.
4. **Jagadeesh T. R. and Jayaram M. A**., Design of Bridge Structures, Prentice-Hall of India, 2000.
5. **Krishna Raju, N**., Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 5th edition 2017.

Reference Books

1. **Hambly E. C.,** Bridge Deck Behavior, E&FN Spon Publications, 2ndEdition,1991.
2. **Ryall M. J., Parke G. A. R., and Harding J. E.**, The Manual of Bridge Engineering, Thomas Telford Publishers, 2000.
3. **Rajagopalan R**., Bridge Superstructure, Tata McGraw-Hill Publishing Company Limited, 2000.
4. **Aswani, M. G., Vazirani, V. N., and Ratwani, M. M**., Design of Concrete Bridges,Khanna Publishers, 1995.
5. **Rakshit, K. S**., Design and Construction of Highway Bridges, New Central Book Agency (P) Ltd., Pune, 2010.
6. **Lee David**, Bridge Bearings and Expansion Joints, E & FNSpon Publications, published during 1990–2000.

Indian Standards

1. IRC:6-2017, Standard Specifications and Code of Practice for Road Bridges, Section II- Loads and Stresses (7thRevision), Indian Road Congress, New Delhi.
2. IRC:18-2000, Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete) (3rdRevision), Indian Road Congress, New Delhi.
3. IRC:21-2000, Standard Specifications and Code of Practice for Road Bridges, Section III – Cement Concrete (plain and Reinforced) (3rdRevision), Indian Road Congress, New Delhi.
4. IRC:112-2011, Code of practice for Concrete Road Bridges, IRC, New Delhi

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	1	-	-	1	-	-	1	-	1	1	2
CO2	3	3	3	2	2	-	-	-	2	-	1	-	3
CO3	3	3	3	2	2	-	1	1	2	1	1	-	3
CO4	3	3	3	2	2	-	1	1	2	-	1	-	3
CO5	2	2	1	-	1	1	-	-	1	-	1	1	2

3- High 2- Medium 1-Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	05	05	02	10
K2	Understand	05	05	03	20
K3	Apply	05	05	05	20
K4	Analyze	-	-	-	10
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2, K3**	**K1, K2, K3**	**K2, K3,K4**	**K2, K3,K4**	**K1, K2, K3**
	CO1	CO2	CO3	CO4	CO5
ISEI (15 Marks)	05	10	-	-	-
ISEII (15 Marks)	-	-	08	07	-
ISEIII (10Marks)	01	03	03	02	01
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	18	25	23	21	13

PROGRAM ELECTIVE III CEPEC4001: Ground Water Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/week	**ISEI**	**15 Marks**
Credits: 03	**ISEII**	**15 Marks**
	ISEIII	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: CEPCC3002

Course Description: This course provides a comprehensive understanding of groundwater hydrology, covering fundamental concepts such as aquifer properties, groundwater occurrence, and flow dynamics. It introduces students to well hydraulics, aquifer parameter evaluation through field tests, and modern techniques like MODFLOW and machine learning. The course emphasizes groundwater exploration using remote sensing, GIS, and geophysical methods, alongside sustainable development and management strategies. Topics such as artificial recharge, managed aquifer recharge (MAR), and the use of IoT for real-time monitoring are explored. Legal, institutional, and climate-related aspects of groundwater governance in India are also discussed.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	explain fundamental groundwater concepts, aquifer properties, and the impact of climate change using geospatial tools
CO2	analyze groundwater flow in aquifers using well hydraulics theories and numerical simulation methods like modflow
CO3	identify aquifer parameters through various field-testing methods and apply modern data-driven techniques
CO4	choose suitable groundwater exploration techniques and assess groundwater potential with ground water modeling
CO5	compare suitable ground water development and management methods

Detailed Syllabus:

Unit 1	**Ground Water**: zone of aeration, saturation, soil water, adsorbed water, capillary water, capillary potential, storage coefficients of aquifers, porosity, specific yield, specific retention, unconfined and confined aquifer, fluctuation of water table, Role of remote sensing and GIS in groundwater exploration, ground water potential in India, geophysical methods for groundwater explorations, Impact of climate change on groundwater levels and recharge
Unit 2	**Well Hydraulics**: Darcy's law, permeability and transmissibility, Theim and Dupuit's theory for unconfined and confined aquifers. Groundwater flow potential,

	Ground water theory for one, two and three-dimensional problem, Application of MODFLOW in groundwater flow simulations, Differential equations governing groundwater flow for steady and unsteady state problems, overview of finite element and analytical element methods
Unit 3	**Evaluation of Aquifer Properties**: Aquifer tests control well, observation well, measurement during test, Theism's method, Jacob and Chow's method of determination of aquifer parameters, Slug test and step-drawdown tests (for field- level testing of aquifer parameters). Theism's recovery method, bounded aquifer, interference among wells, Image well theory and its application in groundwater flow, recent advances in machine learning applications for aquifer parameter prediction
Unit 4	**Drilling of Wells and Ground Water Modeling**: Groundwater well losses, water well design and well drilling: well screen, development and completion of wells, Rotary drilling and Rotary percussion drilling, maintenance of wells. Introduction to Groundwater Modeling: MODFLOW, Visual MODFLOW. Calibration and validation of groundwater models, Uncertainty and sensitivity analysis in groundwater models
Unit 5	**Groundwater Development and Management**: Conjunctive use, artificial recharge of groundwater-different methods, subsurface dam, wastewater recharge, recharge by urban storm runoff, ground water storage changes, percolation from tanks, recharge from irrigated fields, dating of ground water, estimation of ground water discharge, ground water resource evaluation in India, Integrated Water Resources Management (IWRM) concepts with groundwater focus, Managed Aquifer Recharge (MAR), Legal and institutional aspects of groundwater governance in India, Nitrate and fluoride contamination in groundwater– causes and remediation, Emphasize use of IoT and sensors for real-time groundwater monitoring

Text and Reference Books

1. Todd, D. K. and Mays, L. W**.** "Groundwater Hydrology" 3rd Edition, John Wiley & Sons, Singapore,2011
2. Raghunath, H. M**.** *Ground Water*. 3rd Edition, New Age International (P) Ltd., New Delhi, 2007
3. Karanth, K. R. Ground Water Assessment, Development and Management. Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1987
4. Domenico, P. A. "Concepts and Models in Groundwater Hydrology" McGraw-Hill Inc., New York, 1972
5. Hamill, L. and Bell, F. G**.** "Groundwater Resource Development" Butterworth-Heinemann (Elsevier), London, 2014**.**
6. Wang, H. F. and Anderson, M. P. "Introduction to Groundwater Modeling" W. H. Freeman and Company, New York, 1982

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	-	2	3	2	-	-	-	-	2	1	-
CO2	3	3	2	3	3	-	-	-	-	-	2	2	-
CO3	3	3	2	3	3	-	-	-	-	-	2	1	-
CO4	3	3	3	2	3	-	-	-	-	-	2	2	-
CO5	2	2	3	2	2	3	2	-	-	2	2	2	-

3- High 2- Medium 1- Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	5	5	3	20
K2	Understand	5	5	2	20
K3	Apply	5	5	5	20
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3
	CO1	CO2	CO3	CO4	CO5
ISEI(15 Marks)	7	8	-	-	-
ISEII (15 Marks)	-	-	8	7	-
ISEIII (10Marks)	2	2	2	2	2
ESE Assessment (60Marks)	12	12	12	12	12
TotalMarks100	21	22	22	21	14

PROGRAM ELECTIVE III CEPEC4002: Water Power Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures:03hrs/week	**ISE I**	**15 Marks**
Credits:03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: CEPCC3005, CEPCC2002

Course Description: This course introduces the principles and practices of hydropower engineering and water power utilization, covering energy needs, environmental aspects, reservoir sedimentation, and management strategies. It explores hydropower development methods (storage, pump storage, run-of-river), hydrological analysis (stream gauging, rainfall–runoff, flood estimation), and the planning and operation of multipurpose projects. Course also includes the design and operation of hydroelectric project components such as intakes, penstocks, surge tanks, spillways, forebays, turbines, valves, gates, and powerhouses. The course also covers pumps, turbines, water hammer, and surge analysis**,** along with an introduction to tidal power development. Emphasis is also given to policy, electricity regulations, and management of hydropower plants for sustainable water and energy resources.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcomes
CO1	explain the principles, energy needs, and environmental aspects of hydropower development.
CO2	apply hydrological methods for stream gauging, runoff estimation, and flood prediction in hydropower design
CO3	analyze major hydropower components including turbines, penstocks, and spillways.
CO4	design surge tanks, valves, and power house layouts for safe and efficient operation.
CO5	discuss the working principles of pumps and tidal power generation systems

Detailed Syllabus:

Unit 1	**Water Power Development & Policy** - Development and principles of water power utilization, energy needs, environmental aspects, reservoir sedimentation, capacity loss, and management strategies. Basics of water power development, storage power development, pump storage power development, river power development, water policy, hydropower policy.
Unit 2	**Hydrology and Hydropower Project Management**- Methods for stream gauging, rainfall, runoff and its estimation by different methods, peak flood estimation. Multipurpose of hydro project sandit's types, operation and maintenance, management of hydropower plants. Principal components of hydroelectric projects. Storage and benefits from storage, Electricity act and electricity regulations.

Unit 3	**Hydraulic Structures and Turbines –** Intake structures, penstocks, surge tanks, cross drainage works, balancing reservoir, spillway, and forebay. Turbines over view classification, characteristics curves, Francis & Kaplan turbines, selection criteria, and draft tubes. Design salient dimensions, number of units, turbine sizing, and efficiency considerations.
Unit 4	**Water Hammer, Surge Tanks & Powerhouse Engineering**-Valves, gates, water hammer, and surge in power tunnels design of surge tanks, Concepts, applications, and planning aspects. Powerhouse engineering – layout, building & machine foundations, underground powerhouse - advantages and limitations.
Unit 5	**Water Hammer, Surge Tanks & Powerhouse Engineering**-Valves, gates, water hammer, and surge in power tunnels design of surge tanks, Concepts, applications, and planning aspects. Powerhouse engineering – layout, building & machine foundations, underground powerhouse - advantages and limitations.

Text and Reference Books

1. Water Power Engineering – **B.C. Punmia, B.B. Pande, Ashok Kumar Jain, Arun Kumar Jain –2016**
2. Hydro Power Development – **Satya Narayan Choudhury –2004**
3. Bare Act Publication – **Electricity Act & Policies (India) –Latest Edition (2003 with amendments)**
4. Water Power Engineering – **M.M. Dandekar & K.N. Sharma –2013**
5. Water Power Development – **E. Mosonyi –1991**
6. Water Power Engineering – **B.C. Punmia et al. –2016**
7. Turbines and Pumps **Jagdish Lal– 2010**
8. Water and Energy Management in India – **K. Subramanya –2008**
9. Electricity Act (2003) and Dam Safety Act, 2021
10. Water and Energy Management in India (2021) — Springer
11. Hydroelectric Power (2024) — MDPI

Mapping of Course outcome with Program Outcomes and Program Specific Outcome

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	1	1	-	1	-	-	-	1	-	2	2	-
CO2	3	1	-	-	2	2	-	-	1	-	2	3	-
CO3	2	1	1	2	2	-	-	-	1	-	2	2	-
CO4	3	1	2	2	2	-	-	1	3	-	2	3	-
CO5	3	1	2	-	2	2	-	1	-	2	2	3	-

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3 – High 2 – Medium 1-Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	05	05	05	20
K2	Understand	05	05	05	20
K3	Apply	05	05	-	20
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
Total Marks100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3
	CO1	CO2	CO3	CO4	CO5
ISEI(15 Marks)	07	08	-	-	-
ISEII (15 Marks)	-	-	08	07	-
ISEIII (10Marks)	02	02	02	02	02
ESE Assessment (60Marks)	12	12	12	12	12
Total Marks 100	21	22	22	21	14

PROGRAM ELECTIVE III AMPEC4002: Design of Advanced RC Structures		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs / week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: AMESC1001, AMPCC2001, AMPCC2003, AMPCC3004.

Course description: This course offers civil Engineering students an opportunity to design special types of RC Structures.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcomes
CO1	analyze the structural behavior of RC normal and deep beams under torsion, flexure, shear, and deflection
CO2	analyze and design of flat slabs and circular slabs
CO3	analyze and design of shallow foundations
CO4	analyze and design of deep foundations
CO5	analyze and design of water tanks

Detailed Syllabus:

Unit 1	**Behavior of RC Beams Subjected to torsion:** Design of RC beams under flexure, shear and torsion: Design of RC framed structures, Deflection of RC beams and structural cracks in RC members **Design of deep beams** Deep beam requirements as per IS provisions, Analysis and design of deep beam, Applications
Unit 2	**Analysis and Design of flat Slab and circular slab** Flat Slab: Introduction, proportioning of flat slab, Determination of bending moment by direct method, slab reinforcement detail, Design for punching shear. Circular Slab: Introduction, Design principles of circular slabs. Determination of bending moment, Determination of critical section for checking shear
Unit 3	**Design of Shallow Foundations:** Classification of foundations: Shallow and Deep Foundations. Types and design of shallow foundations: Combined Footings, Strip Footings, Raft, annular raft foundations
Unit 4	**Design of Deep Foundations:** Introduction to Deep Foundations, Design of Piles, piles in group, under-reamed piles, design of pile cap. Introduction to design of Caission and Well Foundation,

	method of construction
Unit 5	**Design of Water Tanks:** Types of water tanks, Design requirements, Design of circular, rectangular water tanks on ground and underground. Introduction to various loads and forces for design of container and staging for elevated water tanks. Reinforcement detailing as per IS 13920.

Text Books

1. **N. Krishna Raju** — Advanced Reinforced Concrete Design (IS : 456-2000) — 3rd edition, 2016— CBS Publishers & Distributors Pvt. Ltd, New Delhi
2. **S. Unnikrishna Pillai & Devdas Menon** — Reinforced Concrete Design — 4th Edition, 2021 (published Oct 2021) — McGraw Hill Education (India).
3. **Dr. H. J. Shah** — Reinforced Concrete Design, Vol. I & II — 8th edition, 2023 — Charotar Publishing House / Charotar Publishing Pvt. Ltd., Anand (Gujarat).
4. **S. S. Bhavikatti** — Advance R.C.C. Design (R.C.C. Vol. II) — (multiple editions / 2016 and later — New Age International (P) Ltd., New Delhi.
5. **B. C. Punmia, Ashok K. Jain & Arun K. Jain** — Reinforced Concrete Structures, Vol. II — 5th Edition,— 2015— Laxmi Publications ,New Delhi.

Reference Books

1. **S. Ramamrutham & R. Narayanan** — *Design of Reinforced Concrete Structures* — **reprint** (latest editions) — **2011**— Dhanpat Rai Publishing Company, New Delhi.
2. **P. C. Varghese** — *Advanced Reinforced Concrete Design* — **2nd Edition** — **2005** — Prentice-Hall of India Pvt. Ltd., New Delhi.
3. **N. C. Sinha & S. K. Roy** — *Fundamentals of Reinforced Concrete* — **(standard paperback edition / reprint)** — **2007** — S. Chand & Co. Ltd., New Delhi.

Indian Standards

1. IS: 456-2000, Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.
2. IS 1893 (Part 1): 2016, Reaffirmed in 2021, Criteria for Earthquake Resistant Design of Structures - Part 1: General Provisions and Buildings, Bureau of Indian Standards, New Delhi.
3. IS 13920: 2016 Reaffirmed in 2021, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice (First Revision), Bureau of Indian Standards, New Delhi.
4. IS: 3370-2021, Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	1	2	1	-	-	-	2	-	2
CO2	3	2	3	1	1	1	1	-	-	-	2	-	3
CO3	3	3	3	2	1	2	1	-	-	1	2	-	2
CO4	3	2	3	2	1	1	1	1	1	-	2	-	3
CO5	3	3	3	2	1	1	1	1	1	1	2	-	3

3- High 2- Medium 1- Low

Assessment:

ISE I: Based on unit I and unit II

ISE II: Based on unit III and IV

ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following,

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	-	-	-	-
K2	Understand	05	05	-	10
K3	Apply	05	05	05	25
K4	Analyze	05	05	05	25
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

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

PROGRAM ELECTIVE III CEPEC4003: Solid Waste Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/ week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Nil

Course description: This course provides an in-depth understanding of the principles, regulations, and technologies involved in the management of municipal, hazardous, electronic (E-waste), and radioactive wastes. It emphasizes the legal framework, waste characterization, environmental risk assessment, and a range of treatment and disposal technologies, including physicochemical, biological, and engineering approaches such as landfill design. Students will develop competencies to plan and implement integrated solid waste management systems ensuring environmental sustainability, resource recovery, and compliance with regulatory standards.

Course Outcomes:

After completing the course, students will able to:

	Course Outcomes
CO1	explain the sources, classification, and characteristics of municipal, hazardous, electronic, and radioactive wastes along with relevant national and international regulations.
CO2	explain the environmental and health risks associated with solid, hazardous, and electronic wastes, including pathways, fate, and toxicity.
CO3	select & apply appropriate physicochemical, biological, and engineering treatment technologies for municipal, hazardous, and E-waste streams.
CO4	design sanitary, hazardous, and secured landfills including leachate collection, cover systems, and environmental safeguards for integrated disposal.
CO5	apply integrated solid waste management strategies considering recycling, E-waste recovery, energy generation, and environmental sustainability.

Detailed Syllabus:

Unit 1	**Regulatory Framework & Fundamentals of Solid Waste** **Overview of regulations:** Municipal Solid Waste (Management & Handling) Rules, Hazardous Waste Rules, Biomedical Waste Rules, Flyash Rules, Plastic Waste Rules, Batteries Rules, and E-Waste Management Rules (2016, amended 2022). •**Fundamentals of MSW:** Sources, generation rates, composition, collection, separation, transfer, transport. •**Waste treatment and disposal options overview.**
Unit 2	**Hazardous, Radioactive & Electronic Waste — Characterization & Risk** • **Hazardous Waste:** Chemical compatibility, flammability, reactivity, environmental fate, transport mechanisms, and health impacts. • **Radioactive Waste:** Sources, types, health effects, generation from nuclear facilities, and disposal strategies.

	• **E-Waste:** Sources and composition (consumer electronics, IT equipment, etc.), Toxic constituents (Pb, Cd, Hg, Cr, PCBs), Collection, segregation, and recycling challenges, Environmental and health impacts of informal recycling, Environmental Risk Assessment: Definition, frameworks, methodologies, and case studies**.**
Unit 3	**Treatment Technologies — Physicochemical Methods** **Treatment of solid and hazardous waste:** Combustion, stabilization, solidification, soil vapour extraction, air stripping, chemical oxidation. **E-Waste Recycling Technologies:** Dismantling, material recovery (precious metals, plastics), hydrometallurgical and pyrometallurgical processes, Extended Producer Responsibility (EPR) and sustainable recycling practices, Groundwater contamination control and remediation techniques..
Unit 4	**Biological Treatment & Landfill Design** **Biological treatment approaches:** Composting, anaerobic digestion, bioreactors, toxic waste biodegradation, co-metabolism, oxidative/reductive processes. **Landfill engineering and design:** Sanitary and hazardous landfills, leachate collection, cover systems, landfill-incineration integration, Secured Landfills for E-waste residues (slag, ash, and toxic metal residues).
Unit 5	**Integrated Waste Management & Life-Cycle Considerations** **Integrated Waste Management:** Cohesive planning that combines collection, segregation, treatment, recycling, recovery, and safe disposal. **Circular economy and E-Waste recovery chain:** refurbishment, reuse, product stewardship, Life-cycle assessment (LCA), environmental trade-offs, and optimization, Role of technology, economics, and policy in achieving sustainability.

Text and Reference Books

1. Tchobanoglous, G., Theisen, H., & Vigil, S. (2014). Integrated Solid Waste Management: Engineering Principles and Management Issues. McGraw-Hill.
2. LaGrega, M.D., Buckingham, P.L., & Evans, J.C. (2010). Hazardous Waste Management. McGraw-Hill.
3. Pichtel, J. (2014). Waste Management Practices: Municipal, Hazardous, and Industrial. CRC Press.
4. Peavy, H.S., Rowe, D.R., & Tchobanoglous, G. (1985). Environmental Engineering. McGraw-Hill.
5. Christensen, T.H. (2011). Solid Waste Technology & Management. Wiley-Blackwell.
6. Kumar, S. & Dixit, S. (2021). E-Waste Management: Sustainable Approaches and Regulations. Springer International publication.
7. MoEFCC. (2022). E-Waste (Management) Rules, 2022. Government of India.
8. Kumar et al. (2023) – Municipal Solid Waste Management, Springer International publication.
9. Forsberg (2022) – Radioactive Waste Management and Cleanup, Woodhead publication
10. Agarwal & Pratap (2023) – E-Waste Recycling, CRC Press (Taylor & Francis group)
11. Thorne & Akindoyo (2023) – Circular Economy in Solid Waste Management, Springer Chan (Springer Nature Switzerland AG) Publication
12. Datta, Raje & Dewoolkar (2022) - book titled Landfill Design & Operation, Springer Newyork (Science & Business Media) Publication

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	-	-	-	3	2	-	1	-	2	-	-
CO2	3	3	2	3	-	3	2	1	1	1	2	1	-
CO3	3	3	3	2	3	2	2	-	2	2	2	1	-
CO4	3	2	3	2	3	2	-	1	2	1	2	1	-
CO5	3	3	3	2	3	3	3	2	3	3	3	2	-

3 – High 2 – Medium 1 - Low

Assessment:
ISEI: Shall be based on Unit-I and Unit-II
ISEII: Shall be based on Unit-III and Unit-IV
ISE-III: Teachers Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. 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	3	20
K2	Understand	5	5	2	20
K3	Apply	5	5	5	20
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1 to K3	K1 to K3	K1 to K3	K1 to K3	K1 to K3
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8	-	-	-
ISE II (15 Marks)	-	-	7	8	-
ISE III (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

PROGRAM ELECTIVE III CEPEC4004: Construction Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/ week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisite- Nil

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 above said aspects which are useful to civil engineer to perform and complete the project successfully.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	explain the importance of Constriction Management in Civil Engineering
CO2	carry out planning, scheduling and controlling the Construction activities
CO3	optimize the resources required for construction project such as manpower, machinery, and materials.
CO4	carry out financial planning, cash flow analysis, and site safety protocols
CO5	explain and implement of labor laws, risk mitigation strategies on-site. etc.

Detailed Syllabus:

Unit 1	**Introduction to Construction Management**-, necessity, different application of management function, science behind the concept, key element of construction management, Construction manager: Role, Qualities, Ethics, Duties, Responsibilities, Authorities. Stakeholders of a project. Engineering economy in construction projects. Tools for time management and function of work breakdown structure.

Unit 2	**Construction Scheduling and Network Analysis** Construction scheduling: Network analysis, bar charts, Programme Evaluation and

	Review Techniques (PERT) and Critical Path method(CPM). Fundamental network crashing in network analysis. Site layout planning. Time-cost relationship and application of linear programming. Introduction of different software like Procore, PlanGrid, Primavera etc.
Unit 3	**Resource and Financial Management** Introduction, resources smoothing, resources levelling, 4-M's in Construction Organizing for construction, Organization- principles. Types of organization structures. Material Management, role of material manager. Inventory Control-Necessity, Techniques, ABC analysis, Lead-time, safety stocks, procurement strategies. Introduction to financial management, and its necessity.
Unit 4	**Construction equipment-** Time and motion study, Suitability of Use, Factors affecting Selection, Calculation of Output estimation and economics of equipment, types of equipment like Earth moving, hauling equipment, hoisting equipment, Concrete Mixers, Cranes, Road Construction Equipment etc. Useful life estimation of equipment. Productivity analysis. Safety Engineering- equipment, use, safety laws, accident prevention, PPE standards, safety engineer.
Unit 5	**Management Information System (MIS)** Legal Aspect and Laws Applicable to Construction Industry: Works contract act, Child labour act, Workman's compensation Act, Employees provided fund Act 1952, Minimum wages Act, Payment of bonus Act 1965 Risk Management: Introduction–Principal-Types, Origin, Costs of Risks. Risk Control –Role of Risk Manager in construction. Application of MIS: System Development, Data processing, Flow charting, DBM, Data Communication System, Developments, Data processing.

Text and Reference Books

1. Dr. S. Seetharaman "Construction Engineering and Management", 5th Edition, Umesh Pub., (2014)
2. Peurify, Schexnayder, Shapira, "Construction Planning, Equipment and Methods", Tata Mc Graw-Hill Publication 10th Edition, (2002).
3. Sandra Christensen Weber, "Scheduling Construction Projects-Principles and Practices", 5th Edition, Pearson Publication, (1997).
4. L. S. Srinath, Affiliated East- West, 'PERT and CPM-Principles and Applications', 3rd Edition, Press Pvt. Ltd Publication, (1995).
5. S. C. Sharma, "Construction Equipment and its Management", 6th Edition, Khanna Publishers

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B.Tech. Civil Engineering Curriculum
With effect from Academic Year 2026–2027
Approved in the 32nd Academic Council Meeting, dated 28th July 2026

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	-	-	2	2	-	-	2	3	-	2	-
CO2	3	3	-	3	2	2	2	-	3	3	2	1	-
CO3	3	3	3	2	-	-	-	3	2	3	-	2	-
CO4	3	3	-	-	3	3	2	3	1	3	2	1	-
CO5	2	2	1	1	2	1	3	1	1	-	-	1	-

3- High 2- Medium 1- Low

Assessment:

ISE I: Based on unit I and unit II

ISE II: Based on unit III and IV

ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	7	-	4	20
K2	Understand	8	7	3	20
K3	Apply	-	8	3	20
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

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

PROGRAM ELECTIVE III APMPEC4003: Lab – Design of Bridges		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
CO1	plan structural details of components of RC or PSC highway bridges
CO2	analyze and design different types of highway bridge using IRC provisions
CO3	draw detailed drawings of the designed highway bridges

List of the Experiments

The students, shall perform following experiments:

Sr. No.	**Title of the Experiments**
1	Analysis and Design of single/multiple span RC bridge (at least one example) and compare the results using any software
2	Analysis and Design of single/multiple span PSC bridge (at least one example) and compare the results using any software.
3	Prepare the design basis report (DBR) and the professional working drawing of designed bridges.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2	3	1	3	2	1	3	2	1	-	2	-	3
CO2	3	3	3	3	2	3	1	2	1	1	2	-	3
CO3	2	-	-	1	-	3	1	2	1	2	2	-	3

3– High 2 – Medium 1-Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEIII	End Semester Examination
S1	Imitation	01	01
S2	Manipulation	05	05
S3	Precision	09	09
S4	Articulation	10	10
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3	S2, S3, S4	S2, S3, S4
ISEIII:(25 Marks)	5	12	8
ESE Assessment (25 Marks)	8	9	8
Total Marks(50)	13	21	16

PROGRAM ELECTIVE III CEPEC4005: Lab –Ground Water Engineering		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
CO1	solve steady and unsteady groundwater flow problems using differential equations and analytical methods.
CO2	determine aquifer parameters and hydraulic conductivity using Thiem's, Dupuit's, and other field testing methods.
CO3	assess groundwater potential through case studies, including legislation, well design, artificial recharge, and conjunctive use.

List of the Experiments:

The student shall perform minimum eight experiments of the following:

Sr. No.	**Title of the Experiments**
1	Writing a brief report on ground water potential of a region/ state/India
2	Compute hydraulic conductivity by Thiem's and Dupuit's theory from the given data
3	Solutions to problems based on differential equations governing groundwater flow for Steady and unsteady state
4	Determination of aquifer parameters by Thies's method/Jacob method /Chow's Method
5	Solutions to problems based on interference among wells
6	Solutions to problems based on water well design
7	Case study based on groundwater models
8	Case study based on conjunctive use or artificial recharge of groundwater
9	Solutions to problems based on ground water resource evaluation in India

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	-	-	-	2	2	-	2	-	-	2	2	-
CO2	3	2	2	3	-	-	-	-	-	-	3	3	-
CO3	3	2	3	3	2	-	-	-	-	-	3	3	-

3 – High 2 – Medium 1-Low

Assessment:
ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.
ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEIII	End Semester Examination
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation		
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3	S1, S2, S3	S1, S2, S3
ISEIII: (25 Marks)	7	11	7
ESE Assessment (25 Marks)	8	9	8
Total Marks(50)	15	20	15

PROGRAM ELECTIVE III CEPEC4006: Lab–Water Power Engineering		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
CO1	analyze ground water flow in aquifers using well hydraulics theories and numerical simulation methods like MODFLOW
CO2	identify aquifer parameters through data available from various field testing methods and apply modern data-driven techniques
CO3	choose suitable ground water exploration techniques and assess ground water potential with ground water modeling.

List of the Experiments

The student shall perform minimum eight experiments of the following:

Sr.No.	Title of the Experiments
1	To Study Impact Of Policies On Hydropower Capacity.
2	To Determine River Discharge Using Velocity–Area Method (Stream Gauging And Discharge Measurement)
3	Determination Of Efficiency Of Hydraulic Jump And Evaluation Of Energy Loss.
4	Study Of Sedimentation Impact On Reservoir Storage
5	Design Flood Estimation. (Empirical Formulae, Frequency Analysis)
6	Prepare A Surface / Underground Powerhouse Layout For A Hydropower Project
7	Study Of Surge Tank And Water Hammer Phenomenon Using A Hydraulic Model
8	Study Of Estimate Tidal Energy.
9	Design Exercise On Penstock Or turbine Selection Using Given Site Data.
10	Field Visit To A Hydropower Plant And Preparation Of Technical Report.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	-	-	-	2	2	-	2	-	-	2	2	-
CO2	3	2	2	3	-	-	-	-	-	-	3	3	-
CO3	3	2	3	3	2	-	-	-	-	-	3	3	-

3 – High 2 – Medium 1-Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE III**	**End Semester Examination**
S1	Imitation	5	5
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	-	-
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	**CO1**	**CO2**	**CO3**
	S1, S2, S3	S1, S2, S3	S1, S2, S3
ISEIII:(25 Marks)	7	11	7
ESE Assessment (25 Marks)	8	9	8
Total Marks(50)	15	20	15

PROGRAM ELECTIVE III AMPEC4004: Lab –Design of Advanced RC Structures		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
CO1	interpret the behavior of RC Beams subjected to torsion.
CO2	analysis and Design of structures as mentioned in AMPEC4004: Advance Design of RC Structure course viz. Deep Beam, flat slab, circular slab, combined footing/Raft foundations, piles and pile cap, water tank.
CO3	draw relevant drawing of the RC structures.

TERM WORK

Term work shall consist of a design report containing problem statement followed by analysis, design and reinforcement detailing of RC structures mentioned as below.

Sr. No.	**Title of the Experiments**
1	Analysis, design and reinforcement detailing of Beam subjected Torsion
2	Analysis, design and reinforcement detailing of Deep Beam
3	Analysis, design and reinforcement detailing of Flat slab/ circular slab
4	Analysis, design and reinforcement detailing of Combined footing/ Raft Foundation
5	Analysis, design and reinforcement detailing of Piles and Pile cap

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	1	2	1	-	-	-	2	-	2
CO2	3	2	3	1	1	1	1	-	-	-	2	-	3
CO3	3	3	3	2	1	2	1	-	-	1	2	-	2

3 – High 2 – Medium 1 – Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	End Semester Examination
S1	Imitation	01	01
S2	Manipulation	05	05
S3	Precision	09	09
S4	Articulation	10	10
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3, S4	S1, S2, S3, S4	S1, S2, S3, S4
ISE III: (25 Marks)	7	11	7
ESE Assessment (25 Marks)	8	9	8
Total Marks (50)	15	20	15

PROGRAM ELECTIVE III CEPEC4007: Lab - Solid Waste Management		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Examination**	**25 Marks**

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

	Course Outcome
CO1	perform physical, chemical, and biological characterization of municipal and hazardous solid wastes through standard laboratory procedures.
CO2	analyze experimental, field, and simulated data to assess treatment feasibility, environmental impacts, and compliance with regulatory standards.
CO3	develop and demonstrate small-scale designs, process models, and management strategies for effective solid and hazardous waste handling.

List of Experiments: The student shall perform minimum eight experiments of the following:

Sr. No.	Title of the Experiments
1	Experimental Characterization of Municipal Solid Waste (MSW) by Physical Fractionation.
2	Moisture Content and Proximate Analysis of Waste Samples.
3	Calorific Value Determination for Waste-to-Energy Assessment.
4	Pilot Composting of Organic Fraction and Parameter Monitoring.
5	Laboratory Leaching Column Study to Simulate Landfill Leachate.
6	Toxicity Characteristic Leaching Procedure (TCLP) for Hazardous Samples.
7	Engineering Design and Fabrication of a Scaled Landfill Cell Model.
8	Site Visit and Technical Audit of a Local SWM Facility.
9	Analysis of Collection Routes and Waste Generation Data Using Spreadsheet/Software.
10	Comparative Case Study of MSW Regulations and Preparation of an Integrated Solid Waste Management (ISWM) Plan

Mapping of Course outcome with Program Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	-	-	-	2	2	3	2	3	2	2	1	-
CO2	3	2	-	2	-	2	3	3	2	3	3	1	-
CO3	2	2	3	2	3	2	3	3	2	3	3	-	-

3 – High 2 – Medium 1 – Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.
ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Table:

Assessment Tool	C01,CO2,CO3	C01,CO2,CO3	C01,CO2,CO3
	S1	S2	S3
ISE III: (25 Marks)	5	10	10
ESE Assessment (25 Marks)	10	5	10

Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work	Practical Examination
S1	Imitation	5	10
S2	Manipulation	10	5
S3	Precision	10	10
S4	Articulation	-	-
55	Naturalization	-	-
Total Marks		25	25

PROGRAM ELECTIVE III CEPEC4008: Lab – Construction management		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
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

List of the Experiments

The student shall perform minimum Seven experiments of the following:

Sr. No.	Title of the Experiments
1	Prepare Bar chart/Mile stone chart for construction project.
2	Prepare Planning and Scheduling for given construction project.
3	Prepare network diagram and solve given problem by network techniques.
4	Crash the network based on relevant activities of construction project.
5	Allocate resources of project by resources allocation method.
6	Use of at least one soft computing technique in construction management such as Primavera, MS Project, etc.
7	Solve problem based on benefit – cost ratio.
8	Use any Inventory control method for given project.
9	To visit construction site and study inventory control, safety techniques adopted on construction site.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	1	1	2	-	2	1	1	1	2	2	1	-	-
CO2	1	1	2	1	2	1	1	1	2	2	1	1	-
CO3	-	2	2	-	1	1	-	-	-	-	-	1	-

3 – High 2 – Medium 1

- Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	End Semester Examination
S1	Imitation	15	15
S2	Manipulation	5	5
S3	Precision	5	5
S4	Articulation	-	-
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3	S1, S2, S3	S1, S2, S3
ISE III: (25 Marks)	9	8	8
ESE Assessment (25 Marks)	10	9	6

Total Marks (50)	19	17	14

CEELC4001: RESEARCH METHODOLOGY			
Teaching Scheme		**Evaluation Scheme**	
Theory	2 hrs/week	ISE I	10 marks
Tutorial		ISE II	10 marks
Total Credits	2	ISE III	-
		ESE	30 marks
		Total	50 Marks

Course Description:

1. To guide students from understanding foundational research concepts to critically formulating research problems, culminating in the adept creation of comprehensive research plans and literature reviews.
2. To develop a comprehensive understanding of various research methods, both qualitative and quantitative
3. To facilitate students in analyzing, evaluating, and creating research proposals.
4. To attain mastery in data collection methods, sampling, data analysis techniques, and result interpretation for robust research outcomes.
5. To equip students with the skills to proficiently create and present diverse research reports, encompassing various formats, oral delivery, technical writing, and ethical awareness regarding plagiarism.

Course Outcomes:

After completing the course students will able to

Course Outcomes	
CO1	Explain the fundamental concepts of research methodology, including research design, literature review, and problem formulation.
CO2	Select and apply appropriate qualitative and quantitative research methods, sampling techniques, and data collection tools.
CO3	Develop a basic research proposal with clear objectives and hypotheses, and interpret research findings using appropriate methods.

Detailed Syllabus:

Unit 1	**Introduction to Research Methodology** Meaning and objectives of research, Types and approaches of research, Significance of research, Research methods and methodology, Research process, Characteristics of good research, Identification and formulation of research problems, Research design, Literature review, Development of a research plan

Unit 2	**Research Methods and Data Collection** Qualitative and quantitative research methods, Historical, survey, case study and experimental methods, Sampling techniques, Probability and non-probability sampling, Methods and tools of data collection, Questionnaire, Interview, Observation, Rating scales, Basics of data collection and organization, Research ethics**.**
Unit 3	**Research Proposal and Report Writing** Research proposal and its components, Formulation of research objectives and hypotheses, Data presentation using tables, charts and graphs, Introduction to descriptive statistics, Interpretation of research findings, Technical report writing, Referencing and citation styles, Plagiarism and intellectual property rights (IPR).

Text and Reference Books

1. Garg B. L., Karadia R., Agarwal F. and Agarwal U. K., An introduction to Research Methodology, RBSA Publishers, 2002
2. Kothari C. R., Research Methodology: Methods and Techniques. New Age International, 1990.
3. Merriam S. B., Tisdell E. J., Qualitative Research: A Guide to Design and Implementation, 4th edition, John Wiley & Sons, 2016.
4. Creswell J. W., Research Design: Qualitative, Quantitative and Mixed Methods Approaches, 4th edition, SAGE Publications, Inc, 2014.
5. Olsen C., Devore J., Peck R., Introduction to Statistics and Data Analysis, 5th edition, Brooks/Cole, 2015.
6. Panneerselvam R., Research Methodology, 2nd edition, PHI Learning,

2014.

Teacher's Assessment: Teachers Assessment of 20 marks may be based on one or more of the following

1. Surprise Test
2. Assignment
3. Quiz
4. Any other activity suggested by course coordinator

Mapping of Course Outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO
--CO1	3	2	3	-	-	-
CO2	2	2	2	-	-	-
CO3	2	-	3	1	-	-

3-High, 2- Medium, 1 – Low

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	End Semester Examination
K1	Remember	5	0	10
K2	Understand	5	5	10
K3	Apply	0	5	10
K4	Analyse	0	0	0
K5	Evaluate	0	0	0
	Total Marks	10	10	30

PROGRAM ELECTIVE IV AMPEC4005: Prestressed Concrete Design		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: AMPCC2001, AMPCC2003, AMPCC3004

Course description: This course equips the students to understand the systems, mechanism of prestressing and behavior of Prestressed Concrete element under different loading. The students will be exposed to the analysis and design of Prestressed Concrete structures like beam, slab, pipes, poles, sleepers etc. for flexure and shear with respect to the relevant codal provisions

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	summarize basic principle of prestressing along with its methods and analysis the symmetrical Prestressed Concrete section
CO2	compute the losses in prestressing and sketch the pressure line, thrust line in the Section
CO3	design anchor blocks and design the section for flexure &shear
CO4	design Prestressed Concrete slabs and beams
CO5	analyze and design special types of Prestressed Concrete sections like pipes, poles, sleepers etc.

Detailed Syllabus:

Unit 1	a. Introduction to Prestressed Concrete, basic principles of prestressing, need of high strength steel and concrete, advantages, limitations, pre and post tensioning methods, systems of prestressing b. Analysis of symmetrical Prestressed Concrete sections, effect of cable profile on the analysis of section
Unit 2	a. Study and computation of losses in pre and post tensioning b. Concepts of cracking moment, kern line, pressure line and thrust line etc. for Prestressed Concrete section
Unit 3	a. Design of anchor blocks by Guyon's method, Magnel's method and Indian Standard Code method b. Design of Prestressed Concrete section for flexure and shear
Unit 4	a. Design of Prestressed Concrete beams b. Design of Prestressed Concrete slabs

Unit 5	Analysis of special types of Prestressed Concrete Structures like non-cylindrical PSC pipes, poles, sleepers and water tanks etc.

Text Books

1. **Krishna Raju N**. 'Prestressed Concrete', Tata McGraw Hill Publications, New Delhi. Seventh edition 2025
2. **Rajagopalan N**, 'Prestressed Concrete', Alpha Science, Narosa publishing house Second edition 2010, reprint 2017
3. **Ramaswamy G. S.**, 'Modern Prestressed Concrete Design', Tata McGraw-Hill Education, New Delhi. Edition 2010
4. **Mallic S. K. and Gupta A. P.,** 'Prestressed Concrete' Oxford and IBH publishing Company Pvt. Ltd. Edition 1983
5. IS 1343- 2012, 'Code of Practice for Prestressed Concrete, Bureau of Indian Standard, New Delhi.'
6. IS 784-2019, 'Prestressed Concrete Pipes (Including Specials) — Specification'

Reference Books

1. **Lin T. Y**. 'Design of Prestressed Concrete Structures', Third Edition 1981, Wiley India Pvt. Ltd., New Delhi
2. **David A Sheppard, William R. and Philips**, 'Plant cast Precast and Prestressed Concrete- a Design Guide', McGraw Hill, New Delhi. Edition 1989

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	3	-	-	-	-	1	2	-	2	-	2
CO2	3	2	3	1	1	2	1	1	1	-	2	-	2
CO3	3	3	3	2	2	1	1	1	1	-	2	-	3
CO4	3	3	3	1	1	1	1	1	2	-	2	-	3
CO5	3	3	3	-	1	2	2	1	1	-	2	-	3

3 – High 2 – Medium 1 - Low

Assessment:

ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable

3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	-	-	02	05
K2	Understand	05	02	02	10
K3	Apply	10	07	06	25
K4	Analyze	-	06	-	20
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2, K3	K2, K3	K2, K3, K4	K2, K3, K4	K2, K3, K4
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
ISE I (15 Marks)	07	08	-	-	-
ISE II (15 Marks)	-	-	08	07	-
ISE III (10 Marks)	01	02	02	02	03
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks (100 Marks)	20	22	22	21	15

PROGRAM ELECTIVE IV CEPEC4009: Industrial Waste Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/ week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: CEPCC2006

Course Description: This specialized course explores advanced methods for treating industrial wastewater areas often not emphasized in conventional wastewater treatment curricula. Key topics includes Removal of heavy metals, Adsorption techniques, Ion exchange processes, Membrane technologies, Advanced oxidation processes (AOPs). It is designed to equip learners with the understanding and tools essential for addressing various industrial effluent challenges.

Course Outcomes:

After completing the course, students will able to:

	Course Outcomes
CO1	explain and characterize industrial wastewater, including its environmental impacts.
CO2	explain and apply physical–chemical treatment mechanisms such as adsorption and ion exchange.
CO3	compare and critically assess membrane processes and advanced oxidation technologies for complex pollutant removal.
CO4	design treatment strategies for heavy metal removal, incorporating AOPs and membrane applications.
CO5	apply integrated wastewater treatment solutions for diverse industrial scenarios using state-of-the-art techniques.

Detailed Syllabus:

Unit 1	**Fundamentals of Industrial Wastewater** Sources and characteristics of industrial wastewater, Environmental impacts of untreated discharge, Wastewater management strategies: volume reduction, neutralization, equalization, proportioning.
Unit 2	**Physical–Chemical Treatment Technologies** Adsorption methods (activated carbon, etc.), Ion exchange processes, Gas transfer and air stripping (e.g., ammonia removal).
Unit 3	**Advanced Treatment Processes** Advanced oxidation processes (AOPs), Membrane technologies (microfiltration, ultrafiltration, etc.), Coagulation, precipitation, and heavy-metal removal, Sludge handling, disposal, and "Zero Pollution" industrial complexes.

Unit 4	**Industry-Specific Wastewater Treatment—Group I** Distillery and dairy wastewater treatment, Tannery and pulp & paper industry effluent processing, Textile, dye, and fertilizer industry wastewater management.
Unit 5	**Industry-Specific Wastewater Treatment—Group II** Refinery and iron & steel (coke ovens) wastewater treatment, Pharmaceutical industry effluent strategies, Mine wastewater, acid mine drainage, and coal water treatment.

Text and Reference Books

1. Metcalf & Eddy – Wastewater Engineering: Treatment and Reuse, 4th Edition, Tata McGraw Hill, 2017.
2. M.N. Rao & A.K. Dutta – Wastewater Treatment, Oxford & IBH Publishing Co. Pvt. Ltd., Revised edition 2018.
3. Peavy, Rowe & Tchobanoglous – Environmental Engineering, McGraw-Hill Education, 1985.
4. Eckenfelder, W.W. – Industrial Water Pollution Control, 3rd Edition, McGraw-Hill, 3rd edition 2017.
5. Sawyer, C.N., McCarty, P.L., and Parkin, G.F. – Chemistry for Environmental Engineering and Science, McGraw-Hill, 2003

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PSO 1	PSO 2
CO1	2	2	-	-	-	3	2	1	1	1	2	-	-
CO2	2	3	2	3	2	2	2	-	-	1	2	1	-
CO3	3	3	3	2	3	2	-	1	2	2	2	1	-
CO4	3	2	3	2	3	2	-	-	2	1	2	1	-
CO5	3	3	3	2	2	3	2	2	3	3	3	-	-

3 – High 2 – Medium 1 - Low

Assessment:

ISE I: Based on unit I and unit II

ISE II: Based on unit III and IV

ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. 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	3	20
K2	Understand	5	5	2	20
K3	Apply	5	5	5	20
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1 to K3	K1 to K3	K1 to K3	K1 to K3	K1 to K3
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	7	8	-	-	-
ISE II (15 Marks)	-	-	7	8	-
ISE III (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

Reference IIT-ISM Dhanbad
[onlinecourses.nptel.ac.in/noc24_ce53/preview]

PROGRAM ELECTIVE IV CEPEC4010: Infrastructural Development		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/ week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Nil

Course Description:

This course introduces students to the planning, design, and implementation of infrastructure systems essential for sustainable urban and regional development. It covers various sectors such as transportation, water supply, sanitation, energy, and solid waste management. The course emphasizes integrated planning, stakeholder engagement, and long-term asset management strategies. Students will learn to assess infrastructure needs, prioritize investments, and align projects with socio-economic and environmental goals.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	explain the concept and importance of Urban Infrastructure.
CO2	apply financial structures, risk allocation mechanisms, and performance indicators in PPP projects.
CO3	discuss environmental, social, and economic impacts of infrastructure projects using standard assessment techniques.
CO4	explain the role of the public and private sectors in infrastructure planning and development and describe the principles, models, and structures of Public–Private Partnerships (PPPs).
CO5	assess the role of risk analysis, mitigation strategies, and legal frameworks in project financing.

Detailed Syllabus:

Unit 1	Basic Concepts Related to Infrastructure scenario in India, Data required for provision & planning of Urban Infrastructure, Types, Significance, impact on urban form, norms and financial aspects, tools and technology (GIS and BIM) in urban infrastructure, public, private, infrastructure policy
Unit 2	Financing of infrastructure projects, Risk assessment and management in infrastructure finance, financial modeling and cost-benefit analysis (CBA), Maintenance of Infrastructure, Importance, types, Maintenance planning and scheduling, Asset management systems and tools (GIS, BIM, CMMS)

Unit 3	Infrastructure planning, types of infrastructure assets, stages in infrastructure project developing, Stakeholders and regulatory bodies in infrastructure projects. Infrastructure Asset Creation, Project lifecycle, Procurement methods, Quality assurance and quality control in construction. Environmental impact assessment. Sustainable Infrastructure Development.
Unit 4	Private Sector Participation in Infrastructure, Need, Public-Private Partnership (PPP), Evolution and definition of PPP, Characteristics and principles, Models of PPP, Indian policies on PPP, Life cycle of PPP, risk identification and allocation, Performance monitoring and dispute resolution, Case Studies on PPPs in India.
Unit 5	Risk in Infrastructure planning and development, Introduction, Types and Sources of risk, Risk assessment Methods, Risk Mitigation and allocation, Risk in large infrastructure projects. Challenges in construction and maintenance in infrastructure projects.

Text and Reference Books

1. "Urban infrastructure: Finance and Management", R. R. Krishnamurthy, 1st Edition 2010, New Century Publications, New Delhi
2. "Infrastructure Finance" , Neil S. Grigg , 1st Edition 2010, John Wiley & Sons, Inc. (Wiley-Blackwell)
3. "Sustainable urban and regional infrastructure development: technologies, application, and management", Yigitcanlar, Global publishing company, 2010
4. "Environmental Impact Assessment', Tony Grahame, 1st Edition, 2003, McGraw-Hill Education, New Delhi India
5. "Infrastructure Planning Handbook: Planning Engineering and Economics''- Alvin S. 2nd Edition, 2006, McGraw-Hill Education, New York, USA.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PSO 1	PSO 2
CO1	2	1	1	-	1	-	-	-	1	-	2	2	-
CO2	3	1	-	-	2	2	-	-	1	-	2	3	-
CO3	2	1	1	2	2	-	-	-	1	-	2	2	-
CO4	3	1	2	2	2	-	-	1	3	-	2	3	-
CO5	3	1	2	-	2	2	-	1	-	2	2	3	-

3 – High 2 – Medium 1 - Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

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

Assessment table:

Assessment Tool	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	07	08	-	-	-
ISE II (15 Marks)	-	-	08	07	-
ISE III (10 Marks)	02	02	02	02	02
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	19	22	22	21	14

PROGRAM ELECTIVE IV CEPEC4011: Advanced Geotechnical Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/week	**ISEI**	**15 Marks**
Credits: 03	**ISEII**	**15 Marks**
	ISEIII	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: CEPC3001

Course description: This course delves into advanced topics in geotechnical engineering, building upon fundamental principles to address analysis, and design challenges in soil mechanics and foundation design. It's designed for a deeper understanding of ground mechanics and its applications in civil infrastructure.

Course Outcomes:
After successful completion, students will be able to:

	Course Outcome
CO1	explain various methods of soil exploration and ground improvement techniques.
CO2	determine the stress developed in soil mass due to different types of surface loading and resulting settlements
CO3	determine earth pressure on retaining walls for different soil and site conditions and carry out stability analysis of retaining walls.
CO4	determine stress in soil and carryout slope stability analysis for various field situations
CO5	carry out analysis and design of pile and pile groups for various field situations

Detailed Syllabus:

Unit 1	**Soil Exploration:** Objectives, methods of exploration, soil boring, drilling, Type of samples and samplers, Field Tests and geophysical methods, Soil investigation report, Planning of sub-surface programs, Stages in sub-surface exploration, Reconnaissance, Lateral extent and depth of exploration. **Ground Improvement Techniques**: Necessity, Various mechanisms, Applications, In-situ densification by Vibratory compaction in sands, Ground improvement Techniques for soft clay deposits, Accelerated pre-consolidation, Electro-osmosis Deep mixing, Rammed stone column, Grouting.

Unit 2	**Stress in soil mass:** Geostatic stresses, Stresses due to surface loads, Boussinesq's theory, Pressure distribution diagrams, Isobars and pressure bulbs, Newmark's influence chart, Contact pressure. **Settlement:** types, factors and causes for differential settlement, codal provision for total and differential settlement, proportioning of footing for uniform settlement.
Unit 3	**Earth Pressure:** Earth pressure at rest, Rankin's states of plastic equilibrium, Rankine's earth pressure theory, Coulomb's earth pressure theory, Graphical methods of earth pressure determination. **Retaining walls:** Types of retaining walls, Modes of failure and stability of retaining walls.
Unit 4	**Stability of Slopes:** Stability analysis of a slope, & steady seepage, sudden drawdown and earthquake conditions, Taylors Stability no. and charts, Various methods of analysis of finite slopes, factors of safety as per IS, Methods for enhancing stability of unstable slopes. **Stress Strain relationship and Shear Strength of soil** Mohr circle and its characteristics, Mohr- Coulomb theory of failure, Laboratory measurement of shear strength, UU,CU and CD tests, Pore-pressure coefficients, Elastic modulus from triaxial tests, Field measurement of shear strength, Stress paths in p-q space; Stress-strain behavior, Stress paths in triaxial and octahedral plane.
Unit 5	**Deep Foundations:** Types, Classification of piles, Pile driving equipment, bearing capacity of single pile–Statical methods for cast-in-situ piles, Pile capacity from Pile-driving formula, Pile load test, Negative skin friction, Pile group settlement, Pile cap. Geosynthetics –functions, types and their application in Civil Engineering **Reinforced Soil:** Mechanism, Types of reinforcing elements, Reinforcement-soil interaction, Reinforced soil foundation bed, Rock Reinforcement.

Text and Reference Books:

1. Soil Mechanics and Foundation Engineering, K.R.Arora, Standard Publishers Distributers, Delhi, 7th edition, Reprint 2025.
2. Soil Mechanics and Foundation Engineering, B. C. Punmia, Laxmi Publication House, New Delhi, 18 th Edition 2023.
3. P Purushothama Raj, "Geotechnical Engineering, Tata McGraw Hill Publishing Company Limited, New Delhi, 2nd Edition 2013.
4. Geotechnical Engineering, S. K. Gulhati and Manoj Datta, Tata McGraw Hill Publishing Company Limited, New Delhi 2009.
5. Design Aids in Soil Mechanics and Foundation Engineering, S. R. Kaniraj, Tata McGraw Hill Publishing Company Limited, New Delhi, 7 th Edition 2017.
6. Ground Improvement Techniques, P Purushothams Raj, University Science Press, 2011.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	2	1	1	-	2	1	-	1	1	-
CO2	3	3	3	2	1	1	-	2	1	-	1	1	-
CO3	3	3	3	2	1	1	-	2	1	-	1	1	-
CO4	3	3	3	2	1	1	-	2	1	-	1	1	-
CO5	3	3	3	2	1	1	-	2	1	-	1	1	-

3- High 2- Medium 1- Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	05	05	4	12
K2	Understand	05	05	4	12
K3	Apply	05	05	2	36
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3
	CO1	CO2	CO3	CO4	CO5
ISEI (15 Marks)	8	7	-	-	-
ISEII (15 Marks)	-	-	8	7	-
ISEIII (10Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	22	21	22	21	14

PROGRAMME ELECTIVE IV CEPEC4018: Traffic Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 04hrs./ week	**ISE I**	**15 Marks**
Credits: 04	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: CEPCC3001

Course description: Traffic Congestion has become a serious 'urban illness' in the modern era of urbanization especially in emerging countries such as India. This results in an increase in travel time, rise in traffic accidents, rise in fuel depletion, excessive exhaust emissions, etc. which can retard the growth of any city and its sustainable development. This course will help in capacity building amongst master students, policy makers, practitioners, etc. to understand traffic engineer's role in all relevant dimensions, and develop strategies, programs and projects accordingly.

Course Outcomes:

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

	Course Outcomes
CO1	understand traffic components, characteristics, and traffic stream parameters with their interrelationships.
CO2	apply EIA procedures including screening, scoping, and baseline condition assessment for transportation projects.
CO3	analyze shockwaves, queuing, roadway capacity, and level of service using US-HCM-2016 and INDO-HCM-2016.
CO4	design and evaluate traffic control systems at intersections for efficient traffic operations.
CO5	apply traffic flow models, traffic simulation, and traffic management techniques to improve parking and traffic safety.

Detailed Syllabus:

Unit 1	**Traffic flow :-**Traffic Components and Characteristics, Traffic Stream Parameters and their Relationships
Unit 2	**EIA:-** EIA Procedure - Scoping & Screening and Establishing Baseline Conditions Shockwave and Queuing, Capacity and LOS (U.S HCM-2016).
Unit 3	**Traffic Capacity** :- Capacity and LOS (INDO-HCM-2016), Traffic Control at Intersections.
Unit 4	**Traffic Simulation** Traffic Control at Intersections (Continued…), Traffic Control at Intersections (Continued…) Car Following Models and Traffic Simulation.
Unit 5	**Management** Traffic Control and Management, Parking Management, Traffic Safety.

Text and Reference Books

1. **Kadiyali, L. R.**, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.
2. **Khanna, S. K. and Justo, C. E. G.**, Highway Engineering, Nem Chand & Bros., Roorkee.
3. **Papacostas, C. S. and Prevedouros, P. D. (Indian Reprint Edition)**, Transportation Engineering and Planning, Prentice Hall of India, New Delhi.
4. **Peavy, H. S. and Row, R. (Indian Edition)**, Environmental Engineering, McGraw Hill Education (India).
5. **Canter, L. W. (Indian Edition)**, Environmental Impact Assessment, McGraw Hill Education (India).
6. **MoEF&CC (India)**, EIA Notification and Guidelines, Government of India Publications.
7. **K. V. Krishna Rao**, Traffic Engineering, Khanna Publishers, New Delhi.
8. **IRC Publications**, INDO-HCM 2016 – Capacity of Urban Roads, Indian Roads Congress, New Delhi.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	2	1	1	-	2	1	-	1	1	-
CO2	3	3	3	2	1	1	-	2	1	-	1	1	-
CO3	3	3	3	2	1	1	-	2	1	-	1	1	-
CO4	3	3	3	2	1	1	-	2	1	-	1	1	-
CO5	3	3	3	2	1	1	-	2	1	-	1	1	-

3- High 2- Medium 1- Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	3	2	-	8
K2	Understand	5	5	-	18

K3	Apply	5	5	5	18
K4	Analyze	2	3	5	16
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2, K3**	**K1, K2, K3**	**K1, K2, K3**	**K1, K2, K3**	**K1, K2, K3**
	CO1	CO2	CO3	CO4	CO5
ISEI(15 Marks)	07	08	-	-	-
ISEII (15 Marks)	-	-	08	07	-
ISEIII (10Marks)	02	02	02	02	02
ESE Assessment (60Marks)	12	12	12	12	12
TotalMarks100	21	22	22	21	14

PROGRAM ELECTIVE IV AMPEC4006: Building Maintenance and Repairs		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/ week	**ISE I**	**15 Marks**
Credits: 03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: AMPCC2001, AMPCC2003, AMPCC3001, AMPCC3004

Course description: Buildings, especially reinforced concrete and masonry structures, are prone to deterioration due to environmental exposure, material aging, poor workmanship, and overloading. Proper maintenance and timely repair enhance service life, safety, and sustainability of structures. This course equips students with the knowledge of deterioration mechanisms, repair strategies, retrofitting, modern technologies, and contract procedures

Course Outcomes:

After successful completion, students will be able to:

	Course Outcomes
CO1	summaries maintenance and repair strategies for deteriorated building structures.
CO2	select appropriate materials for maintenance and repair work.
CO3	apply restoration and retrofitting techniques to structural elements.
CO4	develop repair plans for RCC and masonry elements based on structural needs.
CO5	conduct structural audits and prepare inspection and audit reports.

Detailed Syllabus:

Unit 1	**Building Maintenance and Repair Strategy**: Introduction to building maintenance – importance, objectives, and classification, Types of maintenance: preventive, corrective, and breakdown, Repair and Rehabilitation, causes of deterioration and durability aspects of RC building, Service life and performance issues in buildings, Overview of CPWD, PWD, and BIS guidelines Condition survey considering repair strategy and non-destructive evaluation of buildings,
Unit 2	Materials for Maintenance and Repair Selection criteria for repair materials, Types of repair materials Polymer-modified mortar and concrete Epoxy resins, sealants, grouts, anti-corrosive coatings Fiber Reinforced Polymers (FRP), bonding agents, Waterproofing materials, Surface protection systems and coatings, etc., Recent development in repairing materials
Unit 3	Restoration and Retrofitting of Structures Repair methods- Crack filling and sealing, grouting, jacketing, and epoxy injection. Understand strengthening techniques such as fiber-reinforced polymers and steel plate bonding. Study retrofitting of beams, columns, slabs, and masonry walls.

Unit 4	Repair Methods, Planning, Redesigning for RCC and masonry structures Understand causes and locations of cracks in masonry and concrete. Learn repair techniques like grouting, epoxy injection, stitching, and jacketing. Study repair of damp roofs and corroded steel in concrete. Get familiar with common repair materials and their uses. Learn structural analysis and design principles for planning effective repairs.
Unit 5	Structural Audit, Budget, and Safety Importance of structural audit and budget estimation. Study inspection methods and preparing audit reports. Understand repair contracts, safety measures, and quality control during repairs. Introduction to digital tools like BIM for project management

Text Books

1. Gupta, B. L. (2011). Maintenance and Repair of Civil Structures. Standard Publishers Distributors, New Delhi.
2. Duggal, S. K. (2008). Repair and Rehabilitation of Structures. New Age International Publishers, New Delhi.
3. Shetty, M. S. (2013). Concrete Technology: Theory and Practice. S. Chand Publishing, New Delhi.
4. Kaushik, S. K. (2012). Concrete Technology. New Age International

Publishers. Reference Books

1. Denison Campbell; Allen; Roper, Harold (1991). Concrete Structures: Materials, Maintenance and Repair. Longman Scientific & Technical.
2. CPWD, Government of India (2019). Handbook on Repair and Rehabilitation of RCC Buildings. Central Public Works Department, New Delhi.
3. Raina, V. K. (2003). Concrete Bridges: Inspection, Repair and Maintenance. Shroff Publishers.
4. Raikar, R. N. (2008). Learning from Failures – Deficiencies in Design, Construction and Service. Association of Consulting Civil Engineers (India).

ACI, BIS, Euro code & BS Standards

1. ACI 201.2R-16 – Guide to Durable Concrete
2. ACI 546R-14 – Guide to Concrete Repair
3. 456:2000 – Plain and Reinforced Concrete
4. IS 15988:2013 – Rehabilitation of RCC Structures
5. Euro code 2 (EN 1992-1-1:2004) – Concrete Structures
6. BS 8110:1997 – Structural Use of Concrete

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	2	2	3	2	2	1	1	1	1	2	-	1
CO2	2	3	3	3	3	2	1	2	1	1	3	-	1
CO3	3	3	3	2	2	3	2	1	2	1	2	-	2
CO4	2	3	3	3	2	3	3	1	2	2	2	-	2
CO5	3	2	3	3	2	3	3	3	2	3	2	-	2

3 – High 2 – Medium 1 – Low

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B.Tech. Civil Engineering Curriculum
With effect from Academic Year 2026–2027
Approved in the 32nd Academic Council Meeting, dated 28th July 2026

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

6. Technical Quiz
7. Power point presentation of industry process & case studies, if applicable
8. Question & answer, interaction
9. Assignments
10. 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	-	10
K2	Understand	07	07	05	20
K3	Apply	05	06	05	20
K4	Analyze	-	-	-	10
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

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

PROGRAM ELECTIVE IV AMPEC4007: Lab - Prestressed Concrete Design		
Teaching Scheme	**Examination Scheme**	
Lectures: 02hrs./ week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Examination**	**25 Marks**

Prerequisites: AMPCC2001, AMPCC3004, AMPEC4005

Course description: This Lab. course will enable the students to understand and apply the principles of the prestressing to solve the various numerical problems on the units in the core course. The students will be given the assignments and they will be exposed to the analysis and design of Prestressed Concrete structures on different structural components like beam, slab, pipes, poles, sleepers etc. for flexure and shear with respect to the relevant codal provisions

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	solve the numerical on analysis of various types of symmetrical Prestressed Concrete Structures and compute the losses in prestressing
CO2	understand and solve the numerical based on the effect different cable profiles
CO3	solve the numerical on design all types of Prestressed Concrete section including some special types of structures

Detailed Syllabus:

A) The students should solve any five assignments

i) Assignment based on basic principle of Prestressed Concrete, types and methods pf Prestressing, advantages and limitations of Prestressed Concrete, need of high strength concrete and steel for Prestressed Concrete and content of unit I in the core subject

ii) Assignment based on analysis of symmetrical Prestressed Concrete section, effect of cable profile on the analysis, thrust line, pressure line and cracking moment

iii) Assignment based on losses in pre and post tensioning

iv) Assignment based on design of anchor blocks, design of Prestressed Concrete members for flexure and shear

v) Assignment based on design of Prestressed Concrete beams and slabs

vi) Assignment based on design of special types of structures like sleepers/ pipes/ poles etc. vii) Assignment based on comparative study of PCC and Prestressed Concrete with respect tomethodology, use of material, suitability, applications and economical concept

B) Compulsory task

a. Preparation of report of a site visit

b. The students will prepare a power Point presentation either on site visit or the content on the core course as defined in different units in a group of 3 or 4 students and present the same for ESE examination

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	2	-	2	-	2
CO2	3	2	3	1	1	2	1	-	1	-	2	-	2
CO3	3	3	3	2	2	1	1	-	1	-	2	-	3

3 – High 2 – Medium 1 - Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	ESE	Total
S1	Imitation	01	01	02
S2	Manipulation	05	05	10
S3	Precision	09	09	18
S4	Articulation	10	10	20
S5	Naturalization	-	-	-
Total Marks 100		25	25	50

Assessment table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3	S2, S3, S4	S2, S3, S4
ISEIII:(25 Marks)	5	12	8
ESE Assessment (25 Marks)	8	9	8
Total Marks(50)	13	21	16

PROGRAM ELECTIVE IV CEPEC4012: Lab - Industrial Waste Management		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Examination**	**25 Marks**

Course Description: This practical course introduces students to the characterization and treatment of industrial wastewater through laboratory-based experiments. Learners will gain hands-on experience in analyzing industrial effluents, determining pollution parameters, and applying various treatment methods such as coagulation, adsorption, ion exchange, membrane processes, and advanced oxidation. The course emphasizes both fundamental water quality analysis and advanced techniques, enabling students to design effective treatment strategies for real-world industrial applications.

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

CO	Course Outcome
CO1	analyze and interpret key physico-chemical and biological characteristics of industrial wastewater using standard laboratory methods.
CO2	apply and evaluate different treatment techniques (coagulation, adsorption, ion exchange, membranes, AOPs) for removal of pollutants from industrial effluents.
CO3	Integrate laboratory findings to propose suitable treatment strategies for specific industrial wastewater through case studies and mini-projects.

List of Experiments: The student shall perform minimum eight experiments of the following:

Sr. No.	Title of the Experiments
1	To determine pH, temperature, turbidity, and color of Dairy industrial effluent.
2	To determine pH, temperature, turbidity, and color of Distillery industrial effluent.
3	To determine pH, temperature, turbidity, and color of Textile industrial effluent.
4	To determine pH, temperature, turbidity, and color of Iron & steel industrial effluent.
5	Comparison in between above 4 industrial effluent parameters.
6	To suggest economical treatment for above 4 industrial effluent.
7	To study removal efficiency of ions like Pb^{2+}, Cr^{6+}, Ni^{2+} using ion exchange resins.
8	To study separation of suspended solids and dissolved organics using micro/ultrafiltration.
9	To study the efficiency of alum/ferric chloride for turbidity and color removal.
10	To analyze an industry-specific effluent (e.g., dairy, distillery, textile) and suggest a treatment train based on laboratory data.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	1	-	1	-	2	2	2	2	3	2	2	1	-
CO2	2	2	-	2	-	2	3	3	2	3	3	1	-
CO3	2	2	3	2	3	2	3	3	2	3	3	1	-

3 – High 2 – Medium 1 – Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Table:

Assessment Tool	C01,CO2,CO3	C01,CO2,CO3	C01,CO2,CO3
	S1	**S2**	**S3**
ISE III: (25 Marks)	05	10	10
ESE Assessment (25 Marks)	10	05	10

Assessment Pattern:

Assessment Pattern Level No.	Skill Level	ISE III	Practical Examination
S1	Imitation	05	10
S2	Manipulation	10	05
S3	Precision	10	10
S4	Articulation	-	-
55	Naturalization	-	-
Total Marks		25	25

PROGRAM ELECTIVE IV CEPEC4013: Lab-Infrastructural Development		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
CO1	identify and describe infrastructure systems, standards, and norms related to urban and regional development.
CO2	analyze real-world infrastructure case studies to understand planning, design, and implementation challenges.
CO3	prepare feasibility studies, technical reports, and present findings related to infrastructure development projects.

List of the Experiments:

Student shall perform following Experiments:

Sr. No.	Title of the Experiments
1	Identify and summarize infrastructure norms and standards for water supply, roads, storm water drainage, and urban land-use zoning (Residential, Commercial, Industrial, Agricultural)
2	Analyze land-use survey records of an urban area and prepare a technical report for residential/commercial zones
3	Examine urban infrastructure initiatives under Smart City Mission through site visit and report preparation (Chhatrapati Sambhajinagar)
4	Prepare a feasibility report for a local infrastructure project including objectives, basic feasibility study, and cost–benefit analysis
5	Evaluate selected infrastructure development projects in India (any two: Metro Rail, Water Supply Project, Coastal Road Project)
6	Evaluate selected infrastructure development projects in India (any two: Metro Rail, Water Supply Project, Coastal Road Project)
7	Assess sustainability features of a green, energy-efficient building through site visit and report preparation

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	1	2	2	1	1	1	1	1	3	1	1	1	-
CO2	1	1	1	2	1	1	1	-	2	1	1	1	-
CO3	1	1	1	1	1	1	-	-	2	1	1	1	-

3 – High 2 – Medium 1 - Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	End Semester Examination
S1	Imitation	5	5
S2	Manipulation	08	08
S3	Precision	12	12
S4	Articulation	-	-
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3	S1, S2, S3	S1, S2, S3
ISE III: (25 Marks)	08	08	09
ESE Assessment (25 Marks)	09	08	08
Total Marks (50)	17	16	17

PROGRAM ELECTIVE IV CEPEC4014: Lab-Advanced Geotechnical Engineering		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits: 01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
CO1	use GEO5/GEO Studio or any other available software for solving problems in Geotechnical Engineering.
CO2	conduct various field tests on soil and interpret their results
CO3	determine the improvement in soil properties after stabilization.

List of the Experiments

The students should perform minimum eight experiments of the following:

Sr. No.	Title of the Experiments
1	Determination of shear strength parameter of soil by performing Undrained Unconsolidated (UU) Triaxial Test on re-moulded soil sample
2	Determination of soil properties by conducting Static Cone Penetration Test
3	Determination of shear strength parameters of gravel soil by conducting Large box Shear test
4	Determination of soil profile by conducting Electrical Resistivity Test/ Seismic Refraction Test
5	Determination in improvement in UCS/CBR of soil by stabilization using commercial Stabilizer (Bioenzyme / chemical etc)
6	Determination of improvement in bearing capacity of soil by conducting model plate Load test on reinforced soil using geotextile/geogrid/ geocell as reinforcement
7	Assignment on design of rock bolt.
8	Assignment on design of sheet pile.
9	Slope stability analysis using software.
10	Analysis/ Design of piles using software.

Mapping of Course out come with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	2	2	3	3	2	-	1	1	-	1	1	-
CO2	2	2	2	3	3	2	-	1	1	-	1	1	-
CO3	3	3	3	3	3	2	-	1	1	-	2	1	-

3 – High 2 – Medium 1-Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEIII	End Semester Examination
S1	Imitation	10	10
S2	Manipulation	10	10
S3	Precision	5	5
S4	Articulation	-	-
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	CO1, CO2, CO3
	S1, S2, S3
ISEIII:(25 Marks)	25
ESE Assessment (25 Marks)	25
Total Marks (50)	50

PROGRAM ELECTIVE IV APMEC4008: Lab-Building Maintenance and Repairs		
Teaching Scheme	**Examination Scheme**	
Practical: 02hrs/Week	**ISE III**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcome
CO1	identify and document common building defects through inspection techniques.
CO2	apply non-destructive testing (NDT) methods for condition assessment.
CO3	select suitable repair materials and recommend appropriate repair and retrofitting techniques through case study analysis

List of the Experiments

The term work shall consist of at least five exercises of following list of Experiments.

Sr. No.	**Title of the Experiments**
1	To perform visual inspection and documentation of visible building defects.
2	To Prepare of Defect Identification Sheet and Inspection Preforms.
3	To Perform Non-Destructive Testing (NDT) for Assessing Structural Conditions.
4	To Evaluate Properties and compatibility of Repair and Rehabilitation Materials.
5	To Demonstrate Repair and Retrofitting Techniques.
6	To Develop repair and Maintenance Plan and Cost Estimate.
7	Prepare Structural Audit / Repair Case Study Report. Visit to the site for on-going retrofitting /repairs of existing buildings

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	3	1	2	1	1	1	2	1	2	-	2
CO2	3	2	3	1	1	2	1	2	1	1	2	-	2
CO3	3	3	3	2	2	1	1	3	1	2	2	-	3

3 – High 2 – Medium 1 – Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	End Semester Examination
S1	Imitation	01	01
S2	Manipulation	05	05
S3	Precision	09	09
S4	Articulation	10	10
S5	Naturalization	-	-
Total Marks		25	25

Assessment Table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3, S4	S1, S2, S3, S4	S1, S2, S3, S4
ISE III: (25 Marks)	7	11	7
ESE Assessment (25 Marks)	8	9	8
Total Marks (50)	15	20	15

CEPRJ4001: Project		
Teaching Scheme	**Examination Scheme**	
Practical: 8hrs/ week	**ISE III**	**100 Marks**
Credits: 04	**End Semester Evaluation**	**100 Marks**

Course Description:

This course offers civil engineering students an opportunity to undertake the work of a project on selected topic in civil engineering in order to solve a research based / 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 completion of this course students will be able to:

	Course Outcome
CO1	identify and compare technical and practical issues in society / Industry and try to give the effective solution by working in a group to develop the leadership/interpersonal skills for finishing task within timeframe.
CO2	search, interpret and compile literature on problem selected
CO3	formulation and development of methodology of working solutions to defined problems through systematic approach in laboratory or field.
CO4	analyze and interpret the solutions obtained for Project work through appropriate interpretation method and draw meaningful conclusion
CO5	write the project report as per the prescribed format.

Term work

1. Student shall select a topic for Project as per guidelines of the institute in the field of Civil Engineering. Topics shall be registered within 15 days after beginning of VII Semester and shall be approved by the concerned guide and Program Head.
2. Students should carry out literature survey related to the topic selected and collect the information / data from the selected references such as reference books, research papers, Project reports, IS codes and Handbooks. Visit to local industries to identify possible problems through interactions/discussions with concerned industries shall also be considered.
3. The project shall be carried out consisting of experimental investigations/ designs / Numerical analysis / model study as per system development and find out the results. Students should then derived meaningful conclusions from the project work carried out.
4. Students shall submit the final project report in proper format as per guidelines given on the college website
5. For uniform and continuous evaluation, evaluation committee for each group shall be formed by

Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.

6. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

Practical/Viva Voce Examination:

The students shall prepare Power Point presentation based on project report and present it to the panel of examiners which shall consist of a supervisor and internal examiner appointed by department.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	3	2	1	1	1	2	1	3	1	-
CO2	3	1	1	3	1	1	1	2	2	1	3	2	-
CO3	3	1	2	3	2	2	-	2	3	-	2	2	-
CO4	3	2	2	3	2	2	-	2	3	-	2	1	-
CO5	3	2	2	3	2	2	1	1	2	-	1	2	-

3 – High 2 – Medium 1 - Low

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	End Semester Examination
S1	Imitation	40	40
S2	Manipulation	20	20
S3	Precision	40	40
S4	Articulation	-	-
S5	Naturalization	-	-
Total Marks	100	100	

Assessment Table: -

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	S1, S2, S3	S1, S2, S3	S1, S2, S3	S1, S2, S3	S1, S2, S3
ISE III: (100 Marks)	20	10	30	20	20
ESE Assessment (100 Marks)	20	10	30	20	20
Total Marks (200)	40	20	60	40	40

PROGRAM ELECTIVE V APMEC4009: Earthquake Analysis and Design		
Teaching Scheme	**Examination Scheme**	
Lectures: 04hrs/ week	**ISE I**	**15 Marks**
Credits: 04	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: MABSC1001, MABSC1003, CEPCC1001, AMPCC2001, AMPCC3003

Course description: This course introduces the fundamentals of structural dynamics and its application to earthquake resistant design. It covers the behavior of structures under dynamic and seismic loads, modeling of single and multi-degree of freedom systems. It includes the provisions of recent code of practice, IS 1893: 2025, IS 13920:2016

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	recognize the fundamentals of engineering geology, seismology and earthquake ground motions and seismic zoning system.
CO2	able to analyze the dynamic behavior of structures, including vibration responses and damping effects.
CO3	apply seismic analysis methods.
CO4	recognize earthquake-resistant design philosophy incorporating performance-based concepts and energy dissipation systems.
CO5	design earthquake resistant structures.

Detailed Syllabus:

Unit 1	**Engineering Geology and Seismology:** Introduction to Earthquake Engineering: Types, causes and their effects, Plate tectonics, theory, elastic rebound theory. Seismic waves: Types of waves and their characteristics. Earthquake magnitude, intensity scales (Richter, Moment Magnitude, Mercalli). Seismic zoning in India (IS 1893 zoning map). Historical earthquakes in India & lessons
Unit 2	**Fundamentals of Structural Dynamics** Introduction of degrees of freedom, Single Degree of Freedom (SDOF) systems: free and forced vibrations, Damping types and effects, Response spectrum and its parameters Multi-Degree of Freedom (MDOF) systems – basics, Modal analysis fundamentals
Unit 3	**Seismic Analysis Methods** Equivalent Static Lateral Force Method, Response Spectrum Method, Time History

	Analysis – introduction. Codal provisions for seismic loads (IS 1893 Part 1 – 2016).Load combinations for seismic design.
Unit 4	**Seismic Design Philosophy** Performance-based design concepts, Ductility and energy dissipation in structures, Base isolation systems and energy dissipation devices, Capacity design principles
Unit 5	**Earthquake-Resistant Design of Structures** Reinforced Concrete framed buildings: analysis and design per IS:1893& IS:13920., Seismic detailing of RC members for ductility. Masonry structures – seismic performance & strengthening. Special structures: water tanks, bridges (introductory concepts).

Text Books

1. **Anil K. Chopra** — Dynamics of Structures: Theory and Applications to Earthquake Engineering — 6th Edition — 2022
2. **S. K. Duggal** — Earthquake Resistant Design of Structures — 2nd Edition — 2013 — Oxford University Press, New Delhi .
3. **Pankaj Agarwal & Manish Shrikhande** — Earthquake Resistant Design of Structures — (common Indian edition / reprint) — 2007 (often cited) — PHI Learning Pvt. Ltd., New Delhi.

Reference Books

1. **Mario Paz** — Structural Dynamics: Theory and Computation — 6th Edition — 2018
2. **R. W. Clough & Joseph Penzien**- Dynamics of Structures- 2nd edition — **1975** — McGraw-Hill, Inc, USA
3. **V. K. Manica Selvam** — *Dynamics / Earthquake-Engineering related book* — **(publisher listing)** — Dhanpat Rai Publishing Company, New Delhi.

Indian Standards

1. IS 1893 (Part 1): 2016 – Criteria for Earthquake Resistant Design of Structures.
2. IS 13920: 2016 – Ductile Detailing of Reinforced Concrete Structures.
3. IS 4326: 2013 – Earthquake Resistant Design and Construction of Buildings.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3 – High 2 – Medium 1 - Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

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

Assessment table:

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

PROGRAM ELECTIVE V APMEC4010: Advanced Structural Analysis		
Teaching Scheme	**Examination Scheme**	
Lectures: 04 hrs./ week	**ISE I**	**15 Marks**
Credits: 04	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: AMPCC2001, AMPCC3003, AMPCC3004

Course Description: The course deals with matrix methods of analysis of beams, plane frames and trusses. It provides fundamental understanding required for analysis of three dimensional structures such as space frames, trusses etc. Analysis of arches, cables and suspension bridges are also included in the syllabus.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	formulate compatibility equations for structural members
CO2	apply and analyze two dimensional structures using Matrix Method
CO3	apply and analyze two dimensional structures using Direct Stiffness Method
CO4	analyze determinate and indeterminate arches
CO5	analyze cables and suspension bridges

Detailed Syllabus:

Unit 1	**Flexibility Matrix Method for Structural Analysis** Concept of Flexibility, Equations of compatibility of displacements, Flexibility matrix of a structure and its characteristics, Analysis of beams, plane frames and trusses.
Unit 2	**Stiffness Matrix Method of Structural Analysis** Concept of Stiffness, Equations of equilibrium of forces, Stiffness matrix of a structure and its characteristics, Analysis of continuous beams and plane frames.
Unit 3	**Direct Stiffness Method** Member stiffness matrix, Joint stiffness matrix, Equivalent joint load vector. Compatibility equations, Application of the method for the analysis of continuous beams and plane frames.

Unit 4	Analysis of beams curved in plan, beams on elastic foundation, stresses in hooks and links in cranes, analysis of steel deep beams
Unit 5	**Cables and Suspension Bridges** Equilibrium of loaded cables, temperature stresses in cables, analysis of suspension bridges with two and three hinged stiffening girders, influence line diagrams

Text Books

1. **Pandit G. S. and Gupta S. P.**, Structural Analysis. Tata McGraw Hill, new Delhi
2. **C. S. Reddy**, Basic Structural Analysis, Tata McGraw Hill, new Delhi
3. **S Ramamrutham and N. Narayan**, Theory of Structures, Dhanpat rai, new Delhi
4. **Devdas Menon**, Structural Analysis, Narosa publications, New Delhi

Reference Books

1. **Timoshenko S. P. and Goodier J. N.**, Theory of Elasticity, Tata McGraw Hill, new Delhi
2. **N. C. Sinha and P. K. Gayen**, Advanced Theory of Structures, Dhanpat rai, New Delhi
3. **Weaver W. and Gere J. M.**, Matrix analysis of Framed Structures, CBS, New Delhi
4. **C. K. Wang**, Indeterminate Structural analysis, Tata McGraw Hill, New Delhi

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3 – High 2 – Medium 1 – Low

Assessment:

ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz

2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	-	-	-	-
K2	Understand	02	02	02	08
K3	Apply	07	07	05	30
K4	Analyze	06	06	03	22
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K2, K3, K4**	**K2, K3, K4**	**K2, K3, K4**	**K2, K3, K4**	**K2, K3, K4**
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	07	08	-	-	-
ISE II (15 Marks)	-	-	08	07	-
ISE III (10 Marks)	01	02	02	02	03
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks(100)	20	22	22	21	15

PROGRAM ELECTIVE V CEPEC4015: Water Resources Systems and Management		
Teaching Scheme	**Examination Scheme**	
Lectures: 04hrs/week	**ISEI**	**15 Marks**
Credits: 04	**ISEII**	**15 Marks**
	ISEIII	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: CEPCC3005

Course description:

This course introduces the principles and methodologies of water resources systems planning, analysis, and management using a systems approach. It covers the components of water resources systems, sectoral water demands, and challenges in water availability with special reference to India. The course emphasizes water resources planning, river basin and reservoir management, and system modeling techniques including simulation, optimization, and decision support systems. Concepts of sustainability, economics, risk, and uncertainty are integrated with modern tools such as GIS, Remote Sensing, and Artificial Intelligence to support effective and sustainable water resources management.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	explain the fundamentals and components of water resources systems.
CO2	apply principles of water resources planning and management to real-world problems.
CO3	apply water resources systems using modeling and optimization techniques.
CO4	apply reservoir and river basin management strategies under varying conditions.
CO5	explain sustainability, economic, and technological aspects of modern water resources management.

Detailed Syllabus:

Unit 1	**Introduction to Water Resources Systems** Water resources systems: concept and need, Components of water resources systems, Hydrologic cycle and water availability, Surface water and groundwater systems, Water demand sectors: irrigation, domestic, industrial, hydropower, Challenges in water resources planning in India.

Unit 2	**Water Resources Planning & Management** Objectives and principles of water resources planning, Single-purpose vs multi-purpose projects, River basin planning approach, Integrated Water Resources Management (IWRM), National Water Policy (India) – overview, Institutional and legal aspects of water management.
Unit 3	**Water Resources System Modeling** Systems approach in water resources engineering, Elements of system analysis: objectives, constraints, alternatives, Linear programming in water resources planning, Dynamic programming concepts, Simulation vs optimization models, Introduction to decision support systems (DSS).
Unit 4	**Reservoir & River Basin Management** Reservoir operation objectives and constraints, Rule curves and reservoir operation policies, Flood control and drought mitigation through reservoirs, Inter-basin water transfer, Sedimentation issues in reservoirs, Climate change impacts on river basin management.
Unit 5	**Sustainability, Economics & Modern Tools** Sustainability in water resources systems, Economic analysis of water resources projects, Water pricing and allocation, Risk and uncertainty analysis, Role of GIS, Remote Sensing, AI & DSS in water management, Case studies of river basin management in India.

Text and Reference Books

1. D.P. Loucks, J.R. Stedinger & D.A. Haith, Water Resources Systems Planning and Analysis, 2nd Edition, Prentice Hall, Upper Saddle River, New Jersey, Year: 1997
2. R.A. Wurbs & W.P. James, Water Resources Engineering, 2nd Edition, Prentice Hall, New Jersey, Year: 2005
3. L.W. Mays, Water Resources Engineering, 2nd Edition, John Wiley & Sons, Hoboken, NJ, Year: 2010
4. S. Vedula & P.P. Mujumdar, Water Resources Systems: Modelling Techniques and Analysis, 1st Edition, Tata McGraw-Hill Education, New Delhi Year: 2001
5. K.N. Mutreja, Applied Hydrology, 3rd Edition, Tata McGraw-Hill Education, New Delhi, Year: 2014
6. S.K. Mishra & V.P. Singh, Water Resources Management, 1st Edition, McGraw-Hill Education, New Delhi, Year: 2014
7. M.K. Jha, Remote Sensing and GIS Applications in Water Resources Engineering, 1st Edition, Springer, Singapore, Year: 2014
8. National Water Policy, Government of India, Ministry of Water Resources (now Ministry of Jal Shakti), 2012 (Updated NWP)
9. UNESCO / Global Water Partnership (GWP), Integrated Water Resources Management (IWRM) - UNESCO/GWP Publication, Varies (Latest available guidelines)

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	-	-	-	1	-	-	-	-	2	1	-
CO2	2	3	2	-	-	2	-	-	-	1	2	2	-
CO3	2	3	3	2	3	-	-	-	-	-	2	1	-
CO4	2	3	2	3	2	2	-	-	-	-	-	1	-
CO5	1	2	2	2	3	2	1	-	-	2	3	2	-

3 – High 2 – Medium 1 – Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	5	5	2	20
K2	Understand	5	5	3	20
K3	Apply	5	5	5	20
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3
	CO1	CO2	CO3	CO4	CO5
ISEI (15 Marks)	8	7	-	-	-
ISEII (15 Marks)	-	-	8	7	-
ISEIII (10Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12

PROGRAM ELECTIVE V CEPEC4016: Environmental Impact Assessment					
Teaching Scheme		**Examination Scheme**			
Lectures: 04hrs./ week		**ISE I**		**15 Marks**	
Credits:04		**ISE II**		**15 Marks**	
		ISE III		**10 Marks**	
		End Semester Examination		**60 Marks**	
		Total		**100**	
Total Marks100	22	21	22	21	14

Prerequisites: CEPCC2006.

Course description: In this course, student will learn environmental impact assessment management plan and environmental audit.

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

	Course Outcomes
CO1	Carry out scoping and screening of developmental projects for environments.
CO2	Study environmental management plans.
CO3	Analyze environmental imbalances and impacts of human activities using indicators and measurements.
CO4	Explain different methodologies for environmental impact assessment.
CO5	To prepare environmental impact assessment reports.

Detailed Syllabus:

Unit 1	**Introduction** Concept of environmental impact, Introduction to Environmental impact assessment (EIA) – definitions, terminology and concepts. Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India.
Unit 2	**Process of EIA-** Evolution of EIA in India, Sustainable development, Generalized EIA process flow chart, Screening, Initial environmental examination (IEE), Scoping, Public participation.
Unit 3	**Impact Management -**, Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition. Documentation of EIA findings, planning.
Unit 4	**Assessment of EIA-** Practical applications of EIA, EIA methodologies, Baseline data collection, Prediction and assessment of impacts on physical, biological and socio-economic environment, Environmental management plan, EIA Tools and techniques, Post project monitoring, environmental impact statement (EIS), environmental appraisal, environmental audit (EA).
Unit 5	**Environmental Management Plan-** Environmental impact factors and areas of consideration, measurement of environmental impact, organization, scope and methodologies of EIA. EIA case studies.

Text and Reference Books

1) A Rosencranz, S. Divan, M.I Noble, Environmental Law and policy in India Cases, Materials and statutes, Tripathi Pvt. Ltd. Bombay
2) S. Mushraf, Legal aspects of Environmental Pollution and its management, C.B.S. Publishers, Delhi 19932.
3) R. K. Jain, L.V.Urban, B.S. Staccy, H.E. Balkbach, Environmental Assessment, McGraw Hill Inc, NY.
4) Rao, J.G. and wooten, Environmental Impact Analysis, Handbook 1980
5) Center, L.W. Environmental Impact Assessment, New York: McGraw Hill Book Company, 1977.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	1	1	2	1	2	2	-	-	1	2	1	-
CO2	3	1	2	-	2	1	1	-	1	2	2	2	-
CO3	3	1	1	1	2	1	1	1	-	1	-	2	-
CO4	2	2	1	2	1	-	2	1	-	1	1	2	-
CO5	3	1	1	2	1	1	1	1	2	1	1	1	-

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Dean , Academics

B.Tech. Civil Engineering Curriculum
With effect from Academic Year 2026–2027
Approved in the 32nd Academic Council Meeting, dated 28th July 2026

3 –High 2- Medium 1- Low

Assessment:
ISE I: Based on unit I and II
ISE II: Based on unit III and IV
ISE-III: Teachers Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	7	-	4	20
K2	Understand	8	7	3	20
K3	Apply	-	8	3	20
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		**15**	**15**	**10**	**60**

Assessment table:

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1 ,K2	K1 ,K2	K1,K2, K3	K1,K2, K3	K1,K2,K3
ISE I (15 Marks)	7	8	-	-	-
ISE II(15 Marks)	-	-	7	8	-
ISE III (10 Marks)	2	2	2	2	2
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	21	22	21	22	14

PROGRAME LECTIVE V CEPEC4017: Engineering Optimization		
Teaching Scheme	**Examination Scheme**	
Lectures: 04hrs/week	**ISEI**	**15 Marks**
Credits: 04	**ISEII**	**15 Marks**
	ISEIII	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Nil

Course Description: The objective of this course is to expose the engineering optimization technique such as linear and dynamic programming, Transportation model and Game Theory, Goal programming and sequencing model, Stochastic programming, Multi Objective programming. With these techniques, it is possible to determine the ultimate goal to minimize the effort required or to maximize the desired benefit.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	explain the concept and types of systems
CO2	formulate and solve linear programming problems using graphical and simplex Methods
CO3	apply classical methods to solve single and multi-variable unconstrained non-linear optimization problems
CO4	solve optimization problems using transportation, assignment, and game theory models
CO5	apply goal programming, sequencing, and multi objective techniques to complex engineering problems

Detailed Syllabus:

Unit 1	**Concept of System** Introduction to system and system analysis: Meaning of system, elements of a system, types of systems, importance of system analysis in engineering. Role of system analysis in civil engineering. Applications of system analysis in planning and construction. Introduction to optimization in engineering: Meaning of optimization, need and benefits of optimization. Applications of optimization in civil engineering. Basic terminology: model, types of models, objective function and constraints.
Unit 2	**Linear Programming** Introduction to linear programming: Meaning of linear programming, decision variables, objective function and constraints. Importance of linear programming in civil engineering. Formulation of linear programming problems: Converting simple real-life civil engineering problems into mathematical LP models. Solution of LP problems. Graphical method: Plotting constraints, feasible region and optimal solution. Introduction to simplex method: Basic idea of simplex method and concept of basic feasible solution. Special cases in LP: Degeneracy, unbounded solution, infeasible solution and multiple solutions (concept only).

Unit 3	**Non-Linear Programming** Introduction to non-linear programming. Single variable unconstrained optimization: Meaning of local and global optima, unimodal function. Basic search techniques: Dichotomous search, Fibonacci method and Golden section method (concept only). Introduction to multivariable unconstrained optimization: Concept of gradient vector and Hessian matrix. Basic optimization techniques: Steepest ascent/descent method and Newton's method (introductory level).
Unit 4	**Transportation Model** Introduction to transportation model. Transportation problem and its basic types. Assignment model and its applications. Introduction to game theory: Basic concepts and simple types of games. Applications of transportation, assignment and game theory models in civil engineering.
Unit 5	**Goal Programming** Introduction to goal programming and its importance. Difference between linear programming and goal programming. Introduction to sequencing models: n jobs through 2 machines and 3 machines. Basic idea of stochastic programming. Introduction to multi-objective programming. Introduction to simulation and its applications in engineering.

Text and Reference Books

1. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International Pvt Ltd., New Delhi, 2000.
2. G.Hadley,"Linearprogramming",NarosaPublishingHouse,NewDelhi,1990.
3. H.A.Taha,"OperationsResearch:AnIntroduction",5thEdition,Macmillan,NewYork, 1992.
4. K.Deb,"OptimizationforEngineeringDesign-AlgorithmsandExamples",Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
5. K. Srinivasa Raju and D. Nagesh Kumar, "Multicriterion Analysis in Engineering and Management", PHI Learning Pvt. Ltd., New Delhi, India, ISBN 978-81-203-3976-7, pp.288, 2010

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	1	1	-	1	-	-	-	1	-	2	2	-
CO2	3	1	-	-	2	2	-	-	1	-	2	3	-
CO3	2	1	1	2	2	-	-	-	1	-	2	2	-
CO4	3	1	2	2	2	-	-	1	3	-	2	3	-
CO5	3	1	2	-	2	2	-	1	-	2	2	3	-

3–High 2 – Medium 1-Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV

ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	06	05	00	15
K2	Understand	07	04	00	15
K3	Apply	07	05	05	15
K4	Analyze	-	06	05	15
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		20	20	10	60

Assessment table:

Assessment Tool	**K1, K2, K3,K4**	**K1, K2, K3,K4**	**K1, K2, K3,K4**	**K1, K2, K3,K4**	**K1, K2, K3,K4**
	CO1	CO2	CO3	CO4	CO5
ISEI(15 Marks)	07	08	-	-	-
ISEII (15 Marks)	-	-	08	07	-
ISEIII (10Marks)	02	02	02	02	02
ESE Assessment (60Marks)	12	12	12	12	12
Total Marks 100	21	22	22	21	14

PROGRAM ELECTIVE V AMPEC4011: Finite Element Method		
Teaching Scheme	**Examination Scheme**	
Lectures:04hrs/week	**ISEI**	**15 Marks**
Credits:04	**ISEII**	**15 Marks**
	ISEIII	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: MABSC1001, MABSC1003, AMPCC2001

Course description: A finite element method (FEM) is a numerical method to find approximate solutions to complex engineering problems by dividing a physical domain into “finite elements" and solving algebraic equations for each DoF. This course is based on fundamental of theory elasticity, differential and integral calculus, energy principles. FEM is applicable to all structural engineering problems, which cannot be solved by classical methods. FEM can be easily applied to Structural Engineering problems using software like ANSYS , MATLAB, Abacus, LS DYNA, NISA-Civil, Cosmos.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	illustrate the constitutive equations of continuum mechanics.
CO2	apply numerical methods to FEM.
CO3	apply the selection of displacement models and load vectors.
CO4	compute the stiffness matrix for explicit and is parametric elements.
CO5	analyze plate bending problems using FEM.

Detailed Syllabus:

Unit 1	History of Finite Element Method. Introduction to Discrete and Continua elements – Discrete Elements - Direct stiffness method - Special characteristics of stiffness matrix - Assemblage of elements – Boundary condition & reaction.1D – truss element, 1D - beam element, Analysis of framed Structures, Solution of displacements by Gauss elimination technique. Basic steps in finite element analysis or FE procedure.
Unit 2	Basic equations of solid mechanics. Differential equilibrium equations - strain displacement relation - linear constitutive relation - special cases, Plane stress and plane strain conditions - Principle of stationary potential energy and principle of virtual work-application to finite element methods - Some numerical techniques in finite element Analysis.

Unit 3	Continua Elements –Pascal's triangle, Selection of order of polynomial, Displacement models - convergence requirements, compatibility, confirming and non-confirming elements. Natural coordinate systems- Shape functions. Interpolation function. Linear and quadratic elements - Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector
Unit 4	Basic Elements: 1D and 2D elements. 1D beam bending element, 2D triangular and quadrilateral- Founded quadrilateral elements - triangular elements. Computation of stiffness matrix for these elements. Transformation of matrices from local to global axes. Isoparametric Elements 2D- numerical integration (Gauss quadrature). Convergence criteria for isoparametric elements. Advantages of isoparametric formulation over explicit formulation of finite elements.
Unit 5	Analysis of plate bending- displacement functions- plate bending Elements, analysis: Triangular elements - rectangular elements, derivation of element stiffness matrix. Example problems using any general-purpose finite element software.

Text Books

1. **Krishnamoorthy,C.S**,FiniteElementAnalysis-TheoryandProgramming,McGraw -Hill, 1995.
2. **David Hutton**, Fundament also Finite Element Analysis, Tata Mc Graw Hill Publishing Company Limited, New Delhi, 2005.
3. **G.R.LiuandS.S.Quek**,FiniteElementMethod:APracticalCourse,Butterworth Heinemann; 1st edition (21 February 2003)
4. **Chennakesava R. Alavala** Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.
5. **R.T.Chandrupatla and A.D.Belegundu**, Introduction to Finite Elements in Engineering, PHI Learning Pvt Ltd, New Delhi, 1997.
6. **S.S.Bhavikatti**, Finite Element Analysis, New AgePublishers,2007.

Reference Books

1 **Buchanan,G.R.,**FiniteElementAnalysis.Schaum'sOutlines,TataMc-Graw-Hill Education Pvt. Ltd., New Delhi, 2006.

2 **Cook, R. D.,** Concept and Applications of Finite Element Analysis. 2d ed., New York, Wiley 1981.

3 **Segerlind,L.J**., Applied FiniteElementAnalysis.2ded., New York, Wiley 1984.

4 **Shames,I.H.,andDym,C.L**.,EnergyandFiniteElementMethodsinStructural Mechanics. McGraw Hill , New York, 1985.

5 **Reddy, J. N**., An Introduction to the Finite Element Method, McGrawHill, New York, 1993.

6 **Zienkiewicz, O. C.,** The Finite Element Method. 3rd ed.,McGraw Hill, New York, 1993.

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B.Tech. Civil Engineering Curriculum
With effect from Academic Year 2026–2027
Approved in the 32nd Academic Council Meeting, dated 28th July 2026

Mapping of Course out come with Program Outcomes and Program Specific outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	2	-	-	-	1	-	-	2	-	2
CO2	3	2	3	2	1	1	1	1	-	-	2	-	2
CO3	3	3	3	2	2	1	1	1	-	-	2	-	3
CO4	3	3	3	2	1	1	1	2	-	-	2	-	3
CO5	3	3	3	1	1	1	1	1	-	-	2	-	3

3-High 2-Medium 1-Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	02	02	-	10
K2	Understand	03	03	02	10
K3	Apply	05	05	05	30
K4	Analyze	05	05	03	10
K5	Evaluate	-	-	-	-
TotalMarks100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2, K3**	**K1, K2, K3**	**K1, K2, K3**	**K1, K2, K3,K4**	**K1, K2, K3,K4**
	CO1	CO2	CO3	CO4	CO5
ISEI (15 Marks)	07	08	-	-	-
ISEII (15 Marks)	-	-	08	07	
ISEIII (10Marks)	01	02	02	02	03
ESE Assessment (60 Marks)	12	12	12	12	12
TotalMarks100	20	22	22	21	15

PROGRAM ELECTIVE V CEPEC4020: Smart Cities		
Teaching Scheme	**Examination Scheme**	
Lectures:04hrs/week	**ISE I**	**15 Marks**
Credits:04	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Nil

Course description: This course offers a comprehensive overview of smart cities from a civil engineering perspective, focusing on sustainable infrastructure, digital technologies, and urban resilience. students will explore topics such as smart mobility, energy systems, green buildings, environmental monitoring, and disaster management. The course also highlights the role of technologies like IoT, GIS, and AI in modern city planning. Through real-world case studies and practical insights, the course bridges theory with implementation in the context of India's Smart City Mission and global best practices.

Course Outcomes:

After successful completion, students will be able to:

	Course Outcome
CO1	comprehend the core concepts, components, and global frameworks of smart cities.
CO2	understand the role of civil engineering in developing sustainable urban infrastructure, including smart mobility, energy systems, and waste management.
CO3	reflect on how digital technologies like IoT, GIS, BIM, and AI are applied in urban planning and governance.
CO4	propose solutions to real-world urban challenges using a smart city framework.
CO5	appraise the principles of urban resilience and disaster management in the context of city planning.

Detailed Syllabus:

Unit 1	Introduction to Smart Cities, Smart Governance & Digital Infrastructure.
Unit 2	Smart Mobility & Transport, Smart Urban Infrastructure.
Unit 3	Smart Energy Systems & Sustainability, Environmental Systems in Smart Cities.
Unit 4	Digital Technologies in Smart Cities, Urban Planning & Land Use, Green Buildings & Sustainable Urban Form.
Unit 5	Resilient Cities & Disaster Management, Case Studies & Global Best Practices, Future Trends & Student Projects.

Text and Reference Books:

1. **Vinod Kumar (Ed.)** "*Smart Economy in Smart Cities",* Springer International Publishing.
2. **Janette Sadik-Khan & Seth Solomonow**, "*Streetfight: Handbook for an Urban Revolution* Viking".
3. **Peter Newman, Timothy Beatley, Heather Boyer,** "*Resilient Cities: Responding to Peak Oil and Climate Change"* Island Press.
4. **Charles J. Kibert**, "*Sustainable Construction: Green Building Design and Delivery* John", Wiley & Sons.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	2	1	1	-	2	1	-	1	1	-
CO2	3	3	3	2	1	1	-	2	1	-	1	1	-
CO3	3	3	3	2	1	1	-	2	1	-	1	1	-
CO4	3	3	3	2	1	1	-	2	1	-	1	1	-
CO5	3	3	3	2	1	1	-	2	1	-	1	1	-

3- High 2- Medium 1- Low

Assessment:
ISE I: Based on unit I and unit II
ISE II: Based on unit III and IV
ISE III: Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical Quiz
2. Power point presentation of industry process & case studies, if applicable
3. Question & answer, interaction
4. Assignments
5. Attendance in the class

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISEI	ISEII	ISEIII	End Semester Examination
K1	Remember	05	05	4	12
K2	Understand	05	05	4	12
K3	Apply	05	05	2	36
K4	Analyze	-	-	-	-
K5	Evaluate	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3	K1, K2, K3
	CO1	CO2	CO3	CO4	CO5
ISEI(15 Marks)	8	7	-	-	-
ISEII (15 Marks)	-	-	8	7	-
ISEIII (10Marks)	2	2	2	2	2
ESE Assessment (60Marks)	12	12	12	12	12
Total Marks100	22	21	22	21	14

CEINT4001: Internship		
Teaching Scheme	**Examination Scheme**	
Practical: -----hrs/week	**ISE III**	**100 Marks**
Credits:12	**End Semester Evaluation**	**100 Marks**

Course Outcomes:

After completion of this course students will be able to:

CO1	identify and evaluate engineering challenges encountered during internship projects and propose appropriate technical or managerial solutions.
CO2	apply fundamental and advanced civil engineering principles in real-world environments such as construction sites, factories, and design offices.
CO3	prepare a comprehensive internship report documenting work carried out, project analysis, challenges faced, and lessons learned in a structured and technical manner.

Scope:

Students are expected to undergo Internship for VIII Semester at factory / construction site / design offices or in combination of these. Internship session shall be guided and certified by qualified engineer / architect / contractor in civil engineering.

Term work: At the conclusion of the Internship 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/ report based on their Internship 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 200.

Assessment:

ISE III: The assessment will consist of continuously assessing the experiment performed in previous week and interaction with the students during assessment of term work.

ESE: The assessment shall be based on oral/practical examination conducted by the course coordinator and external examiner appointed by Controller of Exam.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	1	3	-	-	1	-	3	-	2	-	3	2
CO2	2	3	2	3	-	1	-	2	-	3	-	1	3
CO3	2	2	3	2	-	1	-	2	-	2	-	2	2

3 – High 2 – Medium 1 - Low

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE III	End Semester Examination
S1	Imitation	40	40
S2	Manipulation	40	40
S3	Precision	20	20
S4	Articulation	-	-
S5	Naturalization	-	-
Total Marks		100	100

Assessment Table:

Assessment Tool	CO1	CO2	CO3
	S1, S2, S3	S1, S2, S3	S1, S2, S3
ISE III: (100 Marks)	20	20	60
ESE Assessment (100 Marks)	20	20	60
Total Marks (200)	40	40	120