Teaching and Examination Schemes with Syllabus

of

Master of Technology

in

(Civil) Construction Technology and Management

(Effective 2023-24)

(Approved by the SEC of Senate dated August 8, 2022)

Department of Civil Engineering

Sardar Vallabhbhai National Institute of Technology, Surat

Vision and Mission of the Institute

Vision

To be one of the leading Technical Institutes disseminating globally acceptable education, effective industrial training and relevant research output

Mission

To be a globally accepted centre of excellence in technical education catalyzing absorption, innovation, diffusion and transfer of high technologies resulting in enhanced quality for all the stake holders

Vision and Mission of the Department

Vision

To be a global centre of excellence for creating competent professionals in Civil Engineering

Mission

- To provide excellent education producing technically competent, globally employable civil engineers who will be leaders in the chosen field
- To undertake research in conventional and advanced technologies fulfilling the needs and challenges of modern society
- To provide consultancy services and develop partnerships with society, industry and public organizations.
- To organize seminar, conferences, symposia and continuing education programmes for academic and field community.

Foreword

Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat was established in the year 1961 and the Construction Technology and Management (CTM) Section began its journey since 2020. The post graduate course in CTM is designed to meet the present and the future challenges of construction sector and to explore and apply various construction technologies in execution of projects. It aims to develop the managerial and leadership skill of students to deliver the project in time and assigned budget with ensuring quality, safety, and environment surrounding of the project. The yearly intake of PG program of CTM is 30. Out of this, 25 with scholarships are filled up through Centralized Counselling for M Tech (CCMT) based on GATE score and 5 sponsored category seats are based on their experience and merit. Before commencement of this PG program, its curriculum was designed and formulated through a brainstorming workshop in 2018 in presence of domain experts from academia, research and development organizations, and field professionals. The curriculum includes core courses, multi-disciplinary electives, practical, training, seminars and dissertation. The subjects and their contents have carefully been developed. This CTM section has also benefits of various visiting professors and professional experts. The section organizes various expert lectures and site visits from time to time as an integral part of the study. The section has enough infrastructure and laboratories. The section is actively involved in basic and applied research and consultancy services. It has strong research and academic ties with various IITs, NITs, and London South Bank University, University of Salford, ICHR, AHRC UK, and MoRTH. Many construction companies including L&T, Linde Engineering, KEC, Rail Tech, Federal Bank, GMRC, NHRCL, etc., have recruited and provided internships to students in their projects. We welcome you to visit our section and institute.

Programme Educational Objectives (PEOs)

The graduates of the M. Tech. Construction Technology and Management Programme will:

- Foster their professional career and managerial skill in construction and development of projects.
- Exhibit professionalism through lifelong learning and able to work in teams for collaborative and various task.
- Manifest professionalism, ethical approach, leadership, application of new technology, communication skills, team work in their profession and adapt to modern trends by engaging in lifelong learning.

Programme Outcomes (POs)

The outcomes of the Master of Technology programme in Construction Technology and Management are:

- An ability to independently carry out research /investigation and development work to solve practical problems.
- An ability to write and present a substantial technical report/document.
- Students should be able to 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 Master program.

Programme Specific Outcomes (PSOs)

- Acquire thorough knowledge of Construction Technology and Management to analyse the complex problems and evaluate them over a wide range of feasible and economic solutions by applying the advanced tools, techniques, technology, and latest softwares in order to meet the needs of the society with due consideration of sustainability, quality and safety.
- Conceptualize and solve problems of construction projects, evaluate wide range of potential solutions and arrive at feasible and optimal solutions to meet the needs of the society with respect to safety, economy, legal and environmental considerations.
- Contribute positively to collaborative – multidisciplinary scientific research demonstrating capacity for self-management and teamwork, decision making based on open-mindedness, objectivity using knowledge of group dynamics to achieve common goals of advancement in learning for self and others.

Teaching Scheme
M.Tech. in (Civil) Construction Technology and Management

SEMESTER - I

Sr. No.	Course	Code	Teaching Scheme Hours per week			Credit	Examination Scheme			Total
							Theory	Tuto.	Pract.	
			L	T	P		Mark	Mark	Mark	
1	Construction Project Planning and Control	CECT101	3	1	0	04	100	25	-	125
2	Construction Methods and Equipment	CECT102	3	1	0	04	100	25	-	125
3	Advanced Construction Materials	CECT103	3	0	0	03	100	-	-	100
4	Core Elective-1	CECT###	3	0	0	03	100	-	-	100
5	Core Elective-2	CECT###	3	0	0	03	100	-	-	100
6	Construction Materials Lab	CECT104	0	0	4	02	-	-	50 (20*+30**)	50
7	Graduate Report-I	CECT105	0	0	2	01	-	-	25 (10*+15**)	25
		Total	**15**	**2**	**6**	**20**	**500**	**50**	**75**	**625**

Total Contact Hours/week=23

*ICE (Internal Continuous Evaluation) & **ESE (End Semester Evaluation)

Core Elective-1

CECT110 Design of Formwork Systems
CECT111 Low-Cost Construction
CECT112 Building Services and Management
CECT113 Lean Construction
CECT114 Real Estate Valuation
CETP121 Railways Infrastructure Planning and Design
CEUP121 Geospatial Techniques
CEWR115 Water Supply Distribution Systems

Core Elective-2

CECT120 Organization Management
CECT121 Maintenance and Rehabilitation
CECT122 Heritage Conservation and Management
CECT123 Plumbing Engineering
CECT124 Demolition of Structures
CETP116 Research Analytical Method (3-0-0)
CETP120 Airport Infrastructure Planning and Design
CETP123 Waterways Infrastructure and Design

Allotment of elective

The choice of the elective courses is primarily based on the interest of the students. Faculties offering the respective elective subject interact with all students and brief out the content with relevance of the subject in field or in research. On the basis of merit, students are given the freedom to select the elective of their choice. Emphasize is made to offer maximum number of electives in each semester, however, at least 6 students need to opt a certain elective to run it.

SEMESTER - II

Sr. No.	Course	Code	Teaching Scheme Hours per week			Credit	Examination Scheme			Total
			L	T	P		Theory Mark	Tuto. Mark	Pract. Mark	
1	Project Appraisal and Finance	CECT201	3	1	0	04	100	25	-	125
2	Construction Contract and Law	CECT102	3	1	0	04	100	25	-	125
3	Construction Quality and Safety	CECT203	3	0	0	03	100	-	-	100
4	Core Elective-3	CECT###	3	0	0	03	100	-	-	100
5	Open Elective	CECT###	3	0	0	03	100	-	-	100
6	Construction Management Lab	CECT204	0	0	4	02	-	-	50 (20*+30**)	50
7	Graduate Report-II	CECT205	0	0	2	01	-	-	25 (10*+15**)	25
		Total	**15**	**2**	**6**	**20**	**500**	**50**	**75**	**625**

Total Contact Hours/week=23

*ICE (Internal Continuous Evaluation) & **ESE (End Semester Evaluation)

Core Elective-3

CECT210 Precast and Prestress Construction
CECT211 Building Information Modeling (BIM)
CECT212 Introduction to Internet of Things (IoT)
CECT213 Disaster Management
CEGT211 Tunneling and Underground Structures
CEGT216 Ground Improvement Techniques
CETP213 Road Safety and Environment
CETP215 Operation and Maintenance Management of Pavements
CEUP215 Urban Infrastructure Planning and Management
CEUP221 Real Estate Management

Open Elective offered by CTM section

CECS230 AI/ML Based Applications in Civil Engineering
CECT230 Quantitative Methods
CECT231 Building Information Modeling (BIM)
CECT232 Resilient and Sustainable Infrastructure
CECT233 Smart Infrastructure System
CECT234 Project Management for Engineers
CECT235 Offshore and Marine Projects Management
CECT236 Project Appraisal and Finance (3-0-0)
CETP222 Communication Skills

Allotment of elective

The choice of the elective courses is primarily based on the interest of the students. Faculties offering the respective elective subject interact with all students and brief out the content with relevance of the subject in field or in research. On the basis of merit, students are given the freedom to select the elective of their choice. Emphasize is made to offer maximum number of electives in each semester, however, at least 6 students need to opt a certain elective to run it.

SEMESTER - III

Sr. No.	Course	Code	Teaching Scheme Hours per week			Credit	Examination Scheme			Total
							Theory	Tuto.	Pract.	
			L	T	P		Mark	Mark	Mark	
1	Dissertation Preliminaries	CECT301	0	0	8	04	-	-	100 (40*+60**)	100
2	Summer Training	CECT302	0	0	0	02	-	-	100	100
3	Professional Project	CECT303	0	0	6	03	-	-	150 (60*+90**)	150
4	Seminar	CECT304	0	0	2	01	-	-	50 (20*+30**)	50
		Total	**0**	**0**	**16**	**10**	**-**	**-**	**400**	**400**

Total Contact Hours/week=16

*ICE (Internal Continuous Evaluation) & **ESE (End Semester Evaluation)

SEMESTER - IV

Sr. No.	Course	Code	Teaching Scheme Hours per week			Credit	Examination Scheme			Total
							Theory	Tuto.	Pract.	
			L	T	P		Mark	Mark	Mark	
1	Dissertation	CECT401	0	0	20	10	-	-	400 (160*+240**)	400
		Total	**0**	**0**	**20**	**10**	**-**	**-**	**400**	**400**

Total Contact Hours/week=20

*ICE (Internal Continuous Evaluation) & **ESE (End Semester Evaluation)

Total Credits = 60

Assessment of Performance

Assessment of Theory Courses

The evaluation pattern for the theory courses, *as of now*, shall be as under:

Mid-semester examination: 30 marks
Assignment/Quizzes: 20 marks
Tutorials (if applicable): 25 marks
End-semester exam: 50 marks

The mid- and end-semester examinations are of 1.5 hours and 3 hours, respectively.

Assessment of Seminar

Internal assessment of 40% weightage by guide(s) and Final assessment of 60% weightage by a panel of examiners

Assessment of Dissertation/Projects

Internal assessment of 40% weightage by guide(s) Final assessment of 60% weightage by a panel of examiners including an examiner from outside the institute

For more details please refer to the institute website
https://www.svnit.ac.in/Data/Notice/AcademicRegulations2013-2014.pdf

Course-wise Detailed Syllabus

Semester I

CECT101 Construction Project Planning and Control

L	T	P	C
3	1	0	4

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1. Course Outcomes (COs)

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

CO1	Comprehend the basic principles of construction project, its complexity and its management.
CO2	Prepare work breakdown structure and find out the tasks necessary for activity completion.
CO3	Plan and apprehend the concepts and principles of project pre-construction, construction and post-construction phases.
CO4	Understand and demonstrate conventional as well as advanced principles and techniques of construction planning, scheduling and controlling.
CO5	Evaluate interrelationships between project time, cost, quality and performance.

2. Syllabus

- **CONCEPT OF PROJECT MANAGEMENT (12 Hours)**

  Conception to closing- A life cycle approach stakeholders in projects, Initiation, Planning, Execution, Monitoring and control and closing, approach to realistic cost estimation, Bid Document preparation and significance of its each segment, bidding stage assumptions and factors influencing project performance, Iron triangle Project Scope, Time and cost, Project Strategy, Project Feasibility, demonstration of practical applications through case studies.

- **WORK BREAKDOWN STRUCTURE (11 Hours)**

  Scope Management, Project Charter, Scope of Work (SoW), Concept of WBS, WBS Quality principles, typical hierarchy in the WBS of a project, desirable characteristic of work packages, determinants having critical influences on the work packages, scope creep, change management, WBS, OBS and RBS, Control Accounts.

- **PROJECT PLANNING AND SCHEDULING (12 Hours)**

  Importance of sound planning, Scheduling, principles and techniques, Scheduling methods (AOA and AON), critical path method, concept of float, project evaluation

and review techniques, line of balance variances in project duration and cost, network scheduling with limited resources, resource allocation, smoothing and levelling, updating the network, master networks, the time -cost trade-off approach, progress review and reporting, risk of schedule delays, missing milestone deliverables and its impact (from client and contractors view point) change management, contemporaneous records, documenting delays and maintaining records.

- **PROJECT CONTROL AND MONITORING (10 Hours)**

  Parameters of project performance, time, cost and quality and their interrelationships, schedule and cost control tools and techniques, performance reporting, audit, corrective and preventive actions, fund flow control, management information system and application of management software, demonstration of practical applications through case studies.

(Total Lectures: 45 hours. Tutorial: 15 hours)

3. References

1. Baldwin, A and Bordoli, D (2014) A Handbook for Construction Planning and Scheduling, Blakwell Publishers.
2. Jha, K N (2011) Construction Project Management, First Edition, Pearson Publishers.
3. Harris, F, McCaffer, R and Edum-Fotwe, F (2006) Modern Construction Management, sixth edition, Blackwell Publishers.
4. Knutson, K, Schexnayder, C J, Fiori, C. and Mayo, R E (2013) Construction Management Fundamentals, MCGraw Hill Publishers.
5. Whyte, A (2015) Integrated Design and cost for civil Engineers, CRC Press, Taylor and Francis Group.
6. Mubarak, S (2010) Construction project scheduling and control, second edition, John Wiley and sons.
7. Fewings, P (2011) Construction Project Management - An integrated approach, Taylor and Francis.
8. Goetsch, D L (2015) Project Management for construction, Pearson publishers.
9. Ottoson, H (2013) Practical project management for building and construction, CRC Press, Taylor and Francis.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	1
CO2	2	3	2	3	2	1
CO3	3	3	3	3	1	1
CO4	3	3	3	3	2	2
CO5	2	2	3	3	3	1

1-Low 2-Moderate 3-High

CECT102 Construction Methods and Equipments

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

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

CO1	Understand different formwork systems and temporary structures.
CO2	Learn in depth about steel and pre-stressed construction.
CO3	Perceive heavy and special construction techniques.
CO4	Perform technical and economic analysis of different construction equipments.
CO5	Judge appropriate selection of construction equipment.

2. Syllabus

- **TEMPORARY STRUCTURES (06 Hours)**

  Temporary structures including Form work, Scaffolding, Shoring, Underpinning, various kinds of slip forms, Reshoring, and Back shoring in Multistorey Building construction.

- **STEEL CONSTRUCTION (06 Hours)**

  Planning and principles of Steel Structural Frames, Structural Steel Frame Components, Connecting structural steel sections, Structural Steel Fabrication, Structural Steel Site Work and Erection.

- **PRESTRESSING AND COMPOSITE CONSTRUCTION METHODS (07 Hours)**

  Different type of Prestressing Systems, Methods of Post tensioning and Pre tensioning, Prefab construction, Modular coordination.

- **SPECIAL CONSTRUCTION METHODS (10 Hours)**

  Bridge construction including segmental construction, incremental construction and push launching techniques, Box pushing method, different types of tunnel construction methods

- **PLANNING AND SELECTION OF CONSTRUCTION EQUIPMENT (10 Hours)**

  Factors affecting selection of equipment - technical and economic, Analysis of production outputs and costs, Different types of Depreciation Methods, Characteristics and performances of equipment for major civil engineering activities such as Earth

moving, erection, material transport, pile driving, Dewatering, and Concreting, Ready mix concrete plants.

(Total Lectures: 45 hours. Tutorial: 15 hours)

3. References

1. Jha K N (2012) Formwork for Concrete Structures, Tata McGraw Hill, New Delhi.
2. Jha, K N (2015) Construction Project Management: Theory and Practice, Second Edition, Pearson Publishers, New Delhi.
3. Robert Peurifoy, Clifford J. Schexnayder and Aviad Shapira (2010) Construction Planning, Equipment and Methods, McGrow Hill India.
4. Roy Chudley Mciob and Roger Greeno (2006) Advanced Construction Technology, Prentice Hall
5. Smith, R C, and Andres, C K (2013) Principles & Practices of Commercial Construction, Prentice Hall.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	1
CO2	2	3	3	2	2	2
CO3	2	2	2	2	3	2
CO4	2	2	3	2	1	2
CO5	2	3	3	2	1	2

1-Low 2-Moderate 3-High

CECT103 Advanced Construction Materials

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Demonstrate the fundamentals of material science.
CO2	Analyse the properties of sustainable material.
CO3	Control the quality of construction.
CO4	Understand the advance concrete constituents.
CO5	Develop new binders for sustainable development.

2. Syllabus

- **MATERIAL SCIENCE (08 Hours)**

  Classification, Standardization, Codification and Variety. Details of Micro Structure of Different construction Materials, Different effects on materials of construction.

- **PROPERTIES OF MATERIALS (09 Hours)**

  Environmental Influences, Thermal effects Effect of Chemicals, Fire resistance, Corrosion and Oxidation, Radiation. Properties of fresh and hardened concrete. Shrinkage and creep of concrete.

- **SUSTAINABLE MATERIALS (12 Hours)**

  Introduction, sustainability and goals, current situation, earth's natural system, carbon cycle, role of construction materials, CO2 from fossil fuel vis-à-vis cement and other construction materials. Construction material and indoor air quality. Energy for production, transportation and erection, Estimation methodology, Computation of embodied energy for building. Primary energy and Energy Concepts.

- **ADVANCE CONCRETE (08 Hours)**

  High volume fly ash concrete, geo-polymer concrete and their embodied energy content against OPC concrete. Aggregate resource depletion, recycled aggregate from demolition etc. role of quality control and admixtures in sustainability. Durability of construction material and life cycle sustainability.

- **OTHER MATERIAL (08 Hours)**

  Polymer materials, Thermo-Plastic, Polymer Concrete, Composite, materials, Ferro cement, Ferro-concrete, Building materials from Agricultural, and Industrial wastes, M

Sand, Glass, Cladding, Light Weight Concrete.

(Total Lectures: 45 hours)

3. References

1. Wu Chung, H (2006) Advanced Civil Infrastructure Materials, First Edition, Woodhead Publishing Limited.
2. Newman, J and Choo, Ban Sang (2003) Advanced Concrete Technology-Processes, 1st Edition, Elsevier.
3. Kubba, S (2010) LEED Practices, Certification, and Accreditation Hand book, 1st ed. Elsevier.
4. Ministry of Power (2007) Energy Conservation Building Code, Revised Version, Bureau of Energy Efficiency.
5. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi, 2007.
6. Neville, A.M., and Brooks, J. J., Concrete Technology, Pearson Education Ltd., 2012.
7. Kalliopi K. Aligizaki., Pore Structure of Cement-Based Materials: Testing, Interpretation and Requirements, CRC Press, 2005.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1
CO2	3	2	2	1	1	1
CO3	3	3	1	2	2	1
CO4	3	2	2	1	1	1
CO5	3	3	1	2	2	1

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CECT110 Design of Formwork Systems

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Illustrate the requirement of formwork; classify the formwork systems and their selection; and choose the appropriate material.
CO2	Determine the expected loads on formwork systems and calculate the permissible values.
CO3	Design of formwork systems for the construction of various structural members.
CO4	Analysis of load distribution on shores and slabs in multi-story building frames.
CO5	Learn the causes of formwork failures and their preventive measures; study the applications of various special formwork.

2. Syllabus

- **INTRODUCTION (06 Hours)**

  Formwork and falsework; Requirement of formwork; Selection of formwork; Classifications of formwork; Materials for formwork

- **FORMWORK DESIGN CONCEPTS (03 Hours)**

  Loads on formwork systems; Design aspects and assumptions; Permissible stresses and deflections as per IS codes

- **FORMWORK FOR FOUNDATION AND WALLS (08 Hours)**

  Various components of formwork for foundations and walls and their design; Proprietary wall formwork systems

- **FORMWORK FOR COLUMNS (05 Hours)**

  Various components of formwork for columns and their design; Proprietary column formwork systems; Disposable column formwork

- **FORMWORK FOR BEAMS AND SLABS (08 Hours)**

  Various components of formwork for beams and slabs and their design; proprietary beam and slab formwork systems

- **FORMWORK IN MULTI-STORY BUILDING CONSTRUCTION (08 Hours)**

  Shoring, reshoring, back-shoring and pre-shoring; Striking and cycle time; Simplified

analysis and their assumptions and limitations; Load distribution on shores and slabs in multi-story building frames; Calculating the strength of the concrete slab at a given point in time

- **FORMWORK FAILURES (02 Hours)**

  Causes of formwork failures; Deficiencies in designing; Preventive measures; Safety in formwork operations

- **SPECIAL FORMWORK (05 Hours)**

  Flying formwork: table forms, tunnel formwork, column-mounted shoring systems, gang forms; Slip formwork; Formwork for precast concrete; Formwork for bridge structures

(Total Lectures: 45 hours)

3. References

1. Jha, K.N., Formwork for concrete structures, First Edition, McGraw Hill. 2012.
2. Peurifoy, R.L. and Oberlender, G.D., Formwork for concrete structures, McGraw Hill. 2011.
3. Robinson, J.R., Piers, abutments, and formwork for bridges. Library Accn No. 29797
4. Austin, C.K., Formwork to concrete, Cleaver - Hume Press, London, 1960.
5. Moore, C.E., Concrete form construction, Delmar Cengage Learning, 1977.
6. IRC 87, Guidelines for the design and erection of falsework for road bridges, The Indian Road Congress, New Delhi, 1984, Reprinted 1996.
7. IS 456, Plain and reinforced concrete - Code of practice, Bureau of Indian Standards, New Delhi, 2000.
8. IS 800, General construction in steel - Code of practice, Bureau of Indian Standards, New Delhi, 2007.
9. IS 875 (Part 1), Code of practice for design loads (other than earthquake) for buildings and structures: Dead loads, Bureau of Indian Standards, New Delhi, 1987, Reaffirmed 2003.
10. IS 875 (Part 2), Code of practice for design loads (other than earthquake) for buildings and structures: Imposed loads, Bureau of Indian Standards, New Delhi, 1987, Reaffirmed 2003.
11. IS 875 (Part 3), Code of practice for design loads (other than earthquake) for buildings and structures: Wind loads, Bureau of Indian Standards, New Delhi, 1987, Reaffirmed

2003.

12. IS 883, (1994), Reaffirmed 2005, Design of Structural Timber in Building- Code of Practice, Bureau of Indian Standards, New Delhi, 1994, Reaffirmed 2005.
13. IS 1161, Steel tubes for structural purposes - Specification, Bureau of Indian Standards, New Delhi, 1998, Reaffirmed 2003.
14. IS 4990, Plywood for concrete shuttering work - Specification, Bureau of Indian Standards, New Delhi, 1993, Reaffirmed 2003.
15. IS 14687, Falsework for concrete structures - Guidelines, Bureau of Indian Standards, New Delhi, 1999, Reaffirmed 2005.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	3	3	3
CO2	3	1	3	2	2	1
CO3	3	2	3	3	3	3
CO4	3	2	3	3	3	3
CO5	3	2	3	3	3	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CECT111 Low Cost Construction

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Comprehend the aspects of low cost and sustainable infrastructure development.
CO2	Identify the cost-effective materials for the infrastructure development projects.
CO3	Illustrate the applicability of low-cost techniques and equipment in construction projects.
CO4	Apply the low-cost methods for wastewater disposal systems and sanitation in rural and urban areas.
CO5	Evaluate the cost benefits of using low-cost methods in construction projects.

2. Syllabus

- **CONCEPTS OF LOW-COST MATERIALS (06 Hours)**

  Soil, Fly ash, Ferro cement, Lime, Fibers, Stone Dust, Boulders and oversize metal, Bitumen etc.

- **LOW-COST BUILDING MATERIAL PRODUCTS (12 Hours)**

  Walls; Stabilized and sun dried, soil blocks and bricks, Hollow concrete blocks, stone masonry blocks, Ferro cement partitions. Roofs; Precast R.C. Plank and Joists roof, Precast channel roof, Precast L-panel roof, Precast Funicular shells, Ferro cement shells, Filler Slab, Seasal Fiber roof, Improved country tiles, Thatch roof.

- **LOW-COST CONSTRUCTION TECHNIQUES AND EQUIPMENT (10 Hours)**

  Techniques; Rat trap bond construction, Precast R.C. and Ferro cement technique, Mud Technology. Equipments; Brick molding machine, Stabilized soil block making machine and plants for the manufacturing of concrete blocks, Low-Cost Roads.

- **LOW-COST SANITATION (08 Hours)**

  Waste water disposal system, Low-cost sanitation for rural and urban areas, Ferro cement Drains.

- **COST ANALYSIS AND COMPARISON (09 Hours)**

  Low-cost materials, Low-cost techniques.

3. References

(Total Lectures: 45 hours)

1. Lal, K (2011) Handbook of Low-Cost Housing, 1st Edition. New Age International Publisher
2. NBO, Handbook of Housing Statistics, Government of India.
3. Jain, A. K (2019) Housing for All, Khanna Publishing House
4. Ruiz, F. P. (2005). Building an Affordable House: Trade Secrets to High-value, Low-cost Construction. Taunton Press.
5. Holm, L., Schaufelberger J. E., Griffin D., Cole T., (2005) Construction Cost Estimating: Process and Practices. Pearson/Prentice Hall

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1
CO2	2	1	2	2	1	2
CO3	2	2	2	2	2	3
CO4	2	2	2	1	1	3
CO5	3	3	3	2	3	3

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CECT112 Building Services and Management

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Learn management of building services provisions in construction sites.
CO2	Identify the building services for the requisite functional needs.
CO3	Estimate space requirements for vertical transportation services.
CO4	Execute relevant system of heating, ventilation and air conditioning for buildings.
CO5	Study the role and strategies of building maintenance in construction process.

2. Syllabus

- **FIRE PROTECTION SYSTEM (12 Hours)**

  Fire Protection: Process of combustion in fire, Effect of fire load and ventilation condition on enclosure fire, growth and decay of fire in enclosure, Concepts of fire resistant and severity, Effect of fire on materials. Design of elements for given fire resistance, structural fire protection, Site Planning, Internal planning for Escape and refuges, Fire detection and suppression systems, Smoke venting.

- **VERTICAL TRANSPORTATION AND HVAC (12 Hours)**

  Lifts and Vertical Transportation: arrangement of lifts and Design for optimum service condition, HVAC System: Design Consideration. Basic psychrometry, Air conditioning process and system. Methods of Air Conditioning, Problems.

- **ELECTRICAL SYSTEM (10 Hours)**

  Element of Electrical Services in building, Illumination and intelligent building.

- **MAINTENANCE AND REPAIR STRATEGIES (11 Hours)**

  Element of Electrical Services in building, Illumination and intelligent building, Definition, Role of building maintenance in construction process Maintenance generators, Expression of Standards, selection of level of maintenance and fixing standards, Maintenance cycle, maintenance profile, repair and replacement models, statistical methods, decision models, optimal renewal cycle, budgeting etc.

(Total Lectures: 45 hours)

3. References

1. Markus, T A, and Morris, E N (1980) Buildings, climate, and energy, Pitman Publishing.
2. Merritt, F S (2012) Building engineering and systems design, Springer Science and Business Media.
3. SP-35 (1987) Handbook of Water supply and drainage, BIS
4. Clements-Croome, D, and Roberts, B M (1975) Airconditioning and ventilation of buildings (Vol. 10), Pergamon.
5. Buchanan, A H, and Abu, A K (2017) Structural design for fire safety, John Wiley and Sons.
6. Drysdale, D (2011) An introduction to fire dynamics, John Wiley and Sons.
7. Chanter, B, and Swallow, P (2008) Building maintenance management, John Wiley and Sons.
8. Purkiss, J A, and Li, L Y (2013) Fire safety engineering design of structures, CRC Press.
9. National Building Code Part 4 – Fire and Life Safety, BIS.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	3	3	3	2
CO2	3	2	2	3	2	1
CO3	3	2	2	3	2	1
CO4	3	2	2	3	2	1
CO5	3	3	1	2	3	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CECT113 Lean Construction

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Learn the fundamentals and origin of lean construction.
CO2	Study different lean construction practices, tools and methods.
CO3	Explore the purpose and role of value management job plan.
CO4	Understand the basics of life cycle costing and cost estimation systems.
CO5	Recognize various methods of valuation used in practice.

2. Syllabus

- **LEAN CONCEPT AND PRINCIPLES (06 Hours)**

  History, basic approach, definitions, lean philosophy, role of value engineering and management, effect of cost on design parameters, purpose and application to construction industry, application to design, market value.

- **VALUE MANAGEMENT JOB PLAN (03 Hours)**

  Role and purpose of VM job plan, steps of VM job plan, general phase, project selection phase, information phase, functional phase, judicial phase, evaluation phase, recommendation phase and implementation phase.

- **FUNCTIONAL ANALYSIS (08 Hours)**

  Functions, relationship, function analysis systems technique (FAST), application in value management, improvement in systems.

- **LIFE CYCLE COSTING (05 Hours)**

  Life cycle cost elements; LCC logic, application to facilities, analysis of the total cost of ownership, escalation and its impact, cost analysis concepts, cost matrix in LCC analysis.

- **COSTING AND COSTING MODELING (08 Hours)**

  Cost estimation system; use of cost models; establishing cost targets; objectives of costing; cost target team and organization; classification of costs based on complexity; datum creation; matrix and functional cost model; quality cost model, equipment cost

model, billing cost model.

- **METHODS OF VALUATION** **(08 Hours)**

  Rental method: essential ingredients, forms of rent, year purchase, capitalized value, shares and debentures, bonds of gilt-edged securities, life of structures, case studies in rental method of evaluation. land and building method: cost of construction, estimate on area basis, estimate on cubic basis, estimate by cost index, residual or demolition value of old building and case studies, profit method of valuation with case studies.

(Total Lectures: 45 hours)

3. References

1. Dell'isola, J. Alphonse (1988) Value Engineering in the Construction Industry, 3rd Edition. Smith, Hinchman & Grylls.
2. James J. O' Brien (1976) Value analysis in design and construction, 1st Edition McGraw Hill Book Company.
3. Namavati, H R (1998) Theory and Practice of Valuation, Lakhani Book Depot.
4. Koskela, L (1999) Management of Production in Construction: A Theoretical View. Proc. 7th Annual Conference of the International Group for Lean Construction (IGLC 7), Berkeley.
5. Howell, G A (1999) What is Lean Construction – 1999, Proc. 7th Annual Conference of the International Group for Lean Construction (IGLC 7), Berkeley, CA, 1-10.
6. Anil Kumar, M (2003) Value Engineering: Concept, Technique and Application, SAGE Publishers.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1
CO2	2	3	2	3	2	2
CO3	2	2	2	3	3	1
CO4	3	2	3	3	3	2
CO5	3	3	2	2	3	1

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CECT114 Real Estate Valuation

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Learn the concepts of microeconomics and macroeconomics and parallel economy.
CO2	Comprehend the various laws on valuation and real estate.
CO3	Understand the elements involved in property valuation.
CO4	Explore the various approaches involved in real estate valuation.
CO5	Know the principles of insurance, risk, and loss assessment.

2. Syllabus

- **PRINCIPLES OF ECONOMICS (06 Hours)**

  Introduction, Microeconomics- Consumption: Indifference curve, consumer surplus; Price mechanism: its determinants, individual and market demand and surplus schedules; Factors of production and their pricing: land, labour, capital, entrepreneur and other factors; Theory of rent; Capital and interest: types of capital, gross interest, net interest; Macroeconomics- Functions and role of money; Inflation- types, causes, effects and control (monetary, fiscal and direct measures); Deflation; Savings and investment; Components of economy: primary, secondary and tertiary sector; Concepts of gross domestic product and gross national product, capital formation, etc., Parallel Economy- definition, causes and effects of use of land and its valuation, impact on real estate market and construction industry.

- **LAWS ON VALUATION (04 Hours)**

  Insolvency and Bankruptcy Code, 2016; The Companies Act, 2013: Sections 192(2), 230(1), 230(2), 230(3), 231, 232, 247 and 281(1); Companies (Registered Valuers and Valuation) Rules, 2017; Securitization and Reconstruction of the Financial Assets and Enforcement of Security Interest Act, 2002 (SARFAESI Act, 2002) concerning valuation; Section 5(n) of the Banking Regulation Act, 1949 on ‘secured loan or advance’.

- **LAWS RELATED TO REAL ESTATE (06 Hours)**

Land Acquisition- the right to fair compensation and transparency in the land acquisition, the Rehabilitation and Resettlement Act, 2013; General building rules and regulations; Rent control laws; Right of way and Section 52: licenses under the Indian Easements Act, 1882; Salient features of the Real Estate (Regulation and Development) Act, 2016 and regulating authorities established under the Act; The Transfer of Property Act, 1882.

- **VALUATION OF REAL ESTATE (09 Hours)**

  Cost, price and value; types of value; basic elements of value – marketability, utility, scarcity, and transferability; factors affecting value; real property: rights and interests in real estate, types of ownerships and types of occupancy in real estate; annuities, capitalisation and rate of capitalization, years purchase, sinking fund, redemption of capital, reversionary value; construction and use of valuation tables; urban infrastructure and its influence on value of real estate; real estate market and its characteristics, investment in real estate, factors influencing demand and supply schedule in real estate.

- **APPROACHES TO VALUE (16 Hours)**

  Income Approach to Value – relation between income and value, valuation of property affected by the Rent Control Acts, licensed property under the Easement Act, 1882, leasehold properties under the Transfer of Property Act, 1882, remunerative rate of interest and accumulative rate of interest, types of rent: outgoings, income, yield, years purchase, determination of market rent and standard rent, lease: lessor and lessee, types of lease, lease provisions and covenants, valuation of lessor's interest, premature termination of lease or surrender of lease, real estate as an investment, investment decisions: discounted cash flow techniques, internal rate of return, net present value and capital assets pricing model, profit method for valuation of special properties; Market Approach to Value – types of market, market survey and data collection, sources of sale transactions, comparison of sale instances, Hedonic model and adjustment grid model under sales comparison method, land characteristics and its effect on land values, hypothetical plotting scheme for value of large size land, residue technique and other development methods, valuation for joint venture development of property; Cost Approach to Value – methods of cost estimates for buildings, life of building: economic, physical, legal; factors affecting life of building, various methods of computation of depreciation, functional, technological and economic obsolescence,

reproduction cost/replacement cost, depreciated replacement cost (DRC) working, land value by market approach and building value by cost estimation method for owner occupied bungalows, factories, public buildings; Various purpose of Valuation – valuation of properties for purposes such as: bank finance, auction reserve, building insurance, sale, purchase, valuation disputes in court, probate, partition, rent fixation, stamp duty, capital gains tax, as per rule 11ua of the Income Tax Act, 1961, lease and mortgage of property, valuation standards as per the provisions of the Companies Act, 2013, valuer as an expert witness in court, valuers' functions and responsibilities.

- **PRINCIPLES OF INSURANCE AND LOSS ASSESSMENT (04 Hours)**
  Principles and legal concepts in relation to insurance of buildings, contract of insurance, insurable interests, liability to insure, duties of the insurer and the insured; types of fire policies, reinstatement value, indemnity policies and policies for other perils; value at risk, sum insured and condition of average, over and under insurance, provisions regarding inflation, depreciation, obsolescence and betterment; preparation of claim for damages due to insured perils; obligations and rights of insurer and insured.

(Total Lectures: 45 hours)

3. References

1. Betts, R M and Ely, S. J. () Basic Real Estate Appraisal, Prentice-Hall.
2. Vakil, C N and Pathak H N (1956) Introduction to Economics, Vora & Co. Publishers Pvt. Ltd.
3. Murthy, M R S (1988) Cost Analysis for Management Decisions, Tata McGraw-Hill Publishing Company Ltd.
4. Namavati, R H. Theory and Practice of Valuation.
5. Savla, H (2021) Real Estate Valuation, Notion Press.
6. Natarajan, K and Nedunchezhiyan B. (2016) Indian Real Estate Law 2016, Notion Press.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	1

CO2	2	3	2	3	3	2
CO3	3	3	3	3	3	3
CO4	3	2	2	3	3	3
CO5	2	2	2	3	3	3

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CETP121 Railways Infrastructure Planning and Design

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Identify the Components of Railway Track, different Railway Gauges.
CO2	Design track Gradients as per given requirements and Discuss various Types of Track Turnouts.
CO3	Describe purposes and facilities at Railway Stations.
CO4	Understanding Interlocking and modern signal system.
CO5	Describe Surface Defects on Railway Track and Their Remedial Measures.

2. Syllabus

- **PLANNING OF RAILWAY LINES NETWORK (05 Hours)**

  Railways operational system, historical background of Indian railways, plans and developments, policy and standards, traffic forecast and surveys, railway alignment, project appraisal, and organization setup.

- **COMPONENT OF RAILWAY TRACK AND ROLLING STOCK (06 Hours)**

  Permanent way, forces acting, rails, the function of rails, rail fixtures and fastenings, sleepers and ballast, rail joints, elements of junctions and layouts, types of traction, locomotives and other rolling stock, brake systems, resistance due to friction, wave action, wind, gradient, curvature, starting, tractive effort of a locomotive, hauling power of a locomotive.

- **GEOMETRIC DESIGN OF RAILWAY TRACK (08 Hours)**

  Right of way and formation, field investigation, geometric design elements, safe speed on curves, speeds computation, string lining of curves, gradients, grade compensation, railway cant and cant deficiency, traction.

- **TRACK CONSTRUCTION (06 Hours)**

  Special considerations and construction practices, track laying, Introduction of the maintenance programme, Monsoon, Pre-Monsoon and Post-Monsoon Maintenance, Causes for Maintenance, Routine Maintenance, Tools for Railway Track Maintenance and Their Functions, Surface Defects and Their Remedial Measures, track drainage,

track circuited lengths, track tolerances, mechanized method, off-track tampers, shovel packing, ballast confinement and directed track maintenance, bridge maintenance, renewal, classification of renewal works, through sleeper renewals, mechanized relaying, track renewal trains.

- **SIGNALING AND INTERLOCKING (04 Hours)**

  Objectives, classification, fixed signals, stop signals, signaling systems, mechanical signaling systems, electrical signaling systems, systems for controlling train movement, interlocking, and modern signaling installations.

- **RAILWAY ACCIDENTS AND SAFETY (06 Hours)**

  Train accidents, collision and derailments and their causes, restoration of traffic, safety measures, disaster management, classification of level crossings, accidents at level crossings, remedial measures, and maintenance of level crossings

- **RAILWAY STATION AND YARDS (06 Hours)**

  Site selection, facilities, classification, platforms, building areas, types of yards, catch sidings, ship sidings, foot over bridges, subways, cranes, weighbridge, loading gauge, end loading ramps, locomotive sheds, ash-pits, water columns, turntable, triangles, traverser, carriage washing platforms, buffer stop, scotch block, derailing switch, sand hump, fouling mark.

- **HIGH-SPEEDED RAILWAYS (04 Hours)**

  Modernization of railways, the effect of high-speed track, vehicle performance on track, high-speed ground transportation system, ballastless track, track requirement for bullet trains, elevated railways, underground and tube railways.

(Total Lectures: 45 hours)

3. References

1. Satish Chandra and M. Agrawal, Railway Engineering, Second Edition, Oxford University Press, 2013.
2. Agarwal, M.M. Indian Railway Track, Prabha & Co., New Delhi, India, 1988.
3. Chandra S. and M.M. Agarwal Railway Engineering, Oxford University Press, New Delhi, India, 2007.
4. Gupta, B.L. Text Book of Railway Engineering, Standard Publishers, New Delhi, India, 1982.

5. Rangwala, S.C. Principles of Railway Engineering, Charotar Publishing House, Anand, India, 1988.
6. S.C. Saxena and S.P. Arora, A text book of Railway engineering, Dhanpat Rai, 2001

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	2	1
CO2	3	2	2	1	2	2
CO3	2	2	3	1	1	1
CO4	2	3	2	2	2	3
CO5	3	2	2	2	1	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CEUP121 Geospatial Techniques

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Summarize various techniques of data acquisition.
CO2	Classify different data structures of remote sensing, GIS and GPS.
CO3	Analyze images based on supervised and unsupervised techniques.
CO4	Generate GIS database model using software.
CO5	Use spatial data analysis techniques for Urban Planning applications.

2. Syllabus

- **INTRODUCTION (02 Hours)**

  Introduction to GIS, Remote Sensing and GPS, Applications in various fields of engineering and planning.

- **CONCEPTS AND FUNDAMENTALS OF REMOTE SENSING (08 Hours)**

  Basics of Arial and Satellite Remote Sensing, Components of Remote Sensing, Principles of Remote Sensing, Energy Sources, Electro Magnetic Radiation (EMR), Electromagnetic Spectrum, Energy Interactions, Active and Passive Remote Sensing, Data acquisition, Remote Sensing Platforms, Satellites, Sensors.

- **IMAGE INTERPRETATION AND DIGITAL IMAGE PROCESSING (08 Hours)**

  Fundamentals of Air photo Interpretation, Keys, Elements of Air photo Interpretation for Terrain Evaluation. Digital image processing, Enhancement of Image, Supervised and Unsupervised Analysis, Classification and Analysis, Ground Truth.

- **STRUCTURE OF GIS (08 Hours)**

  Cartography, Geographic mapping process, Transformations, Map projections, Geospatial and Geomatics Data, Geographic Data Representation, Storage, Quality and Standards of Data, Database management systems, Raster and Vector data representation, Assessment of data quality, Managing data errors.

- **GIS DATA PROCESSING, ANALYSING AND MODELLING (08 Hours)**

  Raster and Vector based data processing, Queries, Spatial analysis, Quadrant counts,

nearest neighbour analysis, Network analysis, Surface modelling, DTM, Case studies of GIS Applications.

- **GLOBAL POSITIONING SYSTEM (04 Hours)**
  Concept, Components of GPS, GPS setup, Accessories, Segments-satellites and receivers, Case studies of GPS applications.

- **INTEGRATED APPLICATIONS (03 Hours)**
  Case studies of Integrated application of RS, GIS and GPS in the field of Urban Planning and Regional planning, Water resources, Environmental studies, Transportation engineering and other civil engineering fields.

- **INTRODUCTION TO SOFTWARE (QGIS/ARCGIS) (04 Hours)**
  Introduction to the software and its interface, setting up coordinates, Georeferencing, Basic drafting tools, Filling up attributes, Plotting of maps etc.

(Total Lectures: 45 hours)

3. References

1. Lo C.P. and Yeung A.K.W. (2006), Concepts and Techniques of Geographic Information Systems, 2nd ed, Prentice Hall of India, New Delhi.
2. Reddy A. (2008), Remote Sensing and Geographical Information Systems, B.S. Publications, Hyderabad
3. Clarke, K., (2001) Getting Started with Geographic Information Systems, Prentice Hall, New Jersey.
4. DeMers M.N. (2008), Fundamentals of Geographic information Systems, 4th ed, John Wiley and Sons, New York.
5. Kennedy M. (2002), The Global Positioning System and GIS: An Introduction, 2nd ed, Ann Arbor Press.
6. Krista L. (2012), 'The Insider's Guide to Technical Writing', Ingram short title.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	1	0	0	2	2	1

CO2	1	1	2	1	2	1
CO3	3	2	2	1	2	1
CO4	3	2	3	1	2	1
CO5	3	3	3	1	1	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 1

CEWR115 Water Supply Distribution Systems

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Identify different intake structures and water treatment processes.
CO2	Understand parameters involved in design of water distribution system.
CO3	Design water distribution system.
CO4	Optimize water distribution system.
CO5	Analyse surge in the pressurized water supply network.

2. Syllabus

- **INTRODUCTION (04 Hours)**

  Introduction to Intake structure, Water Quality, Hydraulics of water treatment processes.

- **TYPE OF DISTRIBUTION SYSTEMS (08 Hours)**

  Equivalent pipe, parameters in distribution system analysis, parameters interrelationship, Formulation of equation, Gravity and Rising Main, Location and Design Principles.

- **ANALYSIS OF WATER DISTRIBUTION SYSTEMS (10 Hours)**

  Methods of analysis: (i) Hardy-Cross Method (ii) Newton-Raphson method and (iii) Linear Theory Method (iv) Gradient Method.

- **DESIGN AND OPTIMIZATION OF WATER DISTRIBUTION SYSTEMS (13 Hours)**

  Design: Trial and error method of design, cost-head loss ratio method. Optimization using linear programming techniques, Surge analysis in water distribution systems, Pump duty stations and detailing valves, Pressure transients in pipe flow.

- **CASE STUDIES (10 Hours)**

  Case studies on new Water Distribution Systems, Rehabilitation systems, DPR preparation of a water supply system including operation and maintenance through

SCADA.

(Total Lectures: 45 hours)

3. References

1. Bhave, P. R., "Optimal Design of Water Distribution Networks", Narosa Publishing House, New Delhi, 2003.
2. Streeter, V. L. and Wylie, E. D., "Fluid Transients in Systems", Pearson., 2010.
3. Bhave, P. R., and Gupta, R., "Analysis of Water Distribution Networks", Narosa Publishing House, New Delhi and Alpha-Science Publication, UK, 2006.
4. CPHEEO (1999), Manual on Water Supply and Treatment, Central Public Health and Environmental Engineering Organisation, Ministry Housing and Urban Affairs (Previously known as Ministry of Urban Development, New Delhi, Third Edition.
5. IS 10500:2012, Drinking Water-Specification, Second Revision, 2012.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2
CO2	3	2	1	1	1	3
CO3	3	2	1	1	1	3
CO4	3	1	2	1	1	2
CO5	3	1	2	1	1	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CECT120 Organization Management

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Develop the understanding of management concept and its relevance in organizations.
CO2	Understand human behaviour in terms of organization management and competency to implement organizational changes.
CO3	Learn concept and functions of HRM, and integrated perspective on the role of HRM in modern business.
CO4	Be able to connect various issues of IR with management and its implications; Learn Employee Discipline, Grievance procedures and various aspects of Industrial conflicts.
CO5	Understand legislative matters related to Organizational Health and Safety, compensation and salary administration.

2. Syllabus

- **PRINCIPLES OF MANAGEMENT (06 Hours)**

  Introduction to the field of management, Development of management thoughts, Characteristics and scope of management, Roles and skills of managers.

- **ORGANIZATION AND HRM (12 Hours)**

  Concept of organization, Span of control, Organization structure, Human Resource Management, recruitment, selection, placement, training and development, Performance Appraisal and Management, Change Management.

- **ORGANIZATION BEHAVIOUR (10 Hours)**

  Individual psychology, Personality, Attitude, Perception, Motivation, morale and productivity, Group Dynamics, Conflict Management and Job Stress, Leadership.

- **INDUSTRIAL RELATION (08 Hours)**

  Introduction of IR, Employee safety and health, discipline and grievance, collective bargaining, Trade Union, Compensation Management.

- **LABOUR LEGISLATION (09 Hours)**

  Contract Labour (R &A) Act, 1970; Inter-State Migrant labour Act, 1979; Factory Act, 1948 as applicable to construction agencies, social security and welfare legislation;

laws relating to wages, bonus and industrial disputes; Labour Welfare Funds Act, 1965 and Workmen's Compensation Act, 1923.

(Total Lectures: 45 hours)

3. References

1. Carleton Counter III and Jill Justice Coulter (1989) The Complete Standard Hand Book of Construction Personnel Management, Prentice Hall, Inc.
2. Josy J. Familaro (1987) Handbook of Human Resources Administration, McGraw Hill International Edition.
3. Monappa, A and Saiyadain, M S (1999) Personnel Management, 2nd Edition. Tata McGraw Hill.
4. Memoria, C B (1997) Personnel Management, 1st Edition. Himalaya Publishing Co.
5. Rao V. S. P. (2020) Human Resource Management, Paperback.
6. Gupta C. B. (2015) Human Resource Management, Sultan Chand & Sons.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	3
CO2	3	3	3	2	2	3
CO3	2	3	3	1	3	3
CO4	2	3	3	2	3	2
CO5	1	3	2	3	3	1

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CECT121 Maintenance and Rehabilitation

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand the concept of maintenance of the structures.
CO2	Inspect and evaluate the damaged structure.
CO3	Analyse the structures through serviceability and durability point of view.
CO4	Compare the different materials used for the repairing and its proper application.
CO5	Evaluate the techniques and methodology for the repairing of the structures.

2. Syllabus

- **MAINTENANCE AND REPAIR STRATEGIES (08 Hours)**

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

- **SERVICEABILITY AND DURABILITY OF CONCRETE (10 Hours)**

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

- **MATERIALS FOR REPAIR (08 Hours)**

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

- **TECHNIQUES FOR REPAIR AND PROTECTION METHODS (09 Hours)**

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

- **REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES**

(08 Hours)

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

(Total Lectures: 45 hours)

3. References

1. Denison Campbell, Allen and Harold Roper (1991) Concrete Structures: Materials, Maintenance and Repair, Longman Publication Group.
2. Allen R T, Edwards, S C and Shaw, J D N (2013) Repair of Concrete Structures, 2nd Edition, Springer.
3. Raikar, R N (1987) Learning from failures - Deficiencies in Design, Construction and Service - R & D Centre (SDCPL), Raikar Bhavan, Bombay.
4. Gupta, B L (2009) Maintenance and Repair of Civil Structures, Standard Publication, Delhi.
5. Gibson, E J (Ed.) (1979) Developments in building maintenance (Vol. 1), Applied Science Publishers.
6. Campbell-Allen, D, and Roper, H (1991) Concrete structures: materials, maintenance and repair, J H Libraries.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	2
CO2	3	2	3	3	3	2
CO3	2	1	3	2	3	2
CO4	3	2	3	3	3	2
CO5	3	3	3	3	3	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CECT122 Heritage Conservation and Management

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand the forms of heritage structures and materials.
CO2	Be aware of roles and responsibilities of a conservation engineer and be able to implement and manage the heritage conservation project.
CO3	Explore the advanced methods of inspection and condition assessment of heritage buildings.
CO4	Study the properties of historic building materials.
CO5	Derive characteristics of heritage conservation projects and diagnose heritage structures for conservation.

2. Syllabus

- **IMPORTANCE OF HERITAGE CONSERVATION (07 Hours)**

  Definition of heritage, classification of heritage, problems and causes of defects in heritage structures, history of conservation, heritage conservation act, UNESCO strategy and efforts towards heritage conservation, national and international bodies and charters for heritage conservation and management.

- **CONSERVATION ENGINEERING (07 Hours)**

  Basics of conservation, introduction to interventions, degree of intervention, prevention of deterioration, restoration, rehabilitation, reproduction, reconstruction, translocation, conservation engineering as arts and science, technologies for intervention, role of conservation engineer.

- **HISTORIC STRUCTURAL FORMS (08 Hours)**

  Forms of historical structure and monuments, built forms in ancient times, built forms in old times, built forms in modern times, structural elements of heritage, historic roof systems, historic brick and stone work, behaviour of heritage buildings, finite element method.

- **HISTORICAL MATERIALS (08 Hours)**

  Martials in historic times, lime, stone, wood, timber, historic mortars, historic masonry, types of material problem and failures, recreation of historic materials, simulation of

historic materials.

- **INSPECTION AND DIAGNOSIS** **(07 Hours)**

  Methods of inspection and condition assessment, reporting and records, diagnosis methods, sensors, radars, sonic tomography, rebound tests, magnetometry analysis, visual methods, image processing, artificial intelligence.

- **CONSERVATION MANAGEMENT** **(08 Hours)**

  Characteristics of heritage conservation project, planning and organization of conservation project, WBS of conservation project, scheduling and activities of conservation project, digital technologies for conservation planning, analysis and simulations.

(Total Lectures: 45 hours)

3. References

1. Mathews, M S (1998) Conservation Engineering, Universidad Karlsruhe.
2. Pickard, R (2001) Policy and law in heritage conservation (Vol. 1). Taylor and Francis.
3. Toniolo, L., Boriani, M., and Guidi, G. (Eds.). (2015). Built heritage: monitoring conservation management. Cham: Springer International Publishing.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	2	3	3	2
CO2	3	3	2	3	2	2
CO3	3	1	3	2	2	2
CO4	3	3	2	3	3	1
CO5	3	1	3	3	3	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CECT123 Plumbing Engineering

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand the importance of plumbing in building services and terminologies related to plumbing safety.
CO2	Identify and select plumbing tools, pipe materials and fittings and their suitability for a given work.
CO3	Design plumbing services and learn emergency response plan in depth.
CO4	Analyze risks associated during plumbing activities.
CO5	Study building water distribution systems in depth

2. Syllabus

- **INTRODUCTION TO PLUMBING AND PLUMBING SAFETY (07 Hours)**
  Plumbing Profession, History of Plumbing, Terminologies used in Plumbing, Phases of Plumbing Projects, Water Conserving Techniques in Plumbing, Defects in Plumbing – Causes and Remedies, Plumbing Safety, Terms associated with plumbing safety, PPE, Respiratory Protection, Hazard Communication, Work Zone Safety, Safety Practices – Working Areas and Surfaces.

- **PLUMBING TOOLS, TOOL SAFETY AND WORK ENVIROMENT (07 Hours)**
  Terminologies, Measuring and Layout Tools, Leveling Tools, Tooth-Edged Cutting Tools, Smooth-Edged Cutting Tools, Drilling and Boring Tools, Pipe Threaders and Soldering tools, Assembly and Holding Tools, Basic Tool Safety, Trenching and Excavation Safety, Lockout/Tagout Rule, Safe Practices for Working in Confined Spaces, Emergency Response.

- **PLUMBING REGULATIONS, MATH, DRAWINGS AND COSTING (07 Hours)**
  General Regulations, Introduction to Plumbing Math, Measuring Pipe, Construction Drawings and its components, Plumbing Drawing and its types, Plumbing Costing.

- **PIPE MATERIALS AND FITTINGS (07 Hours)**
  Types of Pipes and fittings, Process involving cutting, connecting, testing, creating joints, Suitability of different materials, Quality tests.

- **FIXTURES AND FAUCETS AND DRAIN, WASTE AND VENT SYSTEMS (DWV) (06 Hours)**

  Introduction, Terminologies, materials used to make fixtures, types of fixtures, faucets, Major components of DWV systems, Traps and Inceptors, DWV Fittings, Septic Tanks Connections, Waste Treatment and Health Issues.

- **WATER SUPPLY AND DISTRIBUTION SYSTEMS (06 Hours)**

  Sources, Treatment, Distribution, Backflow Preventers and valves, Building water distribution systems, various government approvals, Potable Water Storage Tanks, Water Pressure, Pressure Regulators, Pressure Relief Valves, Vacuum relief valves.

- **SERVICES (05 Hours)**

  Water Heaters, Solar Power, Health Care Facilities and Medical Gases Pipeline Systems, Firestop Protection – Installations and Inspection, Fuel Piping – Gas Piping, Installation, Pressure Testing and Inspection.

(Total Lectures: 45 hours)

3. References

1. Deolalikar, S G, Plumbing Design and Practice, First Edition, Tata McGraw-Hill Publishing Company Limited.
2. Mohan, C R and Anand V, Design and Practical Handbook on Plumbing, Standard Publisher Distributors.
3. Cyril M. Harris, Practical Plumbing Engineering, American Society of Plumbing Engineers.
4. 2017 Uniform Illustrated Plumbing Code – India, Fourth Edition, IAPMO Plumbing Codes and Standards.
5. Refresher Course for Plumbers on Household Connectivity.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	2	2	3
CO2	3	1	2	2	3	2
CO3	3	1	3	3	3	3

CO4	3	1	3	2	3	3
CO5	3	2	2	3	3	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CECT124 Demolition of Structures

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Gain knowledge of the disposal and treatment of construction and demolition wastes.
CO2	Evaluate plan for suitable storage, collection, transfer and transfer strategies for C&D waste management.
CO3	Study in detail various environmental legislations for safe disposal of C&D wastes.
CO4	Formulate 4Rs approach for processing and recovery of C&D waste.
CO5	Understand various modern demolition methods and hazards.

2. Syllabus

- **INTRODUCTION TO C&D WASTE (07 Hours)**

  Solid Waste-its classification, Hazardous Waste-overview, Construction and Demolition Waste, need for disposable management, composition of C&D Waste, Areas of application of C&D Waste, Duties of Waste Generator, Service providers and their contractors, local authority, state pollution control board, state government, central pollution control board, BIS and IRC.

- **C&D WASTE MANAGEMENT (08 Hours)**

  National and International practices, Methods for managing C&D Waste: On-Site Management, Processing and Recovery at a Central Recycling Facility, Land Disposal, C&D Waste Recycling Approaches: The current scenario and Challenges to C&D waste Recycling; Hazardous materials in Demolition Waste; C&D Waste Management Rules, 2016, procedures for determining potential for beneficial use.

- **LEGISLATIONS (08 Hours)**

  Environmental Legislation; Characterization and site assessment; Waste minimization and resource recovery; Storage and Transportation of C&D Waste; Initiatives in promoting C & D waste products by GoI; demolition disputes and legislation.

- **TREATMENT OF C&D WASTE (08 Hours)**

  Collection and transportation of C&D Waste, Sorting of C&D waste, Processing and

treatment of C&D Waste, 4R concepts, Hazard in processing and treatment; Physical, Chemical, Thermal and Biological processes; C&D waste disposal.

- **DISPOSAL OF C&D WASTE (07 Hours)**

  Landfill disposal and land storage, Challenges and issues in C&D Waste disposal; Groundwater contamination: Containment, Remedial alternatives.

- **DEMOLITION METHODS (07 Hours)**

  Dismantling, Demolition and Deconstruction, Methods of Demolition – Conventional Demolition Methods, Modern Demolition Methods, Special Demolition Methods, Implosion; Phases of demolition, Demolition planning, Demolition cost estimation, accidents and hazards in demolition works, challenges and issues in demolition, provisions in codes of practices.

(Total Lectures: 45 hours)

3. References

1. Construction and Demolition Waste Management Rules, 2016, MoEF&CC
2. Design, Construction and Monitoring of Landfills, Bagchi, A., Wiley Interscience.
3. Hazardous and Industrial Waste Treatment, Haas, C. N. and Vamos, R. J., Prentice Hall.
4. Hazardous Waste Management Engineering, Martin, E. J. and Johnson, J. H., Van Nostrand.
5. Hazardous Waste Management, 2nd Ed., Wentz, C. A., McGraw Hill, 1995.
6. Biological Treatment of Hazardous Wastes, Lewandowski, G. A. and DeFilippi, L. J., John Wiley and Sons, INC.
7. Practical Management of Chemicals and Hazardous Wastes: An Environmental and Safety Professional's Guide, Kuhre, W. L., Prentice Hall.
8. BIS (Bureau of Indian Standards), 2002. Demolition of Building – Code of Safety (second revision), BIS 4130, New Delhi, India.
9. BSI (British Standards Institution), 2011. Code of Practice for Full and Partial Demolition, BS 6187, London, UK.
10. Building Department Hong Kong, 2004. Code of Practice for Demolition, Hong Kong.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	3	3	3
CO2	3	1	3	3	2	2
CO3	3	1	2	3	2	2
CO4	3	1	3	2	3	2
CO5	3	1	3	3	3	3

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CETP116 Research Analytical Method (3-0-0)

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Perform statistical analysis of the sample data collected using different sampling techniques towards insightful inferences.
CO2	Analyse different continuous and discrete probability distributions.
CO3	Develop correlations by analysing univariate and multivariate data.
CO4	Apply hypothesis testing techniques using different sampling distributions/tests.
CO5	Solve the real-world problem with appropriate optimization tool.

2. Syllabus

- **SOCIAL RESEARCH FORMULATION (09 Hours)**

  Design of research - Scaling techniques - Sampling design - Design of questionnaire - Data collection and statistical processing, variables, types of variables, scaling of variables, coding of variables in software tools.

- **STATISTICS AND PROBABILITY CONCEPTS (09 Hours)**

  Various probability distributions and their applications - Parameter estimation - Hypothesis testing - Random variables - Method of maximum likelihood - Hypothesis testing to compare multiple population - Statistical quality control.

- **HYPOTHESIS TESTING (09 Hours)**

  Hypothesis testing, types of error in hypothesis, confidence interval, significance tests for comparing variances and means, tests with small and large samples, two-tail and one-tail student's t-test, analysis of variance (ANOVA), non-parametric tests (Chi-square test and Kolmogorov–Smirnov test), central limit theorem, practice with transportation data.

- **REGRESSION ANALYSIS (09 Hours)**

  Simple linear regression, residuals and variances, Assumptions, multiple linear regression, two stage regression, forward, backward and step-wise regression, residual analysis, correlation analysis, type of correlations, coefficient of correlation, Karl-Pearson's coefficient, multivariate data analysis, factor analysis, applications in

transportation engineering, goodness-of-fit tests and curve fitting.

- **OPTIMIZATION TECHNIQUES (09 Hours)**

  Linear programming - Simplex method - Transportation model - Concepts of non–linear programming - Decision theories – Rules - Decision under uncertainty, Applications in Transportation Engineering.

(Total Lectures: 45 hours)

3. References

1. Benjamin J. R., Cornell C. A., Probability Statistics and Decision for Civil Engineers, McGraw-Hill, 1970.
2. Kothari, C.R., Research Methodology: Method and Techniques, New Age International Publication, 2004.
3. Hines W. W., Montgomery D. C., Probability and Statistics in Engineering and Management Science, John Wiley and Sons, New York, 1990.
4. Sharma J.K., Operation Research: Theory & Applications, MacMillan India Ltd., 2000.
5. Bhandarkar P.L., Wilkinson T.S., Methodology & Techniques of Social Research, Himalaya Publishing House, 1991.
6. Simon P. Washington, Matthew G. Karlaftis, Fred, Mannering L., Statistical and econometric methods for transportation data analysis, CRC Press, Second Edition, 2010.
7. Washinton SP, Karlafits MG, Mannering F.L., Statistical and econometric method for transportation data analysis, 2nd addition, CRC Press, 2011.
8. Richard A. Johnson, Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, 1992.
9. Cooley, WW and Lohnes, RR, Multivariate Data Analysis, John Wiley, 1971.
10. Joseph F. Hair, Bill Black, Barry Babin, Rolph E. Anderson, Ronald L. Tatham, Multivariate Data Analysis, Prentice Hall; 2005.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3

CO2	3	2	3	2	2	2
CO3	3	3	3	3	3	3
CO4	3	3	3	3	2	3
CO5	3	2	3	3	3	3

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CETP120 Airport Infrastructure Planning and Design

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Do the planning of orientation of airport elements.
CO2	Analysing the requirement of airport layout with respect to international regulation.
CO3	Design Airport Pavement, Taxiway, and Apron.
CO4	Understand visual aid required for safe landing and takeoff operation from passenger and cargo terminal.
CO5	Summarise the concept of the terminal service facility.

2. Syllabus

- **AIRPORT PLANNING (05 Hours)**

  Airport planning: commercial service aviation, air cargo, and general aviation; civil aviation airports; major acts and policies of the Ministry of Civil Aviation in India

  Aviation organizations and functions: Federal Aviation Administration, International Civil Aviation Organization, Directorate General of Civil Aviation, Airports Authority of India.

  Airport planning studies: airport system plan, airport site selection, airport master plan, airport project plan; continuous planning process.

- **AIRCRAFT CHARACTERISTICS (06 Hours)**

  Landing gear configurations, aircraft weight, and engine types.

  Atmospheric conditions affecting aircraft performance: air pressure, temperature, wind speed, and direction.

  Aircraft performance characteristics: speed, payload, range, runway performance, declared distances, wingtip vortices.

- **AIR TRAFFIC MANAGEMENT (06 Hours)**

  Air traffic separation rules: vertical separation, flight altitudes, longitudinal separation, and lateral separation.

  Navigational aids: ground-based systems, satellite-based systems.

- **GEOMETRIC DESIGN OF THE AIRFIELD (10 Hours)**

  Airport classification: utility airports, transport airports.

  Runways: runway configurations, runway orientation, the wind rose, estimating runway length, sight distance, and longitudinal profile, transverse gradient, airfield separation requirements, obstacle clearance requirements.

  Taxiways and taxi lanes: widths and slopes, taxiway and taxi lane separation requirements, sight distance and longitudinal profile, exit taxiway geometry, location of exit taxiways, design of taxiway curves and intersections, and end-around taxiways.

- **STRUCTURAL DESIGN OF AIRPORT PAVEMENTS (06 Hours)**

  Soil investigation and evaluation: CBR, plate bearing test, Young's modulus, the effect of frost on soil strength, subgrade stabilization.

  FAA pavement design methods: equivalent aircraft method, cumulative damage failure method.

  Design of flexible pavements: CBR method, layered elastic design.

  Design of rigid pavements: Westergaard's analysis, finite element theory, joints and joint spacing, continuously reinforced concrete pavements.

- **AIRPORT LIGHTING, MARKING AND SIGNAGE (06 Hours)**

  Requirements of visual aids, approach lighting system configurations, visual approach slope aids, threshold lighting.

  Runway lighting, taxiway lighting.

  Runway and taxiway marking, airfield signage.

- **PLANNING AND DESIGN OF THE TERMINAL AREA (06 Hours)**

  Passenger terminal system and its components.

  Design considerations: terminal demand parameters, facility classification, level of service criteria.

  Terminal planning process: overall space requirements, concept development, horizontal distribution concepts, vertical distribution concepts.

  Apron gate system: number of gates, ramp charts, gate size, aircraft parking type, apron layout, apron circulation, passenger conveyance to aircraft, apron utility requirements.

(Total Lectures: 45 hours)

3. References

1. Ashford, N. J., Mumayiz, S. A., and Wright, P. H. Airport Engineering: Planning, Design and Development of 21st Century Airports, Fourth Edition, John Wiley and Sons, New Jersey, USA, 2011.
2. Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B. Planning and Design of Airports, Fifth Edition, McGraw-Hill, New York, USA, 2010.
3. Kazda, A., and Caves, R. E. Airport Design and Operation, Second Edition, Elsevier, Oxford, U.K., 2007.
4. Khanna, S. K., Arora, M. G., and Jain, S. S. Airport planning and Design, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012.
5. Kumar, V., and Chandra, S. Air Transportation Planning and Design, Galgotia Publications Pvt. Ltd., New Delhi, India, 1999.
6. Neufville, R. D., and Odoni, A. Airport Systems: Planning, Design, and Management, McGraw-Hill, New York, USA, 2003.
7. Young, S. B., and Wells, A. T. Airport Planning and Management, Sixth Edition, McGraw-Hill, New York, USA, 2011.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	2	1	3
CO2	3	2	2	1	2	3
CO3	3	2	3	1	2	2
CO4	2	1	2	3	3	2
CO5	1	2	2	1	1	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 2

CETP123 Waterways Infrastructure Planning and Design

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Define the importance of Water Transportation and its types.
CO2	Identify the need for Harbour and Port Planning.
CO3	Design of Harbour Infrastructure.
CO4	Understanding docks and repair facilities.
CO5	Evaluate the environmental impact of the Seaport Project and economic evaluation.

2. Syllabus

- **INTRODUCTION TO WATER TRANSPORTATION (06 Hours)**

  History, Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, Canal, Inland water transportation, Harbor, Port, Dock, Development of Ports and Harbors, classification, Harbor site selection, Harbor dimensioning.

- **HARBOUR AND PORT PLANNING (12 Hours)**

  Selection of site and planning of harbours, location of harbour, traffic estimation, master plan, ship characteristics, harbour design, turning basin, harbour entrances, Site investigations – hydrographic survey, topographic survey, soil investigations, current observations, tidal observations.

  Characteristics of good seaport and principles of seaport planning, size of the seaport, site selection criteria and layout of the seaport, Dry ports, Bulk cargo, Transhipment ports, Port of call, Surveys to be carried out for seaport planning, regional and intercontinental transportation development, forecasting cargo and passenger demand, regional connectivity, cargo handling capacity of the port.

- **HARBOUR INFRASTRUCTURE (09 Hours)**

  Ship characteristics, Design of Harbour entrance, Design and construction of breakwaters, berthing structures - jetties, fenders, piers, wharves, dolphins, trestle, moles, navigational aids, requirements of signals, fixed navigation structures, the

necessity of navigational aids, lighthouses, beacon lights, floating navigational aids, lightships, buoys, radar.

- **DOCKS AND REPAIR FACILITIES (06 Hours)**

  Harbor docks, use of wet docks, design of wet docks, repair docks, lift docks, dry docks, keel and bilge blocking, construction of dry docks, gates for dry docks, pumping plant, floating docks, slipways, locks, size of the lock, lock gates, types of gates.

- **DREDGING AND COASTAL PROTECTION (06 Hours)**

  Classification, types of dredgers, choice of dredger, uses of dredged materials, coastal erosion and protection, sea wall, revetment, bulkhead, coastal zone, and beach profile.

- **INLAND NAVIGATION (03 Hours)**

  Inland waterways, Inland water transportation in India, classification of waterways, the economics of inland waterways transportation, and national waterways.

- **IMPACT ANALYSIS (03 Hours)**

  An economic evaluation the of port project, Environmental impacts of port activities.

(Total Lectures: 45 hours)

3. References

1. Ashford, N. J., Mumayiz, S. A., and Wright, P. H. Airport Engineering: Planning, Design, and Development of 21st Century Airports, Fourth Edition, John Wiley and Sons, New Jersey, USA, 2011.
2. Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B. Planning and Design of Airports, Fifth Edition, McGraw-Hill, New York, USA, 2010.
3. Kazda, A., and Caves, R. E. Airport Design and Operation, Second Edition, Elsevier, Oxford, U.K., 2007.
4. Khanna, S. K., Arora, M. G., and Jain, S. S. Airport planning and Design, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012.
5. Kumar, V., and Chandra, S. Air Transportation Planning and Design, Galgotia Publications Pvt. Ltd., New Delhi, India, 1999.
6. Young, S. B., and Wells, A. T. Airport Planning and Management, Sixth Edition, McGraw-Hill, New York, USA, 2011.
7. Bindra, S.P. A Course in Docks and Harbour Engineering, Dhanpat Rai and Sons, New Delhi, India, 1992.

8. Seetharaman, S. Dock and Harbour Engineering, Umesh Publications, New Delhi, India, 1999.
9. Srinivasan, R. Harbour, Dock and Tunnel Engineering, Charotar Publishing House, Anand, India, 1987.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	1
CO2	3	2	2	3	2	1
CO3	3	3	3	2	3	1
CO4	3	2	3	2	2	1
CO5	2	2	2	2	2	1

1-Low 2-Moderate 3-High

CECT104 Construction Materials Lab

L	T	P	C
0	0	4	2

1. Course Outcomes (COs)

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

CO1	Test the properties of materials.
CO2	Design the concrete.
CO3	Analyse the results of experiments.
CO4	Apply the NDT to do the assessment of existing structures.
CO5	Create the relation between the mix parameters with strength and durability of concrete.

2. Syllabus

Tests related to quality control at site, in-situ tests, tests related to damage and deterioration assessment, performance monitoring of structures will be performed.

- Testing of cements and supplementary cementations materials
- Testing of fine and coarse aggregates
- Testing of chemical admixtures
- Mixture design of special concretes
- Non-destructive tests, half-cell potential, pH measurement, carbonation depth, water and air permeability
- Effect of high temperature on concrete
- Advanced characterization of construction materials
- Behavior of construction joints, water-proofing and precast joints

3. References

1. Richardson, M G (2002) Fundamentals of Durable Reinforced Concrete, First Edition, Spon Press.
2. Mehta, P K and Monteiro, P J M (2006) Concrete Microstructure Properties and Materials, Third Edition, Tata McGraw Hill.
3. Bohni, H (2005) Corrosion in Reinforced Concrete Structures, CRC Press.
4. Bensted, J. and Barnes, P (2002) Structure and Performance of Cements, Second Edition, Spon Press.

5. Newman, J and Choo, B S (2003) Advanced Concrete Technology- Processes, Elsevier.
6. Newman, J and Choo, B S (2003) Advanced Concrete Technology – Testing and Quality, Elsevier.
7. Neville, A M (2006) Properties of Concrete, Fourth Edition, Pearson

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	1
CO2	2	1	2	2	2	1
CO3	2	2	2	2	2	2
CO4	2	2	3	2	2	1
CO5	2	1	2	2	3	2

1-Low 2-Moderate 3-High

CECT105 Graduate Report I

L	T	P	C
0	0	2	1

1. Course Outcomes (COs)

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

CO1	Identify problems that have relevance to the current industrial needs.
CO2	Conduct literature survey in the chosen field.
CO3	Discover the research gap from the existing literature.
CO4	Be aware about current innovative practices and technology.
CO5	Develop technical writing, presentation and communication skills.

2. Syllabus

Students are expected to prepare graduate reports on various topics of the subjects as assigned by the faculty advisor and submit duly computer typed reports, present and participate in subject wise group discussion.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3
CO2	3	3	3	3	3	2
CO3	3	3	2	3	2	2
CO4	3	3	3	3	3	2
CO5	3	3	2	3	3	3

1-Low 2-Moderate 3-High

Semester II

CECT201 Project Appraisal and Finance

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

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

CO1	Learn the basics of measurement of project performance.
CO2	Understand the various discounting and compounding criteria.
CO3	Familiarize with accounting fundamentals.
CO4	Study the theories of working capital management.
CO5	Apply financial methods in making capital investment decisions in projects.

2. Syllabus

- **PROJECT FORMULATION (10 Hours)**

  Generation and screening of project ideas, project identification, preliminary analysis, market, technical, financial, economic and ecological-pre-feasibility report and its clearance, project estimates and techno-economic feasibility report, detailed project report, different project clearances required.

- **PROJECT APPRAISAL (10 Hours)**

  NPV, BCR, IRR, ARR, urgency-payback period, assessment of various methods, Indian practice of investment appraisal, international practice of appraisal, analysis of risk, different methods for selection of a project and risk analysis in practice, ownership structures; BOT, BOLT, BOOT models.

- **PROJECT ACCOUNTING (09 Hours)**

  Profit and loss, balance sheet, income statement, ratio analysis, depreciation and amortization, preparation of financial statements, inflation accounting and corporate practices in India.

- **WORKING CAPITAL MANAGEMENT (08 Hours)**

  Policy for working capital, estimating working capital need, inventory management, account receivable, credit and cash management, managing payments to supplies and outstanding, capital investment decisions, techniques of capital budgeting, cost of

capital. Cash flow analysis.

- **LONG TERM FINANCING AND BUDGETING (08 Hours)**
  Working of financial institutes in India and abroad, self-financing, stock exchanges, types of securities, borrowings, debentures, types of budgeting, procedure for master budget, key factor, budget manual, and new approach to budgeting, cash flow forecast.

(Total Lectures: 45 hours. Tutorial: 15 hours)

3. References

1. Prasanna Chandra (1995) Projects Preparation, Appraisals, Budgeting and Implementation, 3rd Edition, Tata Mc Graw Hill Publishing Co. Ltd.
2. Van Horne, J C (1990). Fundamentals of Financial Management, Prentice-Hall of India Ltd.
3. Kolb, R W and Rodriguez, R J (1992) Financial Management D C Heath & Co.
4. Maheshwari, S N (2002) Cost and Management Accounting, Sultan Chand & Sons.
5. McCarthy, J F (2010) Construction project management - A managerial approach, Pareto publishers.
6. Desai, Vasant (2011) The Dynamics of Entrepreneurial Development and Management, 6th edition, Himalaya Publishing House.
7. Desai, Vasant and Kaur Kulveen (2015) Entrepreneurship: Development and Management, Himalaya Publishing House.
8. Pandey, I M (2021) Financial Management, 12th edition, Pearson.
9. Khan, M Y and Jain P K (2018) Financial Management, 8th edition, McGraw Hill Education.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	2
CO2	2	2	1	2	2	2
CO3	3	2	3	3	2	2
CO4	3	2	2	3	1	2
CO5	3	2	2	3	2	2

1-Low 2-Moderate 3-High

CECT202 Construction Contract and Law

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

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

CO1	Attain knowledge about contracts, types of contracts, contract documents and roles and functions of parties involved in a contract.
CO2	Understand the legal meaning of contract and implications.
CO3	Learn the common methods of dispute resolution in Indian scenario and understand difference between Alternative Dispute Resolution Methods and Litigation
CO4	Obtain basic understanding of Arbitration and Conciliation Act 1996 as amended in 2015, Law of Contract 1872 and its application in dispute resolution pertaining to construction contracts.
CO5	Be aware of common and regulatory laws to manage a construction project.

2. Syllabus

- **CONSTRUCTION CONTRACTS (12 Hours)**

  Concept of contract, types of contracts, joint venture, merging, acquisition, features and suitability, design of contract documents, international contract document, standard contract document, Concession agreements, law of torts, Indian contract act 1872, Introduction to various standard forms of contract such as FIDIC, JCT and NEC.

- **CONTRACTS CLAUSES AND TERMS AND CONDITIONS (12 Hours)**

  Potential contractual problems, Importance of Clauses and Terms and Conditions of Contract, Rules of interpretation of contract clauses.

- **CONSTRUCTION CLAIMS, DISPUTES AND ALTERNATIVE DISPUTE RESOLUTION (10 Hours)**

  Sources of claims and disputes, construction claims procedure, methods of dispute resolution, alternative dispute resolution method, comparison of actions and laws, agreements, subject matter, violations, Arbitration and Conciliation act 1996 and recent amendments in 2015, Delay analysis, case studies, professional ethics, duties and responsibilities of parties.

- **INTERNATIONAL CONSTRUCTION CONTRACTS (11 Hours)**

  Type of contracts, surety bonds, time provisions, safety clause, insurance, Employer's Liability Policy, Builder's risk, Foreign corrupt practice Act, rate of inflation, use of local labor, Differences in Ethic, languages and culture.

(Total Lectures: 45 hours. Tutorial: 15 hours)

3. References

1. Jimmie W Hinze (2013) Construction Contracts, 3rd Edition. McGraw Hill.
2. Joseph T Bockrath (2013) Contracts and the Legal Environment for Engineers and Architects, 6th Edition. McGraw Hill.
3. Indian Contract Act 1872.
4. Arbitration Act (1996) (with amendment 2015)
5. Bhatt, V and Vyas, P (2015) Laws for Engineers (Contract, Arbitration, Evidence, Limitations), Second Edition, Procare.
6. Ramaswamy, B S (2005) Contracts ad their Management, Lexis Nexis Butterworths.
7. Murdoch, J and Hughes, W (2002) Construction Contracts, Spon Press.
8. Ross, A and Williams, P (2013) Financial Management in Construction Contracting, Wiley-Blackwell.
9. Ndekugri, I and Rycroft, M (2009) the JCT Standard Building Contract: Law and Administration, Elsevier.
10. Fenn, P (2012) Commercial Conflict Management and Dispute Resolution, Spon Press.
11. Atkinson, D (2007) Causation in Construction Law – Principles and Methods of Analysis, Danial Atkinson Limited.
12. Roy Chowdhury, S K, Saharay, H K (1996) Law of Arbitration and Conciliation, Eastern Law House.
13. Collier, Keith (1986) Construction Contracts, Reston Publishing Company Inc. Reston Virginia.
14. Murdoch, John and Hughes Will (2007) Construction Contracts: Law and Management, Taylor and Francis.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1
CO2	2	3	2	2	2	1
CO3	2	3	2	2	3	1

CO4	3	3	3	3	3	3
CO5	3	2	2	3	3	3

1-Low 2-Moderate 3-High

CECT203 Construction Quality and Safety

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Explain the importance of quality and quality management methods in construction.
CO2	Develop quality assurance plan to meet required international and national quality standards.
CO3	Understand importance of various aspects of safety during execution of construction activities.
CO4	Learn the application of the principles and theories of safety to construction projects.
CO5	Identify the causes, investigations and prevention of accidents in construction job sites.

2. Syllabus

- **CONSTRUCTION ORGANIZATION (08 Hours)**

  Types of organization, inspection, control and enforcement, quality management systems and method, responsibilities and authorities in quality assurance and quality control; architects, engineers, contractors, and consultants, quality circle.

- **QUALITY ASSURANCE AND CONTROL (08 Hours)**

  Objectives, regularity agent; owner, design, contract and construction oriented objectives, methods/techniques and needs of QA/QC different aspects of quality, appraisals, factors influencing construction quality-critical, major failure aspects and failure mode analysis stability methods and tools, optimum design, reliability testing, reliability coefficient and reliability prediction selection of new materials.

- **TOTAL QUALITY MANAGEMENT (08 Hours)**

  Road Map for TQM Implementation, Role of management in TQM, Quality improvement planning measurement, construction site implementation, six sigma in quality management.

- **SAFETY AND HEALTH IN CONSTRUCTION (06 Hours)**

  Safety and accidents in construction projects, theories of accident causation, health and illness related with construction works, cost of construction injuries, safety risk analysis and control, personal protective equipment, occupational and safety hazard assessment, legal implications, OSH Management System.

- **SAFETY PROGRAMME AND CONTRACTUAL OBLIGATIONS (07 Hours)**
  Problem areas in construction safety, elements of an effective safety programme, job site safety assessment, safety meetings, and safety incentives Safety in construction contracts, substance abuse, safety record keeping.

- **DECISION FOR SAFETY (08 Hours)**
  Safety culture, safe workers, safety and first line supervisors, safety and middle managers, top management practices, company activities and safety, safety personnel, sub contractual obligation, project coordination and safety procedures and workers compensation.

(Total Lectures: 45 hours)

3. References

1. Yang, K. and El-Haik, B S (2009). Design for Six Sigma, Tata McGraw Hill.
2. McCabe, S (1998) Quality improvement techniques in construction, Pearson Education.
3. Rumane, A R (2011) Quality management in construction projects, CRC Press, T&F.
4. Rumane, A R (2013) Quality tools for managing construction projects, CRC Press, T&F.
5. Juran J M and Gryna, F M (1993) Quality Planning and Analysis: From Product Development through Use, 3rd Edition, and Tata McGraw Hill.
6. Levitt, R E and Samelson, Nancy Morse (1993) Construction Safety Management 2nd Edition, Wiley Publisher.
7. Goetsch. David L (2014) Occupational Safety and Health for Technologists, Engineers and Managers, 8th Edition, New Jersey: Pearson. Edu. Inc.
8. Hinzie, J W (1997) Construction safety, Prentice Hall.
9. MacCollum, D V (1995) Construction safety planning, John Wiley & sons.
10. MacCollum, D V (2007) Construction safety engineering principles - designing and managing safer job sites, Tata McGraw Hill.
11. Holt, A S J (2005) Principles of construction safety, Blackwell Publishers.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3

CO1	3	1	2	3	2	3
CO2	3	2	3	2	2	2
CO3	3	2	3	3	2	1
CO4	3	2	3	3	2	1
CO5	3	3	2	3	2	1

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CECT210 Precast and Prestress Construction

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Appreciate modular construction and industrialized construction.
CO2	Design the precast and pre-stress elements.
CO3	Apply the construction method using prefabricated elements.

2. Syllabus

- **PREFABRICATED CONSTRUCTION (08 Hours)**

  Prefabricated construction, necessity, Advantages, disadvantages, Mass produced steel, reinforced concrete and masonry systems, industrialized buildings.

- **MODULAR CONSTRUCTION (10 Hours)**

  Modular coordination, basic module, planning and design modules, Modular grid systems, National Building Code Specification, Standardization, Dimensioning of products, Preferred dimensions and sizes, tolerances and deviations layout and processes.

- **PREFABRICATES (10 Hours)**

  Classification, foundation, columns, beams, roof and floor panels, wall panels, clay units, box prefabricates erection and assembly.

- **DESIGN OF PREFABRICATED ELEMENTS (10 Hours)**

  Lift points, beams, slabs, columns, wall panels, footings, design of joints to transfer axial forces, moments and shear forces.

- **CONSTRUCTION TECHNIQUES (07 Hours)**

  Large panel construction, Lift slab system, Glover system, Jack block system, Constrain V-Plate system, Bis on system, Silber-Kuhi System, Control of construction processes. Equipments, horizontal and vertical transportation.

(Total Lectures: 45 hours)

3. References

1. Hass, A M (1983) Precast Concrete Design and Applications, Applied Science Publishers.
2. Promyslolw, V (1980) Design and Erection of Reinforced Concrete Structure, MIR Publishers, Moscow.
3. Structural Design Manual (1978) Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	1
CO2	3	2	3	2	1	1
CO3	2	2	3	2	1	1

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CECT211 Building Information Modeling (BIM)

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand Building Information Modelling and various BIM software systems.
CO2	Explore model-based engineering workflows in building and infrastructure lifecycles.
CO3	Achieve engineering objectives of virtual design and construction in practice.
CO4	Learn construction scheduling, quantity take-offs and run nD simulations using BIM software.
CO5	Utilize BIM for system clash detection and prevention.

2. Syllabus

- **INTRODUCTION OF BIM** **(07 Hours)**

  Introduction to BIM process and integrated project delivery, nD modelling, BIM software systems and guidelines to choosing different BIM software systems.

- **BASIC MODELLING** **(07 Hours)**

  Introduction of modelling environment and tools, modelling approaches to producing plans, 3D models, views and sections of buildings, creating an initial sample of 3D BIM model using a BIM authoring software, Modelling of building including basic and vital elements, production of plans, views and 3D models, annotations and preparations of sheets for printing and publishing.

- **ADVANCE CONCEPTS** **(08 Hours)**

  Model customizations, elements and materials, creation of internal components, external elements, massing and site modelling, Elements visibility, visualization and walkthroughs, model/information exchange and merging of models.

- **nD MODELLING** **(08 Hours)**

  Introduction to aspects of nD modelling, scheduling and quantity take-offs using BIM-enabled systems and export to spreadsheets, Production of a 4D program in 4D BIM software, cost estimation, producing cost estimates in a 5D BIM software.

- **INTEROPERABILITY IN BIM** **(08 Hours)**

  Basics about interoperability, Export formats and applications, exchange of information through IFC, COBie, BIM 360 Glue, Mobile BIM.

- **ADVANCES IN BIM** **(07 Hours)**

  Clash detection, Overview of clash detection tools, use of software to detect/resolve clashes in a BIM model, project collaboration using cloud/mobile BIM systems and common data environments.

(Total Lectures: 45 hours)

3. References

1. Eastman, C M, Chuck Eastman, Paul Teicholz, and Rafael Sacks (2011) BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, John Wiley and Sons.
2. Hardin, Brad and Dave McCool (2015) BIM and Construction Management: Proven Tools, Methods, and Workflows, John Wiley and Sons.
3. Kymmell, Willem (2007) Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations (McGraw-Hill Construction Series): Planning and Managing Construction Projects with 4D CAD and Simulations, McGraw Hill Professional.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	3
CO2	2	1	3	2	3	3
CO3	3	2	3	3	3	3
CO4	3	1	2	3	3	3
CO5	3	1	2	3	3	3

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CECT212 Introduction of Internet of Things (IOT)

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand the history of computer networking and internet protocols.
CO2	Learn in depth about sensors and communication protocols.
CO3	Study fundamentals of IoT and its application in construction industry.
CO4	Design sensor networks for different construction projects/problems.
CO5	Explore case studies of application of IoT in smart infrastructure.

2. Syllabus

- **FUNDAMENTALS OF NETWORKING (07 Hours)**

  Understanding of network and Internet, IPV4, IPV6, The network edge, The network core, Understanding of Delay, Loss and Throughput in the packet switching network, protocols layers and their service model, History of the computer network.

- **SENSOR NETWORK AND COMMUNICATION PROTOCOL (07 Hours)**

  Sensors- classes, types, errors, application and construction case study Actuators -types, application and case study, Communication protocols, Types of sensor networks, node behaviour, coverage, UAV networks.

- **INTRODUCTION TO IOT (08 Hours)**

  Introduction to Internet of Things, concept and fundamental understanding, application and connectivity terminologies, IoT components, addressing in IoT, challenges in IoT applications, construction industry application, case studies, Machine-to-Machine communications, interoperability in IoT.

- **PROGRAMMING (08 Hours)**

  Introduction to arduino programming, integration of sensors and actuators with arduino, Introduction to python programming, python library for Raspberry Pi, implementation of construction project with Raspberry Pi.

- **DATA HANDLING AND ANALYTICS WITH CLOUD COMPUTING**

  (07 Hours)

Smart cities and smart homes, smart grid, agriculture, healthcare, activity monitoring, construction.

(Total Lectures: 45 hours)

3. References

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Computer Networking: A Top-down Approach Book by Jim Kurose

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	2	2	3	3
CO2	1	1	1	2	2	1
CO3	3	1	3	3	3	3
CO4	2	2	3	2	3	3
CO5	3	1	3	3	3	3

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CECT213 Disaster Management

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Review the concept of disaster and disaster management.
CO2	Recognize institutions and organization setup.
CO3	Identify housing design and planning at pre and post disaster level.
CO4	Integrate disaster management in development plan.
CO5	Apply geospatial software QGIS for Disaster mitigation strategies.

2. Syllabus

- **DISASTER** **(10 Hours)**

  Meaning, factors and significance, Characteristic, causes and effects of natural hazards viz. Drought, earthquake, flood and other hazards, Vulnerability, Risk, Capacity – Disaster and Development, Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

- **DISASTER PROFILE OF INDIA** **(11 Hours)**

  Regional and seasonal, Scope and objectives of disaster mitigation, Preparedness and response. Prerequisite for preparedness planning, action plans and procedure, models and checklists. Disaster response planning in Tsunami and Natural Hazards or Natural Disasters, roles and responsibilities of various agencies. Emergency operation support and management. Role of urban planner.

- **DISASTER MANAGEMENT CYCLE AND FRAMEWORK** **(12 Hours)**

  Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Community based DRR, Structural nonstructural measures in DRR; Roles and Responsibilities, Public Awareness and Warnings, Conducting a participatory capacity and vulnerability analysis, , Sustainable Management, Survey of Activities Before Disasters Strike, Survey of Activities During Disasters, DRR Master Planning for the Future, Capacity Building, Sphere Standards. Rehabilitation measures

and long-term reconstruction. Psychosocial care provision during the different phases of disaster.

- **AWARENESS DURING DISASTER** **(12 Hours)**

  Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.

(Total Lectures: 45 hours)

3. References

1. Scheneid T (2000), "Disaster Management and Preparedness", CRC Press.
2. Gupta H. (2003), "Disaster Management", Indian National Science academy.
3. Sharma V (2013), "Disaster Management", National Center for Disaster Management. Scientific International private limited.
4. Debora M. (2011), 'Urban Planning and Disaster Risk Management'
5. Federica R. (2012), 'A Workbook on Planning for Urban Resilience in the Face of Disaster' World Bank Publication

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	1	1	1	3	1	3
CO2	1	0	0	3	1	2
CO3	2	1	2	3	1	2
CO4	3	3	3	2	1	3
CO5	3	2	3	1	1	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CEGT211 Tunnelling and Underground Structures

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Comprehend the design aspects of various underground structures in soil and rockmass.
CO2	Identify the excavation methods for construction of underground structures in different ground conditions.
CO3	Analyze the underground structures in rock and soil using elastic and elastoplastic solutions.
CO4	Appraise the underground structure using empirical, observational, analytical and numerical approaches.
CO5	Design the support and safety system for underground structures.

2. Syllabus

- **INTRODUCTION (06 Hours)**

  Introduction to underground space and tunnelling, History, Tunnelling challenges, Types and classification of underground opening, Factors affecting design, Design methodology, Functional aspects, Size and shapes, Support systems, Codal provisions.

- **EXCAVATION METHOD AND MACHINERY (10 Hours)**

  Drilling and Blasting for Underground and Open Excavations, blast operation planning, Explosive products, Blast Design, controlled Blasting techniques, Blasting damage and control, safe practices with explosives and shots. Tunnel driving techniques, TBM techniques, Bottom up and bottom down method, Tunnelling in difficult ground condition, Underground supports, theory of arching, rock loads and loads on tunnel linings, Safety aspects, Case histories.

- **ANALYSIS AND DESIGN OF UNDERGROUND OPENININGS (12 Hours)**

  Analysis of Underground openings, stresses around different shapes, initial state of stresses, Closed form solutions, BEM, FEM, Design based on analytical methods, Empirical methods based on RSR, RMR, Q systems, Observational method- NATM, Convergence-confinement method, Design based on Wedge failure and key block analysis, Design of Shafts and hydraulic tunnels.

- **DESIGN OF SUPPORT SYSTEM (09 Hours)**

  Tunnel support systems, Different type of supports, Standup time, Ground Reaction Curve, Stability of excavation face and Tunnel portals, Surface settlement due to underground works, Ground subsidence study, Use of appropriate software packages, Shotcreting including some case histories, Underground instrumentation and monitoring.

- **TUNNEL HEALTH AND SAFETY ISSUES (08 Hours)**

  Construction methods, Ventilation, De-watering, Control and monitoring system: services, operations and maintenance, Lighting: specifications, maintenance, emergency lighting, Power supply and distribution, Water supply and distribution, Safety provisions, Localized hazards, Fire hazards in highway tunnels, Rapid transit tunnels. Surveillance and control system for highway tunnels. Tunnel finish, Rehabilitation: Inspection methods, Repairs, Tunnel construction contracting.

(Total Lectures: 45 hours)

3. References

1. Ramamurthy T., “Engineering in Rocks for Slopes, Foundation and tunnels”, Prentice Hall of India Pvt Ltd, New Delhi, 2010.
2. Kolymbas, D., “Tunneling and tunnel mechanics: A rational approach to tunnelling”, Springer Publications. 2008.
3. Goodman, R. E., “Introduction to Rock Mechanics”, John Wiley and Sons, 1989.
4. Hoek, E. and Brown, E. T., “Underground excavations in rock”, The Institute of mining and metallurgy. 2005.
5. Brady, B. H. G. and Brown, E. T., “Rock mechanics for underground mining”, Springer Publication, 2006.
6. Obert, L. and Duvall, W.I., “Rock mechanics and the design of structures in rock”, John Wiley and Sons, 1967.
7. Chapman D, Metje, N and Stark A, “Introduction to tunnel construction”, Spon Press, Taylor and Francis, 2010.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1
CO2	2	2	3	3	2	1
CO3	2	3	3	2	2	2
CO4	3	3	3	2	2	2
CO5	3	3	3	3	3	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CEGT216 Ground Improvement Techniques

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Identify the mineral composition responsible for the weak soil deposits and problems associated with it.
CO2	Understand general construction procedures and inspection items for ground improvement techniques.
CO3	Analyse various index/strength properties of soil and suggest suitable ground improvement method.
CO4	Ability to design the ground improvement methods as per site requirements using various national/international codal guidelines.
CO5	Ability to prepare numerical modelling for various ground improvement techniques.

2. Syllabus

- **INTRODUCTION (06 Hours)**

  Ground Improvement: Definition, Objectives of soil improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. Weak Deposits – Identification – Problems associated with weak deposits – Mitchel chart of applicability of treatment methods – Principles – Suitable methods. Mechanical Modification, Principle of modification for various types of soils.

- **DEEP GROUND IMPROVEMENT (10 Hours)**

  Insitu compaction of cohesion less soil – Dynamic compaction and blasting - Vibroflotation – stone column – Encased stone column, stone column design as per codal provisions – strengthening of sub soil by stone column installation. Lime piles.

- **HYDRAULIC MODIFICATION (06 Hours)**

  Definition, aim, principle, techniques. gravity drain, lowering of water table, multistage well point, vacuum dewatering. Discharge equations. Design of dewatering system including pipe line effects of dewatering, Preloading, vertical drains, sand drains. Assessment of ground condition for preloading, Electro kinetic dewatering.

- **GEOSYNTHETICS AND REINFORCED SOIL (07 Hours)**

Types of geosynthetics like geotextiles, geogrids, geonets, geocells, geo-composites, their functions, applications and manufacturing methods. Index properties and Strength properties of Geosynthetics. Historical background of reinforced soil, Principles of reinforced soil. Concept of MSE wall and Reinforced Soil slopes.

- **GROUTING (06 Hours)**

  Types of Grouts, Desirable characteristics of Grout, Grouting methods- Permeation grouting, displacement-compaction grouting, displacement-soil fracture grouting, Jet or Replacement-displacement grouting. Grouting pressure, Grouting technology.

- **SOIL STABILIZATION (05 Hours)**

  Soil stabilization with admixtures like lime, flyash, cement etc, Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

- **MISCELLANEOUS METHODS (05 Hours)**

  Micro piles, Soil nailing, Ground Anchors, ground freezing and heating methods.

(Total Lectures: 45 hours)

3. References

1. Hausmann M.R. “Engineering Principles of Ground Modification” McGraw Hill Publishing Company, New York, 2013
2. Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 6th edition, 2012.
3. Jie H., " Principles and Practice of Ground Improvement, Wiley India, 2018
4. Patra N. H., “Ground Improvement Techniques”, Vikas publishing house Pvt. Ltd., 2013.
5. Chu, Jian; Indraratna, B; Rujikiatkamjorn, C, " Ground improvement case histories: compaction, grouting, and geosynthetics", Butterworth Heinemann - Elsevier, 2015
6. Design guidelines from IS code, FHWA, BS and other codal organizations

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	2

CO2	1	1	1	2	1	1
CO3	2	2	2	2	2	1
CO4	2	2	2	2	2	2
CO5	2	2	3	2	2	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CETP213 Road Safety and Environment

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Analyse the present scenario about transport safety and environment with a multidisciplinary approach.
CO2	Examine factors affecting road safety engineering and crash investigation, human factors relating to crashes/accidents, crash/accident.
CO3	Predict hazard identification related to the transport safety and environment and take management measures for improving safety and environment.
CO4	Create awareness about empathetic and improving the present practices related to the Transportation Safety Audit and Environmental Impact Assessment (EIA) for transportation projects.
CO5	Evaluate effectiveness of measures for improving traffic safety and environment.

2. Syllabus

- **INTRODUCTION** **(06 Hours)**

  Transportation Safety scenario in India and World, Accident Characteristics, Distribution among different modes. Need of Planning for Network, Land Use and Road Environment for Safety, Designing for Safety: Road Link Design, Junctions. Introduction to Road Safety Engineering and Crash Investigation, Human Factors Relating to Crashes/Accidents, Crash/Accident.

- **ROAD SAFETY DIAGNOSIS** **(06 Hours)**

  Investigation and Crash Problem Diagnosing, Crash Problems into Solutions and Crash, Investigation Reporting, Crash/Accident, Costing, Economic Appraisal. Safety at Construction Site: Safety provisions for workers at construction site, Construction Zone markings, signs.

- **ROAD SAFETY AUDIT** **(10 Hours)**

  Road Safety Auditing: An Introduction, Concept and need of Road Safety Audit (RSA). Procedures in RSA, design standards, audit tasks, stages of road safety audit, Road Safety Audit Types, key legal aspects, process, audit team and requirements, Checklist, how to use Checklists Road Safety inspection.

- **TRANSPORT AND ENVIRONMENT ISSUES (08 Hours)**

  Introduction to transport and the environment: Context, mechanisms and sustainability; Air Pollution: Mechanisms, technology solutions, modelling and social costs; Traffic Noise: Units, sources, and impacts Climate Change: Transport contribution, potential impacts, regulatory framework and policies.

- **MEASUREMENT AND MODELLING (08 Hours)**

  Environmental planning and assessment practices, Measurement of environmental impacts of transport: Emissions, air quality and noise, Modelling of environmental impacts of transport: Emissions, air quality and noise, Land use transport relationships.

- **IMPACT ASSESSMENT (07 Hours)**

  Environmental Impact Assessment for Transportation Projects: Basic Concepts, Objectives, Transportation Related Environmental Impacts; Vehicular Impacts; Safety and Capacity Impacts; Roadway Impacts, Construction Impacts, Environmental Impact Assessment, Environmental Impact Statement, Environment Audit, Typical case studies.

(Total Lectures: 45 hours)

3. References

1. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2022).
2. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999.
3. J. Stannard Baker, Traffic Collision Investigation, Northwestern University Center for Public Safety, 2002.
4. Leonard Evans, Traffic Safety, Science Serving Society, 2004.
5. Lynn B. Fricke, Traffic Accident Reconstruction, Northwestern University Center for Public Safety, 1990.
6. Ogden, K. W. Safer Roads: A Guide to Road Safety Engineering. Avebury Technical, 1996.
7. Popkess C. A, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997.
8. Rune Elvik and Truls Vaa, The Handbook of Road Safety Measures, Elseiver, 2004.
9. Towards Safe Roads in Developing country, TRL – ODA, 2004.
10. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making

Cities, Roads, and Vehicles Safer, CRC Press, 2016.

11. IRC SP:88 (2019) Manual on Road Safety Audit.
12. Periodic NHAI Circulars.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	0	2	2	2	3
CO2	3	2	3	1	2	2
CO3	2	2	3	2	2	2
CO4	1	2	2	2	2	3
CO5	3	0	3	2	2	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CETP215 Operation and Maintenance Management of Pavements

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Comprehend the maintenance management program of pavement by prioritizing the need for maintenance.
CO2	Evaluate the functional and structural condition of existing pavement.
CO3	Identify appropriate tools for pavement evaluation.
CO4	Examine the need for rehabilitation of pavement.
CO5	Design the overlays for the existing pavement using various approaches using BBD and FWD.

2. Syllabus

- **INTRODUCTION (09 Hours)**

  Operation and maintenance (O&M) of the Project Highway - Model Concession Agreement (MCA) for various types of PPP projects -Management and Organization - Project Cycle -Levels of Management - Administration and Logistics - Site Management - Road Maintenance – Approach – Organization - Management Activities

- **OPERATIONAL MANAGEMENT ACTIVITIES (09 Hours)**

  Road Inventory - Assessment of Maintenance Requirements – Drainage - Running Surface – Structures - Setting Priorities - Planning Maintenance Works - Implementation - Work Activities and Task Rates - Tools for Maintenance Works - Reporting and Monitoring

- **DISTRESS MEASURING EQUIPMENT (09 Hours)**

  Functional and structural evaluation - Functions parameters such as roughness - Distress, rutting - Skid resistance, etc. testing using conventional and NSV techniques, structural parameters such as structural capacity - Benkelman beam - bump integrator - demonstration of equipment for dynamic testing of pavements (LWD) - pavement skid resistance measuring equipment - fatigue testing equipment

- **DESIGN OF OVERLAYS (09 Hours)**

  Types of Overlays - Design Methodologies - Flexible overlays - Rigid overlays - design

of overlay by Benkelman beam and falling weight Deflectometer - Asphalt Institute Method - Portland Cement Association Method, -AASHTO Method, Use of Geosynthetics in Pavement Overlays.

- **PAVEMENT MANAGEMENT SYSTEM (09 Hours)**

  Development of Pavement Management System: Concepts of pavement management systems, pavement performance prediction – concepts, modeling techniques, structural conditional deterioration models, mechanistic and empirical models, functional condition deterioration models, unevenness deterioration models and other models, ranking and optimization methodologies

(Total Lectures: 45 hours)

3. References

1. Hass, R., Hudson, W.R. and Zaniewski, J., Modern Pavement Management, Krieger,1994
2. Hass, R. and Hudson, W.R., Pavement Management System, McGraw Hill Company, Inc,1978
3. Yang H. Huang, Design of functional pavements, Pearson Prentice Hall, 2004
4. Yoder, E.J. and Witczak, M.W., Principles of Pavement Design, John Wiley and sons, 1975
5. Khanna S.K., Justo C.E.G., Highway Engineering, Nem Chand & Bros., Roorkee
6. Kadiyali L.R., Principles & Practice of Highway Engineering, Khanna Publishers, 2003
7. Relevant IRC code & Infrastructure development form Planning commission of India Publication, MORTHs Publications

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	2	1	3	1
CO2	3	1	2	1	1	1
CO3	3	1	1	3	2	1
CO4	3	1	1	3	2	1
CO5	3	3	3	1	1	1

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CEUP215 Urban Infrastructure Planning and Management

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand Urban Infrastructure fundamentals with practical application.
CO2	Review different norms and guidelines of municipal infrastructure.
CO3	Adopt the most suitable management techniques for the better maintenance of infrastructure in future growth.
CO4	Identify different shortcomings and challenges in the current practices.
CO5	Explore modern techniques and technology in place of conventional methods.

2. Syllabus

- **URBAN INFRASTRUCTURE PLANNING (05 Hours)**

  Data required for provision and planning of urban Infrastructure, Types, significance, impact on urban form, norms and financial aspects, public private, SPV and PPP models in infrastructure provisions, infrastructure policy.

- **NETWORKS AND SERVICES SYSTEMS (06 Hours)**

  Urban services overview, classification and significance, concepts and theories for design and operation, components, interrelationship, requirements of appropriate technology, cost recovery, Gap analysis.

- **WATER SUPPLY NETWORK (06 Hours)**

  City and Household Network Scenario, Norms, National water policy, Water rights: excess and underutilization of water, role of community in water provision, water harvesting, privatization of water supply and its implications.

- **SEWERAGE NETWORK (06 Hours)**

  City and Household Network Scenario, Norms. Sewerage drainage, refuse collection, storage, recycling and disposal, minimum basic needs, formulation of objectives, norms and standards both for space allocation and quality control, Storm water Network.

- **SANITATION AND SOLID WASTE MANAGEMENT (06 Hours)**

  Types, Generation, collection system, transfer station location, Segregation,

transportation, disposal, site selection, Effect of population density, Impact of Urban land use, Bio-medical waste and disposal, Policies and programs in the provision of sanitation at various level, Low-Cost Sanitation, city sanitation plan and state sanitation strategies, cost recovery in solid waste.

- **ELECTRICITY AND COMMUNICATION NETWORK (06 Hours)**
  Planning for electrification, Current scenario, services and space standards of Transformers space standards for electricity networks, Space station Location, Street lighting requirements, Communication network requirement.

- **SOCIAL INFRASTRUCTURE (10 Hours)**
  Health and Education hierarchy, norms and location. Energy distribution, fire protection: requirements, norms and standards, planning provision, milk distribution system, Recreation and Open Space Planning in Social Infrastructure.

(Total Lectures: 45 hours)

3. References

1. National Institute of Urban Affairs (2005). Status of water supply, sanitation, and solid waste management in the urban area.
2. Yigitcanlar, T. (2010). Sustainable urban and regional infrastructure development: technologies, application, and management. IGI Global publishing company.
3. CPHEEO (2013). CPHEEO Manual on Sewerage and Sewage Treatment Systems.
4. CPHEEO (2016). CPHEEO Manual on Municipal Solid Waste Management.
5. CPHEEO (2019). CPHEEO Manual on Storm Water Drainage Systems.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	0	0	0	2	2	2
CO2	1	1	2	3	2	2
CO3	3	1	3	3	2	1
CO4	1	2	1	3	3	2
CO5	3	3	3	2	2	2

1-Low 2-Moderate 3-High

CORE ELECTIVE – 3

CEUP221 Real Estate Management

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand the concept and principles of real estate sector.
CO2	Identify the role of urban building industry.
CO3	Review urban land policy and its direct government action, legal and physical controls.
CO4	Explain the role of real estate in Urban growth and land dynamics.
CO5	Identify legal aspects of real estate development.

2. Syllabus

- **REAL ESTATE** **(15 Hours)**

  Terminology Land Documentation, Land Revenue Records, Document Registration, City Survey Record, Land Registration Process, Property Card, Index concepts and characteristics; Urban real estate market problems, factors affecting real estate property, rights and interests; Contract law and real estate; Speculation in urban land; betterment and worsening.

- **ECONOMICS AND LOCATION MODELLING** **(16 Hours)**

  Factors affecting different land uses such as residential, commercial, industrial, public and semi-public; Land value – Concept and factors affecting; Rent and modern theory of rent; Macro and Micro approaches of Location such as trade-off model and environment preference model.

- **URBAN LAND POLICY** **(14 Hours)**

  Contents, importance, objectives, measures, instruments for its implementation, direct Govt. action, legal and physical controls; Relationship between economic trends, land market and urban development.

  Modern Methods for Land Pooling; PPP Method for Land Pooling; Issues and strategies for Land Management.

(Total Lectures: 45 hours)

3. References

1. Lean, W. (1982). Aspects of Land use Planning. New Jersey: Gonthic Publications.
2. Paul, B.N. (1997). Urban Land Economics. London: The McMillan Press.
3. Singh B, (2011). Urban Infrastructure and Real Estate Management, Surendra Publications.
4. Barry. Haynes (2017), 'Corporate Real Estate Asset Managements: Strategy and Implementation'
5. John. R (2003), 'Urban Planning and Real Estate Development.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	0	0	0	3	2	3
CO2	1	0	1	3	2	2
CO3	1	2	2	3	3	3
CO4	2	1	1	2	1	2
CO5	2	2	2	2	3	3

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECS230 AI/ML Based Applications in Civil Engineering

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Comprehend the basic principles of artificial intelligence (AI) and machine learning (ML) algorithms.
CO2	Understanding Data collection and management tools and techniques for AI/ML application to Civil Engineering.
CO3	Derive the need and benefits of using AI/ML algorithms for developing applications in Civil Engineering using big-data analysis.
CO4	Solve the real-life problems in Civil Engineering using real-time data collection and big-data analysis involving AI/ML tools.
CO5	Evaluate the performance of different AI/ML algorithms towards a given application in civil engineering.

2. Syllabus

- **INTRODUCTION TO MACHINE LEARNING (08 Hours)**

  Machine Learning Basics: Data Collection, Data Management, Big data, taxonomy of machine learning algorithms, **Supervised Learning:** Classification – Bayesian Classifier, K-nearest Neighbours, Regression- Linear Regression, Multivariate Regression, Logistic regression. Support Vector Machine (SVM) Algorithm. **Unsupervised Learning:** Clustering- K-means clustering algorithm and Hierarchical clustering algorithm. **Reinforcement Learning:** Q-Learning algorithm.

- **DATA COLLECTION APPARATUSES (08 Hours)**

  Type of data sources, Types of data, Types of sensors, Edge-devices, Introduction to microcontrollers, data communication protocols, Cloud storage and cloud computing, Local server setup, Cloud server setup, Introduction to Python, Introduction to Django server, Database setup.

- **APPLICATIONS IN CIVIL ENGINEERING (15 Hours)**

  Intelligent Transportation systems, smart mobility, shared mobility, Mobility as a Service (MaaS), Real-time data monitoring, Structural health monitoring, Fire resistance evaluation of structures, automation in water resource management, Water quality monitoring, water distribution system monitoring, air and noise pollution

monitoring, Rainfall-runoff modelling, Climate change monitoring, Soil liquefaction, Forecasting foundation related parameters, Building occupancy modelling, Building information modelling, Energy demand prediction, Predictive maintenance of equipment, roads and buildings.

- **APPLICATION PART I: DATA COLLECTION AND MANAGEMENT**

  (07 Hours)

  Image processing for real time applications in Civil Engineering, Description of available database across specialisations, Selection of sensors and microcontroller, Integration of sensors with Edge-device, Programming of Edge-devices, Programming of server in Django framework, Collection of sensor data and storing to Database, Cloud computing.

- **APPLICATION PART II: BIG DATA ANALYSIS** **(07 Hours)**

  Selecting the appropriate ML algorithm for analysis, Data Processing, Analysing the importance of each variable in decision making, and Analysis of processed data.

(Total Lectures: 45 hours)

3. References

1. Machine Learning using Python, by Manaranjan Pradhan, U Dinesh Kumar, Wiley.
2. A Primer on Machine Learning Applications in Civil Engineering, by Deka P C, Taylor & Francis.
3. Structural Health Monitoring: A Machine Learning Perspective, by Charles R. Farrar, Keith Worden, Wiley.
4. Building Blocks for IoT Analytics, By John Soldatos, Athens Information Technology, Greece, River Publishers.
5. Django - The Easy Way (2nd Edition), By Samuli Natri.
6. The Django Book (Release 2.0), By Adrian Holovaty, Jacob Kaplan-Moss, et al., 2013.
7. Benjamin J. R., Cornell C. A., Probability Statistics and Decision for Civil Engineers, McGraw-Hill, 1970.
8. Simon P. Washington, Matthew G. Karlaftis, Fred, Mannering L., Statistical and econometric methods for transportation data analysis, CRC Press, Second Edition, 2010.
9. Richard A. Johnson, Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, 1992.

4. Other Materials

1. Arduino-ESP32 (Release 2.0.2), Espressif, 2022.

5. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3
CO2	3	2	3	3	3	3
CO3	3	3	3	2	3	3
CO4	3	3	3	2	3	3
CO5	3	2	3	2	3	3

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECT230 Quantitative Methods

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Learn basics of statistical methods and modelling techniques.
CO2	Demonstrate the ability to analyse data using operation research methods.
CO3	Understand simulation models and inventory control methods for production management.
CO4	Be aware of various deterministic and probabilistic decision-making theories.
CO5	Study cost concepts and break-even analysis in managerial economics.

2. Syllabus

- **STATISTICS** **(07 Hours)**

  Probability, Sampling, Uni-square and analysis of variance, simple regression and correlation, multiple regression and modeling techniques.

- **OPERATION RESEARCH** **(10 Hours)**

  Introduction to operations research, linear programming, graphical and simplex methods, duality and post-optimality analysis, transportation and assignment problems, queuing theory, queuing model, optimization techniques, model formulation, models, sensitivity analysis, non-linear programming problem – Kuhn-Tucjker conditions min cost flow problems – max flow problem.

- **PRODUCTION MANAGEMENT** **(10 Hours)**

  Inventory control – probabilistic and deterministic, EOQ, quantity discounts, safety stock-replacement theory-modification and improvement on PERT and CPM, simulation models, geometric programming, scheduling and sequencing – single server and multiple server models.

- **DECISION THEORY** **(09 Hours)**

  Decision theory, decision rules, decision making under conditions of certainty, risk and uncertainty, decision trees utility theory, decision making techniques. Deterministic and probabilistic situation, single and multiple person decision making.

- **MANAGERIAL ECONOMICS** **(09 Hours)**

  Cost concepts, break-even analysis, pricing techniques, game theory and its applications, competitive models, single and multi-channel problems, sequencing models, dynamic programming, flow in networks, elementary graph theory, parametric programming.

(Total Lectures: 45 hours)

3. References

1. Winston, L (2003) Operations Research: Application and Algorithms, 4th Edition. Kent P.W.S.
2. Vohra, N D (2017) Quantitative technique in Management, 5th Edition. McGraw Hill Publication.
3. Ravindran, Philips, D T and Solberg, J J (1987) Operations Research: Principles and Practice, 2nd Edition. Wiley.
4. Richard Levin and David S. Rubin (1993) Quantitative Approach to Management, 8th Edition. McGraw Hill Publication.
5. Bazaraa, S, Jarvis J J and Sherali, H D (2009) Linear Programming and Network Flows, 4th Edition. Wiley.
6. Deb, K (1995) Optimization for Engineering Design, Prentice Hall of India.
7. Roa, S S (1984) Optimization Theory and Application, Wiley Easter

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	2
CO2	3	3	2	1	1	2
CO3	3	2	2	2	2	2
CO4	3	2	2	1	2	2
CO5	3	2	2	2	2	2

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECT231 Building Information Modeling (BIM)

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand Building Information Modelling and various BIM software systems.
CO2	Explore model-based engineering workflows in building and infrastructure lifecycles.
CO3	Achieve engineering objectives of virtual design and construction in practice.
CO4	Learn construction scheduling, quantity take-offs and run nD simulations using BIM software.
CO5	Utilize BIM for system clash detection and prevention.

2. Syllabus

- **INTRODUCTION OF BIM** **(07 Hours)**

  Introduction to BIM process and integrated project delivery, nD modelling, BIM software systems and guidelines to choosing different BIM software systems.

- **BASIC MODELLING** **(07 Hours)**

  Introduction of modelling environment and tools, modelling approaches to producing plans, 3D models, views and sections of buildings, creating an initial sample of 3D BIM model using a BIM authoring software, Modelling of building including basic and vital elements, production of plans, views and 3D models, annotations and preparations of sheets for printing and publishing.

- **ADVANCE CONCEPTS** **(08 Hours)**

  Model customizations, elements and materials, creation of internal components, external elements, massing and site modelling, Elements visibility, visualization and walkthroughs, model/information exchange and merging of models.

- **nD MODELLING** **(08 Hours)**

  Introduction to aspects of nD modelling, scheduling and quantity take-offs using BIM-enabled systems and export to spreadsheets, Production of a 4D program in 4D BIM software, cost estimation, producing cost estimates in a 5D BIM software.

- **INTEROPERABILITY IN BIM** **(08 Hours)**

  Basics about interoperability, Export formats and applications, exchange of information through IFC, COBie, BIM 360 Glue, Mobile BIM.

- **ADVANCES IN BIM** **(07 Hours)**

  Clash detection, Overview of clash detection tools, use of software to detect/resolve clashes in a BIM model, project collaboration using cloud/mobile BIM systems and common data environments.

(Total Lectures: 45 hours)

3. References

1. Eastman, C M, Chuck Eastman, Paul Teicholz, and Rafael Sacks (2011) BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, John Wiley and Sons.
2. Hardin, Brad and Dave McCool (2015) BIM and Construction Management: Proven Tools, Methods, and Workflows, John Wiley and Sons.
3. Kymmell, Willem (2007) Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations (McGraw-Hill Construction Series): Planning and Managing Construction Projects with 4D CAD and Simulations, McGraw Hill Professional.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	3
CO2	2	1	3	2	3	3
CO3	3	2	3	3	3	3
CO4	3	1	2	3	3	3
CO5	3	1	2	3	3	3

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECT232 Resilient and Sustainable Infrastructure

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand in depth the framework and techniques of infrastructure asset management.
CO2	Study risk analysis techniques in advanced infrastructure asset management.
CO3	Explore tools and techniques of performance management.
CO4	Correlate infrastructure sustainability management tools and techniques with real world problems.
CO5	Correlate infrastructure resiliency management tools and techniques with real world problems.

2. Syllabus

- **INTRODUCTION OF INFRASTRUCTURE ASSET MANAGEMENT**

  (09 Hours)

  Infrastructure Asset Management Definitions, Framework and Primers, Infrastructure Asset Management Steps Process and Techniques, Infrastructure Asset Management Hierarch, Inventory, and Register.

- **ADVANCED INFRASTRUCTURE ASSET MANAGEMENT (09 Hours)**

  Advanced Infrastructure Management: Likelihood of Failure, Advanced Infrastructure Management: Likelihood of Failure, Advanced Infrastructure Management: Risk Analysis and Management.

- **PERFORMANCE OF INFRASTRUCTURE ASSET MANAGEMENT**

  (09 Hours)

  Infrastructure Performance Management Definition, Framework and Primers, Infrastructure Performance Metrics, Indices, Tools and Techniques, Infrastructure Performance Management and Real-World Application.

- **INFRASTRUCTURE ASSET MANAGEMENT – SUSTAINABILITY (09 Hours)**

  Infrastructure Sustainability Management Definition, Framework and Primers, Infrastructure Sustainability Metrics, Indices, Tools and Techniques, Infrastructure Sustainability Management and Real-World Application.

- **INFRASTRUCTURE ASSET MANAGEMENT - RESILIENCY (09 Hours)** Infrastructure Resiliency Management Definition, Framework and Primers, Infrastructure Resiliency Metrics, Indices, Tools and Techniques, Infrastructure Resiliency Management and Real-World Application.

(Total Lectures: 45 hours)

3. References

1. Gopalakrishnan, Kasthurirangan and Srinivas Peeta (2010) Sustainable and Resilient Critical Infrastructure Systems: Simulation, Modeling, and Intelligent Engineering, Springer.
2. Pollalis, Spiro N (2016) Planning Sustainable Cities: An Infrastructure-Based Approach, Routledge.
3. Novotny, Vladimir and Paul Brown (2007) Cities of the Future, IWA Publishing.
4. Elzen, Boelie, Frank W. Geels, and Kenneth Green (2004) System Innovation and the Transition to Sustainability: Theory, Evidence and Policy, Edward Elgar Publishing.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2
CO2	3	2	3	3	3	2
CO3	2	2	3	3	3	3
CO4	2	2	3	3	3	3
CO5	2	2	3	3	3	3

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECT233 Smart Infrastructure System

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Learn basic concepts of modern cities and develop sustainable smart solutions.
CO2	Study surveillance and traffic systems for smart security infrastructure.
CO3	Explore wired and wireless network systems for smart infrastructure.
CO4	Understand the smart transport system for smart cities and its application.
CO5	Refer case studies of various countries for smart and renewable energy systems.

2. Syllabus

- **MODERN CITIES – CHARACTERISTICS (09 Hours)**

  Three layers concept of modern cities (Urban infrastructure, facility and service layers), Understanding the need to reduce carbon emissions and developing sustainable smart solutions. Four facets of smart solutions - Physical, Institutional, Social and Economic Infrastructure; Framework of public information system in smart cities.

- **SMART SECURITY INFRASTRUCTURE (09 Hours)**

  City surveillance systems, Intelligent Traffic Management Systems, Emergency Response systems and smart solutions to handle crisis management.

- **SMART TELE COMMUNICATIONS INFRASTRUCTURE (09 Hours)**

  Wired and wireless network systems, Role of satellite communication, Wi-Fi and RF systems in smart communication, Optical Fiber Cable and DWDM (Dense Wave Division Multiplexing), IPMPCS (Multi Protocol Cable Switching) solutions.

- **SMART TRASNPORT INFRASTRUCTURE (09 Hours)**

  Smart transportation, Logistics, Real time Information systems, traffic information management, smart solutions for water supply and waste water engineering; remote sensing and GIS technology.

- **ENERGY SOLUTIONS (09 Hours)**

  Renewable energy, Smart grid systems, reducing carbon emissions without compromising on convenience of users, Community Energy Management systems,

Energy on wheels, H2H and V2H (Home to Home and Vehicle to Home) Energy solutions, smart meters, case studies-Japan and Europe countries.

(Total Lectures: 45 hours)

3. References

1. Various papers edited by T.Chou in his book on Remote sensing and smart city WTS press
2. Concept oriented research and development in Information Technology Edited by Kinji Mori WILEY Publ.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	3	2	3
CO2	2	2	2	3	3	3
CO3	2	2	2	2	2	3
CO4	2	2	2	2	2	1
CO5	3	2	3	3	3	2

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECT234 Project Management for Engineers

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand the various aspects of project management critical for implementation of projects.
CO2	Demonstrate construction planning, scheduling, and controlling.
CO3	Apply techniques of total quality assurance and quality control programme and cost implication.
CO4	Assess project costs, risks and claims.
CO5	Comprehend fundamentals of contract administration and supply chain management.

2. Syllabus

- **INTRODUCTION TO PROJECT MANAGEMENT (04 Hours)**

  About projects, significance of projects in nation building, about project management, project organizations, project acquisition and execution, business development and sales, tendering and cost estimation.

- **OVERALL PROJECT MANAGEMENT PLAN AND SCOPE MANAGEMENT (08 Hours)**

  Scope of work, key deliverables and project requirements, completion time and key milestones, project cost and budget, performance parameters and guarantees, scope management, developing scope management plan, understanding technical specifications and project requirements, work breakdown structure, creating scope baseline, controlling scope.

- **PROJECT PLANNING AND SCHEDULING (08 Hours)**

  About schedule management, developing schedule management plan, understanding contractual schedule and milestones, estimation of activities' duration, sequencing and relationships, techniques in planning and scheduling, bar chart, Gantt chart, networks, PERT and PERT analysis, CPM network, baseline, monitor and control schedule.

- **COSTING AND BUDGETING (04 Hours)**

  Review pre-tender cost estimation, preparation of detailed cost estimate, budget and

approval process, cost baseline, monitor and control costs, variance analysis, earned value analysis.

- **QUALITY MANAGEMENT (04 Hours)**

  Objectives, Quality Control and Assurance, Tools used in quality control, Quality Management, perform quality assurance activities, monitor and control quality.

- **PROJECT RISK MANAGEMENT (05 Hours)**

  Introduction, different types of risks, risk management, risk appetite and threshold limit, risk profile, risk management process, risk identification, risk analysis (qualitative and quantitative), risk response, monitor risks, prepare and update risk.

- **CONTRACTS AND CLAIMS MANAGEMENT (05 Hours)**

  Basic concepts and definitions, contract classifications, understanding contract clauses, contract administration and interpretation, change management, claims management, dispute resolution.

- **SUPPLY CHAIN MANAGEMENT (04 Hours)**

  About subcontracting, benefits and risks, subcontracting strategy and plan, subcontract formation and administration, performance monitoring, procurement process, procurement contracts, risks and benefits, digitization.

- **PROJECT CLOSURE (03 Hours)**

  Completion of key deliverables, closure of purchase orders and subcontracts, commercial closure, demobilization of resources, project hand-over, closure of main contracts.

(Total Lectures: 45 hours)

3. References

1. Baldwin, A and Bordoli, D (2014) A Handbook for Construction Planning and Scheduling, Blackwell Publishers.
2. Jha, K N (2011) Construction Project Management, First Edition, Pearson Publishers.
3. Harris, F, McCaffer, R and Edum-Fotwe, F (2006) Modern Construction Management, sixth edition, Blackwell Publishers.
4. Knutson, K, Schexnayder, C J, Fiori, C. and Mayo, R E (2013) Construction Management Fundamentals, MCGraw Hill Publishers.

5. Whyte, A (2015) Integrated Design and cost for civil Engineers, CRC Press, Taylor and Francis Group.
6. Mubarak, S (2010) Construction project scheduling and control, second edition, John Wiley and sons.
7. Fewings, P (2011) Construction Project Management - An integrated approach, Taylor and Francis.
8. Goetsch, D L (2015) Project Management for construction, Pearson publishers.
9. Ottoson, H (2013) Practical project management for building and construction, CRC Press, Taylor and Francis.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	3	3	2
CO2	3	1	2	3	3	3
CO3	3	1	3	3	2	2
CO4	3	1	3	3	3	2
CO5	3	1	3	3	2	2

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECT235 Offshore and Marine Projects Management

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Recognize and manage key design and operational interfaces between the major components of offshore facilities systems.
CO2	Introduce the fundamentals of offshore engineering, and marine engineering.
CO3	Provide latest engineering knowledge in the context of offshore survey.
CO4	Understand the concept, significance and basic knowledge of asset management.
CO5	Apply useful techniques to identify, analyse, mitigate and monitor risks throughout the project life cycle.

2. Syllabus

- **CONCEPT OF OFFSHORE AND MARINE PROJECT MANAGEMENT**

  (14 Hours)

  Field development concepts, selection and sizing of facility, major systems in subsea development, drilling operations, onshore vs offshore drilling, rules, regulations and environmental considerations (design codes, industry standards and regulations), design basis for offshore oil and gas facilities, modular design and standardization, interfaces and interface management, safety in design and operation, process system (separation system, gas handling system, utility systems), power generation, piping design, electrical, instrumentation and telecommunication design, insulation and trace heating, construction planning and progress reporting, construction site scope, load-out plan and procedures, installation and hook-up, mechanical completion, commissioning, start-up, and handover, decommissioning.

- **FUNDAMENTALS OF OFFSHORE, SUBSEA AND PIPELINE ENGINEERING** **(12 Hours)**

  Offshore oil and gas development, Offshore survey: principles and technologies of offshore survey, potential flow theory and overview of ocean environmental conditions, Other offshore development: ocean renewable energy, decommissioning and ocean space utilization, Subsea communication and control, Overview of Autonomous Underwater Vehicles (AUV) and Remotely Operated Vehicles (ROV), Reservoir

geochemistry and chemical processing, Fundamentals of pipelines and flow assurance, Drilling Engineering, Subsea structures, installation and field architecture.

- **ASSET MANAGEMENT IN MARINE ENGINEERING (09 Hours)**
  Facility reliability, FMECA and fault tree analysis of marine components, NDT techniques, condition monitoring methods and advanced signal processing and fault diagnosis techniques, maintenance strategies.

- **OFFSHORE AND MARINE PROJECTS RISKS MANAGEMENT (10 Hours)**
  Risk Management Framework and Planning, Plan the approach to offshore project risk management, project risk identification process, project risk assessment and quantification processes, risk analysis tools and techniques, concepts of risk including quantitative, semi-quantitative and qualitative approaches, ALARP criteria, individual and societal risk factors, project risk rating and prioritising, use of failure modes and effects and criticality analysis to identify system and component failure. Hazard and operability studies to identify hazards in offshore and subsea processes, risk response plan development, risk response control, risk response plan execution, evaluating risk response results.

(Total Lectures: 45 hours)

3. References

1. Baldwin, A and Bordoli, D (2014) A Handbook for Construction Planning and Scheduling, Blackwell Publishers.
2. Jha, K N (2011) Construction Project Management, First Edition, Pearson Publishers.
3. Harris, F, McCaffer, R and Edum-Fotwe, F (2006) Modern Construction Management, sixth edition, Blackwell Publishers.
4. Knutson, K, Schexnayder, C J, Fiori, C. and Mayo, R E (2013) Construction Management Fundamentals, MCGraw Hill Publishers.
5. Whyte, A (2015) Integrated Design and cost for civil Engineers, CRC Press, Taylor and Francis Group.
6. Mubarak, S (2010) Construction project scheduling and control, second edition, John Wiley and sons.
7. Fewings, P (2011) Construction Project Management - An integrated approach, Taylor and Francis.
8. Goetsch, D L (2015) Project Management for construction, Pearson publishers.

9. Ottoson, H (2013) Practical project management for building and construction, CRC Press, Taylor and Francis.

4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	2
CO2	3	1	2	3	3	3
CO3	3	1	2	3	3	2
CO4	3	1	3	3	3	2
CO5	3	1	3	3	2	1

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CECT236 Project Appraisal and Finance (3-0-0)

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Learn the basics of measurement of project performance.
CO2	Understand the various discounting and compounding criteria.
CO3	Familiarize with accounting fundamentals.
CO4	Study the theories of working capital management.
CO5	Apply financial methods in making capital investment decisions in projects.

2. Syllabus

- **PROJECT FORMULATION (10 Hours)**

  Generation and screening of project ideas, project identification, preliminary analysis, market, technical, financial, economic and ecological-pre-feasibility report and its clearance, project estimates and techno-economic feasibility report, detailed project report, different project clearances required.

- **PROJECT APPRAISAL (10 Hours)**

  NPV, BCR, IRR, ARR, urgency-payback period, assessment of various methods, Indian practice of investment appraisal, international practice of appraisal, analysis of risk, different methods for selection of a project and risk analysis in practice, ownership structures; BOT, BOLT, BOOT models.

- **PROJECT ACCOUNTING (09 Hours)**

  Profit and loss, balance sheet, income statement, ratio analysis, depreciation and amortization, preparation of financial statements, inflation accounting and corporate practices in India.

- **WORKING CAPITAL MANAGEMENT (08 Hours)**

  Policy for working capital, estimating working capital need, inventory management, account receivable, credit and cash management, managing payments to supplies and outstanding, capital investment decisions, techniques of capital budgeting, cost of capital. Cash flow analysis.

- **LONG TERM FINANCING AND BUDGETING (08 Hours)**

  Working of financial institutes in India and abroad, self-financing, stock exchanges, types of securities, borrowings, debentures, types of budgeting, procedure for master budget, key factor, budget manual, and new approach to budgeting, cash flow forecast.

(Total Lectures: 45 hours)

3. References

1. Prasanna Chandra (1995) Projects Preparation, Appraisals, Budgeting and Implementation, 3rd Edition, Tata Mc Graw Hill Publishing Co. Ltd.
2. Van Horne, J C (1990). Fundamentals of Financial Management, Prentice-Hall of India Ltd.
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5. McCarthy, J F (2010) Construction project management - A managerial approach, Pareto publishers.
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4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	2
CO2	2	2	1	2	2	2
CO3	3	2	3	3	2	2
CO4	3	2	2	3	1	2
CO5	3	2	2	3	2	2

1-Low 2-Moderate 3-High

OPEN ELECTIVE

CETP222 Communication Skills

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Select the appropriate element of grammar during the written and oral communication.
CO2	Select the active voice or passive voice of the sentence based on the type of the content.
CO3	Write the technical report with by incorporating required components.
CO4	Comprehend the importance of personal factors during oral communication.
CO5	Present the content verbally in individual as well as group presentations and discussions.

2. Syllabus

- **ENRICHING LANGUAGE SKILLS (12 Hours)**

  Functional English Grammar – Parts of Speech - Uses of Articles – Prepositions – Tenses - Active and Passive Voice - Conditional Sentences - Punctuation - Common Errors and Vocabulary.

- **WRITTEN COMMUNICATION (15 Hours)**

  Paragraphs - Kinds and Construction – Letters - Seven C's of Letter Writing and Structure - Reports- Kinds and Structure - Research Paper - Characteristics and Components - E-mail etiquette.

- **ORAL COMMUNICATION (18 Hours)**

  Non-Verbal Communication- Body Language, Space and Personal Appearance; Job Interviews- Objectives and Preparation - Group Discussion- Speaking in a GD - Presentation – Planning - Structuring and Nuances of Delivery.

(Total Lectures: 45 hours)

3. References

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3. Farahthullah, T.M. Communication Skills for Technical Students. 5th Edition, Kolkatta: Orient Blackswan, 2009.
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4. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	0	3	2	2	3	2
CO2	0	3	2	2	3	2
CO3	0	3	2	2	3	2
CO4	0	3	2	2	3	2
CO5	0	3	2	2	3	2

1-Low 2-Moderate 3-High

CECT204 Construction Management Lab

L	T	P	C
0	0	4	2

1. Course Outcomes (COs)

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

CO1	Study various construction management software available in industry.
CO2	Learn in depth about planning and scheduling using software.
CO3	Understand the working of MS Project and Primavera software in detail.
CO4	Prepare entire project schedule of any construction project in software.
CO5	Explore the benefits of REVIT and NavisWorks in construction management.

2. Syllabus

- **INTRODUCTION**

  Introduction to construction project models - analytical and numerical. Application of software for project planning, scheduling and control.

- **PLANNING AND SCHEDULING**

  Programming exercises for estimation, exploring user interface, working with MS Project and Primavera elements, network planning and control, creating a new OBS, EPS, WBS; adding activities; creating relationships; creating and assigning calenders; assigning roles, resources and expenses; activity and resource codes baselines, updating; earned value analysis; S-curve and reporting project performance; Risk Management in Primavera P6; other relevant functions.

- **MODELLING**

  Exploring the user interface, working with Revit elements; creating a basic floor plan, working with grids and structural columns; adding and modifying walls, loading additional building components; importing and exporting using external files and linking files; creating advanced components, creating and modifying parametric families, viewing the building model, controlling object visibility, creating and modifying section and elevation views; developing the building model, creating and modifying floors, ceilings, roofs and curtain wall; detailing and drafting, duplicating views, creating elevations, creating section structural works, floor framing, working with roofs, working with structural steel frames; working with sloped beams, working with floor decks, working with foundation slabs and slabs, footings and grade beams,

managing revisions, user interface and file organization.

- **MODEL DEVELOPMENT**

  Exploring the user interface, working with NavisWorks elements and file organization; overriding transparency, colour, and object/model location; importing 3D files, how to import and append 3D model file; understanding NavisWorks file formats, object enablers; navigation, zooming, panning, walking around sectioning, moving objects, hiding layers and objects, establishing selection sets; viewpoints, establishing and organizing custom, viewpoints, publishing the model file and viewpoints, internal/in-house clash detection, 4D simulation.

  Termwork based on above exercises with continuous evaluation during the course of the semester.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3
CO2	3	2	3	3	2	3
CO3	3	2	3	3	2	3
CO4	2	3	2	3	2	3
CO5	3	2	3	3	2	3

1-Low 2-Moderate 3-High

CECT205 Graduate Report II

L	T	P	C
0	0	2	1

1. Course Outcomes (COs)

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

CO1	Identify problems that have relevance to the current industrial needs.
CO2	Conduct literature survey in the chosen field.
CO3	Discover the research gap from the existing literature.
CO4	Be aware about current innovative practices and technology.
CO5	Develop technical writing, presentation and communication skills.

2. Syllabus

Students are expected to prepare graduate reports on various topics of the subjects as assigned by the faculty advisor and submit duly computer typed reports, present and participate in subject wise group discussion.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3
CO2	3	3	3	3	3	2
CO3	3	3	2	3	2	2
CO4	3	3	3	3	3	2
CO5	3	3	2	3	3	3

1-Low 2-Moderate 3-High

Semester III

CECT301 Dissertation Preliminaries

L	T	P	C
0	0	8	4

1. Course Outcomes (COs)

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

CO1	Identify research gap by conducting a persistent literature review.
CO2	Construct a problem statement based on identified research gap.
CO3	Devise objective and scope that bridges the identified gap.
CO4	Develop methodology including tools and techniques to be used in alignment with the desired scope and objective.
CO5	Prepare a detailed report and presentation to improve technical writing and presentation skills.

2. Syllabus

Dissertation preliminaries should clearly identify the goals and objectives and scope of the dissertation work taken up by the candidate. The focus is on data identification and proposed field surveys, questionnaire design, sample size decision. The study methodology and literature review on the dissertation topic is to be completed and a typed report is to be finalized in consultation with dissertation supervisor and submitted for the assessment at the end of the semester.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3
CO2	2	3	3	2	3	3
CO3	3	3	2	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	2	3	3	3

1-Low 2-Moderate 3-High

CECT302 Summer Training

L	T	P	C
0	0	4	2

1. Course Outcomes (COs)

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

CO1	Understand the organisational structure, their function along with the services of organisation.
CO2	Analyse the gap between theoretical knowledge and actual practices done on site.
CO3	Familiarize with various construction techniques used in construction industry.
CO4	Study the assumptions and approximations adopted in practices while dealing with live engineering issues.
CO5	Understand the roles and responsibilities of a construction project manager.

2. Syllabus

Six/Eight-week summer training on construction projects, is to be carried at National/State/Local Government Project level after the Second Semester Examination and prior to opening of Third Semester and project report on the same is to be prepared and submitted duly certified by the Project Organization as well as presented in institute.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	2
CO2	3	1	2	2	2	2
CO3	1	2	3	2	2	2
CO4	1	1	3	3	3	2
CO5	2	1	3	3	3	3

1-Low 2-Moderate 3-High

CECT303 Professional Project

L	T	P	C
0	0	6	3

1. Course Outcomes (COs)

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

CO1	Select an appropriate live construction project.
CO2	Apply various engineering and management topics according to real site conditions.
CO3	Conduct regular site visits to monitor the on-going site work.
CO4	Identify the problems which can occur during the execution of the project.
CO5	Find solutions to the problems using various construction management tools and techniques.

2. Syllabus

Twelve weeks including summer vacation training on major construction projects is to be carried at National/State/Local Government Project level after the Second Semester Examination and prior to the first test of third Semester and project report on the same is to be prepared and submitted duly certified by the Project Organization.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	2	3	2	2
CO2	3	2	2	3	2	3
CO3	1	3	2	1	2	2
CO4	3	2	3	3	2	1
CO5	2	2	2	3	2	1

1-Low 2-Moderate 3-High

CECT304 Seminar

L	T	P	C
0	0	2	1

1. Course Outcomes (COs)

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

CO1	Explore the available literature in form of research journals, conference articles.
CO2	Identify a relevant problem with the help of thorough literature review.
CO3	Understand the current industrial scenario with respect to the identified problem.
CO4	Reveal the study done to demonstrate the understanding of chosen problem.
CO5	Develop technical writing and communication skills by preparing technical report and presentation.

2. Syllabus

- Each student is required to prepare and submit a seminar paper from any area of material/ technology/management with emphasis on development of a project/process/techniques /materials/organization techno economic feasibility studies etc. in consultation with Dissertation Supervisor.
- At least two seminars in area of construction technology and management will be organized by invited professionals, experts, researchers, and policy makers.
- Seminar is to be presented on scheduled date decided by the P.G. Centre. Focus will be on development of attitudes, training of mind, independent and innovative thinking etc.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	1
CO2	3	3	3	2	2	1
CO3	3	2	2	3	2	1
CO4	3	2	2	2	2	1
CO5	3	2	3	2	2	2

1-Low 2-Moderate 3-High

Semester IV

CECT401 Dissertation

L	T	P	C
0	0	20	10

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1. Course Outcomes (COs)

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

CO1	Enhance the ability for conception of the idea by conducing thorough research.
CO2	Improve the ability and confidence to undertake field studies, data collection and analysis.
CO3	Develop an ability of preparing research proposal.
CO4	Organize the research work in order to prepare dissertation report.
CO5	Defend the research work through presentation demonstrating comprehensive understanding of the problem and research conclusions.

2. Syllabus

- The preliminary dissertation work initiated in Third semester is further extended over fourth semester to cover up the field studies, data analysis, modeling, if any and research finding followed by conclusion etc.
- The main objective of the dissertation work is to provide scope for original and independent research to express the ability of using analytical approach or technical investigation.
- Thesis is to be prepared by each student under the guidance of faculty supervisor and finally submitted in six typed bound sets as per the specified time.
- The assessment of the dissertation work will be carried out in two stages, first during the semester for 160 marks, and final viva-voce exam for 240 marks at the end of the semester. semester.

3. CO-PO-PSO Mapping

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	2
CO2	3	2	3	3	2	3
CO3	3	3	3	3	3	3

CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3

1-Low 2-Moderate 3-High