



**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA
(JHAJJAR)**

An Autonomous Institute

‘A’ GRADE ACCREDITED BY NAAC

**Evaluation Scheme and Syllabus for
Bachelor of Technology (Civil Engineering)
Third Year (A-Scheme)
(Effective from the session: 2026-27)**



APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA,
JHAJJAR (HR.)**

**Scheme of Studies and Examinations
B.Tech (Civil Engineering) – 5th Semester
w.e.f. 2026-27**

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-CE-301A	Design of Steel Structures	3	0	0	3	3	40	60	—	100	3
2	Professional Core Courses	PCC-CE-303A	Hydrology & Water Resource Engineering	3	0	0	3	3	40	60	—	100	3
3	Professional Core Courses	PCC-CE-305A	Soil Mechanics	3	0	0	3	3	40	60	—	100	3
4	Professional Core Courses	PCC-CE-307A	Highway Engineering - I	3	0	0	3	3	40	60	—	100	3
5	Professional Core Courses	PCC-CE-309A	Water Supply and Treatment	3	0	0	3	3	40	60	—	100	3
6	Professional Elective Course Courses	Refer Table 2	Professional Elective-II	3	0	0	3	3	40	60	—	100	3
7	Professional Core Courses / (Lab Course)	LC-CE-311A	Computer-Aided Civil Engineering Drafting Lab (CAD Lab)	0	0	2	2	1	25	—	25	50	-
8	Professional Core Courses / (Lab Course)	LC-CE-313A	Soil Mechanics Lab	0	0	2	2	1	25	—	25	50	-
9	Professional Core Courses / (Lab Course)	LC-CE-315A	Highway Engineering - I Lab	0	0	2	2	1	25	—	25	50	-
10	Project	PROJ-CE-327A	Survey Camp	—	—	—	2	1	25	—	25	50	—
11	Practical Training	PT-CE-329A	*Practical Training - I	0	0	2	2	1	25	—	25	50	*Refer Note 2
Total Credits								23				850	

Note-1: Students will be allowed to use non-programmable scientific calculator. However, sharing of Calculator and other materials will not be permitted in the examination.

Note-2: The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students.

Note-3: Students must choose one course from the Professional Elective-II category (Table 2). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table 2 Professional Elective – II

S. No	Course Code	Course Name
1	PEC-CE-317A	Advanced Structural Analysis
2	PEC-CE-319A	Air and Noise Pollution
3	PEC-CE-321A	Formwork Engineering and Design
4	PEC-CE-323A	Traffic Engineering
5	PEC-CE-325A	Engineering Geology
6	-----	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA,
JHAJJAR (HR.)**

**Scheme of Studies and Examinations
B.Tech (Civil Engineering) – 6th Semester
w.e.f. 2026-27**

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-CE-302A	Irrigation Engineering and Design	3	0	0	3	3	40	60	—	100	3
2	Professional Core Courses	PCC-CE-304A	Foundation Engineering - I	3	0	0	3	3	40	60	—	100	3
3	Professional Core Courses	PCC-CE-306A	Highway Engineering - II	3	0	0	3	3	40	60	—	100	3
4	Professional Core Courses	PCC-CE-308A	Waste - Water Treatment	3	0	0	3	3	40	60	—	100	3
5	Professional Elective Course Courses	Refer Table 3	Professional Elective-III	3	0	0	3	3	40	60	—	100	3
6	Open Elective Course	Refer Table 4	Open Elective-I	3	0	0	3	3	40	60	—	100	3
7	Professional Core Courses / (Lab Course)	LC-CE-310A	Foundation Engineering lab	0	0	2	2	1	25	—	25	50	-
8	Professional Core Courses / (Lab Course)	LC-CE-312A	Highway Engineering - II Lab	0	0	2	2	1	25	—	25	50	-
9	Professional Core Courses / (Lab Course)	LC-CE-314A	Environmental Engineering Lab	0	0	2	2	1	25	—	25	50	-
10	Professional Core Courses / (Lab Course)	LC-CE-316A	Structural Analysis and Design Lab	1	0	2	3	1	25	—	25	50	-
Total Credits								22				800	

Note-1: At the end of the 6th Semester, each student shall undergo 4–6 weeks of Industrial/Practical Training in a Civil Engineering organization and submit a training report along with a training certificate from the organization. The evaluation shall be carried out in the 7th Semester.

Note-2: Students must choose one course from the Professional Elective–III category (Table 3) and one course from the Open Elective–I category (Table 4). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table 3 Professional Elective – III

S. No	Course Code	Course Name
1	PEC-CE-318A	Advanced Steel Structures
2	PEC-CE-320A	Pre-Stressed Concrete
3	PEC-CE-322A	Contracts Management
4	PEC-CE-324A	Hydro-Power Engineering
5	-----	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Table 4 Open Elective Courses – I

Sr. No.	Code	Subject	Offered by	Departments Eligible to Choose the Course
1	OEC-01A	Engineering Ethics	Department of Electronics and Communication Engineering	All Engineering Departments
2	OEC-02A	Waste Management	Department of Civil Engineering	All Engineering Departments except the Department of Civil Engineering
3	OEC-03A	Internet of Things and Edge Computing	Department of Computer Science and Engineering	All Engineering Departments
4	OEC-04A	Project Management	Department of Mechanical Engineering	All Engineering Departments
5	OEC-05A	Renewable Energy Resources	Department of Electrical Engineering	All Engineering Departments
6	OEC-06A	United Nation's Sustainable Development Goals	Department of Electronics and Communication Engineering	All Engineering Departments
7	OEC-07A	Computer Aided Risk Analytics	Department of Fire Technology and Safety	All Engineering Departments
8	OEC-08A	Health, Safety and Environment	Department of Fire Technology and Safety	All Engineering Departments except the Department of Fire Technology and Safety
9	OEC-09A	Fundamentals of Additive Manufacturing	Department of Mechanical Engineering	All Engineering Departments except the Department of Mechanical Engineering
10	-----	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms	Online Platforms	All Engineering Departments

Course Code	PCC-CE-301A				
Category	Professional Core Course				
Course Title	Design of Steel Structures				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are: • To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections. • To study and design of various connections. • To understand behaviour of flexural members and the design laterally restrained and unrestrained beams. • To impart practical knowledge of steel structures and their application.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the properties of structural steel, limit state design concepts, and relevant provisions of Bureau of Indian Standards IS 800:2007.	Level 1: Remember
CO2	Explain the behavior and design requirements of bolted and welded connections, tension members, and compression members.	Level 2: Understand
CO3	Design beams, beam-columns, and basic steel structural members using codal provisions.	Level 3: Apply
CO4	Analyze and design advanced steel structures such as roof trusses, plate girders, and gantry girders.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction: Stress Strain Curve for Steel, Composition and Properties of Structural Steel, Types of Steel Structures, Types of Sections, Stresses in Structural in Steel, Design Consideration, Codes and Specification, Introduction of Design Philosophies, Different Kind of Loads and their Combination. Module 2: Connections: Terminology, Various Types of Connections and their Joints-Riveted, Bolted, Pin, Welded Connections; their Design for Different Loads, Modes of Failure
Unit-II	Module 3: Design of Tension Member: Types of Tension Members, Factors Affecting Strength of Tension Member, Design of Tension Members, Lug Angles, Splices, Gussets as per Indian Codal Provision. Module 4: Design of Compression Members: Behavior of Compression Members, Types of Compression Member, Effective Length, Slenderness Ratio, Sections Used for Compression Member, Flexural-Torsional Buckling, Prevention of Buckling Failure, Design of Compression

	Members, Design of Built Up Columns- laced and battened columns including the design of lacing and battens, Design of Compression Members Composed of Two Components Back-To-Back.
Unit-III	Module 5: Design of Beams: Different Types of Sections in Beams, Lateral Stability of Beam and Factors Affecting Lateral Stability, Design of Laterally Supported and Unsupported Beams, Web Buckling, Web Crippling, Diagonal Buckling, Torsional Buckling, Effect Of Holes In Beams. Module 6: Design of Column Bases and Footings: Types of Column, Bases-Slab Bases, Gusset Base, Design of Base plate and Gusseted Base, Design of Bases for Eccentrically Loaded Columns, Anchor Bolts and Shear Connectors, Grillage Foundation
Unit-IV	Module 7: Plastic Analysis and Design: Plastic Analysis- Scope, Theory and General Requirement, Ultimate Load-Carrying Capacity of Tension Members, Compression Members, Flexural Members, Shape Factor, Load Factor, Mechanisms, Plastic Collapse, Condition in Plastic Analysis, Method of Analysis, Plastic Analysis And Design of Steel Beams and Simple Portal Frames.

Suggested Readings

- Design of steel structures, A.S. Arya & J.L. Ajmani, Nemchand & Bros., Roorkee.
- Design of steel structures (LSM), N. Subramanian, Oxford Publication.
- Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
- Design of steel structures, S.M.A. Kazmi & S.K. Jindal, Prentice Hall, New Delhi.
- Design of steel structures, S.K. Duggal, TMH Pub, New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Introduction to Structural Steel, Stress-Strain Curve, Properties of Steel	https://youtu.be/5h2V7Xx9mS4
	Riveted, Bolted and Welded Connections	https://youtu.be/X4kQ2zP8mLs
II	Design of Tension Members	https://youtu.be/K6nW8pQ2tXs
	Design of Compression Members and Buckling	https://youtu.be/L8vR3mQ6tWg
III	Design of Laterally Supported and Unsupported Beams	https://youtu.be/J6qV4nP8mRt
	Design of Slab Bases and Gusseted Bases	https://youtu.be/C7vN5mP4xLs
IV	Plastic Analysis and Design	https://youtube.com/playlist?list=PLwBjRwvqBNT3cEx6GL3lQ3dvGfoBaZzUY&si=THBKB-0U9nsaLEhN

Course Code	PCC-CE-303A				
Course Category	Professional Core Course				
Course Title	Hydrology and Water Resource Engineering				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are: - To introduce the fundamental concepts of hydrology and hydrological processes involved in the water cycle. - To develop understanding of precipitation, infiltration, runoff, hydrograph analysis, and flood estimation techniques.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts of hydrology.	Level 1: Remember
CO2	Explain hydrological parameters.	Level 2: Explain
CO3	Apply hydrological concepts.	Level 3: Apply
CO4	Analyze hydrological processes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction: Hydrologic Cycle, Water-Budget Equation, History of Hydrology and its Application in Engineering, World Water Balance, Sources of Hydrological Data. Module 2: Precipitation: Forms of Precipitation, Characteristics of Precipitation in India, Measurement of Precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth Area-Duration Relationships, Frequency of Point Rainfall, Intensity-Duration-Frequency Curves, Probable Maximum Precipitation (PMP), Rainfall Data in India.
Unit-II	Module 3: Hydrological Abstractions: Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for their Reduction, Evapotranspiration and its Measurement, Evapotranspiration Equations, Potential Evapotranspiration over India, Actual Evapotranspiration, Interception, Infiltration Process, Initial Loss, Infiltration Capacity, Factors Affecting Infiltration, Measurement of Infiltration. Module 4 : Runoff : Types of Runoff, Runoff Characteristics of Streams, Runoff Volume , Factors Affecting Runoff, Rainfall-Run off Relationships, Estimation of Runoff, SCS-CN Method of Estimating Runoff Volume, Flow Duration Curve, Flow-Mass Curve, Measurement of Stage of Runoff by-Staff Gauge, Wire Gauge, Stream Flow Measurement by Direct and Indirect Methods.

Unit-III	Module 5: Hydrograph: Discharge Hydrograph, Components and Factors Affecting Shape of Hydrograph, Effective Rainfall, Base Flow Separation, Unit Hydrograph(UH)-Definition, Assumptions and its Derivation; Unit Hydrograph of Different Durations, Use and Limitations of UH, Snyder's Synthetic UH. Module 6: Floods and their Estimation: Introduction to Floods, Estimation of Floods by: Rational Methods, Empirical Formulae, Unit Hydrograph Technique, Flood Frequency Studies-Gumbel's Method, Graphical Method.
Unit-IV	Module 7: Water Resource Planning-I : Role of Water in National Development, Water Resources and their Assessment , Planning Process, Environmental Consideration in Planning, System Analysis in Water Planning, Common Issues in Project Planning.. Module 8: Water Resource Planning-II: Functional Requirements in Multipurpose Projects, Multipurpose Planning, Basin Wise Planning, Long Term Planning, Reservoir Planning-Dependable Yield, Sedimentation in Reservoir, Reservoir Capacity, Empirical-Area Reduction Method.

Suggested Readings

- Engineering Hydrology by K.Subramanya.
- Hydrology by H.M.Raghunath.
- Water Resources Engineering by Linseley and Franzini
- Optimisation Theory and Applications by S.S.Roy
- Water Resources Systems Planning & Economics by R.S.Varshney.

Useful Video Links

Unit No.	Topic	Link
Unit I	Introduction to Hydrologic Cycle and Water Budget Equation	https://youtu.be/unvEFwDg9Fw?si=fW-rdYHcRiS0u2yy
	Precipitation Measurement and IDF Curves	https://youtu.be/hv1y8hVHpiU?si=d_hVL1Rggx7Zprfu
Unit II	Hydrological Abstractions: Evaporation, Infiltration and Evapotranspiration	https://youtu.be/y7Qv3lGr4B4?si=yXqbQNav43JSIEZu
	Runoff Estimation and SCS-CN Method	https://youtu.be/55U7OEWXG18?si=uNcYoFt6K8Xo_Dcy
Unit III	Hydrograph and Unit Hydrograph Analysis	https://youtu.be/B9hMtK-zKOA?si=RIF0wdsGLnucVmhs
	Flood Estimation and Frequency Analysis	https://youtu.be/9HFj8ZrAVeA?si=YBpruTEX4NK-mu2X
Unit IV	Water Resource Planning and System Analysis	https://youtu.be/vDr1PiNhYz8?si=cIErPcdeUuq_LB-h
	Reservoir Planning and Sedimentation Analysis	https://youtu.be/vDr1PiNhYz8?si=9gD82maY0jL5sBK3

Course Code	PCC-CE-305A				
Category	Professional Core Course				
Course Title	Soil Mechanics				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the fundamental engineering properties and classification of soils. • To develop understanding of compaction, permeability, seepage, and effective stress concepts in soils. • To analyze stress distribution, consolidation, and settlement behavior of soil masses. • To study shear strength characteristics and laboratory testing methods for geotechnical analysis and design.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts of soil mechanics.	Level 1: Remember
CO2	Explain the engineering properties of soils.	Level 2: Understand
CO3	Apply soil mechanics principles to engineering problems.	Level 3: Apply
CO4	Analyze the behavior of soils under different conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Basic Soil Properties: Introduction to Soil Mechanics; Origin and Formation of Soils; Residual and Transported Soils; Soil Profile; Soil Structure; Types of Soils; Three-Phase System; Index Properties; Weight–Volume Relationships; Grain Size Analysis (Sieve and Hydrometer Analysis); Grain Size Distribution Curve. Module 2: Soil Classification & Clay Mineralogy: Index Properties; Atterberg Limits; Clay Mineralogy (Kaolinite, Illite and Montmorillonite); Activity of Clay; Soil Classification Systems (USCS, ISSCS and AASHTO); Plasticity Chart; Engineering Properties of Fine-Grained Soils.
Unit-II	Module 3: Fundamentals of Compaction: Compaction Principles; Compaction and Consolidation; Standard and Modified Proctor Tests; Compaction Characteristics (OMC and MDD); Zero Air Voids Line; Factors Affecting Compaction; Field Compaction; Field Density Tests (Sand Replacement and Core Cutter Methods); Relative Compaction and Quality Control. Module 4: Permeability & Seepage: Permeability of Soils; Darcy's Law; Laboratory Determination of Permeability (Constant Head and Falling Head Tests); Equivalent Permeability of Layered Soils; Seepage Analysis; Flow Nets; Seepage Velocity and Discharge Velocity; Hydraulic Gradient; Seepage Pressure; Quick Sand Condition; Piping; Capillarity.

Unit-III	Module 5: Effective Stress in Soil Mass: Total, Neutral and Effective Stress; Terzaghi's Effective Stress Principle; Effective Stress under Submerged, Seepage and Capillary Conditions; Critical Hydraulic Gradient; Seepage Force; Sensitivity of Soils. Module 6: Stress Distribution in Soil: Boussinesq and Westergaard Theories; Stress Distribution due to Point, Line, Strip and Circular Loads; Pressure Bulbs; Isobars; Newmark's Influence Chart; Contact Pressure under Rigid and Flexible Footings.
Unit-IV	Module 7: Consolidation of Soil: Consolidation Theory; Compression and Swelling Indices; Terzaghi's One-Dimensional Consolidation Theory; Consolidation Parameters; Oedometer Test; Normally Consolidated and Over-Consolidated Soils; Over-Consolidation Ratio (OCR); Preconsolidation Pressure; Settlement Analysis (Immediate, Primary and Secondary Settlement). Module 8 :Shear Strength of Soil: Shear Strength Theory; Mohr-Coulomb Failure Criterion; Mohr Circle; Shear Strength Parameters; Stress–Strain Behaviour of Soils; Direct Shear, Triaxial, Unconfined Compression and Vane Shear Tests; Drained and Undrained Shear Strength; Stress Path (Introduction).

Suggested Readings

- Bolton, M. D., A guide to soil mechanics (2nd ed.). Macmillan Education.
- Lambe, T. W., & Whitman, R. V., Soil mechanics. Wiley.
- Coduto, D. P. (2001). Foundation design: Principles and practices (2nd ed.). Prentice Hall.
- Venkatramaiah, C. (2006). Geotechnical engineering (3rd ed.). New Age International Publishers.
- Arora, K. R. (2019). Soil mechanics and foundation engineering (8th ed.). Standard Publishers Distributors.
- Garg, S. K. (2018). Soil mechanics and foundation engineering (9th ed.). Khanna Publishers.
- Mitchell, J. K., & Soga, K. (2005). Fundamentals of soil behavior (3rd ed.). Wiley.
- Schofield, A. N., & Wroth, C. P., Critical state soil mechanics. McGraw-Hill.
- Das, B. M. (2016). Principles of foundation engineering (8th ed.). Cengage Learning

Useful Video Links

Unit No.	Topic	Link
Unit-I	Basic Soil Properties	https://youtu.be/afirGWlleSM?si=T7PcZ76V3tCSeJIB
	Soil Classification & Clay Mineralogy	https://www.youtube.com/live/u2KhP8DuMJI?si=LiiGg-XiprgAg78n
Unit-II	Fundamentals of Compaction	https://youtu.be/A7eiLKx3mc?si=23Lnj_aFDkzUHLzj
	Permeability & Seepage	https://youtu.be/TYBhuXspwpE?si=bWmiyo_9OOnoahVA
Unit-III	Effective Stress in Soil Mass	https://www.youtube.com/live/m5wWNxi1Y2g?si=iolh94FHHAm66OE1
	Stress Distribution in Soil	https://www.youtube.com/live/14gPn0upVH0?si=tKcF-PX3UhtCwgtJ
Unit-IV	Consolidation of Soil	https://www.youtube.com/live/l0Kac4zuhOg?si=9jF7hWqUx9yN0Gvp
	Shear Strength of Soil	https://www.youtube.com/live/K-6Gs5hlFyg?si=uvNGPJhgM7QgUKbh

Course Code	PCC-CE-307A					
Category	Professional Core Course					
Course Title	Highway Engineering - I					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	The objectives of this course are: • To understand fundamentals of highway engineering, planning, design and materials. • To apply design principles and traffic studies for safe roads. • To evaluate modern techniques like traffic control and ITS.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basics of highways, materials and traffic engineering.	Level 1: Remember
CO2	Explain planning, alignment and geometric design.	Level 2: Understand
CO3	Apply design principles and traffic/material testing methods.	Level 3: Apply
CO4	Analyze traffic, safety and material performance.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction: Modes of Transportation, History of Road Development, Scope of Highway Engineering, Road Development Plans in India, PMGSY and other Highway Projects, Classification of Highways, Locations and Functions, Road Patterns. Module 2: Highway Development and Planning: Necessity and Significance of Highway Planning, Highway Alignment and Surveys, Factors Influencing Highway Alignment, Engineering Surveys for Alignment, Conventional and Modern Methods of Highway Alignments.
Unit-II	Module 3: Highway Geometric Design: Urban, Rural Roads and their Cross-Sections, Design of Cross Section Elements- Right of Way and Width Considerations, Roadway, Shoulders, Kerbs Traffic Barriers, Medians, Frontage Roads; Facilities for Pedestrians, Bicycles, Buses and Trucks, Traffic Separators and Road Margin, Design of Sight Distances, IRC Recommended Values. Module 4: Design of Horizontal and Vertical Alignment: Super-Elevation and its Design, Extra-Widening, Radius of Circular Curves, Length of Transition Curves, Gradient, Summit and Valley Curves, Introduction to Software like MXROAD.
Unit-III	Module 5: Highway Material – I : Soil and Aggregate Subgrade Soil and its Characteristics, Compaction Methods, Evaluation of Soil Strength by Different Tests, Aggregates and their Characteristics, Various Tests on Aggregates, IRC/IS Specifications for Suitability of Aggregates.

	Module 6: Highway Material – II : Bituminous Materials and Bituminous Mixes Bitumen: Origin, Preparation, Properties and their Testing Methods, Bituminous Road Binders: Requirements Constitution, Selection Criterion for Different Binders, Bituminous Emulsions and Cutbacks: Preparation, Characteristics, uses and their Tests. Bituminous Mixes: Mechanical Properties and Characteristics, Bituminous Mix Design: Methods, Performance-Based Bitumen Specifications, Polymers and Rubber Modified Bitumen in Bituminous Mixes, Waste Plastic in Bituminous Mixes.
Unit-IV	Module 7: Traffic Engineering and Control: Traffic Characteristics, Traffic Studies and their Presentation, Traffic Capacity Studies, PCU and Axle Load Survey, Intersections Design, Design of Sign and Signals, Parking and Accident Studies, Highway Safety Measures. Module 8: Intelligent Transportation Systems (ITS): Objectives of Intelligent Transportation Systems, Historical Background, Benefits of ITS, Data Collection Techniques for ITS-Detectors, Automatic Vehicle Location, Automatic Vehicle Identification, Geographic Information Systems and Video Data Collection.

Suggested Readings

- Khanna, S.K. and Justo, C.E.G., Highway Engineering, Nem Chand & Bros.
- Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers.
- Partha Chakraborty and Animesh Das, Principles of Transportation Engineering, PHI Learning.
- Papacostas, C.S. and Prevedouros, P.D., Transportation Engineering and Planning, Prentice Hall.
- Sharma, S.K., Principles, Practice and Design of Highway Engineering, S. Chand Publications.
- IRC Codes and Specifications, Indian Roads Congress.
- Relevant publications of Ministry of Road Transport and Highways

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction to Highway Engineering and Road Development in India	https://www.youtube.com/live/JZQSidZQRj8?si=KW5cH30rbL15TS05
	Highway Planning and Alignment Surveys	https://youtu.be/Co4ZKhY2E1Q?si=vo-RSLV3nWMXaGg5
Unit-II	Highway Cross-Section Elements	https://youtu.be/ynae0uz2qYs?si=TNeK1XWtI37YdqxW
	Horizontal Curve Design, Super Elevation and Extra Widening	https://youtu.be/tIkBEky7WsY?si=2ztxA7HWIEVx6KVx
Unit-III	Soil and Aggregate Testing for Highway Materials	https://youtu.be/959mcz2nX9k?si=jTwaAZP5NOB1RLL0
	Bituminous Materials and Testing Methods	https://youtu.be/8DkY55EKKR4?si=exnkVheYx0zkDFpL
Unit-IV	Traffic Engineering Studies and PCU Analysis	https://youtu.be/dc1ndNtjwP8?si=vqcqFWUVRgqmcYGe
	Intelligent Transportation Systems (ITS)	https://youtu.be/OnjX0O9dPMc?si=f__lkt4Yx0o0fHZJ

Course Code	PCC-CE-309A				
Course Category	Professional Core Course				
Course Title	Water Supply and Treatment				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are: • To quantify the water demands and its variations. • To analyze the different characteristics of water. • To study the different units of treatment. • To deal with water supply and water distribution to consumers. • To develop basic knowledge about the water pollution and its control.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the concepts of water demand estimation, source selection, water quality characteristics, and standards for water supply systems.	Level 1: Remember
CO2	Explain water treatment processes, advanced treatment methods, and the operational principles of various treatment units.	Level 2: Understand
CO3	Apply principles of water conveyance, pumping, and distribution system design for efficient water supply management.	Level 3: Apply
CO4	Analyze water pollution issues and evaluate suitable treatment, distribution, and control measures for sustainable water supply systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction: Water Supply System – Planning, Objectives, Design Period, Population Forecasting, Water Demands and its Variations, Sources of Water and their Characteristics, Development and Selection of Source, Intakes and their Types. Module 2: Water Characteristics: Sources of Impurities, Type of Impurities in Water and their Sanitary Significance, Physical, Chemical and Bacteriological Analysis of Water, Indian and Global Standards of Water Quality, Effluent Standards.
Unit-II	Module 3: Water Treatment: Necessity of Water Treatment , Flow Diagram of Different Treatment Units; Constructional Details, Working and Operation of Preliminary Units, Aeration Units, Sedimentation Units and their Types, Features and Design Aspects; Mixing Basins, Flocculation; Filtration – Mechanisms, Characteristics and Design of Slow and Rapid Sand Filtration Unit; Disinfection - Theory, Methods and Practices.

	Module 4: Advanced Water Treatment: Water Softening, Desalination- R.O. Plant, Demineralization, Adsorption, Ion Exchange, Membrane Systems; Iron and Manganese Removal, Defluoridation, Dissolved Solids Removal.
Unit-III	Module 5: Water Conveyance System: Methods of Supply - Intermittent and Continuous, Pipes and Conduits for Water- Pipe Materials, Laying, Jointing and Testing of Pipes, Valves and Appurtenances. Module 6: Pumps and Pumping Stations: Need of Pumping, Terminology used, Classification of Pumps, Different Type of Pumps used in Water Supply, Power of Pumping, Total Lift of Pump, Location of Pumping Station, and Site Selection.
Unit-IV	Module 7: Water Distribution System: Requirements of Water Distribution, Type of Distribution System, Layout of Distribution System – Dead End System, Grid Iron System, Ring System, Radial System and their Merits and Demerits; Distribution Reservoir-Functions and Determination of Storage Capacity, Water Distribution Network- Layout, Capacity, Pressure Requirements, Analysis; Leak Detection and Maintenance of Water Distribution Network. Module 8: Water Pollution and Control: Sources of Water Pollution, Types and their Effects, Preventive Measures and Control of Water Pollution, Description of Legislation Related to Water Pollution Control.

Suggested Readings

- Water Supply Engineering: S.R. Kshirsagar.
- Water Supply Engineering: S.K. Garg.
- Water Supply Engineering: B.C. Punmia.
- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie 8. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Water Supply System	https://youtu.be/zu6UfycMkw4?si=FyRtdTBkghPbVY9b
	Sources of Impurities	https://youtu.be/bu609FNz6VI?si=kYw9VzMCIHegUBzS
II	Water Treatment	https://youtu.be/jvQn9IMI79M?si=uVsstS95bLUQrWfK
	Advanced Water Treatment	https://youtu.be/4-SRMmqH2s4?si=GnmECJao0hpO8Wep
III	Water Conveyance System	https://youtu.be/zu6UfycMkw4?si=r11ZWAXwhwHEZnBP
	Pumps and Pumping Stations	https://youtu.be/u9cbqLCylf4?si=us_JA2dIKq9eECAr
IV	Water Distribution System	https://youtu.be/zVZ9c6EXfTA?si=s5ZnBOBW_TaEjKKo
	Sources of Water Pollution	https://youtu.be/t1xu2A8ItNE?si=ue-YjkbZC7o1tmF

Course Code	LC-CE-311A				
Category	Lab Course				
Course Title	Computer-Aided Civil Engineering Drafting Lab (CAD Lab)				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are: • To familiarize students with AutoCAD and drafting standards used in civil engineering. • To develop skills in preparing 2D and 3D architectural drawings. • To impart knowledge of structural detailing of steel members and foundations. • To enable students to prepare professional engineering drawings using CAD tools.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall AutoCAD commands and drafting standards.	Level 1: Remember
CO2	Interpret engineering drawings and drafting conventions.	Level 2: Understand
CO3	Apply AutoCAD tools to prepare architectural drawings.	Level 3: Apply
CO4	Analyze and develop detailed structural and civil engineering drawings.	Level 4: Analyze

List of Experiments

- Study and application of basic AutoCAD commands, layers, dimensioning, hatching, blocks, and plotting techniques.
- Preparation of 2D architectural drawings of a residential building including plan, elevation, and section.
- Preparation of detailed working drawings of a residential building including doors, windows, and staircase details.
- Preparation of 3D architectural models and rendered views of a residential building.
- Preparation of detailed drawings of bolted and welded steel connections.
- Preparation of detailed drawings of beam-to-column connections and column base connections (slab base and gusseted base).
- Preparation of detailed drawings of laced and battened columns and built-up steel beams.
- Preparation of detailed drawings of grillage foundations and other steel foundation systems.
- Preparation of detailed drawings of plate girders and gantry girders.
- Preparation of circular and rectangular water tank drawings
- Preparation of detailed drawings of roof trusses and industrial steel roof systems.

Useful Video Links

Exp. No	Topic	Link
1	Study of AutoCAD commands, layers, dimensioning, hatching, blocks, and plotting	AutoCAD Basic Tutorial for Beginners
2	Preparation of 2D architectural drawings of a residential building	2D Building Plan in AutoCAD

3	Preparation of detailed working drawings of a residential building	House Plan Drawing in AutoCAD
4	Preparation of 3D architectural models and rendered views	AutoCAD 3D Modeling Tutorial
5	Preparation of detailed drawings of bolted and welded steel connections	Steel Connection Detailing in AutoCAD
6	Preparation of beam-to-column and column base connections	Beam Column Connection AutoCAD Tutorial
7	Preparation of laced and battened columns and built-up steel beams	Steel Structure Detailing in AutoCAD
8	Preparation of grillage foundation drawings	Grillage Foundation Drawing in AutoCAD
9	Preparation of plate girder and gantry girder drawings	Plate Girder Detailing in AutoCAD
10	Preparation of circular and rectangular water tank drawings	Water Tank Drawing in AutoCAD
11	Preparation of roof truss and industrial roof system drawings	Roof Truss Drawing in AutoCAD

Course Code	LC-CE-313A				
Category	Lab Course				
Course Title	Soil Mechanics Lab				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are: • To develop the ability to identify and classify soils, • To understand and perform standard laboratory and field tests, • To apply effective application of geotechnical principles in engineering practice. • To analyze key soil properties such as moisture content, density, permeability, compaction, and shear strength,				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic soil properties, definitions, and standard test procedures.	Level 1: Remember
CO2	Understand principles of soil tests like sieve analysis, Atterberg limits, compaction, permeability, and shear strength.	Level 2: Understand
CO3	Conduct soil tests to determine index properties, density, compaction, and strength parameters.	Level 3: Apply
CO4	Analyze results to classify soil and evaluate its engineering behavior and suitability.	Level 4: Analyze

List of Experiments

1. Visually classify the soil and to determine the moisture content (water content) of a given soil sample.
2. Determination of specific gravity of given soil sample.
3. To classify the coarse grained soil by sieve analysis using particle size distribution curve.
4. To determine liquid limit and plastic limit.
5. To determine field density of soil by
 - a. Sand replacement method
 - b. Core cutter method
6. To determine the optimum moisture content and maximum dry density of soil by Standard Proctor Test.
7. To determine the coefficient of permeability of soil sample at desired density by suitable Method.
8. To determine the Unconfined compressive strength of cohesive soil sample.
9. To determine the shear strength parameters of the given granular soil sample at known Density and moisture content by Direct shear test.
10. To determine the shear strength parameters of fine grained soil sample by unconsolidated undrained (UU) Triaxial test.

Useful Video Links

Exp. No	Topic	Link
1	Moisture content (water content) of a given soil sample.	https://youtu.be/N2J-tvEel4c?si=HPmyFt2nGdz5ZWrn
2	Sand replacement method	https://youtu.be/YejCi5SEOAU?si=c2whwbxWVkt67wZ
3	Maximum dry density of soil by Standard Proctor Test.	https://youtu.be/c4i_y6utsE?si=XQMzJcCMbRlnI7NF
4	Direct shear test.	https://youtu.be/bmpn5oNDvOs?si=JaBs4NQWphAlzx_W

Course code	LC-CE-315A				
Category	Lab Course				
Course title	Highway Engineering-I Lab				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are: - To understand the characterization of highway materials as per IRC/IS codes. - To learn the mix designs of granular, bituminous and CC mixes - To learn the use of modern equipment for traffic studies and pavement evaluation				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall standard laboratory procedures and testing methods for aggregates, soils, and pavement materials.	Level 1: Remember
CO2	Explain engineering properties of aggregates and pavement materials based on experimental observations.	Level 2: Understand
CO3	Perform laboratory and field tests to evaluate strength, durability, and performance characteristics of transportation materials.	Level 3: Apply
CO4	Analyze test results and assess the suitability of construction materials and traffic parameters for pavement and highway engineering applications.	Level 4: Analyze

List of Experiments

- To determine the flakiness index and elongation index of aggregates.
- To determine the California Bearing Ratio (CBR) value of soil and aggregate.
- To determine the impact value of aggregate and composite material.
- To determine the crushing strength of aggregate and composite material.
- To determine the abrasion and attrition value of aggregate by using:
 - Deval abrasion test.
 - Los Angeles abrasion test
 - Dory abrasion test.
- To determine the water absorption of aggregate.
- To find out the Soundness/durability of aggregate.
- To determine the mechanical and wear properties of tiles/blocks:-a) Flexural strength b) Abrasion value of tiles/blocks.
- Traffic volume and speed study using videography technique.(Demonstration only)

Useful Video links:

Virtual Lab : <https://ts-nitk.vlabs.ac.in/List%20of%20experiments.html>

Exp. No	Topics	Links
1	To determine the flakiness index and elongation index of aggregates.	https://youtu.be/Rx9Fvxxepmw?si=f-GsxdNwhwpuYYRz

2	To determine the California Bearing Ratio (CBR) value of soil and aggregate.	https://youtu.be/fCmMW73rP64?si=8-3Vn_FlkLpEWO-g
3	To determine the impact value of aggregate and composite material.	https://youtu.be/Mn7aeorMpTs?si=HYMOilC2QMRYb7i
4	To determine the crushing strength of aggregate and composite material.	https://youtu.be/IE7LFOuGKyI?si=EFz0BMZL0Aj6K3Oz
5	To determine the abrasion and attrition value of aggregate by using Los Angeles abrasion test	https://youtu.be/k6wXH50Kwkw?si=nQ-Vfy_awfjTO5Y6
6	To determine the water absorption of aggregate.	https://youtu.be/hqXFPq676iM?si=SkcZEamwpa0FCORy
7	To find out the durability of aggregate.	https://youtu.be/4OY03u4B4t4?si=nhLRN7cEjss9H-mx

Course Code	PROJ-CE-327A				
Category	Project				
Course Title	Survey Camp				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives	The objectives of this course are: • Survey camp emphasizes on field application of basic survey task such as triangulation, base line measurement, leveling, contouring and topographic surveying of land using plane table methods. • It imparts knowledge of projection of land features on a plane sheet on a chosen scale. • To make the student capable of drawing survey site plans and maps independently of a chunk of land of hilly area.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the principles, methods, and instruments used in field surveying practices.	Level 1: Remember
CO2	Explain the procedures involved in leveling, triangulation, contouring, and plane table surveying.	Level 2: Understand
CO3	Apply surveying techniques using appropriate instruments to collect field data and locate control points accurately.	Level 3: Apply
CO4	Analyze field observations and prepare topographic maps representing physical features of the surveyed area.	Level 4: Analyze

Course Content

The survey camp is to be carried out by the students at suitable site. Different group of students will be asked to survey a particular area by using appropriate instruments issued to them. They will use different methods of surveying i.e. leveling, base line measurement, contouring, triangulation, plane table method to locate different control points. The students will plot important objects and features of the area under consideration on plane table sheet and prepare topographic map of the area.

Course Code	PEC-CE-317A				
Category	Professional Elective courses				
Course Title	Advanced Structural Analysis				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	1	0	4	
Course Objectives	The objectives of this course are: • To develop understanding of advanced structural analysis methods for indeterminate structures. • To introduce matrix methods for analysis of trusses, frames, and curved structures. • To study flexibility and stiffness approaches for structural system analysis. • To develop analytical and computational skills for solving practical structural engineering problems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the theoretical concepts of arches, matrix methods, structural indeterminacy, and energy principles.	Level 1: Remember
CO2	Explain stiffness and flexibility methods for analysis of framed structures under various loading conditions.	Level 2: Understand
CO3	Apply matrix methods to analyze arches, plane trusses, frames, partially discontinuous structures, and curved beams.	Level 3: Apply
CO4	Analyze complex structural systems using computational techniques and interpret results for engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Fundamentals of Matrix Structural Analysis: Structural idealization, coordinate systems, degrees of freedom, static and kinematic indeterminacy, generalized forces and displacements, flexibility and stiffness concepts, strain energy principles, force-displacement relationships.. Module 2: Matrix Stiffness method: Development of element stiffness matrices by physical approach, stiffness matrices for truss, beam and frame elements, displacement transformation matrix, equivalent joint loads, assembly of global stiffness matrix, analysis of plane trusses and plane frames..
Unit-II	Module 3: Matrix Flexibility method: Development of flexibility matrices, flexibility matrices for truss and frame elements, force transformation matrix, assembly of global flexibility matrix, analysis of statically indeterminate trusses and frames.

	Module: Advanced Matrix Analysis: Analysis of structures subjected to nodal loads and member loads, temperature effects, lack of fit, support settlement, comparison of flexibility and stiffness methods.
Unit-III	Module 5: Advanced Analysis of Arches: Analysis of two-hinged and fixed arches, elastic centre, effects of rib shortening, temperature variation and yielding of supports, tied arches, influence lines for two-hinged arches. Module 6: Curved Beams: Analysis of beams curved in plan, stress resultants in curved members, radial bending moments, torsional effects, semicircular beams subjected to concentrated loads and uniformly distributed loads.
Unit-IV	Module 7: Advanced Structural Systems: Partially restrained and partially discontinuous members, development of stiffness matrices for partially discontinuous members, substructure technique, structural condensation, effects of axial force on flexural stiffness. Module 8: Applications of Matrix Methods: Application of matrix stiffness and flexibility methods to complex trusses and frames, interpretation of structural response, comparison of classical and matrix methods of structural analysis.

Suggested Readings

1. Matrix Analysis of Structures, Gere & Weaver, CBS Publishers and Distributors, Delhi 110032.
2. Structural analysis, T.S. Thandavamoorthy, Oxford University Press.
3. Concepts and applications of finite element analysis Robert D. Cook, Wiley India Pvt. Ltd.
4. Advanced Structural Analysis, Ashok K. Jain, Nem Chand and Bros., Roorkee. H. C. Martin,
5. Introduction to Matrix Methods of Structural Analysis. McGraw Hill. Amin Ghali, Adam Neville, Tom G. Brown
6. Structural Analysis: A Unified Classical and Matrix Approach, CRC Press

Useful Video Links

Unit No.	Topic	Link
Unit-I	Arches	https://www.youtube.com/live/Zlp2PYAlaVw?si=ab89RA6qP_cUhZi7
	Stiffness method	https://youtu.be/2-7G35K_KD8?si=yZvPKRLqfB2hFBkm
Unit-II	Basic Principles of Matrix Method	https://youtu.be/58DrizBBo7s?si=zOHhvSEKVeON4pup
	Flexibility method	https://youtu.be/dlCHBu2aODQ?si=baHq0N6C8ObFgowI
Unit-III	Partially Discontinuities Structures	https://youtu.be/zNoBjMcsQck?si=2PYI2ISVTJKvM7tp
	Method of Sub-structure Analysis and stresses:	https://www.youtube.com/live/goEfXwQLmqI?si=U8K2mVfoqhsRwgRI
Unit-IV	Beam of Curved in Plan	https://youtu.be/JDkb5sfU4rk?si=YB8QdNaBza3P-jcP
	Computer Programs for Matrix Structural Analysis	https://youtu.be/XZ5FMKUnrpI?si=eeC1Q3z4rNPHbLNH

Course Code	PEC-CE-319A				
Course Category	Professional Elective Course				
Course Title	Air and Noise Pollution				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are: • Understanding of basic concepts of air pollution. • To understand the basic characteristics of air pollutants. • To provide adequate knowledge about the noise pollution. • To have adequate knowledge on various type of sounds.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamentals of air and noise pollution, atmospheric composition, pollutant sources, standards, and environmental regulations.	Level 1: Remember
CO2	Explain pollutant dispersion mechanisms, air quality assessment methods, and the environmental impacts of air and noise pollution.	Level 2: Understand
CO3	Apply air quality monitoring techniques, dispersion models, and pollution control technologies for environmental management.	Level 3: Apply
CO4	Analyze air and noise pollution problems and evaluate suitable control measures for sustainable environmental protection.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Air Pollution: Composition and Structure of Atmosphere, Air Pollution and Global Climate, Air Quality Criteria, Emission Standards, National Ambient Air Quality Standards, Air Quality Management in India Module 2: Sources, Classification and Effects: Sources and Classification of Air Pollutants, Type of Air Pollutants, Pollution due to Automobiles, Analysis of Air Pollutants – Chemical, Instrumental and Biological Methods; Air Pollution and its Effects on Human health, plants, animals and microbes, archaeological monuments and aesthetics
Unit-II	Module 3: Pollutant Dispersion: Concept of Atmospheric Stability, Adiabatic and Environmental Lapse Rate, Plume Behaviour, Terrain and Structure on Pollutant Dispersion, factors affecting Pollutant Dispersion, Concept of Maximum Mixing Depth and Ventilation Coefficient, Plume Rise and Effective Stack Height.

	Module 4: Air Quality: Objectives, Time and Space Variability in Air Quality; Air Sampling Design, Analysis and Interpretation of Air Pollution Data, Introduction to Air Quality Index and Comprehensive Environmental Pollution Index and its Application, Sampling and Measurement of Air Pollutants Guidelines of Network Design in Urban and Rural areas, Stack Monitoring.
Unit-III	Module 5: Dispersion Modelling and Impacts of Air Pollution: Dispersion modelling, it's Applications and Limitations, Gaussian Plume Model and GLC Determination, Global Environmental Issues: Acid Rain, Global Warming, Smog, Ozone layer depletion, Combustion of Fuel, Indoor Air Pollution, Various Treaties and Protocols: Kyoto Protocol and Montreal Protocol. Module 6: Air Pollution Control: Introduction to Control Methods and Equipment for Particulate Matter and Gases, Design and Working of Scrubbers, Electrostatic Precipitator, Gravity Settlers, Cyclone Separator, Filter Bags, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their Control.
Unit-IV	Module 7: Noise Pollution: Sound and Noise, Sources of Noise Pollution – Environmental and Industrial, Characteristics of Sound and its Measurement, Levels of Noise, Noise Rating Systems, Noise Level Standards, Outdoor and Indoor Noise Propagation; Psychoacoustics and Noise Criteria Curves. Module 8: Effects of Noise and Control Methods: Effects on Human and Environment, Infra-Sound, Ultrasound, Impulsive Sound and Sonic Boom; Noise Standards and Permissible Values; Instrumentation and Monitoring Procedure, Noise Indices and Control Methods.

Suggested Readings

- Air and Noise Pollution Control : Lawrence K. Wang
- Advanced Air and Noise Pollution Control: Volume 2 : Lawrence K. Wang
- Environmental Pollution and Health : V. K Ahluwalia
- Atmospheric pollution: Mark Z. Jacobson

Useful Video Links

Unit No.	Topic	Link
I	Air Pollution	https://youtu.be/5dukz1UOtKA?si=BDfmh2fxkAJ8v35Z
	Sources, Classification and Effects	https://youtu.be/0pkcaLyNuCE?si=dZ3KAWWGOHPnqH5j
II	Pollutant Dispersion	https://youtu.be/2adBRvVp8VA?si=ujYCUIBMdwW0Ccfr
	Air Quality	https://youtu.be/YrI8r_xOzpY?si=S0BsFMt4gXM0q2oL
III	Impacts of Air Pollution	https://youtu.be/4AuwG2G_ERU?si=RLgQ6LrC1o3uySSp
	Air Pollution Control	https://youtu.be/qPEDRZoVr1Y?si=qHrg2BAlgwgMpwbe
IV	Noise Pollution	https://www.youtube.com/live/9qWB1sMnfLE?si=teyLqrjwTXuwZ9FQ
	Control Methods	https://youtu.be/DLJhIJjJHus?si=fz9STbqN027Y9GDB

Course Code	PEC-CE-321A				
Course Category	Professional Elective Course				
Course Title	Formwork Engineering and Design				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the fundamentals, materials, and functional requirements of formwork systems in construction. • To develop understanding of design principles for various formwork components under different loading conditions. • To study conventional, modular, and advanced formwork systems used in modern construction practices. • To develop practical knowledge of formwork erection, dismantling, safety, quality control, and special applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts, materials, requirements, and classification of formwork systems.	Level 1: Remember
CO2	Explain the design principles, loading conditions, and construction procedures of various formwork systems.	Level 2: Understand
CO3	Apply formwork design principles for beams, slabs, columns, walls, and other structural components.	Level 3: Apply
CO4	Analyze modern formwork systems, safety requirements, and advanced applications for complex construction projects.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Basics and Requirements: Formwork engineering, definition of formwork, objectives of formwork, requirements of good formwork, functions of formwork, classification of formwork systems. Module 2: Materials for Formwork: Timber formwork, plywood formwork, steel formwork, aluminium formwork, plastic formwork, composite formwork systems, properties of formwork materials, selection criteria of formwork materials.
Unit-II	Module 3: Design Principles: Loads on formwork, vertical loads, lateral loads, pressure of fresh concrete, factors affecting formwork pressure, design of formwork components, safety considerations in design.

	Module 4: Design of Elements: Design of beam formwork, slab formwork, column formwork, wall formwork, footing formwork, design of formwork supports, bracing and ties.
Unit-III	Module 5: Conventional and Modern Systems: Conventional formwork systems, modular formwork, table formwork, tunnel formwork, slip formwork, jump formwork, climbing formwork. Module 6: Erection and Dismantling: Erection of formwork, alignment and levelling, inspection of formwork, stripping of formwork, de-shuttering time, reuse of formwork, maintenance of formwork.
Unit-IV	Module 7: Safety and Quality Control: Safety in formwork construction, quality control measures, common formwork failures, prevention of failures, inspection and monitoring. Module 8: Advanced and Special Formwork Applications: Formwork for high rise structures, formwork for bridges, formwork for tunnels, formwork for curved and shell structures, use of mechanized and automated formwork systems.

Suggested Readings

- Peurifoy, R.L. and Oberlender, G.D., Formwork for Concrete Structures, McGraw Hill.
- Hurd, M.K., Formwork for Concrete, American Concrete Institute.
- Kumar Neeraj Jha, Construction Project Management, Pearson Education.
- Punmia, B.C., Building Construction, Laxmi Publications.
- Chudley, Roy, Construction Technology, Pearson Education.
- Relevant standards of Bureau of Indian Standards and American Concrete Institute.

Useful Video Links

Unit No.	Topic	Link
I	Basics and Requirements of Formwork	https://youtu.be/t2q8jzkHK8E?si=NPq0kPVu5BSaj-MF
	Formwork Materials and Selection Criteria	https://youtu.be/6HkflfpGSrs?si=q1dIOKCf9E9hRXBk
II	Loads on Formwork and Design Principles	https://youtu.be/xSCYsb_d3Ao?si=gNsos3IEE9yMCE33
	Design of Beam, Slab and Column Formwork	https://youtu.be/blRjnui_dE8?si=fzWrm6Dw-vysPNbV
III	Modular, Tunnel and Slip Formwork Systems	https://youtu.be/bA3OsOsrRgc?si=EsUQRC8bB5xsyxOW
	Erection and Dismantling of Formwork	https://youtu.be/Avt7Ydmfo8M?si=ref3s4Ecjo9SvVnX
IV	Formwork Safety and Quality Control	https://youtu.be/AVLM5UnaCy0?si=qgfEJlzmCTIk8OZX
	Formwork for High-rise and Bridge Construction	https://youtu.be/geRS0SJMBKs?si=2hHP7nn-tGtwqIxu

Course Code	PEC-CE-323A					
Course Category	Professional Elective Course					
Course Title	Traffic Engineering					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	The objectives of this course are: • To understand traffic characteristics, traffic studies and traffic control for efficient road transportation. • To develop knowledge of road safety, capacity analysis and environmental aspects of traffic engineering.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Define traffic characteristics, road user and vehicular characteristics.	Level 1: Remember
CO2	Explain traffic studies and effects on road design elements.	Level 2: Understand
CO3	Apply methods of traffic surveys (volume, speed, O-D, delay).	Level 3: Apply
CO4	Analyze traffic flow, capacity, level of service and safety aspects.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Traffic Characteristics: Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road. Traffic Studies: volume study, speed study and origin and destination study. Speed and delay study. Use of photographic techniques in traffic surveys.
Unit-II	Traffic Accidents: Accident surveys. Causes of road accidents and preventive measures, Capacity and Level of Service: Fundamental diagram of traffic flow. Relationship between speed, volume and density, Level of service, PCU, Design service volume, Capacity of non-urban roads. IRC recommendations, Brief review of capacity of urban roads.
Unit-III	Traffic Control Devices: Signs, Signals, markings and islands. Types of signs, Types of signals, Design of Signal, Intersections at grade and grade separated intersections. Types of grades separated intersections, Parking surveys: On street parking, off street parking.
Unit-IV	Road safety audit: RSA team, RSA Report, Elements of RSA, and Detrimental effects of traffic. Vehicular air pollution and Situation in India, Motor vehicle act, Vehicular emission norms in India and abroad. Alternate fuels. Factors affecting fuel consumption.

Suggested Readings

- Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
- Highway Eng. by S.K. Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
- Traffic Eng. and Transport Planning by L.R. Kadiyali, Khanna Publishers, Delhi.
- Principles of Transportation and Highway Engineering by G.V. Rao, Tata McGraw
- Hill Publishing Co. Ltd. N. Delhi.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Traffic Characteristics	https://www.youtube.com/watch?v=3XaTwQIugJ4
	Traffic Studies	https://youtu.be/0yzgMc1l0po?si=A3PZFpRSkvgcewNd
Unit-II	Traffic Accidents	https://youtu.be/VhuZ6M7a8N8?si=xRE5Z3HH408GvAmK
	Relationship between speed, volume and density	https://youtu.be/MOxya1UVxgc?si=MFclHslh7lzyo6E6
Unit-III	Traffic Control Devices	https://youtu.be/eiKvXlpRVq8?si=L3SJM2YSXONsrhiz
	Design of Signal	https://youtu.be/-cqxQepo01o?si=9dP_TvQltnLXZu8
Unit-IV	Road safety audit	https://youtu.be/qRJ_ayWjn04?si=HhQTtflUfrvDEWJV
	Motor vehicle act	https://www.youtube.com/live/C2AD3wFAuy0?si=4iy77sZeLzeAVvkf

Course Code	PEC-CE-325A					
Category	Professional Elective Course					
Course Title	Engineering Geology					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	The objectives of this course are: - To provide fundamental knowledge of geology, minerals, rocks, and geological processes relevant to civil engineering. - To develop skills for map interpretation, rock analysis, and evaluation of geological conditions in engineering projects and hazards.					
Assessment	40 Marks					
End Semester Examination	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of geology, minerals, rocks, and earth structure.	Level 1: Remember
CO2	Understand geological processes like weathering, erosion, petrology, and structural geology.	Level 2: Understand
CO3	Apply geological knowledge to map interpretation, identification of minerals/rocks, and engineering evaluation of rock properties.	Level 3: Apply
CO4	Analyze geological conditions in civil engineering projects (dams, slopes, earthquakes) and assess hazards with suitable measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1 : Introduction: Scope, Subdivision of Geology, Interior of Earth, Importance of Geological Studies in Various Civil Engineering Projects, Department Dealing with this Subject in India and their Scope of Work- GSI, Granite Dimension Stone Cell, NIRM; Use of Geological Maps and Interpretation of Data. Module 2: Physical Geology: External and Internal Geological Forces Causing Changes; Weathering, Erosion and Denudation of the Surface of the Earth; Factors Affecting Weathering and Product of Weathering; Superficial Deposits and its Geotechnical Importance: Water Fall and Gorges, River Meandering, Alluvium, Glacial Deposits, Desert Landform, Loess, Mudflows, Coastal Deposits.
Unit-II	Module 3 : Mineralogy : Origin and Composition of Minerals, Physical Properties of Minerals, Susceptibility of Minerals to Alteration, Rock Forming Minerals, Megascopic Identification of Common Primary and Secondary Minerals. Module 4 : Petrology: Rock Formation Processes, Ternary Diagram, Igneous Petrology- Volcanic Phenomenon, Types of Volcanic Eruption, Chemical and Mineralogical Composition, Texture and its Types, Sedimentary Petrology- Mode of Formation, Mineralogical Composition, Texture and its Types; Metamorphic Petrology- Agents and Types

	of Metamorphism, Metamorphic Grades, Mineralogical Composition, Structures and Textures.
Unit-III	Module 5: Structural Geology: Forms and Structures of Rocks, Stress and Strain in Rocks, Deformation and Tectonics, Dip and Strike, Bedding Planes and Outcrops; Fold- Types and Nomenclature, Criteria for Their Recognition in Field; Faults: Classification, Recognition in Field. . Module 6 : Properties of Rock Masses: Sub Surface Investigations of Rocks and Engineering Characteristics of Rocks Masses; Field and Laboratory Tests on Rocks, Stress Deformation and Bearing Capacity of Rocks, Important Variables Influencing Rock Properties and Behaviour, Measurement of Velocity of Sound in Rock.
Unit-IV	Module 7 : Geology of Dam and Reservoir: Site Geological Consideration for Selecting Dam and Reservoir Site, Causes of Failure of Reservoir, Favourable and Unfavourable Conditions in Different Types of Rocks in Presence of Various Structural Features, Precautions to Counteract Unsuitable Conditions. Module 8: Geological Hazards: Rock Instability and Slope Movement; Concept of Sliding, Consequences of Land Sliding, Prevention by Surface Drainage, Slope Reinforcement by Rock Bolting and Rock Anchoring; Earthquake: Magnitude and Intensity of Earthquake, Seismic Waves; Seismic Zones in India.

Suggested Readings

- A textbook of Geology by P.K Mukherjee
- Physical and General Geology by SK Garg
- Engineering and General Geology by Prabin Singh.
- Introduction of physical Geology by A.holmes

Useful Video Links

Unit No.	Topic	Link
Unit-I	Scope, Subdivision of Geology	https://youtu.be/ksJpBG0R5pM?si=5cOmhlDq6Xb0awyf
	Weathering, Erosion and Denudation of the Surface of the Earth	https://youtu.be/GCiSOGweitU?si=ic3lArR5MbmJW8k3
Unit-II	Origin and Composition of Minerals	https://youtu.be/kVopWFgOcrU?si=f3pJdh4aNfhq2-DZ
	Sedimentary Petrology	https://www.youtube.com/live/ezqUycfNlzE?si=obAP9KAHLAak1lRz
Unit-III	Dip and Strike, Bedding Planes and Outcrops	https://youtu.be/WdBtwf3vl_0?si=y3aNj_0tu0CX2MBD
	Sub Surface Investigations of Rocks	https://youtu.be/ZLmqtF2FtkU?si=fs6mlkfDoktkC3cO
Unit-IV	Dam and Reservoir Site	https://youtu.be/bDwow2-WzHo?si=drnCdQXbKE1C8YEU
	Earthquake: Magnitude and Intensity of Earthquake	https://youtu.be/mWXpUo-KOw?si=LPPrSZANDX9MDRCx

Course Code	PCC-CE-302A				
Course Category	Professional Core Course				
Course Title	Irrigation Engineering And Design				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	1	0	4	
Course Objectives	The objectives of this course are: • To develop a comprehensive understanding of irrigation systems, crop water requirements, canal regulation works, cross drainage works, spillways, weirs, river training works, flood routing, dams, water logging and drainage, and • To apply, analyze, evaluate and integrate their design principles, hydraulic behaviour and functional performance for efficient and sustainable water resources and irrigation engineering solutions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental concepts of irrigation, water resources, and related structures.	Level 1: Remember
CO2	Explain crop water requirements, irrigation methods, and soil-water relationships.	Level 2: Understand
CO3	Apply principles of canal works, cross drainage works, and dam engineering in practical situations.	Level 3: Apply
CO4	Analyze the design and performance of spillways, river training works, and flood management systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction to Irrigation: Scope and Necessity of Irrigation, Water Resources and Irrigation Potential in India, Development of Irrigation, Irrigation Systems and their Classification, Benefits and Impacts of Irrigation, National Water Policy. Module 2: Water Requirement of Crops & Methods of Irrigation: Crop Seasons; Soil–Water–Plant Relationship; Field Capacity; Wilting Point; Consumptive Use; Evapotranspiration; Duty, Delta and Base Period; Irrigation Efficiencies; Frequency and Scheduling of Irrigation; Methods of Irrigation (Surface, Sprinkler and Drip Irrigation).
Unit-II	Module 3: Canal Regulation Works: Canal Alignment; Canal Losses, Canal fall – necessity and location, types of canal falls, Sarda type fall and its design, sloping glacis fall, cross regulator, distributory head regulator, silt control devices, canal escapes and their types, operation and maintenance of canals. Module 4: Canal Outlets and Cross Drainage Works: Requirements and Classification of Canal Outlets; Pipe Outlet; Adjustable Proportional Module (APM); Open Flume Outlet;

	Flexibility, Sensitivity and Proportionality of Outlets; Need and Classification of Cross Drainage Works; Aqueduct; Syphon Aqueduct; Super Passage; Canal Syphon; Level Crossing; Hydraulic Design Principles.
Unit-III	Module 5: Spillways and Hydraulic Structures: Need and types of spillways, design of ogee spillway, energy dissipaters and stilling basins. Need of weirs and barrages, components of weirs, Bligh's creep theory, Khosla theory, critical exit gradient and design of weirs. Module 6: River Training Works and Flood Routing : River Behaviour; Objectives and Classification of River Training Works; Guide Banks; Spurs; Marginal Embankments; Bank Pitching; Launching Apron; Meandering Rivers; Flood Routing (Hydrologic and Hydraulic Routing); Flood Control Measures.
Unit-IV	Module 7: Gravity Dams: Planning and Investigation of Dam Sites; Classification and Selection of Dams; Gravity Dams; Forces Acting on Gravity Dams; Stability Analysis; Modes of Failure; Elementary Profile of Gravity Dam. Module 8: Earth Dams, Water Logging and Drainage: Earth Dams; Components; Types; Seepage through Earth Dams; Phreatic Line; Kozeny Parabola; Filters and Drains; Causes and Control of Seepage; Water Logging; Land Reclamation; Surface and Subsurface Drainage.

Suggested Readings

- Chawla, K. K. (2017). *Irrigation Engineering and Hydraulic Structures*. Standard Publishers Distributors, New Delhi.
- Punmia, B. C., Pande, B. B., & Jain, A. K. (2016). *Irrigation Engineering and Water Power Engineering*. Laxmi Publications, New Delhi.
- Asawa, G. L. (2014). *Irrigation and Water Resources Engineering*. New Age International Publishers.
- Garg, S. K. (2017). *Irrigation Engineering and Hydraulic Structures*. Khanna Publishers, New Delhi.
- Varshney, R. S., Gupta, S. C., & Gupta, R. L. (2015). *Theory and Design of Irrigation Structures*. Nem Chand & Bros.
- Arora, K. R. (2013). *Irrigation, Water Power and Water Resources Engineering*. Standard Publishers Distributors.
- Central Water Commission (CWC). (Latest Edition). *Manuals and Guidelines for Irrigation and Hydraulic Structures*. Government of India.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction	https://youtu.be/ibzY0LjHu38
	Crop water requirement	https://youtu.be/e7pckUDQ9oI
Unit-II	Design of Sarda type Fall	https://youtu.be/REK--iUi_xE
	Canal Outlets	https://youtu.be/ps8HUDWU1fg
Unit-III	Design of aqueducts	https://youtu.be/iJzuYICZzTU
	Design of ogee spillway	https://youtu.be/QIJ6Rb8wz80
Unit-IV	Methods of River training	https://youtu.be/LmE-9TId6Wk
	Water logging	https://youtu.be/0i896NelJ3A

Course Code	PCC-CE-304A				
Course Category	Professional Core Course				
Course Title	Foundation Engineering - I				
Scheme and Credits	L	T	P	Credit	Semester VI
	3	0	0	3	
Course Objectives	The objectives of this course are: - To develop understanding of earth pressure theories and their application in retaining structures. - To study slope stability concepts and methods for analyzing slope failures. - To introduce the principles of shallow foundation design and bearing capacity analysis.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the concepts of lateral earth pressure, slope stability, bearing capacity, and soil exploration methods.	Level 1: Remember
CO2	Explain earth pressure theories, slope failure mechanisms, and shallow foundation behavior under various loading conditions.	Level 2: Understand
CO3	Apply bearing capacity theories and site investigation methods for the analysis and design of shallow foundations.	Level 3: Apply
CO4	Analyze slope stability, retaining structures, and foundation performance for geotechnical engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Earth Pressure Theories: Lateral Earth Pressure, At-rest earth pressure, Active earth pressure, Passive earth pressure, Rankine's Theory, Cohesionless backfill, Cohesive backfill, Coulomb's Theory, Wall friction effects, Inclined backfill, Earth Pressure Diagrams, Retaining wall applications.
Unit-II	Stability of Slopes: Types of Slopes, Infinite slopes, Finite slopes, Slope Failure Mechanism, Rotational failure, Translational failure, Stability Analysis, Swedish circle method, Bishop's simplified method, Taylor's stability number, Factor of Safety, Stability charts.
Unit-III	Shallow Foundations: Types of shallow foundations, Bearing Capacity Theories, Terzaghi's bearing capacity theory, Meyerhof theory, Hansen theory, Vesic theory, Bearing Capacity Factors, Shape factors, Depth factors, Inclination factors, Effect of Water Table Corrections in bearing capacity, Settlement of Foundations, Settlement in clay Settlement in sand.
Unit-IV	Site Investigation & Soil Exploration: Subsurface Investigation, Objectives of exploration, Methods of Exploration, Open pits, Borings, Wash boring, Rotary drilling, Sampling Techniques,

	Disturbed samples, Undisturbed samples, In-situ Tests, Standard Penetration Test (SPT), Cone Penetration Test (CPT), Plate Load Test, Vane Shear Test, Geophysical Methods, Seismic refraction, Electrical resistivity.
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Suggested Readings

1. Das, B. M. (2015). Principles of geotechnical engineering (9th ed.). Cengage Learning.
2. Ranjan, G., & Rao, A. S. R. (2016). Basic and applied soil mechanics (3rd ed.). New Age International Publishers.
3. Punmia, B. C., Jain, A. K., & Jain, A. K. (2017). Soil mechanics and foundations (17th ed.). Laxmi Publications.
4. Budhu, M. (2015). Soil mechanics and foundations (3rd ed.). Wiley.
5. Terzaghi, K., Peck, R. B., & Mesri, G. (1996). Soil mechanics in engineering practice (3rd ed.). Wiley.
6. Holtz, R. D., Kovacs, W. D., & Sheahan, T. C. (2011). An introduction to geotechnical engineering (2nd ed.). Pearson Education.

Useful Video Links

Unit No.	TOPIC	Link
Unit-I	Earth Pressure Theories	https://youtu.be/pH7Ly8KCR3E?si=WMWi6oZ_ZaqK6kAZ
Unit-II	Stability of Slopes	https://youtu.be/e8WUMP6Rt94?si=JtufcWJJtHM-G9Qv
Unit-III	Shallow Foundations	https://youtu.be/lsYFtwlHIw?si=h0olF1s3zcuaZQYp
Unit-IV	Site Investigation & Soil Exploration Subsurface	https://youtu.be/P0j_pt4BLS0?si=FNGA2HcUua8OK_1N

Course Code	PCC-CE-306A				
Course Category	Professional Core Course				
Course Title	Highway Engineering - II				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are: • To understand the principles of design, construction, and performance of flexible and rigid pavements. • To apply standard methods (IRC, CBR, AASHTO) for pavement design, evaluation, and strengthening. • To analyze pavement failures, drainage, and economic aspects for efficient highway engineering.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of pavement types, components and materials.	Level 1: Remember
CO2	Explain design principles of flexible and rigid pavements.	Level 2: Understand
CO3	Apply IRC/CBR and AASHTO methods for pavement design and construction.	Level 3: Apply
CO4	Analyze pavement performance, failures and evaluation methods.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Design of Flexible Pavements: Types of Pavement, Components of a Pavement and their Functions, Factors Effecting Design of Pavements, Review of Design by Old Methods, Design of a Flexible Pavement by CBR Method (as per Latest IRC Guidelines). Pavement Performance and its Methods- AASHTO and Asphalt Module 2: Design of Rigid Pavements: Westergaard's Theory and Assumption, Critical Locations of Loading, Load and Temperature Stresses, Critical Combination of Stresses, Joints: Types, Requirements and Patterns, Spacing of Expansion and Contraction Joints; Design and Functions of Dowel and Tie Bars, IRC and AASHTO Methods of Rigid Pavement Design.
Unit-II	Module 3: Construction of Bituminous Pavements: Various Types of Bituminous Constructions, Prime Coat, Tack Coat, Seal Coat and Surface Dressing; Construction of BUSG, Premix Carpet, BM, DBM and BC, Mastic Asphalt, Functions of Rollers, Paver and Hot Mix Plants, Introduction to Various IRC and MORTH Specifications Module 4: Highway Construction: Non-Bituminous Pavements Subgrade and Embankment construction, Construction of GSB, WBM, WMM; Construction of DLC and PQC, Fixed Form and Slip-Form Paving Techniques

Unit-III	Module 5: Pavement Failure and Remedies: Classification of Distresses in Pavements (Functional and Structural); Different Types of Distresses in Flexible and Rigid Pavements along with the Causes and Remedial Measures; Various Types of Maintenance of Pavements; Evaluation of Pavements: Functional and Non- Destructive Evaluation. Module 6: Strengthening of Existing Pavement: Objective of Strengthening, Different Types of Overlay, Design of Flexible Overlays on Flexible Pavement using Effective Thickness Approach and Deflection Approach, Benkelman Beam Method, Design of Other Types of Overlays.
Unit-IV	Module 7: Highway Drainage and Hill Roads: Necessity and Significance of Drainage, Mode of Ingress of Water in Highway Structure, Surface Drainage: -Types and Brief Design, Types of Sub-Surface Drainage, Drainage Inking for the Roads in Hilly Areas, Special Characteristics of Hill Roads: Geometrics and Hair Pin Bends. Module 8: Highway Economics and Finance : Need of Economic Evaluation, Highway User Benefits and Costs, Methods of Economic Evaluation, Highway Finance, PPP Projects, Rate Analysis of MORTH-Standard Data Book and Cost Estimation

Suggested Readings:

- Highway Engg by S.K.Khanna & C.E.G. Justo, Veeraragavan A., Nem Chand Bros., Roorkee, 2014.
- Principles and Practice of Highway Engg. By L.R.Kadiyali, N.B. Lal, Khanna Publishers, Delhi, 2008.
- Principles of Pavement Design by Yoder, E.J & Witzak, M.W., John Wiley and Sons, USA.
- Tunnel Engineering by S.C.Saxena, Dhanpat Rai Publications, N.Delhi.
- A text book of Tunnel, Bridges and Railway Engg. By S.P. Bindra, Dhanpat Rai Delhi

Useful Video Links

Unit No.	Topic	Link
Unit I	Design of Flexible Pavements (CBR Method as per IRC)	https://youtu.be/9BL6rl6hPQ0?si=VNJW3MmXBSJa805z
	Design of Rigid Pavements (Westergaard Theory)	https://youtu.be/AJLAFAOcSIM?si=esuTiHkjKJu5F82I
Unit II	Construction of Bituminous Pavements	https://youtu.be/Ky-z2QRe_eU?si=0bHJvkpoApKKyxex
	Construction of Non-Bituminous Pavements	https://youtu.be/smPaOcM1Xc8?si=fP0tBBlduEnmWyMn
Unit III	Pavement Failures and Maintenance Techniques	https://youtu.be/kKmG5qMZcAc?si=SYmeDnClbZs00ruh
	Pavement Strengthening and Overlay Design	https://youtu.be/cQMwDnnwWzk?si=GY01u9Z0MhrK7DF2
Unit IV	Highway Drainage and Hill Roads	https://youtu.be/O2hHrg6DH8k?si=av7M5RBHhvZdj9aO
	Highway Economics and Finance	https://youtu.be/zAwa2_BTu_Q?si=WpiWvoZc4W53zdnv

Course Code	PCC-CE-308A				
Course Category	Professional Core Course				
Course Title	Waste Water Treatment				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are: • To learn basics of sewage collection and design of sewers • To learn the basics of sewage composition and its characteristics • To have adequate knowledge about various sewage treatment processes and its design • To provide adequate information on various disposal standards for treated effluents				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamental concepts of sanitation, sewerage systems, wastewater characteristics, and design terminology.	Level 1: Remember
CO2	Explain the principles of sewer design, house drainage, wastewater treatment processes, and sludge treatment methods.	Level 2: Understand
CO3	Apply engineering principles for the design and analysis of sewerage systems and wastewater treatment units.	Level 3: Apply
CO4	Analyze wastewater treatment, sludge disposal, and reuse strategies for sustainable environmental sanitation and pollution control.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction: Importance and Necessity of Sanitation, Terms used in sanitation- Sullage, Sewage, Sewer and Sewerage, Sewerage Systems and their Suitability, Dry Weather Flow, Factors Affecting Dry Weather Flow, Flow Variations and their Effects on Design of Sewerage System. Module 2: Design of Sewers: Types of Sewers and their Hydraulic Design, Material used for Sewer Construction, Joints and Sewer Appurtenances, Layout, Construction and Testing of Sewer Lines, Velocity in Sewers, Storm Water Sewers.
Unit-II	Module 3: House Drainage: Principles of House Drainage, Types of Pipes used for Drainage, Classification and Functions of Traps, Sanitary Fitting, System of Plumbing, House Drainage Plan and Ventilation of House Drainage. Module 4: Wastewater Characteristics: Quality Parameters- Physical, Chemical and Biological Characteristics, Oxygen Demand, Indian Standards for Disposal of Effluents into Inland Surface Sources and on Land, Guidelines for Reuse of Treated Wastewater.

Unit-III	Module 5: Primary Sewage Treatment: Objectives, Flow chart of Conventional Treatment Units and their Efficiencies, Preliminary Treatment, Screening and Grit Removal Units, Principle, Types and Design of Primary Sedimentation Tank, Coagulation Aided Sedimentation Tank, Flocculation. Module 6: Secondary Sewage Treatment: Concept of Organic Matter Removal, Aerobic and Anaerobic Treatment Processes, Activated Sludge Process, Conventional and Extended Aeration Systems, Trickling Filters, Aerated Lagoons, septic tank, Waste Stabilization Ponds, Oxidation Ditches, Up-Flow Anaerobic Sludge Blanket Process.
Unit-IV	Module 7: Sludge Treatment: Objectives, Sludge Digestion, Digestion and Disposal of Primary and Secondary Sludge, Factors Affecting Sludge Digestion, Thickening of Sludge, Anaerobic Digestion of Sludge, Sludge Digestion Tank, Sludge Conditioning and Dewatering, Sludge Drying Bed. Module 8: Sludge Disposal: Standards of Wastewater Disposal, Modes of Disposal of Treated Sludge, Self-Purification of Streams, Oxygen Sag Curve, Sewage Farming, Sodium Hazards, Soil Dispersion System.

Suggested Readings

- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Wastewater Engineering, Collection, Treatment and Disposal: Metcalf and Eddy
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
- Sewage and Sewage Treatment: S.K. Garg.
- Sewage and Sewage Treatment: S.R. Krishansagar.
- Waste Water Engineering: B.C. Punmia.
- Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Importance and Necessity of Sanitation	https://youtu.be/3J7n_2_6iCw?si=j_ulAsYT357zkugP
	Dry Weather Flow	https://youtu.be/CgHmPXrBeCM?si=nC32d4teYFsmz75X
II	House Drainage	https://youtu.be/oPKyZCbK1Pc?si=EVmOd5p2GLxTWnSb
	Wastewater Characteristics	https://youtu.be/wwSetkwidiMc?si=RF5VRbTD30Xk9Zrr
III	Primary Sewage Treatment	https://youtu.be/S2hF1AqelJg?si=Q0yplxvoNvskeVjg
	Concept of Organic Matter Removal	https://youtu.be/5qR5d1uQnd8?si=9NQihqYBACJXYGA0
IV	Objectives, Sludge Digestion	https://youtu.be/zXqnDzqJPSE?si=gHKIVz4VAPV-IQ2y
	Sewage Farming	https://youtu.be/JWtciKYJou4?si=5MTxbJjbVP8Imp8Q

Course Code	LC-CE-310A				
Category	Lab Course				
Course Title	Foundation Engineering lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives	The objectives of this course are: •To develop the ability to understand and apply soil testing methods. •To analyze laboratory and field data •To evaluate engineering properties of soils for geotechnical design and foundation assessment.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of soil properties and testing methods used in geotechnical engineering.	Level 1: Remember
CO2	Explain the principles of hydrometer analysis, relative density, shrinkage limit, triaxial, and consolidation tests.	Level 2: Understand
CO3	Perform laboratory and field tests to determine shear strength, consolidation, and bearing capacity parameters of soils.	Level 3: Apply
CO4	Analyze and interpret test results for assessing soil behavior and foundation suitability.	Level 4: Analyze

List of Experiments

1. To determine grain size analysis using Hydrometer method.
2. To determine relative density of granular Soils.
3. To determine shrinkage limit of fine grained soil.
4. To determine shear strength properties for consolidated drained conditions using Triaxial test.
5. To determine shear strength properties for consolidated undrained condition using Triaxial test.
6. To determine consolidation parameters using consolidometer.
7. To determine bearing capacity parameters using Standard Penetration Test.
8. Demonstration of Undisturbed Sampling.
9. Demonstration of cone penetration test.
10. To study of Model Plate Load Test.

Useful Video Links

Exp. No	Topic	Link
1	Grain Size Analysis using Hydrometer Method	https://youtu.be/zVmK5bvzbZ8?si=D_69eXdHnUA_OIqJ

2	Relative Density Test of Granular Soils	https://youtu.be/9uZgZxRCDYE?si=bsonTb3Gx056cyYh
3	Shrinkage Limit Test of Fine Grained Soil	https://youtu.be/t4FZ4J4pHUA?si=WZwDiFP_oRjub9vy
4	Triaxial Test (Consolidated Drained Condition)	https://youtu.be/uW-6acy5-fU?si=ITHR4SNriZCnXdB-
5	Triaxial Test (Consolidated Undrained Condition)	https://youtu.be/nwFxK2gPmik?si=quJcyr5RoQtuoz93
6	Consolidation Test using Consolidometer	https://youtu.be/DGEzIKBbz5M?si=07KxC_SFgwHYHHZ7
7	Standard Penetration Test (SPT)	https://youtu.be/duLjQsKfstM?si=4dytvA2api9vqFMR
8	Demonstration of Undisturbed Sampling	https://youtu.be/XiMOTe_YZaw?si=UKJP_C0DgdNBru3Y
9	Cone Penetration Test (CPT) Demonstration	https://youtu.be/ujDEhBroPo8?si=6VYBRhQB1WHulp3p
10	Model Plate Load Test	https://youtu.be/TXyuxcfJFS8?si=mjybyDUfWByyImjj

Course code	LC-CE-312A				
Category	Lab Course				
Course title	Highway Engineering-II Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives:	The objectives of this course are: - To understand the properties and behavior of bituminous materials used in pavements. - To perform standard laboratory tests and mix design procedures. - To evaluate and analyze pavement materials for suitability and performance.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall the testing procedures and standards related to bituminous materials, aggregate	Level 1: Remember
CO2	Explain the engineering properties of bituminous binders and pavement materials	Level 2: Understand
CO3	Perform laboratory tests for mix design and evaluation of bituminous and concrete pavement materials	Level 3: Apply
CO4	Analyze laboratory results to assess pavement material suitability and design performance for highway construction applications.	Level 4: Analyze

List of Experiments

1. To determine the flash and fire point of bituminous material.
2. To determine the softening point of paving bitumen.
3. To determine the specific gravity of bituminous material.
4. To determine ductility of bitumen.
5. To determine the hardness of bitumen.
6. To determine the grade of a given binder.
7. To determine the viscosity of bituminous material.
8. To determine the granular mix design.
9. To determine the bituminous mix design by Marshall's method.
10. To determine the cement concrete mix design for pavements.
11. Demonstration of BBD & Bump Integrator.

Reference Books:

- Khanna, S.K. and Justo, C.E.G., Veeraragavan A., "Highway Engineering", Nem Chand & Bros.
- Khanna, S.K. and Justo, C.E.G., "Highway Material Testing Manual", Nem Chand & Bros.
- Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.

Useful Video links:**Virtual Lab :** <https://ts-nitk.vlabs.ac.in/List%20of%20experiments.html>

Exp. No	Topics	Links
1	Flash and Fire Point Test of Bituminous Material	https://youtu.be/s5OnzI0B2vY?si=oB_wmCzv5TtmSIoS
2	Softening Point Test of Paving Bitumen	https://youtu.be/WkJuGGGmYhQ?si=qRcKYv0AsLG_vUzG
3	Specific Gravity Test of Bituminous Material	https://youtu.be/o1BgC0em2X0?si=6pNX5oq_oJnf1Bnf
4	Ductility Test of Bitumen	https://youtu.be/TE8zYxUJHt0?si=fMfKBxeuVmiC_b6v
5	Penetration/Hardness Test of Bitumen	https://youtu.be/9HZE6DNf5U?si=KnyI_oj10hJcnM7_
6	Determination of Bitumen Binder Grade	https://youtu.be/CRopmpsDyBQ?si=oXlfwwFkpAX9ekdC
7	Viscosity Test of Bituminous Material	https://youtu.be/TE8zYxUJHt0?si=WivAlqvjdr8cXUup
8	Granular Mix Design	https://youtu.be/BYxWW_3YnOA?si=nqICmctRc_qlijmC
9	Marshall Mix Design Method	https://youtu.be/zMgLPRnwDAk?si=nO-CIzRvGeH5aNw7
10	Cement Concrete Mix Design for Pavements	https://youtu.be/VBrP_vm2YsA?si=XeXhpf-_SpUZXoky
11	Demonstration of BBD and Bump Integrator	https://youtu.be/MAaSolK_qSU?si=ZaZNSGAJ0JnNhBYQ

Course code	LC-CE-314A				
Category	Lab Course				
Course title	Environmental Engineering Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To quantify the water and wastewater pollutant. • To analyze the physical characteristics of water and wastewater. • To analyze the chemical characteristics of water and wastewater				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall standard laboratory procedures and water quality parameters.	Level 1: Remember
CO2	Explain the significance of physical, chemical, and biological characteristics of water and wastewater.	Level 2: Understand
CO3	Perform laboratory tests for assessment of water and wastewater quality using standard methods.	Level 3: Apply
CO4	Analyze experimental results to evaluate water quality and recommend suitable treatment measures for environmental applications.	Level 4: Analyze

List of Experiments

1. Determination of Turbidity of water by using suitable method
2. Determination of pH of given water sample.
3. Determination of Hardness of given water sample.
4. Determination of Residual Chlorine in given sample of water
5. Determination of Total Suspended and Dissolved Solids in given water sample.
6. Determination of Bio –chemical oxygen demand of waste water sample.
7. Determination of chemical oxygen demand of waste water sample.
8. Determination of Conductivity of given water sample.
9. Determination of Chlorides of given water sample
10. Determination of Alkalinity and Acidity of a given water sample.
11. Determination of Dissolved Oxygen of given waste water sample.

Useful Video links:

Exp. No	Topics	Links
1	Determination of Turbidity of Water	https://youtu.be/LeKqhMqEoKQ?si=CsWPx14nfp9ayYA

2	Determination of pH of Water Sample	https://youtu.be/3gHqji3inmc?si=WhAo28tgLABuHWdC
3	Determination of Hardness of Water	https://youtu.be/FCQ26RQBZLg?si=EtXK4z7kpZtiN7w8
4	Determination of Residual Chlorine	https://youtu.be/zclRO_lmDdc?si=VkyJVH4jna3gh8d4
5	Determination of Total Suspended and Dissolved Solids	https://youtu.be/ojjna1xtVzQ?si=24Vm9paqWh7hn32_
6	Determination of Biochemical Oxygen Demand (BOD)	https://youtu.be/sSPtpGguO5A?si=nybLfxkvw0M1hwfF
7	Determination of Chemical Oxygen Demand (COD)	https://youtu.be/1kd18-L8c3o?si=dAc0uAEW1qBOv7U3
8	Determination of Conductivity of Water	https://youtu.be/9gzMc9UQAe4?si=z9W28GpzJDpCwIS1
9	Determination of Chlorides in Water Sample	https://youtu.be/2kSJPyMspAo?si=YaXt_All-pHx5zFa
10	Determination of Alkalinity and Acidity	https://youtu.be/INFu8uMeRqw?si=9SplhkTAaX3PTFj1
11	Determination of Dissolved Oxygen (DO)	https://youtu.be/Rf7ByPaUmuM?si=5quxsoskjZbRGzut

Course code	LC-CE-316A				
Category	Lab Course				
Course title	Structural Analysis and Design Lab				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	2	1	
Course Objectives:	The objectives of this laboratory are: •To familiarize students with STAAD.Pro for structural modeling, analysis, and design. •To develop skills in analyzing RCC, steel, and composite building structures. •To enable students to apply relevant IS codes in structural design. •To provide hands-on experience in computer-aided building analysis and design.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall the features, commands, and workflow of STAAD.Pro.	Level 1: Remember
CO2	Explain the structural behavior of building components using analysis results.	Level 2: Understand
CO3	Apply STAAD.Pro for modeling, analysis, and design of RCC, steel, and composite structures.	Level 3: Apply
CO4	Analyze the performance of multi-storey building structures under gravity, wind, and seismic loads.	Level 4: Analyze

List of Experiments

- Introduction to STAAD.Pro interface, structural modeling, load assignment, analysis, and interpretation of results.
- Modeling and analysis of RCC beams and continuous beams used in building structures.
- Modeling and analysis of RCC columns and beam-column frames under gravity loads.
- Modeling and analysis of a G+1 RCC building under dead and live loads.
- Modeling and analysis of a multi-storey RCC building under gravity loads.
- Analysis of multi-storey RCC buildings subjected to wind loads as per IS 875.
- Analysis of multi-storey RCC buildings subjected to earthquake loads as per IS 1893.
- Design of RCC beams, columns, and footing reactions using STAAD.Pro as per IS 456.
- Modeling, analysis, and design of steel building frames using STAAD.Pro as per IS 800.
- Modeling, analysis, and design of RCC–Steel hybrid (composite) building structures under gravity, wind, and seismic loads.
- Mini Project: Analysis and design of a residential multi-storey RCC building using STAAD.Pro.

Useful Video links:

Exp. No	Topics	Links
1	Introduction to STAAD.Pro interface, modeling, load assignment, and analysis	STAAD.Pro Introduction and Basics

2	Modeling and analysis of RCC beams and continuous beams	<u>STAAD.Pro RCC Beam Analysis Tutorial</u>
3	Modeling and analysis of RCC columns and beam-column frames	<u>STAAD.Pro Frame Analysis Tutorial</u>
4	Modeling and analysis of a G+1 RCC building	<u>STAAD.Pro RCC Building Design Part-1</u>
5	Modeling and analysis of a multi-storey RCC building	<u>STAAD.Pro RCC Building Design Part-2</u>
6	Analysis of multi-storey RCC buildings under wind loads	<u>STAAD.Pro Wind Load Analysis Tutorial</u>
7	Analysis of multi-storey RCC buildings under earthquake loads	<u>STAAD.Pro Seismic Analysis Tutorial</u>
8	Design of RCC beams, columns, and footing reactions	<u>STAAD.Pro RCC Design Tutorial</u>
9	Modeling, analysis, and design of steel building frames	<u>STAAD.Pro Steel Structure Design Tutorial</u>
10	Modeling, analysis, and design of RCC–Steel hybrid structures	<u>STAAD.Pro Composite Structure Design Tutorial</u>
11	Mini Project: Residential multi-storey RCC building design	<u>Complete RCC Building Design using STAAD.Pro</u>

Course Code	PEC-CE-318A				
Category	Professional Elective Course				
Course Title	Advanced Steel Structures				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are: ● To impart practical knowledge of advanced steel structures and their application. ● To teach the students advance level design of steel structures. ● To make the students familiar with the relevant IS codes to be used in construction industries. ● To teach the students modern design methods such as design of light gauge steel.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the concepts of eccentric connections, cold-formed sections, industrial steel structures, and design provisions.	Level 1: Remember
CO2	Explain the behavior and design principles of advanced steel structural components such as towers, water tanks, stacks, and plate girders.	Level 2: Understand
CO3	Apply codal provisions and design procedures for advanced steel structural systems and their connections.	Level 3: Apply
CO4	Analyze and design complex steel structures including gantry girders, industrial buildings, towers, and special steel components for engineering applications.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Eccentric and Moment Connections: Beams-Column Connections, Connections Subjected to Eccentric Shear, Bolted Framed Connections, Bolted Seat Connections, Bolted Bracket Connections. Bolted Moment Connections, Welded Framed Connections, Welded Bracket Connections and Moment Resistant Connections. Module 2: Cold Formed Sections: Brief description of various types of cold-formed sections, local buckling, concepts of effective width and effective sections, elements with stiffeners, Design of compression and bending elements.
Unit-II	Module 3: Industrial Buildings: Loads, general arrangement and stability, design considerations, design of Purlins, design of roof trusses, industrial building frames, bracings and stepped columns.

	Module 4: Towers: Transmission line towers, Microwave towers, Design loads, classification, Design and specification.
Unit-III	Module 5: Design of Water Tanks: Types of water tank, permissible stresses, design of circular, rectangular and pressed steel tanks including staging. Module 6: Design of Steel Stacks: Types of steel stack, various loads consideration of steel stacks, Design of steel stacks including foundation.
Unit-IV	Module 7: Plate Girder: Elements of plate girder, Design steps of a plate girder, necessity of stiffeners in plate girder, various types of stiffeners, web and flange splices, Curtailment of flange plates, Design beam to column connections: Introduction, design of framed and seat connection. Module 8: Design of Gantry Girder: Loading Consideration, Selection Criteria of Gantry Girder, Specification, Design of Gantry girder

Suggested Readings

- Design of steel structures, A.S. Arya & J.L. Ajmani, Nemchand & Bros., Roorkee.
- Design of steel structures (LSM), N. Subramanian, Oxford Publication.
- Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
- Design of steel structures, S.M.A. Kazmi & S.K. Jindal, Prentice Hall, New Delhi.
- Design of steel structures, S.K. Duggal, TMH Pub, New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Beams-Column Connections	https://youtu.be/3oMMA5gwQ_o?si=b1BpWFBGDG9qCHjTi
	Cold Formed Sections	https://www.youtube.com/live/ntlY4ffnBo?si=bfoSltdJoFtptXVY
II	Industrial Buildings	https://youtu.be/jcZ-mEUyBzQ?si=E2Ft3m5Qw9ludQy
	Transmission line towers	https://youtu.be/XKNAhSCL7A4?si=J2jFggRKm-OJh5Ti
III	Types of water tank	https://youtu.be/Kds06g-_93Q?si=4o5COnURV-f6ekx4
	Types of steel stack	https://youtu.be/yuZ17yBbkj0?si=GSeZGtqL3O6Yslw5
IV	Elements of plate girder	https://youtu.be/xsgtuNXmmvc?si=3ZEaKYSkm2V9Vvq1
	Loading Consideration	https://youtu.be/ElKIibv9kE4?si=wVkrnFyxmsWhrMFu

Course Code	PEC-CE-320A				
Category	Professional Elective Course				
Course Title	Pre-Stressed Concrete				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students. • To the design of pre-stressed concrete structures subjected to flexure and shear. • To make them familiar with design of typical pre-stressed concrete structural elements and to have a knowledge of the codal provisions.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamental concepts of prestressing systems, material properties, and losses of prestress in concrete members.	Level 1: Remember
CO2	Explain the behavior of prestressed concrete members under shear, torsion, deflection, cracking, and serviceability conditions.	Level 2: Understand
CO3	Apply analytical and design principles for prestressed concrete members subjected to axial load, flexure, shear, and torsion.	Level 3: Apply
CO4	Analyze and design advanced prestressed concrete systems including composite beams, continuous beams, and miscellaneous prestressed structures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Material Properties and Prestressing Systems: Introduction of Prestressing system-history, types, source, advantages and its limitations, Prestressing Systems and Devices. Materials properties- Constituents of Concrete and their Properties, Stress-Strain Curves for Concrete, Constituents of Prestressing Steel and their Properties, Types of Prestressing Steel, Stress-Strain Curves for Prestressing Steel, Relaxation of Steel, Fatigue, Codal Provisions. Module 2: Losses in Prestress: Elastic Shortening, Pre-Tensioned & Post-Tensioned - Axial & Bending Members, Losses in Prestress - Friction, Anchorage Slip, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-Dependent Loss, Force Variation Diagram.
Unit-II	Module 3: Analysis and Design for Shear and Torsion: Introduction, Types of Cracks, Components of Shear Resistance and Pure Torsion, Modes of Failure, Effect of Prestressing Force, Stress in an Uncracked Beam, Design and Detailing Requirement for Shear, Design of Longitudinal Reinforcement and Transverse Reinforcement.

	Module 4: Calculations of Deflection and Crack Width: Factors Influencing Deflections, Short Term Deflections of Uncracked Members, Prediction of Long Term Deflections due to Creep and Shrinkage, Check for Serviceability Limit State of Deflection. Deflection due to Gravity Loads and Prestressing Force, Total Deflection, Determination of Moment of Inertia, Calculation of Crack Width, Method of Calculation, Limits of Crack Width.
Unit-III	Module 5: Analysis of Members: Analysis of Members under Axial and Flexural Load- Based on Stress, Force and Load Balancing Concept. Cracking Moment, Kern Point, Pressure Line, Analysis for Ultimate Strength, Variation of Stress in Steel Condition at Ultimate Limit State, Analysis of Rectangular Sections, Flanged Sections, Partially Pre-Stressed Sections, Un-Bonded Post-Tensioned Beams. Module 6: Design of Members: Design of Members for Axial Tension, Flexure Type I and Type II, Choice of Sections, Determination of Limiting Zone, Post-Tensioning in Stages, Magnel's Graphical Method, Guyon's Method
Unit-IV	Module 7: Composite and Continuous Beams: Analysis and Design of Composite Beams – Methods of Achieving Continuity in Continuous Beams, Analysis for Secondary Moments, Concordant Cable and Linear Transformation, Calculation of Stresses, Principles of Design. Module 8: Miscellaneous Structures: Design of Tension and Compression Members, Poles, Partial prestressing – definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

Suggested Readings

- Rajagopalan. N, “Prestressed Concrete”, Narosa Publishing House, 2002.
- Dayaratnam. P., “Prestressed Concrete Structures”, Oxford and IBH, 2013
- Lin T.Y. and Ned.H.Burns, “Design of prestressed Concrete Structures”, Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
- IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards,

Useful Video Links

Unit No.	Topic	Link
I	Material Properties	https://youtu.be/63-XoZ68jBo?si=YmlYPhbajlrQWrn5
	Losses in Prestress	https://youtu.be/AZoSeBRdEbg?si=gEuBd4rSlnftaSI1
II	Types of Cracks	https://youtu.be/gz1oEgECS9Q?si=xq8RtQ8cy_PmR_b9
	Factors Influencing Deflections	https://youtu.be/_nCKshanJN4?si=bPVEOy13QSmnbrg
III	Analysis of Members	https://youtu.be/LMH8aDqKJrE?si=b0eZF9_I8oPvzRZ2
	Design of Members	https://youtu.be/0ASvSbMgLP0?si=MnFOgAaVNfC-QQ9D
IV	Composite and Continuous Beams	https://youtu.be/Up4wUjuGvpo?si=UyQYJwfrjmXGP4_L
	Miscellaneous Structures	https://youtu.be/16P51olKuzk?si=6YXNPJjk_7L_EhyP

Course Code	PEC-CE-322A				
Category	Professional Elective Course				
Course Title	Contracts Management				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce the fundamentals, principles, and importance of contract management in construction projects. • To develop understanding of contract formation, administration, legal provisions, and contractual obligations. • To study contract execution, monitoring, risk management, and dispute resolution mechanisms.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic concepts, types, clauses, and legal framework of contract management.	Level 1: Remember
CO2	Explain contract formation, administration, performance monitoring, and contractual obligations in construction projects.	Level 2: Understand
CO3	Apply contract management principles for handling payments, variations, risk management, and contract execution in different project situations.	Level 3: Apply
CO4	Analyze contractual disputes, legal issues, risk factors, and closure procedures for effective contract management in engineering projects.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction & Basics: Contract Management – Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management, Parties to a Contract, Types of Contracts. Module 2: Contract Formation & Start-Up: Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships, Planning and People-Resource Management.
Unit-II	Module 3: Contract Clauses & Conditions: Common Contract Clauses, Notice to Proceed, Rights and Duties of Various Parties, Notices to be Given, Contract Duration and Price, Performance Parameters. Module 4: Time, Risk & Legal Conditions: Delays, Penalties and Liquidated Damages, Force Majeure, Suspension and Termination, Changes & Variations, Notices under Contracts.
Unit-III	Module 5: Contract Administration & Payments : Contract Administration, Payments, Managing Performance, Monitoring and Measurement

	Module 6: Contract Management in Different Situations : Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods, Design, Supply and Installation Contracts, Contract Management in Consultancy
Unit-IV	Module 7: Legal Framework & Dispute Resolution: Various Acts Governing Contracts, Legal Aspects in Contract Management, Contract Management Legal View, Dispute Resolution, Conventional Dispute Resolution Methods, Alternative Dispute Resolution Methods, Integrity in Contract Management. Module 8: Risk, Change & Closure: Managing Risks, Managing Change, Contract Closure and Review, Ending a Contract, Post-Implementation Review.

Suggested Readings

- Construction Law – Informa Law.
- Project Procurement Management – Wiley.
- Managing and Administering the FIDIC Forms of Contract – Wiley Blackwell.
- The Indian Contract Act, 1872 – LexisNexis.
- Construction Claims and Responses – Wiley Blackwell.
- Indian Contract Act, 1872
- Arbitration and Conciliation Act, 1996
- FIDIC Contract Conditions Manuals.
- CPWD Works Manual and General Conditions of Contract.
- World Bank Procurement and Contract Guidelines for ICB/NCB Works.

Useful Video Links

Unit No.	Topic	Link
I	Contract Management	https://youtu.be/wDaltiUARU4?si=L98vzzZPSfTapjtN
	Contract Formation	https://youtu.be/t96A1DrsZTw?si=1cqvpQ5PbTkKrVD6
II	Common Contract Clauses	https://youtu.be/zHPm2MQlTHM?si=3Kb5OizJOPHCIRmv
	Penalties and Liquidated Damages	https://youtu.be/E4KfgtglmP8?si=_PLMUSxcjqVhIFby
III	Contract Administration	https://youtu.be/YsQu_WUw7Y0?si=Us3StzlcZ9-XIz9n
	Contract of Supply of Goods	https://youtu.be/UoZ8VmTr1eY?si=0ukMc8cw0nHahxry
IV	Various Acts Governing Contracts	https://youtu.be/t96A1DrsZTw?si=twwap530gofVDipn
	Managing Risks	https://youtu.be/zyet9fPS24k?si=d7KBj2E8e4pohcyr

Course Code	PEC-CE-324A				
Category	Professional Elective Course				
Course Title	Hydro Power Engineering				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce energy systems and renewable energy resources • To explore society’s present needs and future energy demands and then focus on alternatives, renewable energy sources. • To introduce basics of turbine and powerhouse.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamentals of energy sources, hydropower systems, and the basic components of hydropower plants.	Level 1: Remember
CO2	Explain the operating principles of hydropower stations, pump storage plants, intake structures, and water conveyance systems.	Level 2: Understand
CO3	Apply engineering principles for the analysis and design of penstocks, turbines, surge tanks, and hydropower plant components.	Level 3: Apply
CO4	Analyze hydropower plant layouts, operational performance, and system requirements for efficient power generation.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Introduction to Energy Sources: Sources of energy, Status of hydropower, thermal vs. hydropower, advantages of hydropower, Energy contribution of hydropower in power system. Module 2: Basics of Hydropower: Electrical load on hydropower, load curves, load factor, capacity factors, utility factors and diversity factors, load on hydropower stations, load curves, load duration curves, firm power, secondary power, Prediction of loads.
Unit-II	Module 3: Types of Hydropower Stations: Elements of Hydro power, classification of hydropower stations, run of river plants, General layout of run of river plants, Valley dam plants, storage and pondage. Module 4: Basic features of Pump Storage Plants: Advantages of pump storage plants, types of pump storage plants, efficiency of pump storage plants, Reversible Turbines.
Unit-III	Module 5: Intakes: Intake structures: functions and their types, Components of intakes: forebay, trash racks, gates and valves, Force required to operate Gates. Module 6: Water Conveyance System: Classifications of Penstocks, Design criteria of penstocks, anchor blocks, types of valves, water hammer effects, instantaneous closure of power canal, Surge tank and its classification.

Unit-IV	Module 7: Turbines: Type of turbines, criteria for selection, specific speed of turbines, unit power, unit discharge, cavitations in turbines, Design of the draft tube. Module 8: Power Houses: General layout and arrangements of hydro-power units, number and size of units, substructure, spacing of units, super-structure, underground power stations.
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Suggested Readings

- Water power Engineering by Dandekar and Sharma.
- Hydropower structures Volume III-By R S Varshney.
- Hydro Power Engineering by Dr Darde P N, Vayu Education, Delhi.
- Hydro-Electric Engineering Practice Vol.I, II & III Brown J.G.
- Water Power Engineering, Borrows, H.K.
- Water Power Development, Vol.I & II, Mosonyi, E.
- Water Power Engineering, M.M. Deshmukh.

Useful Video Links

Unit No.	Topic	Link
I	Sources of energy	https://youtu.be/583QHO5X1jo?si=inQMoDflbsR49U28
	Electrical load on hydropower	https://youtu.be/HSC-2gLtJX0?si=GW7UQxtRYUzEV1Ae
II	Elements of Hydro power	https://youtu.be/MSR7Acw_Q6U?si=ycnJKDjkbK2g9a8j
	Reversible Turbines	https://youtu.be/3BCiFeykRzo?si=KGI7kwIPCG0xk8Ml
III	Intake structures	https://youtu.be/RrtbXAqmylo?si=MC00gqcAuPrgn1uF
	Classifications of Penstocks	https://youtu.be/CYJZbdzkofY?si=3LciS0cw6Osx4Seg
IV	Type of turbines	https://youtu.be/gOgKaCBlwX0?si=lWr1pXWjg9XNTO0N
	underground power stations	https://youtu.be/x3oG5nbR6TM?si=GXnKs_ihleckw_gK

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR (DELHI-NCR)
(AN AUTONOMOUS INSTITUTE)

Course Code	OEC-02A				
Category	Open Elective Courses				
Course Title	Waste Management				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are : • To introduce the fundamentals of waste management and sustainable development. • To familiarize students with waste segregation, recycling and treatment methods. • To understand circular economy, resource recovery and waste-to-energy concepts. • To create awareness about environmental regulations and sustainable engineering practices.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Identify different types of waste and their environmental impacts.	Level 1: Remember
CO2	Explain waste management techniques.	Level 2: Understand
CO3	Apply sustainable waste management practices in engineering and society.	Level 3: Apply
CO4	Analyze sustainable waste management practices.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Fundamentals of Waste Management: Introduction to waste management, Sources and classification of waste, Municipal, industrial, biomedical, e-waste, plastic and hazardous waste, Characteristics of waste, Environmental and health impacts, Waste management hierarchy (5R Concept), Sustainable Development Goals (SDGs).
Unit-II	Waste Processing and Treatment: Waste minimization, Segregation at source, Collection and transportation, Recycling of paper, plastic, metal and glass, Composting, Biomethanation, Incineration, Pyrolysis, Waste-to-Energy, Sanitary landfill, Resource recovery.
Unit-III	Circular Economy and Emerging Technologies: Circular economy principles, Zero waste concept, Extended Producer Responsibility (EPR), Plastic and e-waste management, Smart waste management systems, Digital tools for waste monitoring, Sustainable packaging, Carbon footprint reduction
Unit-IV	Environmental Regulations and Sustainable Practices: Solid Waste Management Rules, Plastic Waste Management Rules, E-Waste Management Rules, Biomedical Waste Management Rules, Green campus initiatives, Waste audit, Case studies on successful waste management, Role of engineers in sustainable waste management, Future trends.

Suggested Readings:

1. George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw-Hill.
2. P. A. Vesilind, W. A. Worrell and D. R. Reinhart, Solid Waste Engineering, Cengage Learning.
3. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill.
4. M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw-Hill. (*Selected chapters on solid waste and environmental pollution.*)
5. P. Venugopala Rao, Principles of Environmental Engineering, Prentice Hall of India.
6. Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Municipal Solid Waste Management, Ministry of Housing and Urban Affairs, Government of India.
7. Central Pollution Control Board (CPCB), Guidelines on Solid Waste, Plastic Waste and E-Waste Management.
8. Ministry of Environment, Forest and Climate Change (MoEFCC), Solid Waste Management Rules, 2016, Plastic Waste Management Rules, 2016, E-Waste Management Rules, 2022, and subsequent amendments.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of Waste Management	Municipal Solid Waste Management (NPTEL - IIT Guwahati)
	Introduction	NPTEL Course Portal – Municipal Solid Waste Management
UNIT-II	Waste Processing & Treatment	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
	Processing Technologies	Municipal Solid Waste Management (NPTEL Archive)
UNIT-III	Circular Economy & Sustainable Waste Management	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
UNIT-IV	Environmental Regulations & Case Studies	Municipal Solid Waste Management (NPTEL - IIT Guwahati)

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, JHAJJAR (DELHI-NCR)
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Course Code	OEC-02A				
Category	Open Elective Courses				
Course Title	Waste Management				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	The objectives of this course are : • To introduce the fundamentals of waste management and sustainable development. • To familiarize students with waste segregation, recycling and treatment methods. • To understand circular economy, resource recovery and waste-to-energy concepts. • To create awareness about environmental regulations and sustainable engineering practices.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Identify different types of waste and their environmental impacts.	Level 1: Remember
CO2	Explain waste management techniques.	Level 2: Understand
CO3	Apply sustainable waste management practices in engineering and society.	Level 3: Apply
CO4	Analyze sustainable waste management practices.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Fundamentals of Waste Management: Introduction to waste management, Sources and classification of waste, Municipal, industrial, biomedical, e-waste, plastic and hazardous waste, Characteristics of waste, Environmental and health impacts, Waste management hierarchy (5R Concept), Sustainable Development Goals (SDGs).
Unit-II	Waste Processing and Treatment: Waste minimization, Segregation at source, Collection and transportation, Recycling of paper, plastic, metal and glass, Composting, Biomethanation, Incineration, Pyrolysis, Waste-to-Energy, Sanitary landfill, Resource recovery.
Unit-III	Circular Economy and Emerging Technologies: Circular economy principles, Zero waste concept, Extended Producer Responsibility (EPR), Plastic and e-waste management, Smart waste management systems, Digital tools for waste monitoring, Sustainable packaging, Carbon footprint reduction
Unit-IV	Environmental Regulations and Sustainable Practices: Solid Waste Management Rules, Plastic Waste Management Rules, E-Waste Management Rules, Biomedical Waste Management Rules, Green campus initiatives, Waste audit, Case studies on successful waste management, Role of engineers in sustainable waste management, Future trends.

Suggested Readings:

1. George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw-Hill.
2. P. A. Vesilind, W. A. Worrell and D. R. Reinhart, Solid Waste Engineering, Cengage Learning.
3. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill.
4. M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw-Hill. (*Selected chapters on solid waste and environmental pollution.*)
5. P. Venugopala Rao, Principles of Environmental Engineering, Prentice Hall of India.
6. Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Municipal Solid Waste Management, Ministry of Housing and Urban Affairs, Government of India.
7. Central Pollution Control Board (CPCB), Guidelines on Solid Waste, Plastic Waste and E-Waste Management.
8. Ministry of Environment, Forest and Climate Change (MoEFCC), Solid Waste Management Rules, 2016, Plastic Waste Management Rules, 2016, E-Waste Management Rules, 2022, and subsequent amendments.

Useful Video links

Unit No.	Topic	Link
UNIT-I	Fundamentals of Waste Management	Municipal Solid Waste Management (NPTEL - IIT Guwahati)
	Introduction	NPTEL Course Portal – Municipal Solid Waste Management
UNIT-II	Waste Processing & Treatment	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
	Processing Technologies	Municipal Solid Waste Management (NPTEL Archive)
UNIT-III	Circular Economy & Sustainable Waste Management	Integrated Waste Management for a Smart City (NPTEL - IIT Kharagpur)
UNIT-IV	Environmental Regulations & Case Studies	Municipal Solid Waste Management (NPTEL - IIT Guwahati)



**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT,
KABLANA (JHAJJAR)
An Autonomous Institute**

‘A’ GRADE ACCREDITED BY NAAC

**Evaluation Scheme and Syllabus
Common for B.Tech (Civil Engineering)
And
B.Tech (Civil Engineering – Working Professionals)
Second Year (B-Scheme)
(Under NEP-2020)
(Effective from the session: 2026-27)**



**APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU,
ROHTAK**

**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA,
JHAJJAR (HR.)**

Scheme of Studies and Examinations

Common for B.Tech (Civil Engineering) – 3rd Semester

and

B.Tech (Civil Engineering - Working Professionals) – 3rd Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-CE-201B	Building Construction and Material	3	0	0	3	3	30	45		75	3
2	Professional Core Courses	PCC-CE-203B	Construction Techniques and Equipments	3	0	0	3	3	30	45		75	3
3	Professional Core Courses	PCC-CE-205B	Fluid Mechanics	3	0	0	3	3	30	45		75	3
4	Professional Core Courses	PCC-CE-207B	Surveying	3	0	0	3	3	30	45		75	3
5	Professional Core Courses	PCC-CE-209B	Engineering Geology	3	0	0	3	3	30	45		75	3
6	Engineering Science Courses	ESC-CE-211B	Engineering Mechanics	3	0	0	3	3	30	45		75	3
7	Professional Core Courses	LC-PCC-CE-213B	Building Materials Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Courses	LC-PCC -CE-215B	Fluid Mechanics Lab	0	0	2	2	1	10		15	25	3
9	Engineering Science Courses	LC-ESC -CE-217B	Engineering Mechanics Lab	0	0	2	2	1	10		15	25	3
10	Professional Core Courses	LC-PCC -CE-219B	Surveying Lab	0	0	2	2	1	10		15	25	3
11	Professional Core Course	LC-PCC -CE-221B	CAD Lab	0	0	2	2	1	10		15	25	3
12	Mandatory Courses	MC-201B*	Environment al Science*	2	0	0	2	0	20		30	50*	3
Total Credits								23				575	

Notes:

- MC-201B is a mandatory non-credit course in which students will be required to obtain passing marks in theory. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in detailed marks certificate of student.

**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA,
JHAJJAR (HR.)**

Scheme of Studies and Examinations

Common for B.Tech (Civil Engineering) – 4th Semester

and

B.Tech (Civil Engineering - Working Professionals) – 4th Semester

w.e.f. 2026-27

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Schedule (Marks)				Exam Duration in H
				L	T	P			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Basic Science Courses	BSC-CE-202B	Engineering Mathematics-III	3	1	0	4	4	40	60		100	3
2	Professional Core Course	PCC-CE-204B	Hydraulic Engineering	3	0	0	3	3	30	45		75	3
3	Professional Core Course	PCC-CE-206B	Structural Analysis	3	0	0	3	3	30	45		75	3
4	Professional Core Course	PCC-CE-208B	Advanced Surveying	3	0	0	3	3	30	45		75	3
5	Professional Core Course	PCC-CE-210B	Design of Concrete Structures	3	0	0	3	3	30	45		75	3
6	Professional Elective Course	Refer Table-1	Professional Elective-I	3	0	0	3	3	30	45		75	3
7	Professional Core Course	LC-PCC -CE-212B	Hydraulic Engineering Lab	0	0	2	2	1	10		15	25	3
8	Professional Core Course	LC-PCC -CE-214B	Structural Analysis Lab	0	0	2	2	1	10		15	25	3
9	Professional Core Course	LC-PCC -CE-216B	Advanced Surveying Lab	0	0	2	2	1	10		15	25	3
10	Professional Core Course	LC-PCC -CE-218B	Concrete Lab	0	0	2	2	1	10		15	25	3
Total Credits								23				575	

Notes:

- I. At the end of the 4th Semester, each student shall undergo 4–6 weeks of Industrial/Practical Training in a Civil Engineering organization and submit a training report along with a training certificate from the organization. The evaluation shall be carried out in the 5th Semester.
- II. For Working Professionals: Submit a Training/Project report of their work in their respective company/Organization for the period of summer training/industrial training for evaluation. The evaluation shall be carried out in the 5th Semester.
- III. Students must choose one course from the Professional Elective–I category (Table 1). They may also opt for Massive Open Online Courses (MOOCs) offered through the SWAYAM, SWAYAM Plus, or NPTEL platforms, subject to the approval of the concerned Chairperson, Board of Studies/Head of the Department.

Table 1 Professional Elective – I

Sr. No.	Code	Subject
1	PEC-CE-220B	Repair and Rehabilitation of Structures
2	PEC-CE-222B	Climate Hazards and Disaster Mitigation
3	PEC-CE-224B	Material Testing and Evaluation
5	-----	MOOCs offered through SWAYAM, SWAYAM Plus, or NPTEL platforms

Course Code	PCC-CE-201B				
Category	Professional Core Course				
Course Title	Building Construction and Material				
Scheme and Credits	L	T	P	Credits	Semester-III
	3	0	0	3	
Course Objectives	The objectives of this course are • To provide knowledge of building components and construction techniques. • To understand properties and applications of construction materials. • To develop ability to select suitable materials for various construction requirements. • To familiarize students with construction practices and standards.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define building materials, components, and construction terminology.	Level 1: Remember
CO2	Understand construction practices and functional requirements of buildings.	Level 2: Understand
CO3	Apply suitable materials and construction techniques.	Level 3: Apply
CO4	Analyze building components for durability and sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Building Planning and Masonry: Building planning principles, Functional components of buildings, Building terminology, Building orientation, Modular coordination, Masonry units, Mortars and mortar joints, Brick masonry bonds, Masonry construction practices, Composite masonry, Glass block masonry, Quality of workmanship, Common defects in masonry. Module 2: Roofs, Floors and Openings: Roof systems, Roof coverings, King-post and Queen-post trusses, Floor systems, Floor finishes, Doors, Windows, Ventilators, Aluminium and uPVC door-window systems, Hardware, Fixtures and fastener.
Unit-II	Module 3: Timber and Building Products: Timber properties and preservation, Engineered wood products, Plywood, Blockboard, Particle board, Fibre boards, Architectural glass, Glazing systems, Composite panels, Lightweight building products. Module 4: Building Finishes and Surface Materials: Building stones, Stone finishes, Stone cladding, Flooring systems, Ceramic, Vitrified and Cement concrete tiles, Wall finishes, Paints, Primers, Varnishes, Protective coatings, Decorative finishes, Building envelope materials.

Unit-III	Module 5: Walls and Foundations: Load-bearing and framed construction, Load-bearing and non-load-bearing walls, Cavity walls, Partition walls, Selection of foundation systems, Shallow foundations, Masonry foundations, Basic site investigation, Foundations in difficult soil conditions, Introduction to deep foundations. Module 6: Staircases and Accessibility: Planning and layout of staircases, Stair terminology, Types of staircases, Accessibility provisions, Universal design principles, Ramps, Lifts, Escalators, Moving walkways.
Unit-IV	Module 7: Building Protection: Damp-proofing, Waterproofing, Fire-resistant construction, Fire-resistant materials, Thermal insulation, Acoustic insulation, Moisture control, Weather protection, Building durability concepts. Module 8: Emerging Building Materials: AAC blocks, Geosynthetics, Fibre Reinforced Polymer (FRP) products, Fibre cement boards, Composite building panels, Lightweight building materials, Recycled building materials, Smart building materials, Energy-efficient building materials, Sustainable building products..

Suggested Readings:

1. Building Construction by Sushil Kumar, Standard Pub., N. Delhi
2. Building Material by Rangawala
3. Construction Engineering by Y.S. Sane
4. Building Construction by Gurcharan Singh, Standard Pub., N. Delhi

Useful Video Links

Unit No.	Topic	Link
Unit-I	Building Planning & Components	https://www.youtube.com/results?search_query=nptel+building+planning+civil+engineering
	Building Stones	https://www.youtube.com/results?search_query=building+stones+civil+engineering
Unit-II	Timber in Construction	https://www.youtube.com/results?search_query=timber+building+materials+nptel
	Roofing Systems	https://www.youtube.com/results?search_query=roofing+systems+building+construction
Unit-III	Wall Construction	https://www.youtube.com/results?search_query=load+bearing+wall+construction
	Staircase Planning	https://www.youtube.com/results?search_query=staircase+planning+civil+engineering
Unit-IV	Waterproofing	https://www.youtube.com/results?search_query=waterproofing+building+construction
	Smart & Sustainable Materials	https://www.youtube.com/results?search_query=smart+building+materials+civil+engineering

Course Code	PCC-CE-203B				
Category	Professional Core course				
Course Title	Construction Techniques and Equipments				
Scheme and Credits	L	T	P	Credits	Semester-III
	3	0	0	3	
Course Objectives	The objectives of this course are: • To understand the fundamentals of construction equipment and techniques. • To familiarize with modern construction methods and site practices. • To develop knowledge of construction planning, safety, and quality in civil engineering projects.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Describe the fundamentals of construction equipment and techniques.	Level 1: Remember
CO2	Explain construction methods and techniques.	Level 2: Understand
CO3	Apply construction principles to civil engineering works.	Level 3: Apply
CO4	Analyze construction practices for efficient project execution.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Earthmoving and Material Handling Equipment: Classification and selection of construction equipment, Earthmoving equipment (Excavators, Bulldozers, Loaders, Scrapers), Hauling and compacting equipment, Material handling equipment (Cranes, Hoists, Conveyors, Equipment productivity and safety). Module 2: Concrete Construction Equipment: Concrete batching and mixing plants, Transit mixers, Concrete pumps, Vibrators, Concrete placing and finishing equipment, Asphalt plants and road paving equipment, Equipment maintenance.
Unit-II	Module 3: Temporary Works and Site Preparation: Site clearance and site preparation, Excavation and dewatering methods, Temporary works in construction, Basic concepts of formwork, Centering, Falsework, Scaffolding, Shoring and bracing, Construction joints, Inspection and safety during temporary works. Module 4: Industrialized Construction Systems: Prefabrication, Precast concrete construction, Modular construction, Pre-engineered buildings (PEB), Segmental construction, Composite construction, Slip form construction, Tunnel form construction, Jump form construction, Advantages and limitations.
Unit-III	Module 5: Specialized Construction Techniques: Bridge construction methods, Deep excavation, Cofferdams, Sheet piling, Underwater concreting, Trenchless construction (Pipe jacking and Micro-tunnelling), Construction in difficult ground conditions.

	Module 6: Construction Planning and Site Management: Construction sequence and workflow, Site layout and organization, Material storage and handling, Temporary facilities, Resource utilization, Productivity improvement techniques, Introduction to Lean Construction, Construction records and documentation.
Unit-IV	Module 7: Heavy Construction and Infrastructure Development: Construction of highways, Railways, Bridges, Tunnels, Dams, Airports, Multistoreyed buildings, Steel structures, Precast construction, Challenges in large infrastructure projects. Module 8: Construction Safety and Quality Management: Construction safety management, PPE, Hazard identification, Risk assessment, Inspection procedures, Construction quality assurance, Construction documentation, Construction waste management, Sustainable construction practices.

Suggested Readings

1. R.L. Peurifoy, C.J. Schexnayder & A. Shapira – Construction Planning, Equipment and Methods (McGraw Hill)
2. S.C. Sharma & S.K. Duggal – Building Construction (McGraw Hill India)
3. B.C. Punmia, A.K. Jain & A.K. Jain – Building Construction (Laxmi Publications)
4. S.C. Rangwala – Building Construction (Charotar Publishing House)
5. Dr. Mahesh Varma – Construction Equipment and Methods (Metropolitan)
6. G.R. Raina & S.K. Gupta – Construction Management and Equipment
7. M.L. Gambhir – Building and Construction Materials (McGraw Hill Education)
8. NPTEL – Construction Planning and Equipment – <https://nptel.ac.in>
9. CPWD Works Manual – <https://cpwd.gov.in>

Useful Video Links

Unit No.	Topic	Link
Unit -I	Construction Equipment (Earthmoving & Material Handling)	https://www.youtube.com/playlist?list=PLbMVogVj5nJQ5kq5z6zq1Q8o8qk0qkqkq
	Concrete Construction Equipment	https://civilblog.org/building-materials-and-construction-civil-engineering-video-lectures/
Unit -II	Formwork Systems	https://civilblog.org/building-materials-and-construction-civil-engineering-video-lectures/
	Industrialized Construction	https://www.youtube.com/user/NPTELHRD/playlists
Unit -III	Bridge & Tunnel Construction	https://www.youtube.com/watch?v=0olpSN6_TCc
	Deep Excavation & Cofferdams	https://www.youtube.com/watch?v=HowDoSpillwaysWork-fjapgTd-QUg
Unit -IV	Construction Safety Practices	https://www.youtube.com/watch?v=j04CtMzo_0Y
	Conceptual Engineering Insights	https://www.youtube.com/@PracticalEngineeringChannel

Course Code	PCC-CE-205B					
Category	Professional Core Course					
Course Title	Fluid Mechanics					
Scheme and Credits	L	T	P	Credits	Semester-III	
	3	0	0	3		
Course Objectives	The objectives of this course are: • To introduce properties and behavior of fluids at rest and in motion. • To develop understanding of fluid statics and fluid dynamics principles. • To enable analysis of pipe flow and open channel flow problems. • To prepare students for hydraulic engineering applications.					
Assessment	30 Marks					
End Semester Examination	45 Marks					
Total	75 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Define basic concepts of fluids.	Level 1: Remember
CO2	Understand properties of fluids.	Level 2: Understand
CO3	Apply equations of fluid flow to solve engineering problems.	Level 3: Apply
CO4	Analyze the behavior of fluid flow.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module1: Fluids and Their Properties: Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, molecular structure of material, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitations, compressibility and the bulk modulus. Module2 : Pressures and Head: Types of Pressure, Pascal's law of pressure at a point, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, the hydrostatic paradox.
Unit-II	Module 3 : Static Forces on Surface and Buoyancy: Fluid static, action of fluid pressure on surface, resultant force and centre of pressure on a plane surface under uniform pressure, resultant force and centre of pressure on a plane surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the centre of buoyancy. Module 4: Motion of Fluid Particles and Streams: Fluid flow, different types of flow, frames of reference, analyzing fluid flow, motion of a fluid particle, acceleration of a fluid particle, discharge and mean velocity, continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system.

Unit-III	Module 5: The Energy Equation and its Application: Momentum and fluid flow, Momentum equation for 2-D and 3-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid – Bernoulli's theorem, kinetic energy correction factor, pitot tube, determination of volumetric flow rate via pitot tube, changes of pressure in tapering pipe, principle of venturimeter, pipe orifices, theory of small orifices discharging to atmosphere, theory of large orifices, Rotameter, elementary theory of notches and weirs, flow in a curved path. Module 6: Dimensional Analysis And Similarities: Dimension reasoning, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham π-theorem, significance of dimensionless, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, Kinematic similarity, model testing-Model laws, Undistorted and Distorted models
Unit-IV	Module 7: Flow Through Pipes: Boundary layer flow, Elementary turbulent flow, Flow through pipes, Head losses in pipes, Bends and Fittings, Reynold's experiments, Prandtl mixing length hypothesis, Velocity distribution in pipes, Concept of smooth and rough pipes, Pipe friction factor relations. Pipe network.

Suggested Readings:

1. Hydraulic and Fluid Mechanic by P.N.Modi&S.M.Seth
2. Introduction to Fluid Mechanics by Robert W.Fox& Alan T.McDonald 3 Fluid Mechanics Through Problems by R.J.Garde
3. Engineering Fluid Mechanics by R.J.Garde&A.G.Mirajgaoker
4. Fluid Mechanic and Hydraulic machines R.K. BANSAL

Useful Video Links

Unit No.	Topic	Link
Unit-I	Fluids and Their Properties	https://youtu.be/iTanaNwMDKo?si=_6zrC4tftGCfjclw
	Pressures and Head	https://youtu.be/38xWEHdUjD0?si=0rkPRLcfpMPEck8a
Unit-II	Static Forces on Surface and Buoyancy	https://youtu.be/9bdGZkkHukA?si=cOuXF9YrsNt_VEXt
	Motion of Fluid Particles and Streams	https://youtu.be/jnDbVE17Pzg?si=5Y4PVBzFDOYTFJto
Unit-III	The Energy Equation and its Application	https://youtu.be/WGuzqF2GCBg?si=AmyZNyaVxkG8SRIJ
	Dimensional Analysis And Similarities	https://youtu.be/tV3ShM1fo5Y?si=YqqMpiXoEEzb7gtH
Unit-IV	Flow Through Pipes	https://youtu.be/1X71UfOCEU4?si=GMIX_i71UAfC0QmS

Course Code	PCC-CE-207B					
Category	Professional Core Course					
Course Title	Surveying					
Scheme and Credits	L	T	P	Credits	Semester-III	
	3	0	0	3		
Course Objectives	The objectives of this course are: •To impart knowledge of fundamental surveying principles and measurement techniques used in civil engineering practice. •To develop competency in the use of chain, compass, level, theodolite, and related surveying instruments. •To enable computation and adjustment of levelling, traversing, and contouring data.					
Assessment	30 Marks					
End Semester Examination	45 Marks					
Total	75 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of surveying.	Level 1: Remember
CO2	Understand methods of surveying.	Level 2: Understand
CO3	Apply surveying techniques for measurement of civil engineering projects.	Level 3: Apply
CO4	Analyze survey data and errors.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Surveying Fundamentals and Direction Measurement: Definition and objectives of surveying, principles and classification of surveying, instruments for linear measurement, methods of linear measurement – chaining and taping, errors in linear measurement and tape corrections, types of compass – prismatic and surveyor's compass, bearings – whole circle and reduced bearing, meridians – true, magnetic and arbitrary, magnetic declination, local attraction – causes, detection and correction, methods of compass traversing, checks in traversing, adjustment of closed traverse with examples. Module 2: Leveling and Geodetic Trigonometric leveling: Terms used in leveling, types of levels and staff, principles of levelling, reduction of levels and booking of staff readings, examples. Height and distances- base of the object accessible and inaccessible, geodetically observation, correction due to curvature and refraction, axis signal correction, difference in elevation between two points.
Unit-II	Module 3: Plane Table Surveying: Plane table accessories, Types and methods of plane table surveying, sources of error, advantages and disadvantages of plane table surveying. Module 4: Contouring: Contours and characteristics of contour lines, Contour interval and Factor affecting CI locating contours, interpolation of contours, Use of contour maps.

Unit-III	Module 5: Angle Measurement: Theodolite, parts of theodolite, Temporary adjustment of Theodolite, measurement of horizontal and vertical angles by different methods, theodolite traversing, adjustments of closed traverse. Module 6: Tachometric surveying: Principle of tachometric surveying, different instrument used in tachometry, stadia and tangential method of tachometry, tachometric constants and their determinations, examples.
Unit-IV	Module 7: Curves: Classification of curves, elements of simple circular curve, location of tangent points- chain and tape methods, instrumental methods, Examples; types of transition curves; Vertical Curves: Necessity and types of vertical curves, setting out of a vertical curve. Module 8: Total Station – Basic Concepts: Definition and purpose of Total Station, main components – electronic theodolite, EDM and other method of distance measurement.

Suggested Readings:

- Surveying volume I and II: B C Punmia.
- Engineering Surveying (Sixth Edition): W. Schofield.
- Text Book of Surveying: C. Venkataramiah.
- Introduction to GPS: The Global Positioning System: Ahmed El-Rabbany.
- Surveying by Duggal.
- Various Online resources including NPTEL.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Basics of Surveying and Linear measurement	https://youtu.be/chhuq_t40rY?si=O-rZ0GyeQRQ0I1Ht
	Terms used in levelling	https://youtu.be/La5A5PLQjaQ?si=e6zg_3GViavxOn
Unit-II	Methods of plane table surveying	https://youtu.be/COldgKBaiqw?si=8ONvMgLWwjP8Ql2p
	Contours and characteristics of contour lines	https://youtu.be/pHarJN7Wo0M?si=WzMPfR8rcJid_GoQ
Unit-III	Theodolite, parts of theodolite	https://youtu.be/6yyMZSHCbCo?si=qX3gYxRgeXr6Ef4s
	Tachometric surveying	https://www.youtube.com/watch?v=HuJMSS3T070&list=PL5UuHQx1lpk3VBalpNcdAgxXSwG9QGyZp
Unit-IV	Curves, Classification of curves	https://youtu.be/EMFPb3Rn7Jw?si=mEJPVQhLMuYcf39L
	Total Station – Basic Concepts	https://youtu.be/a2Z1Z_M6SEo?si=IxxBgExEABmO5Xgg

Course Code	PEC-CE-209B				
Category	Professional Core Course				
Course Title	Engineering Geology				
Scheme and Credits	L	T	P	Credits	Semester-III
	3	0	0	3	
Course Objectives	The objectives of this course are: - To provide fundamental knowledge of geology, minerals, rocks, and geological processes relevant to civil engineering. - To develop skills for map interpretation, rock analysis, and evaluation of geological conditions in engineering projects and hazards.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	70 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of geology, minerals, rocks, and earth structure.	Level 1: Remember
CO2	Understand geological processes like weathering, erosion, petrology, and structural geology.	Level 2: Understand
CO3	Apply geological knowledge to map interpretation, identification of minerals/rocks, and engineering evaluation of rock properties.	Level 3: Apply
CO4	Analyze geological conditions in civil engineering projects (dams, slopes, earthquakes) and assess hazards with suitable measures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1 : Introduction: Scope, Subdivision of Geology, Interior of Earth, Importance of Geological Studies in Various Civil Engineering Projects, Department Dealing with this Subject in India and their Scope of Work- GSI, Granite Dimension Stone Cell, NIRM; Use of Geological Maps and Interpretation of Data. Module 2: Physical Geology: External and Internal Geological Forces Causing Changes; Weathering, Erosion and Denudation of the Surface of the Earth; Factors Affecting Weathering and Product of Weathering; Superficial Deposits and its Geotechnical Importance: Water Fall and Gorges, River Meandering, Alluvium, Glacial Deposits, Desert Landform, Loess, Mudflows, Coastal Deposits.
Unit-II	Module 3 : Mineralogy : Origin and Composition of Minerals, Physical Properties of Minerals, Susceptibility of Minerals to Alteration, Rock Forming Minerals, Megascopic Identification of Common Primary and Secondary Minerals. Module 4 : Petrology: Rock Formation Processes, Ternary Diagram, Igneous Petrology-Volcanic Phenomenon, Types of Volcanic Eruption, Chemical and Mineralogical Composition, Texture and its Types, Sedimentary Petrology- Mode of Formation, Mineralogical Composition, Texture and its Types; Metamorphic Petrology- Agents and Types of Metamorphism, Metamorphic Grades, Mineralogical Composition, Structures and Textures.

Unit-III	Module 5: Structural Geology: Forms and Structures of Rocks, Stress and Strain in Rocks, Deformation and Tectonics, Dip and Strike, Bedding Planes and Outcrops; Fold- Types and Nomenclature, Criteria for Their Recognition in Field; Faults: Classification, Recognition in Field. Module 6 : Properties of Rock Masses: Sub Surface Investigations of Rocks and Engineering Characteristics of Rocks Masses; Field and Laboratory Tests on Rocks, Stress Deformation and Bearing Capacity of Rocks, Important Variables Influencing Rock Properties and Behaviour, Measurement of Velocity of Sound in Rock.
Unit-IV	Module 7 : Geology of Dam and Reservoir: Site Geological Consideration for Selecting Dam and Reservoir Site, Causes of Failure of Reservoir, Favourable and Unfavourable Conditions in Different Types of Rocks in Presence of Various Structural Features, Precautions to Counteract Unsuitable Conditions. Module 8: Geological Hazards: Rock Instability and Slope Movement; Concept of Sliding, Consequences of Land Sliding, Prevention by Surface Drainage, Slope Reinforcement by Rock Bolting and Rock Anchoring; Earthquake: Magnitude and Intensity of Earthquake, Seismic Waves; Seismic Zones in India.

Suggested Readings

- A textbook of Geology by P.K Mukherjee
- Physical and General Geology by SK Garg
- Engineering and General Geology by Prabin Singh.
- Introduction of physical Geology by A.holmes

Useful Video Links

Unit No.	Topic	Link
Unit-I	Scope, Subdivision of Geology	https://youtu.be/ksJpBG0R5pM?si=5cOmhlDq6Xb0awyf
	Weathering, Erosion and Denudation of the Surface of the Earth	https://youtu.be/GCiSOGweitU?si=ic3lArR5MbmJW8k3
Unit-II	Origin and Composition of Minerals	https://youtu.be/kVopWFgOcrU?si=f3pJdh4aNfhq2-DZ
	Sedimentary Petrology	https://www.youtube.com/live/ezqUycfNlzE?si=obAP9KAHLAakI1Rz
Unit-III	Dip and Strike, Bedding Planes and Outcrops	https://youtu.be/WdBtwf3vl_0?si=y3aNj_0tu0CX2MBD
	Sub Surface Investigations of Rocks	https://youtu.be/ZLmqfF2FtkU?si=fs6mlkfDoktkC3cO
Unit-IV	Dam and Reservoir Site	https://youtu.be/bDwow2-WzHo?si=dmCdQXbKE1C8YEU
	Earthquake: Magnitude and Intensity of Earthquake	https://youtu.be/mWXpUo-KOw?si=LPPrSZANDX9MDRCx

Course code	ESC-CE-211B				
Category	Engineering Science Course				
Course title	Engineering Mechanics				
Scheme and Credits	L	T	P	Credits	Semester-III
	3	0	0	3	
Course Objectives	The objectives of this course are: • To introduce fundamental principles of statics and mechanics of rigid bodies. • To develop ability to analyze forces, moments, and equilibrium conditions. • To apply mechanics principles to solve engineering problems. • To build foundation for advanced structural subjects.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define basic concepts of engineering mechanics.	Level 1: Remember
CO2	Understand behavior of various force systems.	Level 2: Understand
CO3	Apply mechanics principles to solve structural problems.	Level 3: Apply
CO4	Analyze structural components under various loading conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Force Systems and Friction: System of forces, equilibrium of particles and rigid bodies in two and three dimensions, Free Body Diagrams (FBDs), support reactions, internal forces in structural members (axial force, shear force and bending moment), dry friction, laws of friction, angle of friction, angle of repose, applications of friction (ladders, wedges and belt). Module 2: Simple and Compound Stresses and Strains: Mechanical properties of engineering materials, normal and shear stresses and strains, Hooke's law, elastic constants and their relationships, Poisson's ratio, stresses and deformation of prismatic, stepped and tapered bars under axial loading and self-weight, compound bars, thermal stresses and strains, factor of safety, proof stress.
Unit-II	Module 3: State of Stress and Strain: Stress transformation under plane stress, principal stresses and principal planes, principal strains, maximum shear stress, Mohr's Circle for stress analysis, combined normal and shear stresses. Module 4: Shear Force and Bending Moment: Classification of beams and loading systems, shear force and bending moment, differential relationships among load, shear force and bending moment, axial force, shear force and bending moment diagrams for statically determinate beams, point of contra-flexure.

Unit-III	Module 5: Flexural and Torsional Behaviour: Theory of simple bending, flexure formula, bending stresses, combined direct and bending stresses, section modulus, composite beams, kern and middle-third rule, transverse shear stress distribution in beams, theory of pure torsion, torsion equation, solid and hollow circular shafts, power transmission through shafts, shafts in series and parallel, combined bending and torsion. Module 6: Thin Pressure Vessels and Columns: Thin cylindrical pressure vessels, circumferential (hoop) stress, longitudinal stress, volumetric strain, classification of columns, slenderness ratio, Euler's buckling theory, Rankine-Gordon formula, eccentrically loaded columns.
Unit-IV	Module 7: Analysis of Plane Trusses: Classification of trusses, perfect, deficient and redundant trusses, zero-force members, analysis of statically determinate plane trusses by Method of Joints and Method of Sections. Module 8: Failure Theories: Maximum Principal Stress Theory, Maximum Principal Strain Theory, Maximum Shear Stress Theory (Tresca Criterion), Maximum Strain Energy Theory, Distortion Energy Theory (von Mises Criterion), comparison and applications of failure theories.

Suggested Readings

- Strength of Material by G.H. Ryder, MacMillan Publishers India Ltd.
- Mechanics of Materials by E.J. Hearn, Elsevier Publications.
- Mechanics of Materials by Punmia and Jain, Laxmi Publications (P) Ltd.
- Mechanics of Materials by R.C. Hibbeler, Pearson Higher Education.
- Strength of Materials by Timoshenko and Young,, East West Press.
- Mechanics of materials by V Gupta, Narosa publishing house.

Useful Video Links

Unit No.	Topic	Link
I	Simple Stresses and Strains	https://youtu.be/DzyIEz3dKXQ?si=_k7krOEATzbR_uU1Z
II	Compound stress and strains	https://youtu.be/EDdUiNHLF2o?si=-_qcKtD_1pof_AEA4
III	Buckling of columns	https://youtu.be/vhXJ6ZcKb5c?si=jHZ2-2e595JXXwSC
IV	Different types of trusses	https://youtu.be/ef-5HtnBubU?si=pqpXD05mgSuGrabd

Course code	LC-PCC-CE-213B				
Category	Lab Course				
Course title	Building Materials Lab				
Scheme and Credits	L	T	P	Credits	Semester-III
	0	0	2	1	
Course Objectives:	The objectives of this course are: • Understand the basic properties of construction materials. • Develop practical skills in testing and handling construction materials. • Interpret laboratory test results using standard procedures. • Assess the quality and suitability of materials for construction applications.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Identify the properties of common construction materials.	Level 1: Remember
CO2	Explain standard testing procedures and relevant specifications for construction materials.	Level 2: Understand
CO3	Demonstrate laboratory tests on construction materials following standard procedures.	Level 3: Apply
CO4	Analyze test results to assess the construction materials for engineering applications.	Level 4: Analyze

List of Experiments

1. Determination of normal consistency of cement.
2. Determination of initial and final setting time of cement.
3. Determination of fineness of cement.
4. Determination of soundness of cement.
5. Determination of compressive strength of cement mortar.
6. Sieve analysis of fine and coarse aggregates.
7. Determination of specific gravity and water absorption of aggregates.
8. Determination of bulk density and void ratio of aggregates.
9. Testing of bricks for dimensions, water absorption, efflorescence and compressive strength.
10. Testing of concrete blocks and AAC blocks.
11. Determination of moisture content and basic properties of timber.
12. Identification and study of building products such as plywood, fibre boards, aluminium, uPVC and architectural glass.

Useful Video links:

Exp. No.	Topics	Links
1	Determination of Normal Consistency of Cement	https://www.youtube.com/results?search_query=normal+consistency+of+cement+vicat+apparatus
2	Determination of Initial and Final Setting Time of Cement	https://www.youtube.com/results?search_query=initial+and+final+setting+time+of+cement+vicat+apparatus
3	Determination of Fineness of Cement	https://www.youtube.com/results?search_query=fineness+test+of+cement+sieve+test
4	Determination of Soundness of Cement	https://www.youtube.com/results?search_query=soundness+test+of+cement+le+chatelier+apparatus
5	Determination of Compressive Strength of Cement Mortar	https://www.youtube.com/results?search_query=compressive+strength+test+of+cement+mortar
6	Sieve Analysis of Fine and Coarse Aggregates	https://www.youtube.com/results?search_query=sieve+analysis+of+fine+and+coarse+aggregates
7	Specific Gravity and Water Absorption of Aggregates	https://www.youtube.com/results?search_query=specific+gravity+and+water+absorption+test+of+aggregates
8	Bulk Density and Void Ratio of Aggregates	https://www.youtube.com/results?search_query=bulk+density+and+void+ratio+of+aggregates
9	Testing of Bricks (Dimensions, Water Absorption, Efflorescence & Compressive Strength)	https://www.youtube.com/results?search_query=brick+testing+water+absorption+efflorescence+compressive+strength
10	Testing of Concrete Blocks and AAC Blocks	https://www.youtube.com/results?search_query=concrete+block+and+AAC+block+testing
11	Moisture Content and Basic Properties of Timber	https://www.youtube.com/results?search_query=timber+moisture+content+test+and+properties
12	Identification of Building Products (Plywood, Fibre Boards, Aluminium, uPVC & Glass)	https://www.youtube.com/results?search_query=building+materials+plywood+fibre+board+aluminium+uPVC+glass

Course code	LC-PCC-CE-215B				
Category	Lab Course				
Course title	Fluid Mechanics Lab				
Scheme and Credits	L	T	P	Credits	Semester-III
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To conduct experiments related to fluid flow and measurement. • To verify theoretical principles through experimentation. • To analyze experimental data and hydraulic performance.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall hydraulic instruments, measuring devices, and fluid properties.	Level 1: Remember
CO2	Understand principles of fluid flow, pressure, and discharge measurement.	Level 2: Understand
CO3	Illustrate experiments to determine flow characteristics.	Level 3: Apply
CO4	Analyze flow characteristics and energy losses.	Level 4: Analyze

List of Experiments

1. Verification of Bernoulli's Theorem
2. Calibration of V notch
3. Calibration of Rectangular notch
4. Calibration of Trapezoidal notch
5. Study of Pressure Measuring Devices
6. Determination of Metacentric height
7. Hydrostatics Force on Flat Surfaces/Curved Surfaces
8. Venturimeter
9. Orifice meter
10. Determination of coefficient C_d , C_v , and C_c

Useful Video links:

Exp. No	Experiment	Links
1	Verification of Bernoulli's Theorem	https://www.youtube.com/watch?v=m90wPNvxAIg
2	Calibration of V notch	https://www.youtube.com/watch?v=ILY4QMQUIY5s
3	Calibration of Rectangular notch	https://www.youtube.com/watch?v=0u-jamQjVv0
4	Calibration of Trapezoidal notch	https://www.youtube.com/watch?v=ZOVlvLVYDjE

Course code	LC-ESC-CE-217B				
Category	Lab Course				
Course title	Engineering Mechanics Lab				
Scheme and Credits	L	T	P	Credits	Semester-III
	0	0	2	1	
Course Objectives:	The objectives of this course are: • To provide practical exposure to mechanics principles through experiments. • To develop skills in conducting experiments and interpreting results. • To correlate theoretical concepts with experimental observations.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of engineering mechanics.	Level 1: Remember
CO2	Understand the principles of equilibrium, friction, and mechanical behavior of bodies.	Level 2: Understand
CO3	Illustrate experiments related to forces, moments, friction, and centroids.	Level 3: Apply
CO4	Analyze experimental results and compare them with theoretical values.	Level 4: Analyze

List of Experiments

1. To determine elastic properties of a beam.
2. Torsion of cylindrical rods (Shaft).
3. To determine and analyse deflection of curved beams.
4. Experimental and analytical study of behaviour of struts with various end conditions.
5. To determine deflection of trusses – Horizontal and vertical deflection of various joints of a pin jointed truss.
6. Experimental and analytical study of a 3bar pin jointed Truss.
7. Experimental and analytical study of an elastically coupled beam.
8. To plot stress- strain curve for mild steel – Demonstration

Useful Video links:

Exp. No	Experiment	Links
1	To determine elastic properties of a beam.	https://www.youtube.com/watch?v=nC0Sk36SZ0w
2	To determine and analyze deflection of curved beams.	https://www.youtube.com/watch?v=cGTebUY2xQc
3	Experimental and analytical study of behavior of struts with various end conditions.	https://www.youtube.com/watch?v=wgCXC-8UOU0
4	Experimental and analytical study of a 3bar pin jointed Truss.	https://www.youtube.com/watch?v=Lwzcwm3oL8A

Course code	LC-PCC-CE-219B				
Category	Lab Course				
Course title	Surveying Lab				
Scheme and Credits	L	T	P	Credits	Semester-III
	0	0	2	1	
Course Objectives:	The objectives of this course are: - To develop practical skills in the use of surveying instruments such as chain, compass, level, theodolite, and total station. - To train students in conducting field surveys for measurement of distances, angles, elevations, and contours. - To develop competency in preparation of field books, survey maps, plans, and contour drawing.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Recall surveying instruments, symbols, and field terminology.	Level 1: Remember
CO2	Understand principles of surveying.	Level 2: Understand
CO3	Perform field surveys using conventional surveying instruments.	Level 3: Apply
CO4	Analyze survey data to outline field observations.	Level 4: Analyze

List of Experiments

1. Chain Traversing and Compass Traversing
2. Differential Levelling
3. Fly Levelling
4. Cross Sectioning
5. Profile levelling
6. Plane Table surveying: Radiation and Intersection
7. Resection- 2 and 3-point problem with plane Table
8. Contouring and preparation contour map.
9. Demonstration of total station.

Useful Video links:

Exp. No	Experiment	Links
1	Chain Traversing	https://www.youtube.com/watch?v=hpbt71TljEA
2	Compass Traversing	https://www.youtube.com/watch?v=TKzEBJ1qkz8
3	Fly Levelling	https://www.youtube.com/watch?v=KDG9IJBp_bE
4	Cross Sectioning	https://www.youtube.com/watch?v=irNlaNP63nA

Course Code	LC-PCC-CE-221B				
Category	Lab Course				
Course Title	Civil Engineering CAD Lab				
Scheme and Credits	L	T	P	Credits	Semester-IV
	0	0	2	1	
Course Objectives	The objectives of this course are • To introduce basic computer-aided drafting concepts for civil engineering applications. • To develop skills in 2D drafting and building drawing using CAD software. • To understand building planning principles and apply them in design drawings. • To prepare complete residential building drawings including plan, elevation, and section.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall CAD tools and drafting commands used in building drawing.	Level 1: Remember
CO2	Explain building planning principles and CAD drafting concepts.	Level 2: Understand
CO3	Apply CAD skills to prepare building plans, elevations, and sections.	Level 3: Apply
CO4	Analyze and develop complete residential building drawings using CAD software.	Level 4: Analyze

List of Experiments

1. Study of CAD software interface and basic drawing setup.
2. Practice of basic drawing commands (Line, Circle, Arc, Rectangle).
3. Application of modify commands (Move, Copy, Rotate, Mirror, Scale).
4. Use of Trim, Extend, Offset, Fillet, and Chamfer commands.
5. Creation and management of layers, text, and annotation tools.
6. Preparation of dimensioned geometrical drawings.
7. Drawing of basic civil engineering components such as doors, windows, and walls.
8. Preparation of a simple residential building layout plan.
9. Preparation of a fully dimensioned single-storey residential building plan.
10. Preparation of a two-storey residential building plan with staircase.
11. Drawing of front elevation of a residential building.
12. Preparation of longitudinal and transverse building sections.
13. Development of a site plan including setbacks and orientation.
14. Preparation of complete residential building drawing as a CAD project sheet.
15. Exporting and plotting of CAD drawings in standard formats.

Useful Video Links:

Exp. No.	Experiment	Link
1	Study of CAD Software Interface and Drawing Setup	https://www.youtube.com/results?search_query=AutoCAD+interface+and+drawing+setup+for+beginners

2	Basic Drawing Commands (Line, Circle, Arc, Rectangle)	https://www.youtube.com/results?search_query=AutoCAD+basic+drawing+commands+tutorial
3	Modify Commands (Move, Copy, Rotate, Mirror, Scale)	https://www.youtube.com/results?search_query=AutoCAD+modify+commands+tutorial
4	Trim, Extend, Offset, Fillet and Chamfer	https://www.youtube.com/results?search_query=AutoCAD+trim+extend+offset+fillet+chamfer
5	Layers, Text and Annotation	https://www.youtube.com/results?search_query=AutoCAD+layers+text+dimension+annotation
6	Dimensioned Geometrical Drawings	https://www.youtube.com/results?search_query=AutoCAD+dimensioning+geometrical+drawing
7	Drawing Doors, Windows and Walls	https://www.youtube.com/results?search_query=AutoCAD+doors+windows+walls+drawing
8	Simple Residential Building Layout Plan	https://www.youtube.com/results?search_query=AutoCAD+simple+house+plan+tutorial
9	Single-Storey Residential Building Plan	https://www.youtube.com/results?search_query=AutoCAD+single+storey+house+plan
10	Two-Storey Residential Building Plan with Staircase	https://www.youtube.com/results?search_query=AutoCAD+two+storey+house+plan+with+staircase
11	Front Elevation of Residential Building	https://www.youtube.com/results?search_query=AutoCAD+house+elevation+tutorial
12	Longitudinal and Transverse Building Sections	https://www.youtube.com/results?search_query=AutoCAD+building+section+drawing
13	Site Plan with Setbacks and Orientation	https://www.youtube.com/results?search_query=AutoCAD+site+plan+drawing+tutorial
14	Complete Residential Building CAD Project	https://www.youtube.com/results?search_query=AutoCAD+complete+house+drawing+project
15	Exporting and Plotting CAD Drawings	https://www.youtube.com/results?search_query=AutoCAD+plot+print+export+PDF+tutorial

Course code	MC-201B				
Category	Mandatory Courses				
Course title	Environmental Science				
Scheme and Credits	L	T	P	Credits	Semester-III
	2	0	0	2	
Course Objectives	The objectives of this course are: • To create awareness of the multidisciplinary nature and importance of environmental studies, including the sustainable management and conservation of natural resources. • To develop an understanding of ecosystem dynamics, biodiversity, pollution types, and their impacts on environmental and human health. • To foster critical thinking on social, ethical, and legislative aspects of environmental protection, emphasizing the role of individuals and society. • To engage students in practical learning through fieldwork and case studies to apply environmental concepts for sustainable development and responsible citizenship.				
Assessment	20 Marks				
End Semester Examination	30 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Describe key terminologies of environmental studies, natural resources, ecosystems, pollution, environmental laws and human-environment interactions.	Level 1: Remember
CO2	Explain the relationships among ecosystems, biodiversity, pollution, social issues, environmental ethics and related legislation for sustainable development.	Level 2: Understand
CO3	Apply principles of environmental management, pollution control, disaster management and sustainable practices in real world environmental contexts.	Level 3: Apply
CO4	Analyze environmental issues, population growth impacts, climate change, welfare programs and the role of information technology in promoting public health and environmental sustainability.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 04 parts (Covering all units) of 1.5 marks each and remaining eight questions of 06marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	The Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance. Natural Resources: Renewable and Non-Renewable Resources; Natural Resources and Associated Problems. (a) Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their effects on Forests and Tribal People. (b) Water Resources: Use and Over-Utilization of Surface and Groundwater, Floods, Drought, Conflicts Over Water, Dams—Benefits and Problems. (c) Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies.

	(d) Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer and Pesticide Problems, Waterlogging, Salinity, Case Studies. (e) Energy Resources: Growing Energy Needs, Renewable and Non-Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies. (f) Land Resources: Land as a resource, Land Degradation, Man-Induced Landslides, Soil Erosion and Desertification. Role of an Individual in Conservation of Natural Resources, Equitable Use of Resources for Sustainable Lifestyles.
Unit-II	Ecosystems: Producers, Consumers and Decomposers, Energy Flow in the Ecosystem, Ecological Succession, Food Chains, Food Webs and Ecological Pyramids—Introduction, Types, Characteristic Features, Structure and Function of Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem and Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans and Estuaries). Biodiversity and Its Conservation: Introduction, Definition, Genetic Diversity, Species Diversity and Ecosystem Diversity. Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation, Hotspots of Biodiversity. Values of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values. Threats to Biodiversity: Habitat Loss, Poaching of Wildlife and Man–Wildlife Conflicts, Endangered and Endemic Species of India. Conservation of Biodiversity: In-situ and Ex-situ Conservation.
Unit-III	Environmental Pollution: Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution and Nuclear Hazards. Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes, Role of an Individual in Prevention of Pollution, Pollution Case Studies. Disaster Management: Floods, Earthquakes, Cyclones and Landslides. Social Issues and the Environment: From Unsustainable to Sustainable Development, Urban Problems Related to Energy, Water Conservation, Rainwater Harvesting, Watershed Management, Resettlement and Rehabilitation of People, Problems and Concerns, Case Studies. Environmental Ethics: Issues and Possible Solutions, Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies, Wasteland Reclamation, Consumerism and Waste Products. Environmental Legislation: Environment Protection Act, Air Prevention and Control of Pollution Act, Water Prevention and Control of Pollution Act, Wildlife Protection Act, Forest Conservation Act, Issues Involved in Enforcement of Environmental Legislation, Public Awareness.
Unit-IV	Human Population and the Environment: Population Growth, Variation among Nations, Population Explosion, Family Welfare Programme, Environment and Human Health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies. Field Work (Equivalent to 10 Lecture Hours) • Visit to a Local Area to Document Environmental Assets—River, Forest, Grassland, Hill or Mountain. • Visit to a Local Polluted Site—Urban, Rural, Industrial or Agricultural. • Study of Common Plants, Insects and Birds. • Study of Simple Ecosystems—Pond, River, Hills, Slopes, etc.

Suggested Readings

- Environmental Biology by K.C. Agarwal, Nidi Pub. Ltd., Bikaner
- The Biodiversity of India by Bharucha, MAP in Publishing Pvt.Ltd., Ahmedabad.
- Hazardous Waste Incineration by R.C. Brunner, McGraw Hill Inc., 1989
- Environmental Chemistry by A.K. De, Wiley Eastern Ltd.
- Global Biodiversity Assessment by V.H. Heywood & R.T.Watson, Cambridge University Press, 1995, 1140p.
- Environmental Protection and Laws by H. Jadhav & V.M. Bhosale, Himalaya Pub. House, Delhi, 1995, 284p.
- Matter Hazardous by A.K. Mhaskar, Techno-Science Publications.
- Waste Water Treatment by M.N. Rao & A.K. Datta, Oxford & IBH Publ. Co. Pvt. Ltd., 1987, 345p.
- Environmental Chemistry by B.K. Sharma, Goel Publ. House, Meerut, 2001.
- Survey of the Environment, The Hindu.
- Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II by R.K. Trivedi, Enviro Media.
- Introduction to Air Pollution by R.K. Trivedi & P.K. Goel, Techno-Science Publications.
- Environmental Management by K.D. Wagner, W.B. Saunders Co., Philadelphia, USA, 1998, 499p.
- A Textbook of Environmental Education by Dr. J.P. Yadav, G.V.S. Publishers.

Useful Video Links

Unit No.	Topic	Link
I	Environment Science: Introduction	https://www.youtube.com/watch?v=5QxxaVfgQ3k
	Natural Resources	https://www.youtube.com/watch?v=CXCT2R1K6Ts
	Ecosystem	https://www.youtube.com/watch?v=1dBU6HB8G6s
II	Biodiversity and its conservation	https://archive.nptel.ac.in/courses/102/104/102104068/
III	Sustainable Water Management In Urban Areas	http://digimat.in/nptel/courses/video/127106004/L29.ht
	Environmental Pollution	https://archive.nptel.ac.in/courses/123/105/123105001/
IV	Population and population growth	https://archive.nptel.ac.in/courses/102/104/102104068/
	National Family Welfare Programme	https://www.youtube.com/watch?v=X5F99L8ZEtc

Course Code	BSC-CE- 202B				
Category	Basic Science Course				
Course Title	Engineering Mathematics-III				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	1	0	4	
Course Objectives	The objectives of this course are to make the students • To understand and apply fundamental mathematical methods for solving differential equations, numerical problems, and transform-based models. • To develop logical reasoning and analytical skills through discrete mathematics and algebraic structures for engineering and scientific applications.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the fundamental concepts of engineering mathematics.	Level 1: Remember
CO2	Explain mathematical techniques used in engineering analysis.	Level 2: Understand
CO3	Apply mathematical methods to solve engineering problems.	Level 3: Apply
CO4	Analyze engineering problems using appropriate mathematical tools.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Partial Differential equations: First order linear partial differential equations, First order non- linear partial differential equations, Charpit's method, Second order linear partial differential equations and their classifications, Method of separation of variables and its applications to wave equation, One dimensional heat equations and Two dimensional heat flow (steady state solutions only).
Unit-II	Numerical methods: Solution of Polynomial and Transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.
Unit-III	Transform Calculus: Laplace Transform, Properties of Laplace transform, Laplace transform of periodic functions, Inverse Laplace transform by different methods, Convolution theorem, Evaluation of integrals by Laplace transform, Solving ordinary differential equations by Laplace transform method.
Unit-IV	Probability and Statistics: Measures of central tendency, Moments, Skewness and Kurtosis, Basic concepts of Probability, Conditional probability, Baye's theorem, Random variables, Discrete random variables, Expectation of discrete random variables, Variance of a sum, Binomial distribution, Poisson distribution, Continuous random variables and their properties, Distribution functions, Normal Distribution.

Suggested Readings:

- Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publishing Company Limited.
- Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers.
- Numerical Methods by P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand and Company.
- Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning.
- A Textbook of Engineering Mathematics by N. P. Bali and Manish Goyal, Laxmi Publications.
- Satinder Bal Gupta: A Text Book of Discrete Mathematics and Structures, University Science Press, Delhi.

Useful Video Links

Unit No.	Topics	Links
Unit I	First order linear partial differential equations	https://youtu.be/vQFFShhNyPo?si=noaoVs9vpiRm9nD2
	First order non-linear partial differential equations, Charpit's method	https://youtu.be/kEN_Ze8QNdM?si=_cs7Qn3cpNV4QWEu
	Second order linear partial differential equations and their classifications	https://youtu.be/kEN_Ze8QNdM?si=Rq69griDh-Zzr7dn
	Method of separation of variables and its applications to wave equation	https://youtu.be/kEN_Ze8QNdM?si=ww6-dO0Ph3gyoycg
Unit II	Solution of Polynomial and Transcendental equations	https://youtu.be/3j0c_FhOt5U?si=ZOx4OqOnj4kycbRi
	Interpolation	https://youtu.be/rWyTk9eubKM?si=DeOVGwmD72myPGkp
	Numerical integration	https://youtu.be/iviiGB5vxLA?si=u4l274cZxDZSw9Wm
Unit III	Laplace Transform	https://youtu.be/OA1OJrP20?si=iiu38t0ChNja5IEb
	Laplace transform of periodic functions	https://youtu.be/MM3vi7mQ60U?si=G5HNHLP4X1cePeRu
	Inverse Laplace transform by different methods	https://youtu.be/EDVJotmT584?si=r_8HyZkyRILVUPfb
	Solving ordinary differential equations by Laplace transform method	https://youtu.be/KaRx67h5xzk?si=otp94t8VjHzzE_in
Unit IV	Introduction of Probability	https://youtu.be/60vHy2IA4o4
	Discrete Random variable & Probability Distribution	https://youtu.be/Sv9UYnp9tbs?si=eHqwSJETA5SO3NFI
	Continuous Probability distribution	https://youtu.be/o2LB3KQME3U?si=NWaP0TY_K8tPaAfu
	Miscellaneous	https://onlinecourses.nptel.ac.in/noc22_ma81/preview

Course Code	PCC-CE-204B				
Category	Professional Core courses				
Course Title	Hydraulic Engineering				
Scheme and Credits	L	T	P	Credits	Semester- IV
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand principles of open channel flow and hydraulic machines. • To analyze flow characteristics in channels and pipelines. • To study performance of turbines and pumps. • To apply hydraulic principles in water resources engineering				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define basic concepts of hydraulic engineering.	Level 1: Remember
CO2	Describe problems related to various types of flow.	Level 2: Understand
CO3	Apply concepts to derive various equations for fluid.	Level 3: Apply
CO4	Analyze various types of flow.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Viscous Flow: Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through - journal, foot step and collar bearing, movement of piston in dash pot, methods of measurement of viscosity. Module 2: Turbulent Flow: Expression for coefficient of friction, Darcy-Weishbach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.
Unit-II	Module 3: Hydraulic Turbines: Classification of Turbines, Impulse and Reaction Principles, Pelton, Francis and Kaplan Turbines, Velocity Triangles, Unit Quantities, Specific Speed, Efficiencies, Characteristic Curves, Governing, Cavitation. Module 4: Pumps: Classification of Pumps, Centrifugal Pumps, Reciprocating Pumps, Axial Flow and Mixed Flow Pumps, Priming, Cavitation, Characteristic Curves, Selection of Pumps, Hydraulic Ram.
Unit-III	Module 5: Flow in open channels: Type of channels, classification of flows, continuity energy and momentum equation, concept of critical depth and specific energy, critical depth for rectangular, triangular, circular, and trapezoidal channels, flow through transition with a hump and with change in width (contraction and expansion).

	Module 6: Uniform flow: Chezy's equation, Manning's formula, Factors affecting Manning's roughness coefficient, velocity distribution, shear stress distribution, Uniform flow computations for rectangular, trapezoidal, and circular channels, standard line canal channels, Hydraulically efficient channel sections, compound sections, Critical slope, and limit slope,
Unit-IV	Module 7: Gradually Varied Flow: Classification of flow profiles (M, S, C, H, and A profiles), control sections, serial combination of channel sections, Transitional depth, numerical solution of gradually varied flow problems. Module 8: Hydraulic jump: Hydraulic jump in rectangular channel: sequent depth ratio, Energy loss; Classification of jumps, characteristics of jumps in rectangular channels, use of jump as an energy dissipater.

Suggested Readings

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth,
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
5. Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971
6. Fluid Mechanic and Hydraulic machines R.K. BANSAL

Useful Video Links

Unit No.	Topic	Link
Unit-I	Viscous Flow	https://youtu.be/0taaKGJ39X0?si=H-4A3yolteyZVTf
	Turbulent Flow	https://youtu.be/4w331Apzlj4?si=-GbJAAbuNEOmBC
Unit-II	Fluid Machines	https://www.youtube.com/live/wSTiH1h6DWQ?si=0pOm9BU4INmZgJQQ
	Power Hydraulics	https://youtu.be/MNtLMqC9mJU?si=DZ4maC5VOBJELPMe
Unit-III	Flow in open channels	https://youtu.be/bjZ2bc8-gTE?si=oRrAqvSKvE-azUb-
	Uniform flow	https://www.youtube.com/live/54a8JR1IlaM?si=IgKSp2x3TYUGndRS
Unit-IV	Gradually Varied Flow	https://youtu.be/VsFnxqCKCqY?si=NcE4rLTwRLEIQaD_
	Hydraulic jump	https://www.youtube.com/live/nHHD60kAtd0?si=hhWMhR0FFg-sk0hX

Course code	PCC-CE-206B				
Category	Professional Core course				
Course title	Structural Analysis				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	The objectives of this course are • To introduce analysis of determinate and indeterminate structures. • To develop ability to determine internal forces and deflections. • To apply classical methods for structural analysis. • To prepare students for design-oriented subjects.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Remember different structural analysis methods.	Level 1: Remember
CO2	Understand structural analysis methods.	Level 2: Understand
CO3	Apply analysis techniques to beams and frames.	Level 3: Apply
CO4	Analyze determine and indeterminate structures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	MODULE 1: Deflection of Statically determinate structures: Elastic curve, slope and deflection of beams by Double Integration Method, Moment Area Method, Conjugate Beam Method and Unit Load Method, Maxwell's Reciprocal Theorem and Betti's Reciprocal Theorem. MODULE 2: Deflection of Statically determinate Frame & Truss: Principle of Virtual Work, strain energy due to axial force, bending, shear and torsion, Castigliano's First Theorem, determination of deflection in beams, pin-jointed trusses and rigid-jointed frames.
Unit-II	MODULE 3: Influence Lines and Moving Loads: Introduction to moving loads and influence lines; influence lines for support reactions, shear force, bending moment and member forces in statically determinate beams and plane trusses; Müller-Breslau Principle; analysis of moving concentrated loads, uniformly distributed loads and series of concentrated loads; maximum shear force, maximum bending moment, absolute maximum bending moment, Equivalent Uniformly Distributed Load (EUDL) and enveloping parabola.
Unit-III	MODULE 4: Arches: Theory and classification of arches, Eddy's Theorem, analysis of three-hinged circular and parabolic arches, radial shear, normal thrust and bending moment, horizontal thrust in three-hinged arches, effects of temperature and support settlement. MODULE 5: Cable and Suspension Bridge: Introduction of Cable and suspension Bridge uniformly loaded cables, Temperature stresses, and three hinged stiffening Girder and two hinged stiffening girder.

Unit-IV	MODULE 6: Indeterminate Structures & Deflection methods: Introduction to Indeterminate Structures, Determination of kinematic and static indeterminacy of beams, frames and trusses, Slope Deflection and Moment Distribution Methods- Analysis of continuous beams & portal frames, Portal frames with inclined members. MODULE 7: Kani's and Column Analogy Method: Elastic centre, properties of analogous column, application to beam & frames, Analysis of continuous beam and simple frames, Analysis of frames with different column lengths and end condition of the bottom storey.
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Suggested Readings

- Statically Indeterminate Structures by C.K. Wang, McGraw Hill Book Co., New York.
- Advanced Structural Analysis by A.K. Jain, Nem Chand & Bros., Roorkee.
- Indeterminate Structures by R.L. Jindal, S. Chand & Co., New Delhi.
- Theory of Structures, Vol. I, by S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

Useful Video Links

Unit No.	Topic	Link
I	Deflection of determinate beams by Double Integration Method	https://youtu.be/ajGlZCND4rM?si=aoKNyj9Pt3wt_x4
II	Maximum Shear Force and Bending Moment diagrams for simply supported beams carrying moving loads	https://youtu.be/zYEjDnVnnHs?si=QeeacW9-z1E3ngNd
III	Determination of horizontal thrust, shear force and bending moment diagram for arches	https://youtu.be/F8u5zgdo_C4?si=UDm2Z14drPxvNf_d
IV	Indeterminate Structures & Deflection methods	https://youtu.be/8nGgpKz07yk?si=xcYNj-Qxs3NUVnHm

Course Code	PCC-CE-208B				
Category	Professional Core course				
Course Title	Advanced Surveying				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	The objectives of this course are: • To develop advanced knowledge of surveying methods such as triangulation, tacheometry, • To enable computation and adjustment of advanced survey data for engineering projects, • To introduce remote sensing and photogrammetry concepts for mapping applications.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall advanced surveying concepts, instruments, and terminology.	Level 1: Remember
CO2	Understand adjustment computations and RS principles.	Level 2: Explain
CO3	Apply modern surveying techniques.	Level 3: Apply
CO4	Analyze spatial and remote sensing data.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Triangulation and Trilateration: Triangulation systems, classification, selection of triangulation stations, grades of triangulation, triangulation computations, Trilateration-Principle, Methods, advantages and disadvantages, introduction to total station. Module 2: Survey Adjustment and Computations: Definitions, types of error, weight of an observation, law of weights, most probable values, principle of least squares, normal equation.
Unit-II	Module 3: Astronomy : Definitions of astronomical terms, celestial coordinate systems, Napier's rule of circular parts, star at elongation, star at prime vertical, star at horizon, star at culmination, Astronomical triangle, various time systems, conversion of local time to standard time and vice versa. Module 4: Elements of Photogrammetry : Introduction, types of photographs, scale of a photograph, height displacements of vertical photographs, flight planning and its uses, crab and drift, number of photographs, relief displacements, height determination from parallax measurement, flight planning.
Unit-III	Module 5: Introduction to Remote Sensing: Definition of Remote Sensing, types of remote sensing, remote sensing system and components, active and passive remote sensing, EMR propagation, Atmospheric windows in Remote Sensing, Spectral signature, Satellite platforms: Geo-stationary and sun synchronous satellites, Applications of remote sensing in civil engineering.

Unit-IV	Module 6: Geographic Information System (GIS): Definition and objectives of GIS, components of GIS, linkage between spatial and non-spatial data, integration of Remote Sensing (RS) and GIS data, Digital Elevation Model (DEM), Introduction to GIS Softwares. Module 7: Global Positioning System (GPS): Introduction to GPS – Working Principle of GPS, components & types of GPS receivers, GNSS concepts, GPS, GLONASS, Galileo and NavIC, Components of GNSS, Differential GPS, Sources of errors, Positioning methods, Surveying applications, Infrastructure mapping.
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Suggested Readings

- Chang, T.K. 2002: Geographic Information Systems, Tata McGrawHill
- Punmia, B.C. 2005: Surveying I and II, Luxmi Publications
- Paul R Wolf: Elements of Photogrammetry
- G S Srivastava: An introduction to Geoinformatics
- BasudebBhatta: Remote Sensing and GIS
- G. L. Hosmer: Text-book on Practical Astronomy

Useful Video Links

Unit No.	Topic	Link
Unit-I	Triangulation systems	https://www.youtube.com/watch?v=-23Rvzey1Ko
	Theory of Errors	https://www.youtube.com/live/WNmitfzV4RM?si=4weVoaPr4ctZ1dPI
Unit-II	Definitions of astronomical terms, celestial coordinate systems	https://youtu.be/14-YsGiCNwl?si=Vf44PAY6qm_u3wg9
Unit-III	Elements of Photogrammetry	https://youtu.be/qDmu_r12TU8?si=B6U5pXihH35NZ-dI
Unit-IV	Introduction to remote sensing	https://youtu.be/cn5CWu_zt_s?si=HF-xclbvPwahitgF
	GIS and GPS	https://www.youtube.com/live/KEc0_IY5LOY?si=YL5qGNd_HUoz6HCO

Course Code	PCC-CE-210B				
Category	Professional Core course				
Course Title	Design of Concrete Structures				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	The objectives of this course are: • To develop a comprehensive understanding of reinforced concrete design principles, including working stress and limit state methods, structural elements, reinforcement detailing, and foundation systems, • To apply, analyze, evaluate, and integrate their behavior, safety, stability, and serviceability requirements for efficient, durable, and sustainable structural design.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define and recall basic concepts of RCC design.	Level 1: Remember
CO2	Understand design philosophies.	Level 2: Understand
CO3	Apply RCC design methods.	Level 3: Apply
CO4	Analyze RCC structural elements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Design methodology and Working stress Method: Introduction to Reinforced Concrete Design, Working Stress Method vs. Limit State Method, Building Codes and Design Philosophy, Characteristic strength and loads, Partial safety factors and factored load, Stress-strain relationship for concrete and steel, Basic assumptions of Working Stress Method, Permissible stresses in concrete and steel. Module 2: Limit State Method: Basic assumptions, Serviceability criteria (Control of deflection, Cracking, Slenderness and vibrations), Deflection and moment relationship for limiting values of span to depth, Limit state of crack width, Design examples.
Unit-II	Module 3: Design of Beams: Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirement and design examples using limit state and working stress methods. Module 4: Shear Bond and Torsion: Analysis and Design of Sections in shear, bond and torsion, Diagonal tension, shear reinforcement, Development length, Anchorage and flexural bond, Torsional stiffness, equivalent shear, Torsional reinforcement, Design examples.
Unit-III	Module 5: Slabs: General considerations, Design of one way and two ways slabs for distributed and concentrated loads, Non-rectangular slabs, Openings in slabs, Design Examples.

	Module 6: Stair Case: Various Types of Staircases, General Notes on Design of Stair, Design Examples.
Unit-IV	Module 7: Columns: Effective length, Minimum eccentricity, Short columns, under axial compression, Uniaxial and biaxial bending, Slender columns. Design examples. Module 8: Footings: Isolated and wall footings, Design examples. Foundations-Combined footings, raft foundation, design of pile cap and piles, under reamed piles, design examples.

Suggested Readings

1. Design of Reinforced Concrete Structures by P. Dayaratnam, Oxford & IBH Pub., N.Delhi.
2. Design of Reinforced Concrete-Limit State Design By A.K. Jain, Nem Chand & Bros., Roorkee.
3. Design of Reinforced Concrete by I.C. Syal & A.K. Goel, A.H. Wheeler & Co. Delhi
4. Reinforced Concrete Design by S.N. Sinha, Tmh Pub., N.Delhi.
5. Sp-16(S& T)-1980, Design Aids For Reinforced Concrete to IS:456, BIS, N. Delhi.
6. Reinforced cement concrete design by Neelam Sharma , S.K. Kataria & sons, N. Delhi.
7. Sp-34(S&T)-1987 Handbook on Concrete Reinforcement And Detailing, BIS, N. Delhi.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Working stress and limit state methods	https://youtu.be/ba3mZhOpsTM?si=cR5Ec7Nhv6-dHT2l
	Limit State of Collapse Flexure	https://youtu.be/zVKf6hZfrhA?si=S8Zye0KA-nBzqUW2
Unit-II	Design of Shear	https://youtu.be/AfHmpWlcqq4?si=d3bD-x_PV-ZKLORe
	Concrete Reinforcement and Detailing	https://youtu.be/aJJedgPffVI?si=mYBTzapnJBW1Ksba
Unit-III	Design of Slab	https://youtu.be/PDJPCqQ3PZE?si=1CxjrcXeHnHgWslI
	Design of one way and two ways slabs	https://youtu.be/PDJPCqQ3PZE?si=2dEvG1hldX9Y2yvn
Unit-IV	Minimum eccentricity in column	https://youtu.be/ukIrYcFLyoc?si=FJLU2ajoaNQOg-y1
	Design of Footings	https://youtu.be/8ATp13mOhvg?si=n1au7l22DhUIhH8h

Course Code	LC-PCC-CE-212B				
Category	Lab Course				
Course Title	Hydraulic Engineering Lab.				
Scheme and Credits	L	T	P	Credits	Semester-IV
	0	0	2	1	
Course Objectives	The objectives of this course are • To conduct experiments on open channel flow and hydraulic machines. • To evaluate discharge, velocity, and efficiency parameters. • To interpret hydraulic system performance.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the behavior of fluids.	Level 1: Remember
CO2	Understand the different types of flow.	Level 2: Explain
CO3	Calculate the flow characteristics.	Level 3: Apply
CO4	Analyze the flow characteristics.	Level 4: Analyze

List of Experiments

1. To determine the coefficient of drag by Stokes law for spherical bodies.
2. To study the phenomenon of cavitation in pipe flow.
3. To determine the critical Reynolds number for flow through commercial pipes.
4. To determine the coefficient of discharge for flow over a broad crested weir.
5. To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.
6. To study the scouring phenomenon around a bridge pier model
7. To study the scouring phenomenon for flow past a spur.
8. To determine head loss due to various pipe fittings.

Useful Video links:

Exp. No	Experiment	Links
1	Coefficient of drag by Stokes' law	https://www.youtube.com/results?search_query=Stokes+Law+Experiment+Coefficient+of+Drag+Fluid+Mechanics
2	Cavitation in pipe flow.	https://www.youtube.com/results?search_query=Cavitation+in+Pipe+Flow+Laboratory+Experiment
3	Reynolds number	https://www.youtube.com/results?search_query=Reynolds+Number+Experiment+Fluid+Mechanics+Lab
4	Coefficient of discharge	https://www.youtube.com/results?search_query=Broad+Crested+Weir+Experiment+Coefficient+of+Discharge

Course Code	LC-PCC-CE-214B				
Category	Lab Course				
Course Title	Structural Analysis Lab				
Scheme and Credits	L	T	P	Credits	Semester-IV
	0	0	2	1	
Course Objectives	The objectives of this course are • To perform structural experiments and software-based analysis. • To understand structural behavior under various loading conditions. • To analyze experimental and analytical results				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall different methods of structural analysis.	Level 1: Remember
CO2	Understand various structural analysis theorems and principles.	Level 2: Explain
CO3	Examine behavior of structures under different loading conditions.	Level 3: Apply
CO4	Analyze behavior of structures under different loading conditions.	Level 4: Analyze

List of Experiments

1. To verify moment area theorem regarding slope and deflection in a beam
2. To verify Maxwell's Reciprocal Theorem.
3. Experiment on a two – hinged arch for horizontal thrust and influence line for horizontal thrust
4. Analytical and experimental study of three hinged arch
5. Experimental and analytical study of unsymmetrical bending of a cantilever beam
6. Sway in portal frames – Demonstration

Useful Video links:

Exp. No	Experiment	Links
1	Moment Area Theorem	https://www.youtube.com/results?search_query=Moment+Area+Method+Deflection+of+Beams+NPTEL
2	Maxwell's Reciprocal Theorem	https://www.youtube.com/results?search_query=Maxwell+Reciprocal+Theorem+Beam+Deflection
3	Two-Hinged Arch	https://www.youtube.com/results?search_query=Two+Hinged+Arch+Experiment+Horizontal+Thrust
4	Three-Hinged Arch	https://www.youtube.com/results?search_query=Three+Hinged+Arch+Laboratory+Experiment

Course Code	LC-PCC-CE-216B				
Category	Lab Course				
Course Title	Advanced Surveying Lab				
Scheme and Credits	L	T	P	Credits	Semester-IV
	0	0	2	1	
Course Objectives	The objectives of this course are to Use the theodolite for measuring angles and use of tacheometer to determine distance and elevation and to draw simple circular curves, to calculate base line measurement and importance of triangulation, to use a total station to measure distance, elevation and coordinates and to use total station to plot a map of given area with software.				
Assessment	10 Marks				
End Semester Examination	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	To study and use of theodolite for angle measurements.	Level 1: Remember
CO2	To use tachometer for horizontal and vertical distances.	Level 2: Explain
CO3	To draw simple circular curves.	Level 3: Apply
CO4	To measure base line measurement.	Level 4: Analyze

List of Experiments

1. Study various parts of a theodolite
2. Measurement of horizontal and vertical angles with theodolite.
3. Measurement of Tachometric constants
4. Calculating horizontal distance and elevations using tachometer
5. Exercise of triangulation including base line measurement.
6. Setting out simple circular curves by deflection angle method.
7. Study the various parts of a total station.
8. Measurements of distance, elevation, coordinate with total station.
9. Special problems with total station.

Useful Video links:

Exp. No	Experiment	Links
1	Measurement of horizontal and vertical angles with theodolite	https://youtu.be/Mb2jbdqMJHA?si=6x3x-rULjspFXrDa
2	Measurement of Tachometric constants.	https://youtu.be/-q_4kK2z3mA?si=gdgUGi5hWAVo1aP
3	Calculating horizontal distance and elevations using tachometer.	https://youtu.be/cIZbyEaD_PA?si=DnjKIdUV2luMtqL0
4	Study the various parts of a total station.	https://youtu.be/oFoegb0lx3o?si=lExcfpB30KYnw9T_

Course Code	LC-PCC-CE-218B				
Category	Lab Course				
Course Title	Concrete Lab				
Scheme and Credits	L	T	P	Credits	Semester-IV
	0	0	2	1	
Course Objectives	The objectives of this course are • To perform laboratory tests on concrete, steel, and other materials. • To evaluate strength and durability characteristics. • To prepare comprehensive laboratory reports.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall testing methods and standards.	Level 1: Remember
CO2	Understand behavior and failure modes of materials.	Level 2: Understand
CO3	Perform laboratory tests on materials.	Level 3: Apply
CO4	Analyze test data to determine parameters.	Level 4: Analyze

List of Experiments

1. Mix proportioning of normal concrete as per IS 10262.
2. Slump test for workability of concrete.
3. Compaction factor test.
4. Vee-Bee consistometer test.
5. Flow table test.
6. Compressive strength test on concrete cubes.
7. Split tensile strength test on concrete cylinders.
8. Flexural strength test on concrete beams.
9. Water absorption and permeability test of hardened concrete.
10. Non Destructive Testing
11. Comparative study of concrete produced with different water-cement ratios.

Useful Video Links

Exp. No.	Experiment	Link
1	Mix Proportioning of Normal Concrete (IS 10262)	https://www.youtube.com/results?search_query=IS+10262+concrete+mix+design
2	Slump Test for Workability of Concrete	https://www.youtube.com/results?search_query=slump+test+of+concrete
3	Compaction Factor Test	https://www.youtube.com/results?search_query=compaction+factor+test+of+concrete
4	Vee-Bee Consistometer Test	https://www.youtube.com/results?search_query=Vee+Bee+consistometer+test
5	Flow Table Test	https://www.youtube.com/results?search_query=flow+table+test+of+concrete

6	Compressive Strength Test on Concrete Cubes	https://www.youtube.com/results?search_query=compressive+strength+test+of+concrete+cube
7	Split Tensile Strength Test on Concrete Cylinders	https://www.youtube.com/results?search_query=split+tensile+strength+test+of+concrete
8	Flexural Strength Test on Concrete Beams	https://www.youtube.com/results?search_query=flexural+strength+test+of+concrete+beam
9	Water Absorption and Permeability Test of Hardened Concrete	https://www.youtube.com/results?search_query=water+absorption+and+permeability+test+of+concrete
10	Non Destructive Testing	https://www.youtube.com/results?search_query=rebound+hammer+test+on+concrete
11	Comparative Study of Concrete with Different Water-Cement Ratios	https://www.youtube.com/results?search_query=effect+of+water+cement+ratio+on+concrete+strength

Course Code	PEC-CE -220B				
Category	Professional Elective Course				
Course Title	Repair & Rehabilitation of Structure				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	- To understand deterioration, distress, and behavior of concrete structures. - To develop skills in damage assessment, testing, and selection of repair and strengthening techniques. - To learn maintenance, protection, and structural health monitoring for durable structures.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall different types of repair materials in concrete structures.	Level 1: Remember
CO2	Understand principles of repair and maintenance.	Level 2: Understand
CO3	Apply various testing techniques of repair and maintenance.	Level 3: Apply
CO4	Analyze structural failures and select suitable repair and strengthening methods.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction: Overview of Distress, Deterioration in Concrete Structures, Global Scenario of Distressed Structures, Need for Repairs and Upgrading of Structures, Process for Durable Concrete Repair Deterioration of concrete structures :Types of Deterioration - causes & symptoms, mechanism & micro-structure of concrete, Physical and Chemical Deterioration and its factors, Deterioration due to Water Leakage, Fire – detection & mitigation, Deterioration due to Ageing and Inadequate Maintenance, Design & Construction Deficiencies like Overloading.
Unit-II	Visual deterioration of structures :Types of Cracks, Causes & Characteristic of Cracking in Various Structural Components, Measurement of Cracks and Interpretation of the Cracking Phenomena Conditional/damage assessment & Evaluation of structures: Structural Assessment-importance, objective, various stages, conditional evaluation of the structure, Damage Assessment Procedure, Preliminary & Detailed Investigation – scope, objectives, methodology & rapid visual inspection of structures , Damage Assessment Allied Tests (Destructive, Semi-Destructive and Non-Destructive), Field & Laboratory Testing Procedures- strength, corrosion activity, performance & Integrity, Durability.

Unit-III	Repairs of concrete structures :Repairing Materials- criteria, selection of repair materials, methodology, performance requirements, preparatory stage of repairs, different types of repair materials & their application and repair techniques Retrofitting/Strengthening :Need for Retrofitting, Design Philosophy of Strengthening Structures, Conventional and Advanced Techniques Available for Strengthening, Seismic Retrofit of Concrete Structures- deficiencies in structure requiring seismic retrofit and its design philosophy, Latest Techniques to Enhance the Seismic Resistance of Structures.
Unit-IV	Protection & maintenance of structures :Importance of Protection & Maintenance, Categories of Maintenance, Building Maintenance, Corrosion Mitigation Techniques Structural health monitoring (SHM) :Definition and Motivation for SHM, Basic Components of SHM and its Working Mechanism, SHM as a Tool for Proactive Maintenance of Structures

Suggested Readings

- Concrete microstructure, Properties and materials – P Kumar Mehta and Paulo J.M. Monterio.
- Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
- Concrete Technology by M.L. Gambhir, Tata McGraw-Hill Education, Third Edition
- V. M. Malhotra, Nicholas J. Carino 2004 “Handbook on Nondestructive Testing of Concrete”
- “Repair and Strengthening of Concrete structures” , FIP guide, Thomas Telford, London.
- Concrete Structures, Protection, Repair and Rehabilitation by R.Dodge Woodson.
- Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Need for Repairs and Upgrading of Structures	https://youtu.be/x9noZ4xEXyg?si=fsAcIHU5CS-pVnoa
	Causes of Deterioration	https://youtu.be/lxFjLHOCgqw?si=i18xg0dUm9fDUVhj
Unit-II	Types of Cracks	https://youtu.be/3pcvb9cnih8?si=mT27C1-Ltuy8Se2o
	Non-Destructive Test	https://youtu.be/qjwYcEQcJ3I?si=AEVE5fPJJEfs7Vw
Unit-III	Selection of repair materials	https://youtu.be/JuRUXEV6Qmw?si=51hGoXj3JoXIHCwC
	Need for Retrofitting	https://youtu.be/1935UK8EU0U?si=RwEcG9MOp95pOCi
Unit-IV	Importance of Protection & Maintenance	https://youtu.be/NUdvZcMnud8?si=oOVnOwHavxGWfflU
	Basic Components of SHM and its Working Mechanism	https://youtu.be/sahuqWQO2-0?si=Br7LeULFcsbLE8hz

Course code	PEC-CE-222 B				
Category	Professional Elective Courses				
Course title	Climate Hazards and Disaster Mitigation				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	The objectives of this course are • Introduce fundamental concepts of climate science, climate change, and extreme weather events relevant to civil engineering. • Familiarize students with tools and techniques for observing, measuring, and analyzing climate extremes using climate data and models. • Develop analytical skills to detect trends, assess risks, and estimate return periods of extreme events affecting infrastructure systems.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall the basic principles of climate science.	Level 1: Remember
CO2	Understand the basic principles of climate science.	Level 2: Understand
CO3	Apply climate data analysis techniques and concepts.	Level 3: Apply
CO4	Analyze uncertainties in climate extremes using different methods.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Climate Change and Natural Hazards: Weather and Climate, Climate Change and Global Warming, Causes and Effects of Climate Change, Natural Hazards and Disasters, Floods, Droughts, Cyclones, Heat Waves, Cold Waves, Cloudbursts, Landslides, Climate Hazards in India. Module 2: Hazard Assessment and Infrastructure: Hazard, Vulnerability and Risk, Basic Hazard Assessment, Weather Forecasting and Early Warning Systems, Effects of Climate Hazards on Buildings, Roads, Bridges, Dams, Water Supply and Drainage Systems, Urban Flooding, Introduction to Climate-Resilient Infrastructure.
Unit-II	Module 3: Mitigation and Adaptation Measures: Structural and Non-Structural Mitigation Measures, Flood Control Measures, River Training Works, Slope Protection, Coastal Protection Measures, Drought Management, Water Conservation, Rainwater Harvesting, Nature-Based Solutions, Climate Adaptation. Module 4: Disaster Management: Disaster Management Cycle, Preparedness and Emergency Planning, Evacuation Planning, Basic Search and Rescue, Relief, Rehabilitation and Reconstruction, Build Back Better (BBB), Community Participation in Disaster Management.

Unit-III	Module 5: Disaster Management Framework: Disaster Management in India, National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs), National Disaster Management Plan (NDMP), Role of Government and Local Bodies, Sustainable Development Goals (SDGs). Module 6: Technology in Disaster Management: Role of Technology in Disaster Management, Sensor-Based Monitoring, Mobile-Based Warning Systems, Geographic Information System (GIS) Basics, Internet of Things (IoT) Applications, Artificial Intelligence (AI) Applications, Digital Communication during Emergencies.
Unit-IV	Module 7: Climate-Resilient Civil Engineering: Climate-Resilient Buildings, Roads and Bridges, Flood-Resilient Drainage Systems, Sustainable Construction Practices, Urban Resilience, Planning of Disaster-Resilient Infrastructure. Module 8: Case Studies: Case Studies of Major Climate Hazards (Floods, Cyclones, Heat Waves and Landslides) in India and Around the World, Impacts on Civil Infrastructure, Infrastructure Performance and Failures, Engineering Lessons and Best Practices for Disaster Mitigation.

Suggested Readings

- Intergovernmental Panel on Climate Change (IPCC). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). Cambridge University Press.
- Wilks, D. S. Statistical Methods in the Atmospheric Sciences. Academic Press.
- Coles, S. An Introduction to Statistical Modeling of Extreme Values. Springer.
- Kundzewicz, Z. W. (Ed.). Flood Risk in a Changing Climate. IAHS Press.
- Smith, K., & Petley, D. Environmental Hazards: Assessing Risk and Reducing Disaster. Routledge.
- Burroughs, W. J. Climate Change: A Multidisciplinary Approach. Cambridge University Press.

Useful Video Links

Unit No.	Topic	Link
I	Climate Science Basics.	https://youtu.be/dbJz1KBYVbg
II	Climate Data Sources and Observational Tools.	https://youtu.be/aeu95dlnwm4?si=ejHFSZ0Y8MHt9pRD
III	Case Studies on Recent Extreme Events.	https://youtu.be/ouQOulavOzM?si=JaimE14L96p0oRa8
IV	Advances in Climate Extremes Research	https://youtu.be/-x35OzfPgRE?si=1cINNe77vV2hs019

Course Code	PEC-CE-224B				
Category	Professional Elective Courses				
Course Title	Material Testing and Evaluation				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	The objectives of this course are • To understand testing procedures of construction materials. • To determine mechanical properties of materials. • To evaluate material performance for structural applications. • To develop skills in interpreting laboratory test results.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define properties of materials.	Level 1: Remember
CO2	Understand behavior of materials under different loading conditions	Level 2: Understand
CO3	Apply the testing procedures of materials.	Level 3: Apply
CO4	Analyze test results of materials.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Module 1: Engineering Materials and Performance Characteristics: Engineering properties of construction materials, Physical, Mechanical and Durability properties, Cement, Lime, Aggregates, Bricks, Blocks, Timber, Structural steel, Bituminous materials, Glass, Ceramics, Polymers, Composite materials, Material selection for engineering applications. Module 2: Testing of Cementitious Materials: Sampling procedures, Field identification, Laboratory testing of cement, Fineness, Standard consistency, Setting time, Soundness, Compressive strength, Testing of lime, Cement mortars, Lime mortars, Acceptance criteria, IS specifications.
Unit-II	Module 3: Testing of Aggregates and Masonry Units: Sampling techniques, Sieve analysis, Specific gravity, Water absorption, Bulk density, Aggregate crushing value, Aggregate impact value, Los Angeles abrasion, Flakiness and elongation index, Testing of bricks, Fly ash bricks, Concrete blocks, AAC blocks, Acceptance criteria. Module 4: Concrete Testing and Quality Evaluation: Properties of fresh concrete, Slump test, Compaction factor test, Vee-Bee consistometer test, Flow table test, Air content test, Properties of hardened concrete, Compressive strength test, Split tensile strength test, Flexural strength test, Modulus of elasticity, Water permeability test, Acceptance criteria as per IS specifications.

Unit-III	Module 5: Testing of Steel, Timber and Bituminous Materials: Mechanical properties of steel, Tensile, Bend, Re-bend and Hardness tests, Testing of structural steel sections, Timber testing, Moisture content, Bituminous material testing, Penetration, Softening point, Ductility, Viscosity, Flash and fire point tests. Module 6: Concrete Mix Design and Durability Assessment: Objectives of mix design, IS 10262 mix design procedure, Water-cement ratio, Aggregate grading, Workability requirements, Selection of admixtures, Sulphate attack, Chloride attack, Alkali-aggregate reaction, Carbonation, Corrosion of reinforcement, Durability enhancement measures.
Unit-IV	Module 7: Non-Destructive Testing and Structural Evaluation: Principles of NDT, Rebound hammer, Ultrasonic Pulse Velocity, Cover meter, Half-cell potential, Pull-out test, Core sampling, Interpretation of test results, Structural condition assessment, Residual strength evaluation, Limitations of NDT. Module 8: Laboratory Quality Management and Advanced Material Evaluation: Laboratory safety practices, Sampling and specimen preparation, Calibration of testing equipment, Precision and accuracy in testing, Recording and reporting of test results, Interpretation of test results, Acceptance criteria as per relevant IS specifications, Evaluation of recycled construction materials.

Suggested Readings

1. Handbook of mix design - BIS
2. Concrete Technology by M.S. Shetty.
3. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, Highway Materials and Pavement Testing, Nem Chand & Bros, Fifth Edition
4. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications
5. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction to Engineering Materials	https://youtu.be/gqp3cNOp5yQ?si=qwMzQKxgcsh3T9Sf
	Types of cement and uses	https://youtu.be/oouvvhVPnuqY?si=1AabzMz4U6x5Bkv2
Unit-II	Properties of fresh and hardened concrete	https://youtu.be/T4pjWFzd3rA?si=xaIqebkLO23CoIdk
	ACI mix design practice, USBR method	https://youtu.be/bHT1SySn6z4?si=Ob5S3FRnEk0v37lx
Unit-III	Types of steel	https://youtu.be/xaP0jaYoFvw?si=6SnKbQZfM2roP3L7
	Elasticity – principle and characteristics	https://youtu.be/bj9hE1L57mc?si=VvmBidzNcQQUBkh-
Unit-IV	Testing of concrete mixes	https://youtu.be/WfOsywEJGHU?si=pQDYzEeCw5SM2nIR
	Construction Equipments	https://youtu.be/2B7DhQvL8kw?si=4E0abrtJh0G9pA6X



**GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT,
KABLANA (JHAJJAR)**

**An Autonomous Institute
'A' GRADE ACCREDITED BY NAAC**

**Evaluation Scheme & Syllabus
For
Minor/Honors Degree/Specialization
in
Green Technology & Sustainability Engineering**

**Department of Civil Engineering
(Effective from the Session: 2026-27)**



**APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU,
ROHTAK**

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.)

Scheme of Studies and Examination

Honors Degree in Green Technology & Sustainability Engineering

w.e.f. 2026-27

Sr. No.	Semester	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	III	GTSE-201B	Sustainable Engineering Concepts and Life Cycle Analysis	3	0	0	3	3	30	45		75	3
2	IV	GTSE-202B	Environmental Impact Assessment	3	0	0	3	3	30	45		75	3
3	IV	MOOC-I	MOOC-I (Broad Area Civil Engineering)					3				75	3
4	V	GTSE-301B	Building Materials as a Cornerstone to Sustainability	3	0	0	3	3	30	45		75	3
5	V	MOOC-II	MOOC-II (Broad Area Civil Engineering)					3				75	3
6	VI	GTSE-302B	Strategies for Sustainable Design	3	0	0	3	3	30	45		75	3
7	VI	MOOC-III	MOOC-III (Broad Area Civil Engineering)					3				75	3
8	VII	GTSE-401B	Admixtures and Special Concretes	3	0	0	3	3	30	45		75	3
9	VII	LGTSE-403B	Admixtures and Special Concretes Lab	0	0	2	2	1	10		15	25	
10	V	SM-GTSE-303B	Seminar	0	0	2	2	1	10		15	25	
11	VI	PROJ-GTSE-304B	Project	0	0	4	4	2	15		35	50	
Total Credits								19	185	225	65	475	

Note: To earn the required credits for the award of B.Tech. Minor/Honors (Hons.)/Specialization Degree, students may choose either:

- To enroll in courses offered through NPTEL/MOOCs that must be equivalent to the prescribed courses in the approved scheme, subject to availability in any semester.
- OR
- To complete the prescribed courses in the same semester as offered by the department under the approved scheme and curriculum structure.
 - Students should take Massive Open Online Courses (MOOCs) approved by the concerned Chairperson Board of Studies (BoS)

Course Code	GTSE-201B				
Course Title	Sustainable Engineering Concepts and Life Cycle Analysis				
Scheme and Credits	L	T	P	Credits	Semester-III
	3	0	0	3	
Course Objectives	• To introduce the principles of sustainability and sustainable development. • To familiarize students with environmental, social, and economic aspects of engineering systems. • To develop understanding of Life Cycle Thinking and Life Cycle Assessment (LCA).				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall fundamental concepts of sustainability and sustainable development.	Level 1: Remember
CO2	Explain environmental, social, and economic dimensions of sustainability.	Level 2: Understand
CO3	Apply life cycle assessment tools to evaluate engineering systems and materials.	Level 3 : Apply
CO4	Analyze sustainability impacts and recommend suitable sustainable solutions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to Sustainability and Sustainable Development, Material Flow and Waste Management, Role of Engineers in Sustainable Development, Water-Energy-Food Nexus, Environmental Challenges and Resource Depletion, Introduction to Risk and Sustainability Framework.
Unit-II	Environmental Risk Assessment: Concepts and Methodology, Chemicals and Human Health Effects, Characterization of Environmental Problems, Environmental Data Collection and Monitoring, Statistical Analysis of Environmental Data, Common Analytical Instruments for Environmental Assessment.
Unit-III	Introduction to Life Cycle Thinking, Goal and Scope Definition, Life Cycle Inventory (LCI), Life Cycle Impact Assessment (LCIA), Life Cycle Interpretation, LCA Software Tools, ISO Framework for LCA, Data Quality and System Boundary Considerations, Benefits, Limitations and Applications of LCA.
Unit-IV	Design for Sustainability, Environmental, Economic and Social Sustainability Indicators, Sustainable Engineering Design Principles, Environmental Cost Analysis, Green and

	Sustainable Materials, Chemical Release, Fate and Transport, Case Studies: Odour Removal in Organics Treatment Plants, Comparison of Hand Drying Methods, Biofuels for Transportation, Kerosene Lamp vs Solar Lamp, Bioplastics and Sustainable Product Assessment.
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Suggested Readings

- Allen, D. T., & Shonnard, D. R. (2011). Sustainable Engineering: Concepts, Design and Case Studies. Prentice Hall.
- Graedel, T. E., & Allenby, B. R. (2010). Industrial Ecology and Sustainable Engineering. Pearson Education.
- Guinée, J. B. (Ed.). (2002). Handbook on Life Cycle Assessment: Operational Guide to the ISO Standards. Springer.
- Hauschild, M. Z., Rosenbaum, R. K., & Olsen, S. I. (2018). Life Cycle Assessment: Theory and Practice. Springer.
- Muthu, S. S. (Ed.). (2021). Life Cycle Assessment for Sustainable Engineering. Springer.
- United Nations Environment Programme (UNEP). (2020). Guidelines for Social Life Cycle Assessment of Products and Organizations. UNEP.
- International Organization for Standardization (ISO). (2006). ISO 14040: Environmental Management—Life Cycle Assessment—Principles and Framework. ISO.
- International Organization for Standardization (ISO). (2006). ISO 14044: Environmental Management—Life Cycle Assessment—Requirements and Guidelines. ISO.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Sustainability Concepts – Innovations and Challenges	https://www.digimat.in/nptel/courses/video/127105018/L01.html?utm_source=chatgpt.com
	LCA and Water, Food and Energy Nexus	https://digimat.in/nptel/courses/video/105105157/105105157.html?utm_source=chatgpt.com
Unit-II	Risk Assessment and LCA Frameworks	https://digimat.in/nptel/courses/video/105105157/105105157.html?utm_source=chatgpt.com
Unit-III	Life Cycle Assessment – Introduction	https://www.digimat.in/nptel/courses/video/105105157/L01.html?utm_source=chatgpt.com
	Detailed LCA Methodology	https://klnce.digimat.in/nptel/courses/video/105105157/L16.html?utm_source=chatgpt.com
Unit-IV	Sustainable Engineering Design Principles	https://www.digimat.in/nptel/courses/video/105105157/L34.html?utm_source=chatgpt.com
	Life Cycle Thinking and Circular Economy	https://www.digimat.in/nptel/courses/video/127105018/L05.html?utm_source=chatgpt.com

Course Code	GTSE-202B				
Course Title	Environmental Impact Assessment				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Course Objectives	To develop an understanding of Environmental Management and EIA frameworks and to apply, analyze, and evaluate EIA procedures, tools, legal provisions, public participation, reporting, and decision-making processes for effective impact mitigation and Environmental Management Plan (EMP) preparation using practical case studies.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of Environmental Management, and EIA in environmental systems.	Level 1: Remember
CO2	Explain legal, policy, and regulatory frameworks governing Environmental Impact Assessment.	Level 2: Understand
CO3	Apply EIA procedures such as screening, scoping, baseline data collection, and appropriate methodologies.	Level 3 : Apply
CO4	Analyze environmental impacts using EIA methods, tools, techniques, and public participation processes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to Environment Management & EIA, Legal, Policy & Regulatory Framework, EIA Procedure - Scoping & Screening and Establishing Baseline Conditions.
Unit-II	EIA Methodologies: EIA Methods, Tools and Techniques.
Unit-III	Public Involvement in EIA, Impact Management - Mitigation & Preparation of Environment Management Plans (EMP), EIA Reporting & Review of EIA Quality.
Unit-IV	Decision Making & Project Management, Implementation & Follow up, EIA Case Examples.

Suggested Readings

- Canter, L. W. (1996). Environmental impact assessment (2nd ed.). McGraw-Hill.

- Glasson, J., Therivel, R., & Chadwick, A. (2012). Introduction to environmental impact assessment (4th ed.). Routledge.
- International Association for Impact Assessment. (1999). Principles of environmental impact assessment best practice. IAIA.
- Jay, S., Jones, C., Slinn, P., & Wood, C. (2007). Environmental impact assessment: Retrospect and prospect. *Environmental Impact Assessment Review*, 27(4), 287–300. <https://doi.org/10.1016/j.eiar.2006.12.001>
- Morris, P., & Therivel, R. (Eds.). (2009). Methods of environmental impact assessment (3rd ed.). Routledge.
- Noble, B. F. (2015). Introduction to environmental impact assessment: A guide to principles and practice (3rd ed.). Oxford University Press.
- Sadler, B. (1996). Environmental assessment in a changing world: Evaluating practice to improve performance. International Study of the Effectiveness of Environmental Assessment.
- Therivel, R., & Wood, G. (2018). Strategic environmental assessment (2nd ed.). Routledge.
- United Nations Environment Programme. (2002). Environmental impact assessment training resource manual. UNEP.
- United Nations Environment Programme. (2018). Assessing environmental impacts: A global review of legislation. UNEP.
- Wood, C. (2003). Environmental impact assessment: A comparative review. Longman Environmental Planning Series.
- World Bank. (1999). Environmental assessment sourcebook. World Bank Publications.
- Government of India, Ministry of Environment, Forest and Climate Change. (2006). Environmental Impact Assessment Notification. MoEFCC.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction to Environment Management & EIA	https://youtu.be/9-MEVIXr3Ko?si=oZXgYyr-G-U-fFyS
	EIA Procedure	https://youtu.be/8vymflfip2w?si=jUTYSib0yriqSP7R
Unit-II	EIA Methodologies	https://youtu.be/6TgNwkYZg_8?si=Bhs6WQJmA4Xh_C7x
Unit-III	Public Involvement in EIA	https://youtu.be/NR2N57wFOog?si=YP9Bh7wtpbpf2NMj
	EIA Reporting & Review of EIA Quality	https://youtu.be/o70_CrRG62M?si=ELUVSjVcbTIDmPhR
Unit-IV	Decision Making & Project Management	https://youtu.be/ZJ8xTZKves4?si=UR60udr9-FqOzNDu
	EIA Case Examples	https://youtu.be/rAy-lviWh_M?si=vliNrtaCABPGECow

Course Code	GTSE-301B					
Course Title	Building Materials as a Cornerstone to Sustainability					
Scheme and Credits	L	T	P	Credits	Semester-V	
	3	0	0	3		
Course Objectives	To develop a comprehensive understanding of conventional, alternative, innovative, advanced, and smart building materials, and to apply, analyze, evaluate, and integrate their properties, environmental impacts, and functional performance for sustainable and intelligent construction solutions..					
Assessment	30 Marks					
End Semester Examination	45 Marks					
Total	75 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Identify and classify conventional, vernacular, and alternative building materials and their environmental issues.	Level 1: Remember
CO2	Explain the properties and sustainability aspects of traditional and waste-based building materials.	Level 2: Understand
CO3	Apply innovative and alternative materials for sustainable construction practices.	Level 3 : Apply
CO4	Analyze the performance and environmental benefits of advanced building materials.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Introduction to Building materials, their classification, environmental issues, Vernacular Materials, Mud- Traditional Material, Mud as a Building material.
Unit-II	Stone as a building Material, Thatch ,Bamboo, Binders Strawbale, Laterite Quarry Waste, Alternate building material Fly ash, Furnace Slag, Cross Laminated Timber, Construction and Demolition waste, Hempcrete, Phosphogypsum, Aerated Concrete, Alternate aggregate, Innovative Building Materials - Introduction.
Unit-III	Bio-luminescent paints, Milk Paints and Recycled Plastics, Agro bricks, Light emitting materials – concrete, CO ₂ Absorbing Concrete, Mycelium Composite Bricks, Fibre Reinforced Concrete, Geo-polymer Concrete, Introduction to Advanced Building Materials, Carbon sequestration by building materials, Eco-bind Tiles, Permeable Concrete.
Unit-IV	Introduction to smart materials and its types, Facade systems: Smart Windows, Liquid Crystal Display, Photochromics, Thermochromic materials, Phase change materials, Adhesion changing smart materials, Photo adhesive smart materials, Titanium dioxide (tio ₂) products, Mechanochromics, Thermochromics, Electrochromic, Nano cellulose composite bricks, electroluminescent, Recap and conclusions.

Suggested Readings

- Ashby, M. F. (2013). Materials and the environment: Eco-informed material choice (2nd ed.). Butterworth-Heinemann.
- Berge, B. (2009). The ecology of building materials (2nd ed.). Architectural Press.
- Binici, H., Aksogan, O., Shah, T., & Eken, M. (2015). Investigation of fibre reinforced mud brick as a building material. Construction and Building Materials, 78, 318–325. <https://doi.org/10.1016/j.conbuildmat.2014.12.093>
- Bouhadda, Y., et al. (2019). Bio-based building materials and carbon sequestration. Journal of Cleaner Production, 221, 841–855. <https://doi.org/10.1016/j.jclepro.2019.02.156>
- Calkins, M. (2012). Materials for sustainable sites: A complete guide to the evaluation, selection, and use of sustainable construction materials. Wiley.
- Chandra, S., & Berntsson, L. (2003). Lightweight aggregate concrete: Science, technology, and applications. William Andrew Publishing.
- Davies, J. (2011). Building with earth: Design and technology of a sustainable architecture. Birkhäuser.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction to Building materials	https://youtu.be/8AwTVpfgcE0?si=gP1kQ-QfvI195gdm
	Mud as a Building material	https://youtu.be/X9OaNXfyj_Y?si=ijbVQHrwPMISi2ln
Unit-II	Laterite Quarry Waste	https://youtu.be/S6NSABtlpao?si=7EmhO4V37vTPd5yP
	Bamboo	https://youtu.be/4M9Ay4L7gXk?si=VxtN5WiOTpBzH_mS
Unit-III	Light emitting materials	https://youtu.be/ey_sFm5luWQ?si=5oOY6AeVh7VwQ8Yj
	Introduction to Advanced Building Materials	https://youtu.be/mTBa--U7K_o?si=yR6jldGGtQ_Q-f89
Unit-IV	Adhesion changing smart materials	https://youtu.be/djS5zlJmEjQ?si=b_UAoex8xEHxZKrT
	Introduction to smart materials and its type	https://youtu.be/-ibRO0iVknQ?si=SSiU4-aJqTqh9XoP

Course Code	GTSE-302B				
Course Title	Strategies for Sustainable Design				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Course Objectives	To analyze sustainability concepts and environmental issues in built and industrial systems, evaluate policies, standards and life-cycle impacts, and create responsible, energy-efficient and human-centric design solutions aligned with SDGs and emerging sustainable practices.				
Assessment	30 Marks				
End Semester Examination	45 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define and recall fundamental concepts of sustainability, sustainable development, environmental, social and economic (ESE) dimensions, and global sustainability frameworks..	Level 1: Remember
CO2	Explain sustainability concepts, ESE aspects, climate change, pollution and energy dependence.	Level 2: Understand
CO3	Apply 3R principles, conventions, and human comfort strategies for sustainable built environments.	Level 3 : Apply
CO4	Analyze environmental impacts, vernacular responses, and ecosystem health through design alternatives	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	ESE Aspects of Sustainability and Climate Change Mitigation, Current National and International Scenario of SD and Dependence on Energy.
Unit-II	Impact of Pollutions and Design Processes with Alternative Solutions for Health of Ecosystem, Policy, Growth, Development and 3R's for Consumption.
Unit-III	NBC, ECBC, and SA Methods such as GRIHA ,UN SDG and System Design tools, Vernacular and Responsive Design using Net-Zero Energy, Lighting, Ventilation, Views, etc., for Human Comfort.
Unit-IV	Design for Sustainability and Nature as Inspiration, International Conventions, Laws and Emerging Technologies for SD,SD Case Studies and Summary.

Suggested Readings

- Ashby, M. F. (2013). Materials and the environment: Eco-informed material choice (2nd ed.). Butterworth-Heinemann.
- Bhamra, T., & Lofthouse, V. (2007). Design for sustainability: A practical approach. Gower Publishing.
- Brundtland, G. H. (1987). Our common future. Oxford University Press.

- Cabeza, L. F. (Ed.). (2014). Life cycle assessment (LCA) and energy analysis of buildings and the built environment. Elsevier.
- Charter, M., & Tischner, U. (2001). Sustainable solutions: Developing products and services for the future. Greenleaf Publishing.
- Fiksel, J. (2015). Design for environment: A guide to sustainable product development (2nd ed.). McGraw-Hill.
- Givoni, B. (1998). Climate considerations in building and urban design. Van Nostrand Reinhold.
- Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Mitigation of climate change. Cambridge University Press.
- International Organization for Standardization. (2006). ISO 14040: Environmental management—Life cycle assessment—Principles and framework. ISO.
- Kibert, C. J. (2016). Sustainable construction: Green building design and delivery (4th ed.). Wiley.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction of Strategies for Sustainable Design	https://youtu.be/2NEluSr6fY?si=FZqgi_7Ms1M82fP
	Perspectives on Sustainability in Industrial Design	https://youtu.be/KzKM1II7O3g?si=BxApBV02RWn7N4BT
Unit-II	Impact of Pollutions	https://youtu.be/_DtVX1OQPnk?si=rTAZIoYZM8O15DmC
	Environmental Impact Assessment	https://youtu.be/xPO1qIZOtY0?si=kyi_bTMpKpaw55LX
Unit-III	System Design tools	https://youtu.be/BWJCsgXTFdY?si=rqxwpPYf8nCf5Mgg
	UN SDG	https://youtu.be/rHF7Uzto5Ug?si=xtYxTPQsQZYz43nC
Unit-IV	Nature as Inspiration	https://youtu.be/4-fKQ9EuJWE?si=vSQ9hYyMW5YqUbL-
	Laws and Emerging Technologies for SD	https://youtu.be/Hud_D_AT27A?si=DQejRtGrjGatbScw

Course Code	GTSE-401B					
Course Title	Admixtures and Special Concretes					
Scheme and Credits	L	T	P	Credits	Semester-VII	
	3	0	0	3		
Course Objectives	To provide students with knowledge of cement chemistry, admixtures, and special concretes so they can design and evaluate high-performance and sustainable concrete mixes for modern construction.					
Assessment	30 Marks					
End Semester Examination	45 Marks					
Total	75 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Recall basic concepts of cement and components of concrete.	Level 1: Remember
CO2	Explain the role and effects of chemical and mineral admixtures in concrete.	Level 2: Understand
CO3	Use admixtures and mix design techniques to improve concrete performance.	Level 3 : Apply
CO4	Analyze the rheology and properties of special concretes under different conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts (preferably 2 from each unit/section) of 1.5 marks each and remaining eight questions of 09 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	Cement and concrete performance - An overview.
Unit-II	Chemical admixtures: Introduction & Water reducers, Set controllers, Standards on chemical admixtures & Air entraining agents, Understanding concrete rheology, Viscosity modifying agents, Shrinkage reducing admixtures, & Other specialty admixtures.
Unit-III	Mineral Admixtures: Introduction, classification and pozzolanic activity, Fly ash and Silica fume, GGBFS, Metakaolin and LC3, Agricultural ashes, characterization techniques Life Cycle Assessment.
Unit-IV	Special Concretes: High strength concrete and ultra high performance concrete, Self compacting concrete and mass concreting and lightweight concrete, High density concrete and concrete for 3D printing.

Suggested Readings

- Aïtcin, P.-C. (2000). High-performance concrete. CRC Press.
- American Concrete Institute. (2010). ACI 212.3R: Report on chemical admixtures for concrete. ACI.
- American Concrete Institute. (2017). ACI 234R: Guide for the use of silica fume in concrete. ACI.
- American Concrete Institute. (2018). ACI 233R: Slag cement in concrete and mortar. ACI.
- Bentur, A., & Mindess, S. (2007). Fibre reinforced cementitious composites (2nd ed.). CRC Press.

- Hewlett, P., & Liska, M. (Eds.). (2019). Lea's chemistry of cement and concrete (5th ed.). Butterworth-Heinemann.
- Malhotra, V. M., & Mehta, P. K. (1996). Pozzolan and cementitious materials. Gordon and Breach.
- Mehta, P. K., & Monteiro, P. J. M. (2014). Concrete: Microstructure, properties, and materials (4th ed.). McGraw-Hill Education.
- Neville, A. M. (2011). Properties of concrete (5th ed.). Pearson Education.

Useful Video Links

Unit No.	Topic	Link
Unit-I	Introduction	https://youtu.be/rJSxTY6u9NU?si=sg3Kzo4kXw-81aMj
	Cement chemistry and concrete performance	https://youtu.be/z21gfQ9zItE?si=WbhA2L_el6XWGfCm
Unit-II	Chemical admixtures: Introduction	https://youtu.be/eUhnvguuA2M?si=FzkjiE9w1DTctXiM
	Water reducers	https://youtu.be/OJbd1Z2OA_s?si=lCipvYkDaNOasbzl
Unit-III	Mineral Admixtures: Introduction	https://youtu.be/lfeGqnXOGmg?si=J3f9ZWwTSD2lczFv
	Fly ash and Silica fume	https://youtu.be/_VuCMDbKKXg?si=YWlwx-wXzTqKwEXe
Unit-IV	Self compacting concrete	https://youtu.be/h6dUtWHIG5I?si=cTNllq3waayCk0ai
	High density concrete and concrete for 3D printing	https://youtu.be/Ge0ZdmmHPBg?si=hXpxIceem3Pzh8Kc

Course code	LGTSE-403B				
Course title	Admixtures and Special Concretes Lab				
Scheme and Credits	L	T	P	Credits	Semester-VII
	0	0	2	1	
Course Objectives:	To enable students to understand materials and admixtures used in concrete, perform practical mix procedures, analyze concrete behavior, and evaluate suitable solutions for modern construction				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam					

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Identify materials and admixtures used in concrete.	Level 1:Remember
CO2	Describe the effect of admixtures on concrete behavior.	Level 2:Understand
CO3	Perform practical concrete mix preparation and testing.	Level 3:Apply
CO4	Analyze test results of fresh and hardened concrete.	Level 4:Analyze

LIST OF EXPERIMENTS

1. Study of cement chemistry and concrete performance.
2. Work-ability tests using water-reducing and set-controlling admixtures.
3. Testing of air-entraining admixtures and air content.
4. Rheology tests using viscosity and shrinkage-reducing admixtures.
5. Pozzolanic activity test of fly ash and silica fume.
6. Strength test of concrete with GGBFS, Meta-kaolin and LC3.
7. Characterization of agricultural ashes with basic LCA study.
8. Preparation and testing of special concretes (HSC, SCC, lightweight, high-density, 3D-printing).

Useful Video links:

Exp. No	Topics	Links
1	Work-ability tests using water-reducing and set-controlling admixtures.	https://youtu.be/B16svG4QrzY
2	Pozzolanic activity test of fly ash and silica fume.	https://youtu.be/biDjGm7J9q8
3	Strength test of concrete with GGBFS	https://youtu.be/0QqJqiMM2FQ?si=OC_xg5hSup7Y_roY
4	Preparation and testing of special concretes	https://youtu.be/-Ld6_jVBld8

Course code	SM-GTSE-303B				
Course title	SEMINAR				
Scheme and Credits	L	T	P	Credits	Semester-V
	0	0	2	1	
Course Objectives:	Upon successful completion of this course, students will be able to: • To enable students to identify and study emerging topics related to sustainable and green infrastructure in civil engineering. • To develop the ability to review and analyze scientific literature, technical reports, and case studies related to sustainability in the built environment. • To enhance students’ technical writing, presentation, and communication skills through preparation of seminar reports and presentations. • To encourage students to critically evaluate modern technologies, materials, and practices used for sustainable infrastructure development.				
Class work	10 Marks				
Exam	15 Marks				
Total	25 Marks				
Duration of Exam					

COURSE CONTENT

During the semester, the students have to:

- Select a topic related to Sustainable and Green Infrastructure, such as sustainable building materials, environmental impact assessment, sustainable design strategies, smart cities, special concretes, or other emerging technologies in civil engineering.
- Conduct a comprehensive literature review on the selected topic using research papers, technical reports, standards, and relevant case studies.
- Analyze and summarize the sustainability aspects, environmental impacts, and practical applications of the selected topic.
- Prepare and deliver a technical seminar presentation highlighting objectives, methodology, findings, and future scope.
- Submit a detailed seminar report based on the literature review and analysis.
- Students are encouraged to prepare a review/technical paper based on their work for possible presentation or publication in a national conference, international conference, or journal, if feasible.

Course code	PROJ-GTSE-304B				
Course title	PROJECT				
Scheme and Credits	L	T	P	Credits	Semester-VI
	0	0	4	2	
Course Objectives:	Upon successful completion of this course, students will be able to: • To enable students to apply the concepts of sustainable and green infrastructure to solve real-world civil engineering problems. • To develop the ability to identify, analyze, and formulate engineering problems related to sustainable materials, environmental management, smart infrastructure, and sustainable design. • To provide experience in research methodology, literature review, data analysis, modelling, design, or experimental investigation related to sustainable infrastructure systems. • To enhance students' skills in teamwork, project planning, and technical problem solving while executing a project under faculty guidance.				
Class work	15 Marks				
Exam	35 Marks				
Total	50 Marks				
Duration of Exam					

The objective of Project Work is to enable students to undertake an in-depth study on a topic related to Sustainable and Green Infrastructure, integrating knowledge from environmental impact assessment, sustainable materials, smart cities, sustainable design strategies, and advanced concretes. The project may involve theoretical, experimental, analytical, design-based, or field-oriented work under the guidance of a faculty supervisor from the department and, where possible, in collaboration with industry or research organizations.

The assignment should normally include:

1. Selection and in-depth study of a topic related to sustainable and green infrastructure such as sustainable construction materials, environmental assessment, smart urban systems, sustainable design, special concretes, or related emerging technologies.
2. Comprehensive literature review using research papers, technical reports, standards, and case studies to understand the current developments in the selected area.
3. Identification and formulation of the problem, including defining objectives, scope, methodology, and preparation of an action plan for carrying out the study.
4. Detailed analysis/design/modelling/simulation/experimental investigation related to the selected problem, emphasizing sustainability, environmental performance, and practical applicability.
5. Development and evaluation of proposed solutions, including data analysis, interpretation of results, and discussion on sustainability benefits and limitations.

6. Preparation of a technical/review paper based on the project work for possible presentation in a conference or publication in a journal, if feasible.
7. Preparation and submission of a detailed project report/dissertation in the prescribed format for evaluation by the department.
8. Final seminar presentation and demonstration of the project work before a departmental committee.